

SAP Data Hub 2 on SUSE CaaS Platform 4

Installation Guide

SUSE CaaS Platform 4
SUSE Linux Enterprise Server for SAP applications 15 SP1
SAP Data Hub 2

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SAP Data Hub 2 on SUSE CaaS Platform 4

Installation Guide

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SAP Data Hub 2 is the tool set to govern big amounts of data. SUSE CaaS Platform 4 is the Kubernetes base that makes deploying SAP Data Hub 2 easy. This document describes the installation and configuration of SUSE CaaS Platform 4 and SAP Data Hub 2.

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1 Introduction

Today, business and industries create more and more data. As the amount of data grows, so does the need to manage and get the best out of the data. SAP Data Hub 2 is a tool to make it easier to deal with such amounts of data, and with SUSE CaaS Platform 4, SUSE delivers the foundation on top of which to run SAP Data Hub 2.

2 Requirements

To install SAP Data Hub 2 on SUSE CaaS Platform 4, we need to meet certain requirements. Consult the relevant documentation:

- SUSE
 - SUSE CaaS Platform 4 (<https://documentation.suse.com/suse-caasp/4/>) ↗
 - SUSE Enterprise Storage (<https://www.suse.com/documentation/suse-enterprise-storage-5>) ↗
- SAP
 - SAP Data Hub (https://help.sap.com/viewer/product/SAP_DATA_HUB/2.7.latest/en-US) ↗
 - SAP Note 2686169 (<https://launchpad.support.sap.com/#/notes/2686169>) ↗
 - SAP Note 2865345 (<https://launchpad.support.sap.com/#/notes/2865345>) ↗

2.1 Hardware and software requirements

2.1.1 SUSE CaaS Platform 4 cluster

For the hardware requirements, see also SAP's installation guide and sizing recommendations:

- SAP Data Hub Install Guide (https://help.sap.com/viewer/product/SAP_DATA_HUB/) ↗
- SAP Data Hub 2.7 (<https://help.sap.com/viewer/e66c399612e84a83a8abe97c0ee-b443a/2.7.latest/en-US/79724de552db4b2b81c4a893f2c7ed18.html>) ↗

The minimum hardware requirements for installing SAP Data Hub 2 for on-premises production use are:

- 7 Kubernetes cluster nodes (three master nodes and four worker nodes)
 - All machines should have at least four CPU cores
 - The master nodes should have > 32 GiB RAM
 - The worker nodes should have > 64 GiB RAM
- Loadbalancer
- Management host

Environments for non-production use may run with one master, three workers, and a management node.



Note

Having only one master node is not recommended for production environments. For production use, three master nodes are recommended.

- Access to a SUSE Enterprise Storage 5 or SUSE Enterprise Storage 6 system (see SAP Note [Pre-requisites for installing SAP Data Hub \(https://launchpad.support.sap.com/#/notes/2686169\)](https://launchpad.support.sap.com/#/notes/2686169))

2.1.2 Management host

- Two cores
- 16 GiB RAM
- Diskspace:
 - 80 GiB for `/`, including the space for the SAP Data Hub 2 software
 - At least 100 GiB for `/var/lib/docker` (needed for the SAP Data Hub 2 installation)
- Network connectivity to the SUSE CaaS Platform cluster (1 GBit/s)

2.2 Software requirements

The following software is needed:

- SUSE CaaS Platform 4.0.3



Note

For SAP Data Hub, it is required to stay on SUSE CaaS Platform 4.0.0 - 4.0.3., because of the Kubernetes version delivered with our CaaSP product. SAP Data Hub 2 needs a Kubernetes version not higher than 1.15.

- SAP Data Hub 2.7.1 or higher
- SAP Hostagent
- Access to SAP Maintenance Planner
- Connection to a secure private Docker registry
- Optional Hadoop/Spark see Vora's Spark extensions

3 Installing SUSE CaaS Platform 4


3.1 Getting the installation media

All installation media can be found at: [SUSE CaaS Platform ISO images \(https://download.suse.com\)](https://download.suse.com) ↗

3.2 Getting a subscription for SUSE CaaS Platform 4

To be able to get all maintenance updates for your SUSE products, you need a valid subscription for the particular product: * [Order subscription for SUSE CaaS Platform \(https://www.suse.com/support/?id=SUSE_CaaS_Platform\)](https://www.suse.com/support/?id=SUSE_CaaS_Platform) ↗

3.3 Reading the deployment guide for SUSE CaaS Platform 4

SUSE CaaS Platform is designed to make the installation of Kubernetes easy. To get a deeper understanding, you should read the Deployment Guide for SUSE CaaS Platform 4, available at <https://www.suse.com/documentation/> . For further reference, there are also a Quickstart Guide and an Administrator's Guide.

3.4 Installing SUSE CaaS Platform 4

In this guide, we describe the installation of SUSE CaaS Platform 4 on top of SUSE Linux Enterprise 15 SP1 on your premises. We will use the SUSE Linux Enterprise 15 SP1 installer ISO image for starting the installation.

Make sure that the host names you will use for the installation are resolvable via DNS. It is preferred to have a static network setup.

You will need to the FQDN or IP address of your time server. A reliable system time is required. Connect the media to your hardware and boot from the media.

Select **Installation** from the GRUB menu.

3.4.1 Preparation

Install SUSE Linux Enterprise 15 SP1 or higher (as released for CaaS Platform 4.x) on all nodes. The following Modules/Products are required on the respective hosts:

- Management host
 - SUSE Linux Enterprise 15 SP1
 - SUSE Linux Enterprise 15 SP1 Containers Modules
 - SUSE Linux Enterprise 15 SP1 SP1 Public Cloud
 - SUSE CaaSP 4
- Kubernetes master nodes
 - SUSE Linux Enterprise 15 SP1
 - SUSE Linux Enterprise 15 SP1 Public Cloud
 - SUSE CaaSP 4

- Kubernetes worker nodes
 - SUSE Linux Enterprise 15 SP1
 - SUSE Linux Enterprise 15 SP1 Public Cloud
 - SUSE CaaSP 4
- Load balancer host
 - SUSE Linux Enterprise Server for SAP applications 15 SP1
or
 - SUSE Linux Enterprise 15 SP1 plus High Availability Extension

3.4.2 Installing the management node

- Install SUSE Linux Enterprise 15 SP1
- Add the following software repositories
 - Install software pattern "CaaSP management"
 - Install `python2` and `PyYaml - python2` (needed for installing DH2.7)
 - Install Docker (needed for installing DH2.7)

3.4.3 Installing the load balancer

This is only necessary if no other load-balancing device is available. In our setup, we describe the setup of a `haproxy` instance. `haproxy` is available in the SUSE Linux Enterprise High Availability Extension or in SUSE Linux Enterprise Server for SAP applications.

- Install SUSE Linux Enterprise 15 SP1
- Add the "SLE 15 SP1 HA" repository
(in case of SUSE Linux Enterprise Server for SAP applications, this is automatically added)
- Create the `haproxy` configuration
- Enable and start `haproxy`

3.4.4 Installing the master nodes

- Install SUSE Linux Enterprise 15 SP1
 - Set up static IP addresses
 - Use the "Expert Partitioner" to disable any swap partition
 - Disable `firewalld`
 - Enable `ssh`
- Add the necessary software repositories
 - `SUSEConnect -p caasp/4.0/x86_64`
 - `SUSEConnect -p ...`
- Create directory `/var/lib/docker/containers`

3.4.5 Installing the worker nodes

- Install SUSE Linux Enterprise 15 SP1
 - Set up static IP addresses
 - Use the "Expert Partitioner" to disable any swap partition
 - Disable `firewalld`
 - Enable `ssh`
- Add the necessary software repositories
 - `SUSEConnect -p caasp/4.0/x86_64`
 - `SUSEConnect -p ...`

3.4.6 Creating the Kubernetes Cluster on SUSE CaaS Platform 4

- Log in to the management host
 - Ensure that `ssh-agent` is working as expected

(for example, `ssh -A root@managementhost.example.com`)

- Initialize the Kubernetes cluster

```
skuba cluster init --control-plane <LB_IP/FQDN> my-cluster
```

- create the first master node to the Kubernetes cluster

```
cd my-cluster  
skuba node bootstrap --user sles --sudo --target <IP/FQDN> <NODE_NAME>
```

- Add additional master nodes

```
skuba node join --role master --user sles --sudo --target <IP/FQDN> <NODE_NAME>
```

- Add worker nodes to the Kubernetes cluster

```
skuba node join --role worker --user sles --sudo --target <IP/FQDN> <NODE_NAME>
```

- Verify your Kubernetes cluster

```
skuba cluster status
```

- Modifications needed to install SAP Data Hub 2 on CaaSP 4 cluster
 - Change the `pid` parameter in `/etc/crio/crio.conf` to 8192 (was 1024)
 - Edit `/etc/containers/registry.conf` to reflect your private registry

4 Installing SAP Data Hub 2

The following sections describe the preparation and installation of SAP Data Hub 2 on a SUSE CaaS Platform 4 cluster.

4.1 Preparing the SAP Data Hub 2 installation

The steps that are needed to successfully install SAP Data Hub on SUSE CaaS Platform are as follows:

4.1.1 Downloading the SAP Data Hub 2 software archive:

To download and install SAP Data Hub 2:

1. Go to the SAP Software Download Center, log in with your SAP account and search for "SAP DATA HUB 2".
2. Download the SAP Data Hub Foundation file, for example:

- [DHFOUNDATION07_3-80004015.ZIP](#) (SAP DATA HUB - FOUNDATION 2.7)

3. Unzip the software archive on to your management host.

There are three ways to install the SAP Data Hub 2:

- Use the SL Plugin. There are two variants of it:
 - SL Plugin with Maintenance Planner ([mpsl](#))
 - SL Plugin only ([mpfree](#))
- Use the command line [install.sh](#) script.

This document will focus on the Maintenance Planner and SL Plugin installation method.

4.1.2 Prerequisites on the SUSE CaaS Platform 4 cluster

The following steps are done on the jump host if not stated otherwise:

1. Create a new namespace in the Kubernetes cluster, into which to install SAP Data Hub 2:

```
$ kubectl create namespace datahub
```

2. Create the storage class to provide volumes for SAP Data Hub 2 on SUSE Enterprise Storage:
Make sure you have the connection data for your SUSE Enterprise Storage at hand:

- IP addresses and port number (defaults to 6789) of the monitor nodes of your SUSE Storage
- Create a data pool (datahub in this example) on your SUSE Enterprise Storage for the use with SAP Data Hub 2

3. Edit the example below to fit your environment.

```
$ cat > storageClass.yaml <<EOF
apiVersion: storage.kubernetes.io/v1
kind: StorageClass
metadata:
  annotations:
    storageclass.kubernetes.io/is-default-class: "true"
  name: datahub
  namespace: default
parameters:
  adminId: admin
  adminSecretName: ceph-admin-secret
  adminSecretNamespace: default
  imageFeatures: layering
  imageFormat: "2"
  monitors: <IP ADDRESS OF MONITOR 1>:6789, <IP ADDRESS OF MONITOR 2>:6789, <IP
ADDRESS OF MONITOR 3 >:6789
  pool: datahub
  userId: admin
  userSecretName: ceph-user-secret
provisioner: kubernetes.io/rbd
reclaimPolicy: Delete
volumeBindingMode: Immediate
EOF
```

```
$ kubectl create -f storageClass.yaml
```

4. Create the secrets needed to access the storage:

Obtain the keys from your SUSE Enterprise Storage cluster. They are located in `ceph.admin.keyring` and `ceph.user.keyring`.

You must encode the keys using `base64`:

```
echo <YOUR KEY HERE> | base64
```

```
$ cat > ceph-admin-secret.yaml <<EOF
apiVersion: v1
kind: Secret
metadata:
  name: ceph-admin-secret
type: "kubernetes.io/rbd"
data:
  key: <YOUR BASE64 ENCODED KEY HERE>
EOF
image::002-SCT-CaaS.png
$ cat > ceph-user-secret.yaml <<EOF
apiVersion: v1
kind: Secret
metadata:
  name: ceph-user-secret
type: "kubernetes.io/rbd"
data:
  key: <YOUR BASE64 ENCODED KEY HERE>
EOF

$ kubectl create -f ceph-admin-secret.yaml
$ kubectl create -f ceph-user-secret.yaml
```

4.2 Installing SAP Data Hub 2 using the Maintenance Planner with SL Plugin

SAP recommends the "SAP Maintenance Planner with SL Plugin" ([mps1](#)) installation method as the best approach to install SAP Data Hub 2.

SAP recommends this Web-based installation method because it offers the option to send analytic data and feedback to SAP. All the necessary prerequisites have been satisfied by applying all the steps described above.



Note

You need to install the latest SAP Host Agent on the management host. Use the rpm package downloadable from the SAP Software Download center.

- Install SAP Host Agent on management host

- Download the rpm package from the SAP Software Download Center
- Install SAP Host Agent

```
zypper in path to rpm
```

- Start SAP Host Agent

```
/etc/init.d/sapinit start
```

- Configure SAP Host Agent to be used with SAP Maintenance Planner
 - Create certificates according to the documentation provided by SAP
 - Enable CORS webservice in SAP Host Agent
- Navigate to apps.sap.com/mp with your browser
 - Create new plan
 - Select "container based system"
 - Connect to your SAP Host Agent running on the management host
 - Follow the steps given by the wizard
 - Fill in values for the installer as needed.
 - Wait for successful deployment

4.3 Installing SAP Data Hub 2 using the SL Plugin (mpfree method)


This is an alternative command line-based installation method. Refer to the SAP Data Hub documentation (2.7) for more information and the exact procedure.

4.4 Installing SAP Data Hub 2 using the command line (manual installation)

Unpack the SAP Data Hub software archive on the jump host — for example:

```
$ unzip DHFOUNDATION07_3-80004015.ZIP
```

Run the installation command as described in the SAP Data Hub 2 install guide at

- <https://help.sap.com/viewer/e66c399612e84a83a8abe97c0eeb443a/2.7.latest/en-US>  [Installation of SAP Data Hub 2]

```
$ cd SAP-Datahub-2.7.155-Foundation
$ export DOCKER_REGISTRY=<URI of your registry>
$ export NAMESPACE=<YOUR NAME SPACE HERE>
// $ ./install.sh --enable-kaniko=yes --docker-log-path='/var/log/containers' -e vora-
vsystem.vRep.nfsv4MinorVersion=1 -e vora-diagnostic.fluentd.logDriverFormat=regex
$ ./install.sh --enable-kaniko=yes --docker-log-path='/var/log/containers' -e vora-
diagnostic.fluentd.logDriverFormat=regex
```

This interactive script configures the installation of SAP Data Hub 2. You should have the following information at hand:

- Name and credentials of your SAP S-User
- Login credentials to your secure registry

4.5 Post-installation actions

After successful installation, you can connect to the SAP Data Hub web UI. You need to identify the service IP and port of the SAP Data Hub UI.

```
kubectl -n $NAMESPACE get services
kubectl -n $NAMESPACE describe service vsystem
```

Point your browser to the IP and port you obtained from the steps above.

Use the login data you defined during the installation.

4.5.1 Post-installation work

Follow the documentation provided by SAP at

- <https://help.sap.com/viewer/e66c399612e84a83a8abe97c0eeb443a/2.7.latest/en-US/4c472c40595b450283a6ce039f71cfc6.html> 

to the post-installation work.

- Create the `vflow-secret` for the modeler app, as pointed out in the SAP documentation.
- Import any necessary certificate authority, for example the CA that signed the certificate of the secure registry.

5 Upgrading SAP Data Hub 2

This section describes the update of an existing SAP Data Hub 2 installation to a higher version (for example 2.3 to 2.4).

Execute the SAP Data Hub upgrade as described in the official instructions. One can choose between different upgrade methods:

- **Maintenance Planner:**

Upgrade SAP Data Hub 2 using the Maintenance Planner / SL Plugin and SAP Host Agent (<https://help.sap.com/viewer/e66c399612e84a83a8abe97c0eeb443a/2.6.latest/en-US/31079833a65f4f379d5a76957ff8073c.html>) 

- **SL Plugin method:**

Upgrade SAP Data Hub 2 using the SL Plugin and SAP Host Agent (<https://help.sap.com/viewer/e66c399612e84a83a8abe97c0eeb443a/2.6.latest/en-US/ff37f3ccf6504bb38d7db53936fe8017.html>) 

- **Command line method:**

Upgrade SAP Data Hub 2 using the `install.sh` script (<https://help.sap.com/viewer/e66c399612e84a83a8abe97c0eeb443a/2.6.latest/en-US/aec679bc0209443ba4ae03a9018d4bd8.html>) 

6 Appendix

6.1 Secure Private Registry

To satisfy the requirements of SAP Data Hub requirements, you also need a Docker Registry. The easiest way to build and manage one is with the [Portus project \(http://port.us.org/\)](http://port.us.org/).

- [Portus \(http://port.us.org/\)](http://port.us.org/)

First, you need to create a dedicated server for your Docker Registry and Portus stack.

```
# sudo virt-install --name portus-dr --ram 8192 --disk path=/var/lib/libvirt/VMS/portus-dr.qcow2,size=40 --vcpus 4 --os-type linux --os-variant generic --network bridge=common --graphics none --console pty,target_type=serial --location '/var/lib/libvirt/isos/SLE-12-SP4-Server-DVD-x86_64-GM-DVD1.iso' --extra-args 'console=ttyS0,115200n8 serial ifcfg=eth0=10.10.10.11/24,10.10.10.1,10.10.10.11,suse-sap.net hostname=portus-dr domain=suse-sap.net Textmode=1'
```

In our example, this server will be connected to another local bridge which provides common services (DNS, SMT, Docker-registry) for the Data Hub stack.

Our Portus deployment will be based on a container, and orchestrated locally with docker-compose.



Note

Portus deployments using docker-compose require an up-to-date release of the docker-compose tool.

```
sudo curl -L "https://github.com/docker/compose/releases/download/1.24.1/docker-compose-$(uname -s)-$(uname -m)" -o /usr/local/bin/docker-compose
sudo chmod +x /usr/local/bin/docker-compose
sudo ln -s /usr/local/bin/docker-compose /usr/bin/docker-compose
```

Now you can simply clone the Portus repository. Adapt the .env and the nginx configuration to your naming convention.

```
# git clone https://github.com/SUSE/Portus.git /tmp/Portus-DR
# mv /tmp/Portus-DR/examples/compose ./portus
# cd portus
```

Now you can edit both `.env` and `nginx/nginx.conf`. This is how our configuration looks:

```
# cat .env
MACHINE_FQDN=portus-dr.suse-sap.net
SECRET_KEY_BASE=b494a25faa8d22e430e843e220e424e10ac84d2ce0e64231f5b636d21251eb6d267adb042ad5884cbff0f38
PORTUS_PASSWORD=XXXXXXXXX
DATABASE_PASSWORD=YYYYYYYYY
```

In the `nginx/nginx.conf` file, you should adapt the following section :

```
server {
    listen 443 ssl http2;
    server_name portus-dr.suse-sap.net;
    root /srv/Portus/public;
```

Pull the latest `docker-compose.yml`:

```
# rm docker-compose.*
# wget https://gist.githubusercontent.com/Patazerty/d05652294d5874eddf192c9b633751ee/
raw/6bf4ac6ba14192a1fe5c337494ab213200dd076e/docker-compose.yml
```

To avoid dealing with Docker's insecure registry configuration, add SSL to your setup.

```
echo "subjectAltName = DNS:portus-dr.suse-sap.net" > extfile.cnf
openssl genrsa -out secrets/rootca.key 2048
openssl req -x509 -new -nodes -key secrets/rootca.key -subj "/C=FR/ST=FR/O=SUSE" -sha256
-days 1024 -out secrets/rootca.crt
openssl genrsa -out secrets/portus.key 2048
openssl req -new -key secrets/portus.key -out secrets/portus.csr -subj "/C=FR/ST=FR/
O=SUSE/CN
openssl req -new -key secrets/portus.key -out secrets/portus.csr -subj "/C=FR/ST=FR/
O=SUSE/CN=portus-dr.suse-sap.net"
openssl x509 -req -in secrets/portus.csr -CA secrets/rootca.crt -extfile extfile.cnf -
CAkey secrets/rootca.key -CAcreateserial -out secrets/portus.crt -days 500 -sha256
```

Next, all you need to do is to make the servers aware of this certificate:

```
cp -p secrets/rootca.crt /etc/pki/trust/anchors/.net-ca.crt
scp secrets/rootca.crt root@jumpbox.suse-sap.net:/etc/pki/trust/anchors/portus-dr.suse-
sap.net-ca.crt
```

Then, on all servers that need to interact with the `docker-registry`, do the following:

```
sudo update-ca-certificates
sudo systemctl restart docker
```

Start your Portus setup:

```
docker-compose up -d
```

Finally, you can log in to Portus and set the registry:

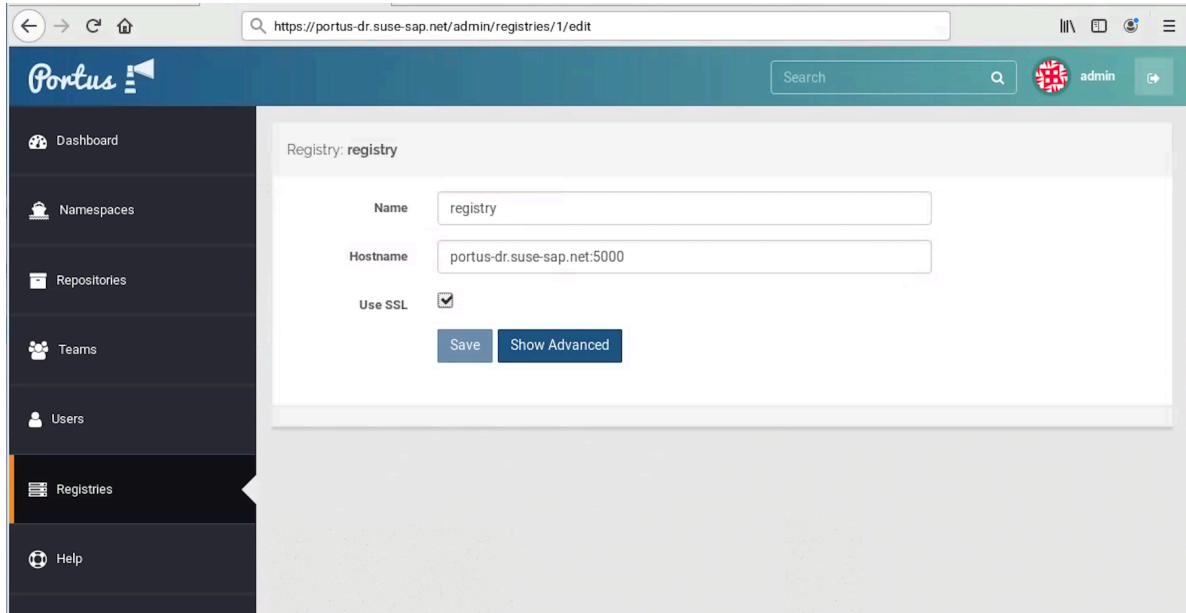


FIGURE 1: SETTING THE REGISTRY IN PORTUS

6.2 Installing and configuring a secure private registry using SUSE Linux Enterprise Server and the SLE-Container-Module

The needed components are Docker, a registry, and Portus. Create SSL certificates as needed. Distribute the CA certificates to all your Kubernetes nodes.

Run:


```
# update-ca-certificates
# systemctl restart docker
```

Create the namespaces on your registry that are needed for SAP Data Hub 2:

- com.sap.hana.container
- com.sap.datahub.linuxx86_64
- com.sap.datahub.linuxx86_64.gcc6


- consul
- elasticsearch
- fabric8
- google_containers
- grafana
- kibana
- prom
- vora
- kaniko-project
- com.sap.bds.docker

6.3 SUSE Enterprise Storage

An on-premises installation of SAP Data Hub 2 requires SUSE Enterprise Storage 5 or higher. If you plan to use SUSE Enterprise Storage not only for your Kubernetes dynamic storage class, but also for your Kubernetes Control plan (virtualized or not), you should reserve enough resources to address the [etcd hardware requirements \(https://github.com/etcd-io/etcd/blob/master/Documentation/op-guide/hardware.md.\)](https://github.com/etcd-io/etcd/blob/master/Documentation/op-guide/hardware.md) 

The following steps will deploy a minimalist, virtualized, test-oriented instance of SUSE Enterprise Storage 5.5. In our example, we will build a four-nodes (1 Admin + 3 OSD) Ceph cluster.

Before you start:

- Obtain registration codes for SUSE Linux Enterprise Server 15 SP1 and SUSE Enterprise Storage from <https://scc.suse.com> , or have a SMT/RMT properly set up and already mirroring these products:

- SCC (<https://scc.suse.com>) 

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Available Architectures

Release schedule

aarch64

ppc64le

s390x

x86_64

beta

Dec 14 2018

released

Jun 21 2019

Type

Product Class

Requires Regcode

EULA

Description

Still supported?

Trial product code

Download information

Installation media

Base

Module

Extension

7261

Yes

https://updates.suse.com/SUSE/Products/SLE-Product-SLES/15-SP1/x86_64/product.license/

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Yes

No trial offered

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Extensions

SUSE CaaS Platform 4.0

SUSE Enterprise Storage 6

SUSE Linux Enterprise High Availability Extension 15 SP1

SUSE Linux Enterprise Live Patching 15 SP1

SUSE Linux Enterprise Server LTSS 15 SP1

SUSE Linux Enterprise Workstation Extension 15 SP1

SUSE Package Hub 15 SP1

Modules

Basesystem Module 15 SP1 **recommended**

Containers Module 15 SP1

Desktop Applications Module 15 SP1 **added in migration**

Development Tools Module 15 SP1 **added in migration**

Legacy Module 15 SP1 **added in migration**

Public Cloud Module 15 SP1

Python 2 Module 15 SP1 **added in migration**

SUSE Cloud Application Platform Tools Module 15 SP1

Server Applications Module 15 SP1 **recommended**

Transactional Server Module 15 SP1

Web and Scripting Module 15 SP1 **added in migration**

Migratable from

openSUSE Leap 15.1 **online**

SUSE Linux Enterprise Server 15 **online**

FIGURE 2: SUSE CUSTOMER CENTER: OVERVIEW SLE

The screenshot displays the SUSE Customer Center interface. The top navigation bar includes the SUSE logo, a hamburger menu, and links for 'suse.com', 'Help', 'English', and a user profile icon. The left sidebar contains 'INTERNAL TOOLS' with a 'Products' link, 'MY ORGANIZATIONS (2)' with a search icon and two user icons, and 'MY TOOLS' with links for 'Support', 'Activate subscriptions', 'Packages', 'Patches', and 'Container Images'. The main content area is titled 'Products > SUSE Linux Enterprise Server 15 SP1 x86_64' with a 'released' status badge. The product details include:

- Available Architectures:** aarch64, ppc64le, s390x, x86_64 (selected).
- Release schedule:** beta (released), Dec 14 2018, Jun 21 2019.
- Type:** Base | Module | Extension.
- Product Class:** 7261.
- Requires Regcode:** Yes.
- EULA:** https://updates.suse.com/SUSE/Products/SLE-Product-SLES/15-SP1/x86_64/product.license/
- Description:** SUSE Linux Enterprise offers a comprehensive suite of products built on a single code base. The platform addresses business needs from the smallest thin-client devices to the world's most powerful high-performance computing and mainframe servers. SUSE Linux Enterprise offers common management tools and technology certifications across the platform, and each product is enterprise-class. [Show technical details](#)
- Still supported?** Yes.
- Trial product code:** No trial offered.
- Download information:** [Show download information](#)
- Installation media:** [Show installation media](#)
- Extensions:** SUSE CaaS Platform 4.0, SUSE Enterprise Storage 6, SUSE Linux Enterprise High Availability Extension 15 SP1, SUSE Linux Enterprise Live Patching 15 SP1, SUSE Linux Enterprise Server LTSS 15 SP1, SUSE Linux Enterprise Workstation Extension 15 SP1, SUSE Package Hub 15 SP1.
- Modules:** Basesystem Module 15 SP1 (recommended), Containers Module 15 SP1, Desktop Applications Module 15 SP1 (added in migration), Development Tools Module 15 SP1 (added in migration), Legacy Module 15 SP1 (added in migration), Public Cloud Module 15 SP1, Python 2 Module 15 SP1 (added in migration), SUSE Cloud Application Platform Tools Module 15 SP1, Server Applications Module 15 SP1 (recommended), Transactional Server Module 15 SP1, Web and Scripting Module 15 SP1 (added in migration).
- Migratable from:** openSUSE Leap 15.1 (online), SUSE Linux Enterprise Server 15 (online).

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FIGURE 3: SUSE CUSTOMER CENTER: SMT

- You should already have set up a DNS zone. In our example, where all Data Hub components are in the same DNS zone and the same subnet, it should look like:

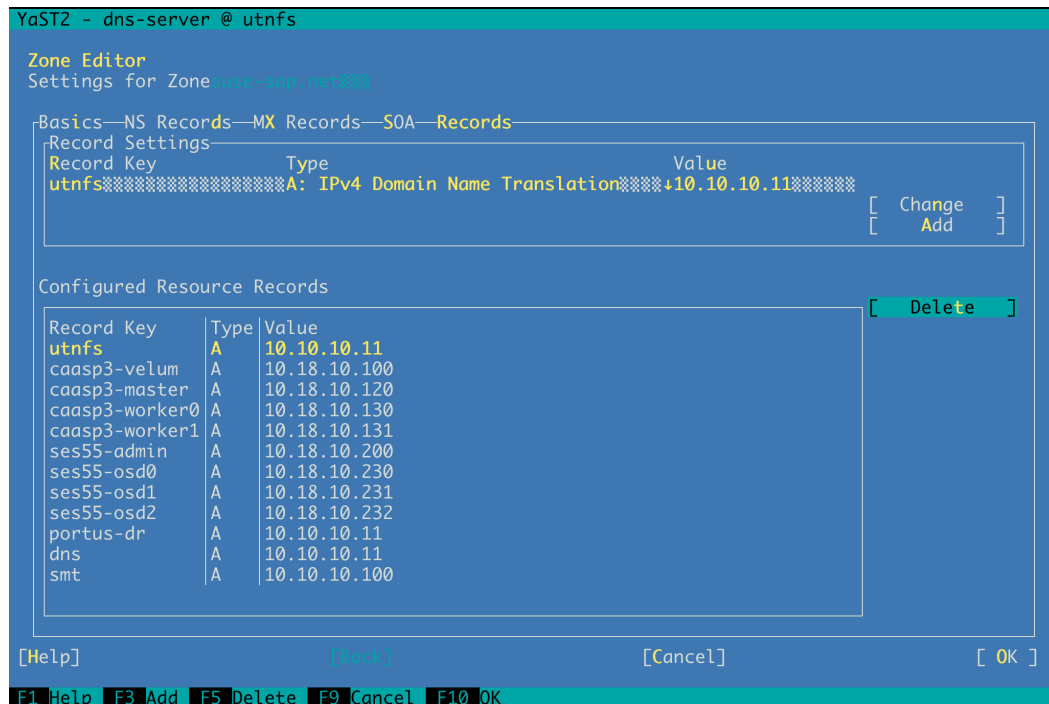


FIGURE 4: DNS ZONE

- To be as efficient as possible when using interactive shell-scripted infrastructure deployment, we advise to use an advanced terminal client or multiplexer which permits to address multiple shells at once.



FIGURE 5: MULTIPLE SHELLS VIEW

Now you can create the virtual machines.

- Create
- first the Admin Node:

```
# sudo virt-install --name ses55-admin --ram 16384 --disk bus=virtio,path=/
var/lib/libvirt/VMS/ses55-admin.qcow2,size=40 --disk bus=virtio,path=/
var/lib/libvirt/VMS/ses55-admin-osd0.qcow2,size=20 --disk bus=virtio,path=/
var/lib/libvirt/VMS/ses55-admin-osd1.qcow2,size=20 --disk bus=virtio,path=/
var/lib/libvirt/VMS/ses55-admin-osd2.qcow2,size=20 --disk bus=virtio,path=/
var/lib/libvirt/VMS/ses55-admin-osd3.qcow2,size=20 --vcpus 4 --
os-type linux --os-variant generic --network bridge=caasp3 --
graphics none --console pty,target_type=serial --location '/var/lib/
libvirt/ISOS/SLE-12-SP3-Server-DVD-x86_64-GM-DVD1.iso' --extra-args
'console=ttyS0,115200n8 serial autoyast-ses5=http://10.10.10.101/autoyast-ses5
ifcfg=eth0=10.18.10.200/24,10.18.10.1,10.10.10.11,suse-sap.net domain=suse-
sap.net Textmode=1'
```

- then the OSD Nodes:

```
# sudo virt-install --name ses55-osd0 --ram 16384 --disk bus=virtio,path=/
var/lib/libvirt/VMS/ses55-osd0.qcow2,size=40 --disk bus=virtio,path=/var/
lib/libvirt/VMS/ses55-osd0-osd0.qcow2,size=20 --disk bus=virtio,path=/
var/lib/libvirt/VMS/ses55-osd0-osd1.qcow2,size=20 --disk bus=virtio,path=/
var/lib/libvirt/VMS/ses55-osd0-osd2.qcow2,size=20 --disk bus=virtio,path=/
var/lib/libvirt/VMS/ses55-osd0-osd3.qcow2,size=20 --vcpus 4 --os-
type linux --os-variant generic --network bridge=caasp3 --graphics
none --console pty,target_type=serial --location '/var/lib/
```



```

libvirt/ISOS/SLE-12-SP3-Server-DVD-x86_64-GM-DVD1.iso' --extra-args
'console=ttyS0,115200n8 serial autoyast-ses5=http://10.10.10.101/autoyast-ses5
ifcfg=eth0=10.18.10.230/24,10.18.10.1,10.10.10.11,suse-sap.net domain=suse-
sap.net Textmode=1'

# sudo virt-install --name ses55-osd1 --ram 16384 --disk bus=virtio,path=/
var/lib/libvirt/VMS/ses55-osd1.qcow2,size=40 --disk bus=virtio,path=/var/
lib/libvirt/VMS/ses55-osd1-osd0.qcow2,size=20 --disk bus=virtio,path=/
var/lib/libvirt/VMS/ses55-osd1-osd1.qcow2,size=20 --disk bus=virtio,path=/
var/lib/libvirt/VMS/ses55-osd1-osd2.qcow2,size=20 --disk bus=virtio,path=/
var/lib/libvirt/VMS/ses55-osd1-osd3.qcow2,size=20 --vcpus 4 --os-
type linux --os-variant generic --network bridge=caasp3 --graphics
none --console pty,target_type=serial --location '/var/lib/
libvirt/ISOS/SLE-12-SP3-Server-DVD-x86_64-GM-DVD1.iso' --extra-args
'console=ttyS0,115200n8 serial autoyast-ses5=http://10.10.10.101/autoyast-ses5
ifcfg=eth0=10.18.10.231/24,10.18.10.1,10.10.10.11,suse-sap.net domain=suse-
sap.net Textmode=1'

# sudo virt-install --name ses55-osd2 --ram 16384 --disk bus=virtio,path=/
var/lib/libvirt/VMS/ses55-osd2.qcow2,size=40 --disk bus=virtio,path=/var/
lib/libvirt/VMS/ses55-osd2-osd0.qcow2,size=20 --disk bus=virtio,path=/
var/lib/libvirt/VMS/ses55-osd2-osd1.qcow2,size=20 --disk bus=virtio,path=/
var/lib/libvirt/VMS/ses55-osd2-osd2.qcow2,size=20 --disk bus=virtio,path=/
var/lib/libvirt/VMS/ses55-osd2-osd3.qcow2,size=20 --vcpus 4 --os-
type linux --os-variant generic --network bridge=caasp3 --graphics
none --console pty,target_type=serial --location '/var/lib/
libvirt/ISOS/SLE-12-SP3-Server-DVD-x86_64-GM-DVD1.iso' --extra-args
'console=ttyS0,115200n8 serial autoyast-ses5=http://10.10.10.101/autoyast-ses5
ifcfg=eth0=10.18.10.232/24,10.18.10.1,10.10.10.11,suse-sap.net domain=suse-
sap.net Textmode=1'

```

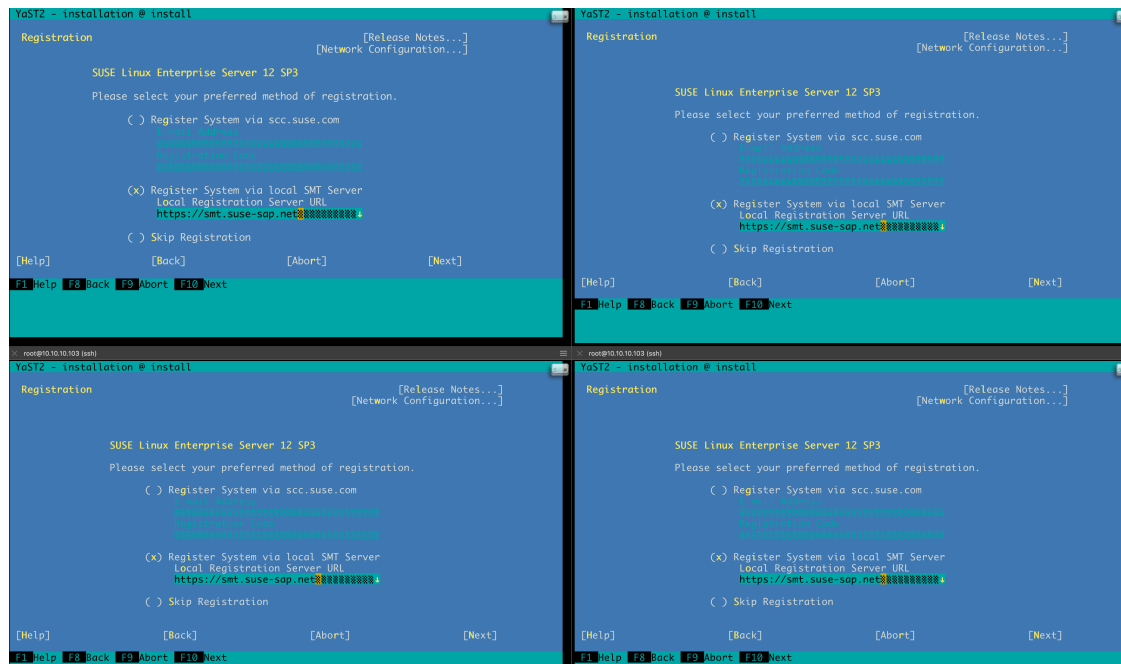


FIGURE 6: MULTIPLE NODES ON SMT VIEW

- Select the SUSE Enterprise Storage 5 extension:

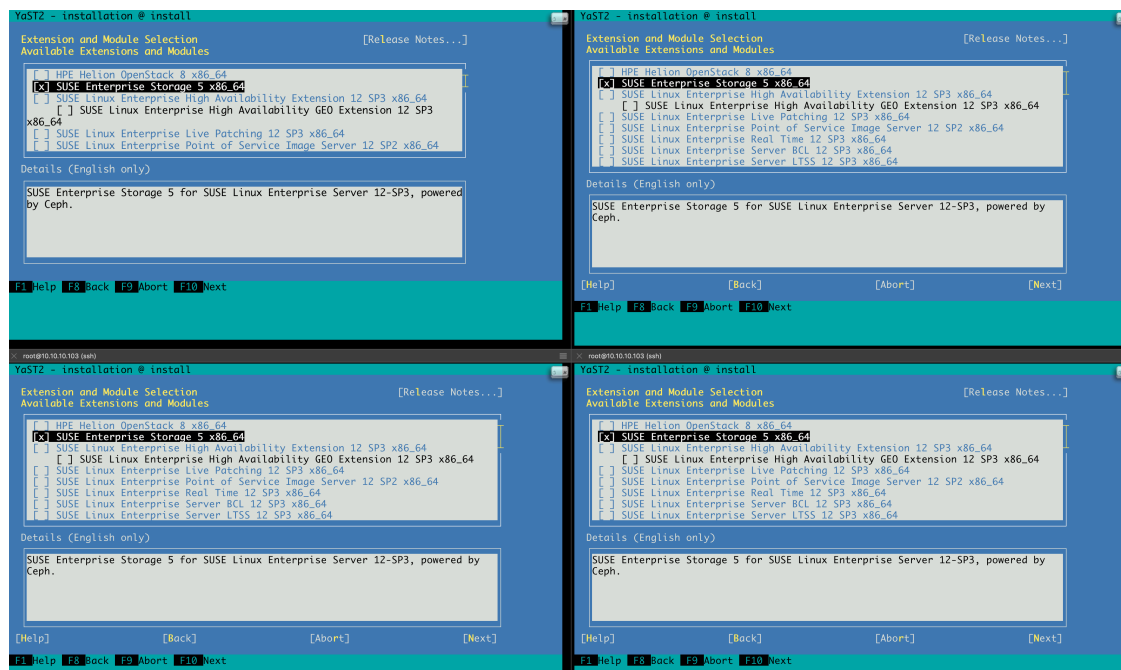


FIGURE 7: SELECTING SES EXTENSIONS ON ALL NODES

- On the hypervisor you should also be able to route or bridge your upcoming SUSE Enterprise Storage 5.5 network segment. Either a traditional bridge using `brctl`, or a `virtual-bridge` will work. In our example, for simplicity, we're using the same bridge and network address than our CaaS cluster: `--network bridge=caasp3`
- In our example below, each node is powered by 16GB of RAM, 4 VCPU, 40 GB for the root disk, 4 x 20GB OSDB disk.

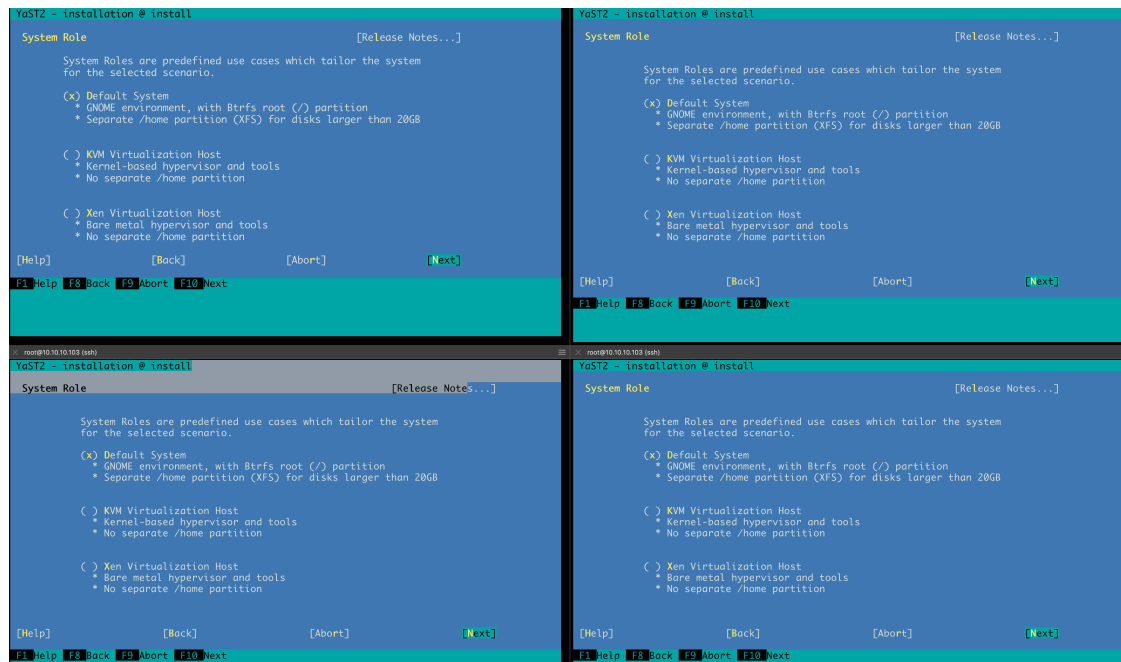


FIGURE 8: SELECTING SYSTEM ROLE ON ALL NODES

- NTP must be configured on each nodes:

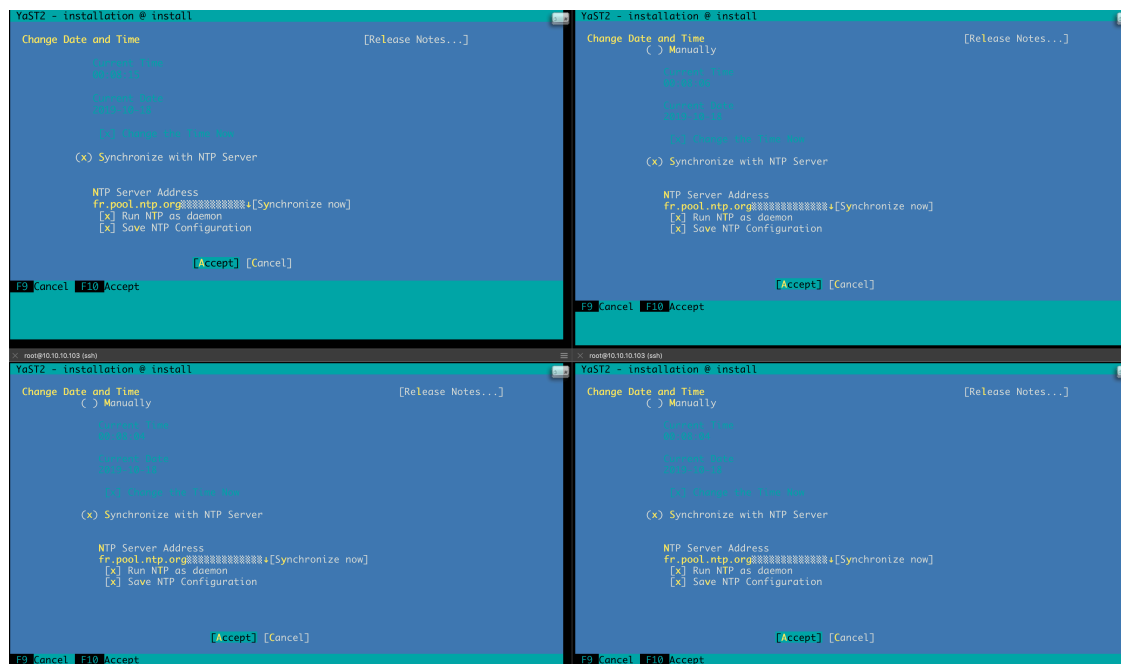


FIGURE 9: CONFIGURING NTP ON ALL NODES

- Deselect "AppArmor" and the unnecessary "X" and "Gnome" Patterns, but select the SUSE Enterprise Storage pattern:

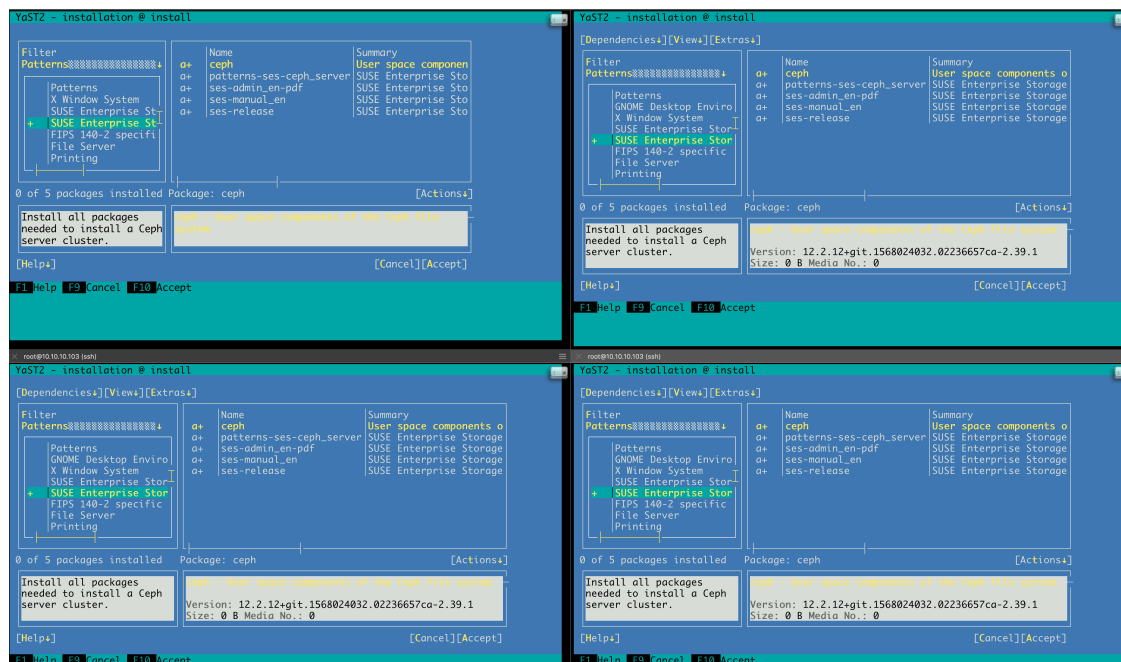


FIGURE 10: SELECTING PATTERNS ON ALL NODES

- De-activate the Firewall on the nodes.
- Start the Installation on all nodes:

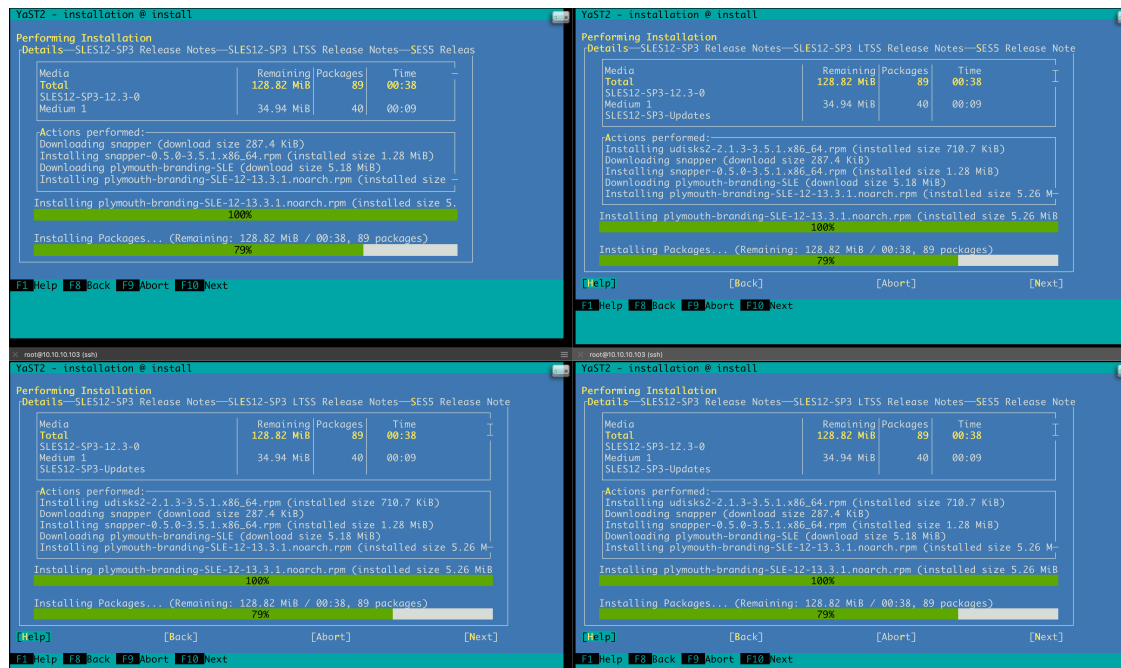


FIGURE 11: STARTING INSTALLATION ON ALL NODES

- When all nodes have rebooted, log in and finish the network/host name and NTP configurations so that `hostname -f` returns the FQDN of the nodes and `ntpq -p` returns a stratum less than 16:

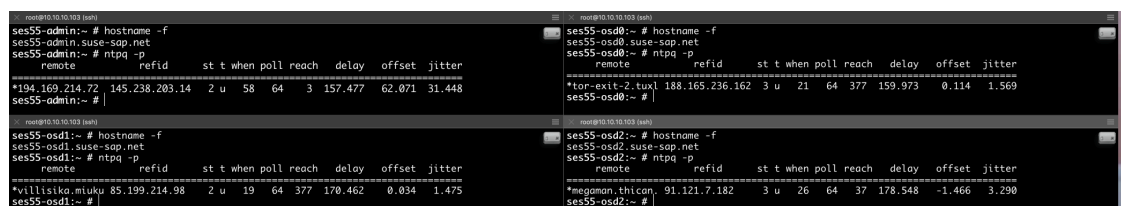


FIGURE 12: FINISHING NTP CONFIGURATION

- Using `ssh-keygen` then `ssh-copy-id`, spread your SUSE Enterprise Storage Admin Node `ssh` public key to all other nodes.
- Verify that the drives you will allocate for SUSE Enterprise Storage OSDs are clean by wiping them.
- On all nodes, including the Admin Node, install `salt-minion`.

- On the Admin Node only, also install salt-master (in our example ses55-admin.suse-sap.net) and deepsea.
- Then, restart salt-minion on all nodes and restart salt-master on the Admin Node:

```

root@10.10.10.103 (ssh)
Refreshing service 'SUSE_Enterprise_Storage_5_x86_64'.
Refreshing service 'SUSE_Linux_Enterprise_Server_12_SP3_x86_64'.
Loading repository data...
Reading installed packages...
Forcing installation of 'salt-master-2016.11.4-48.7.1.x86_64' from repository 'SUSE-Enterprise-Storage-5-Updates'.
Resolving package dependencies...

The following package is going to be reinstalled:
  salt-master

1 package to reinstall.
Overall download size: 1.7 MiB. Already cached: 0 B. No additional space will be
used or freed after the operation.
Continue? [y/n/...? shows all options] (y): y
Retrieving package salt-master-2016.11.4-48.7.1.x86_64
Retrieving: salt-master-2016.11.4-48.7.1.x86_64.rpm .....[done]
Checking for file conflicts: .....[done]
(1/1) Installing: salt-master-2016.11.4-48.7.1.x86_64 .....[done]
ses55-admin:~/SES-scripts # systemctl restart salt-minion.service
ses55-admin:~/SES-scripts # systemctl restart salt-master.service
ses55-admin:~/SES-scripts #

ses55-osd1:~ # systemctl restart salt-minion.service
ses55-osd1:~ #

ses55-osd2:~ # systemctl restart salt-minion.service
ses55-osd2:~ #

```

FIGURE 13: INSTALLING SALT ON ALL NODES

- Accept the related pending Salt keys:

```

Admin:~ # salt-key -L
Accepted Keys:
admin.example.com
mon1.example.com
mon2.example.com
mon3.example.com
Denied Keys:
Unaccepted Keys:
Rejected Keys:

```

FIGURE 14: ACCEPTING SALT KEYS

- Verify that /srv/pillar/ceph/master_minion.sls points to your Admin Node. In our example, it contains our salt-master FQDN :
master_minion: ses55-admin.suse-sap.net
- Prepare the cluster:

```
# salt-run state.orch ceph.stage.0
```

```

Parsing orchestration ceph.stage.prep steps... []
Parsing ceph.stage.prep steps... ✓

[1/17]  ceph.salt.crc.master on
        admin.example.com..... ✓ (0.5s)
[2/17]  ceph.sync on
        admin.example.com..... ✓ (0.8s)
[3/17]  ceph.salt-api on
        admin.example.com..... ✓ (18s)
[4/17]  ceph.repo on
        admin.example.com..... ✓ (0.3s)
[5/17]  ceph.metapackage on
        admin.example.com..... ✓ (0.5s)
[6/17]  ceph.updates on
        admin.example.com..... ✓ (10s)
[7/17]  filequeue.remove(item=lock)..... ✓ (0.0s)
[8/17]  filequeue.enqueue(item=complete)..... ✓ (0.0s)
[9/17]  minions.ready(timeout=300)..... ✓ (0.3s)
[10/17] ceph.salt.crc.minion on
        admin.example.com..... ✓ (1s)
        mon1.example.com..... ✓ (1s)
        mon3.example.com..... ✓ (1s)
        mon2.example.com..... ✓ (2s)
[11/17] ceph.apparmor on
        admin.example.com..... ✓ (14s)
        mon1.example.com..... ✓ (12s)
        mon3.example.com..... ✓ (13s)
        mon2.example.com..... ✓ (13s)
[12/17] ceph.repo on
        admin.example.com..... ✓ (0.4s)
        mon1.example.com..... ✓ (0.5s)
        mon3.example.com..... ✓ (0.4s)
        mon2.example.com..... ✓ (0.4s)
[13/17] ceph.metapackage on
        admin.example.com..... ✓ (0.5s)
        mon1.example.com..... ✓ (0.6s)
        mon3.example.com..... ✓ (0.6s)
        mon2.example.com..... ✓ (0.6s)
[14/17] ceph.packages.common on
        admin.example.com..... ✓ (28s)
        mon1.example.com..... ✓ (65s)
        mon3.example.com..... ✓ (69s)
        mon2.example.com..... ✓ (69s)
[15/17] ceph.sync on
        admin.example.com..... ✓ (2s)
        mon1.example.com..... ✓ (3s)
        mon3.example.com..... ✓ (2s)
        mon2.example.com..... ✓ (2s)
[16/17] ceph.mines on
        admin.example.com..... ✓ (0.7s)
        mon1.example.com..... ✓ (0.8s)
        mon3.example.com..... ✓ (0.8s)
        mon2.example.com..... ✓ (0.7s)
[17/17] ceph.updates on
        admin.example.com..... ✓ (10s)
        mon1.example.com..... ✓ (13s)
        mon3.example.com..... ✓ (13s)
        mon2.example.com..... ✓ (13s)

Ended stage: ceph.stage.prep succeeded=17/17 time=199.7s

```

- Collect information about the nodes:

```
# salt-run state.orch ceph.stage.1
```

```
Parsing orchestration ceph.stage.discovery steps... []
Parsing ceph.stage.discovery steps... ✓

[1/3] minions.ready(timeout=300)..... ✓ (0.4s)
[2/3] ceph.refresh on
      admin.example.com..... ✓ (0.5s)
[3/3] populate.proposals..... ✓ (5s)
Ended stage: ceph.stage.discovery succeeded=3/3 time=12.7s
```

- Adapt the file `/srv/pillar/ceph/proposals/policy.cfg` to your needs. In our example, where the only deployed service is OpenAttic, it contains the following :

```
cluster-ceph/cluster/ses55-osd2.suse-sap.net.sls
config/stack/default/ceph/cluster.yml
config/stack/default/global.yml
profile-default/cluster/ses55-admin.suse-sap.net.sls
profile-default/cluster/ses55-osd0.suse-sap.net.sls
profile-default/cluster/ses55-osd1.suse-sap.net.sls
profile-default/cluster/ses55-osd2.suse-sap.net.sls
profile-default/stack/default/ceph/minions/ses55-admin.suse-sap.net.yml
profile-default/stack/default/ceph/minions/ses55-osd0.suse-sap.net.yml
profile-default/stack/default/ceph/minions/ses55-osd1.suse-sap.net.yml
profile-default/stack/default/ceph/minions/ses55-osd2.suse-sap.net.yml
role-admin/cluster/ses55-admin.suse-sap.net.sls
role-admin/cluster/ses55-osd0.suse-sap.net.sls
role-admin/cluster/ses55-osd1.suse-sap.net.sls
role-admin/cluster/ses55-osd2.suse-sap.net.sls
role-master/cluster/ses55-admin.suse-sap.net.sls
role-mgr/cluster/ses55-osd0.suse-sap.net.sls
role-mgr/cluster/ses55-osd1.suse-sap.net.sls
role-mgr/cluster/ses55-osd2.suse-sap.net.sls
role-mon/cluster/ses55-osd0.suse-sap.net.sls
role-mon/cluster/ses55-osd1.suse-sap.net.sls
role-mon/cluster/ses55-osd2.suse-sap.net.sls
role-openattic/cluster/ses55-admin.suse-sap.net.sls
```

- Prepare the final state of configuration files set:

```
# salt-run state.orch ceph.stage.2
```



```

Parsing orchestration ceph.stage.configure steps... 
Parsing ceph.stage.configure steps... ✓

Stage initialization output:
deepsea_minions      : valid
yaml_syntax           : valid

[1/15]  push.proposal..... ✓ (0.0s)
[2/15]  ceph.refresh on
        mon1.example.com..... ✓ (2s)
        admin.example.com..... ✓ (1s)
        mon2.example.com..... ✓ (1s)
        mon3.example.com..... ✓ (2s)
[3/15]  advise.networks..... ✓ (0.6s)
[4/15]  ceph.packages on
        mon1.example.com..... ✓ (53s)
        admin.example.com..... ✓ (34s)
        mon2.example.com..... ✓ (58s)
        mon3.example.com..... ✓ (57s)
[5/15]  ceph.admin.key on
        admin.example.com..... ✓ (0.6s)
[6/15]  ceph.osd.key on
        admin.example.com..... ✓ (0.4s)
[7/15]  ceph.mon.key on
        admin.example.com..... ✓ (0.4s)
[8/15]  ceph.mgr.key on
        admin.example.com..... ✓ (2s)
[9/15]  ceph.igw.key on
        admin.example.com..... ✓ (0.9s)
[10/15] ceph.mds.key on
        admin.example.com..... ✓ (0.8s)
[11/15] ceph.rgw.key on
        admin.example.com..... ✓ (2s)
[12/15] ceph.ganesha.key on
        admin.example.com..... ✓ (0.8s)
[13/15] ceph.monitoring.prometheus.exporters.node_exporter on
        mon1.example.com..... ✓ (68s)
        admin.example.com..... ✓ (41s)
        mon2.example.com..... ✓ (69s)
        mon3.example.com..... ✓ (64s)
[14/15] ceph.ssl on
        admin.example.com..... ✓ (0.7s)
[15/15] ceph.ssl.distribute_ca on
        admin.example.com..... ✓ (1s)

Ended stage: ceph.stage.configure succeeded=15/15 time=146.0s

```

FIGURE 16: PREPARING CONFIGURATION FILES

- You can now safely deploy your configuration:

```
# salt-run state.orch ceph.stage.3
```

```

Parsing orchestration ceph.stage.deploy steps... []
Parsing ceph.stage.deploy steps... ✓

Stage initialization output:
firewall           : not installed
apparmor           : disabled
fsid               : valid
public_network     : valid
public_interface   : valid
cluster_network    : valid
cluster_interface  : valid
ip_version         : valid
monitors           : valid
subvolume          : valid
mgrs               : valid
storage            : valid
storage_role       : valid
rgw                : valid
ganesha            : valid
master_role        : valid
time_server        : valid
fqdn               : valid

[1/51]  ceph.time on
mon3.example.com..... ✓ (43s)
admin.example.com..... ✓ (0.5s)
mon2.example.com..... ✓ (47s)
mon1.example.com..... ✓ (47s)

[2/51]  ceph.configuration.check on
admin.example.com..... ✓ (0.3s)

[3/51]  ceph.configuration.create on
admin.example.com..... ✓ (5s)

[4/51]  ceph.configuration on
mon3.example.com..... ✓ (0.6s)
admin.example.com..... ✓ (0.5s)
mon2.example.com..... ✓ (0.5s)
mon1.example.com..... ✓ (0.6s)

[50/51] ceph.monitoring.prometheus.exporters.mgr_exporter on
admin.example.com..... ✓ (0.9s)

[51/51] ceph.monitoring.prometheus.exporters.rbd_exporter on
admin.example.com..... ✓ (18s)

Ended stage: ceph.stage.deploy succeeded=51/51 time=302.0s

```

FIGURE 17: DEPLOYING CONFIGURATION FILES

- When stage 3 has completed successfully, check the cluster's health to ensure that everything is running properly:

```
# ceph -s
```

```
ses55-admin:~ # ceph -s
cluster:
  id:      520a906e-e6a3-324f-ba18-856c2e155395
  health: HEALTH_OK

services:
  mon: 3 daemons, quorum ses55-osd0,ses55-osd1,ses55-osd2
  mgr: ses55-osd0(active), standbys: ses55-osd1, ses55-osd2
  osd: 16 osds: 16 up, 16 in

data:
  pools:   0 pools, 0 pgs
  objects: 0 objects, 0B
  usage:   16.1GiB used, 302GiB / 318GiB avail
  pgs:     
```

FIGURE 18: CHECKING CLUSTER HEALTH

- To get the benefits of the OpenAttic WebUI, you must now initiate the `ceph.stage.4`, which will install the OpenAttic service:

```
# salt-run state.orch ceph.stage.4
```

```

Parsing orchestration ceph.stage.services steps... []
Parsing ceph.stage.services steps... ✓

Stage initialization output:
No minions matched the target. No command was sent, no jid was assigned.
kernel_module      : valid
openattic-disabled  : valid

[1/17]  ceph.rgw.auth on
        admin.example.com..... ✓ (4s)

[2/17]  ceph.rgw.users on
        admin.example.com..... ✓ (34s)

[3/17]  ceph.rgw.dashboard on
        admin.example.com..... ✓ (5s)

[4/17]  ceph.rgw on
        mon3.example.com..... ✓ (79s)
        admin.example.com..... ✓ (23s)
        mon2.example.com..... ✓ (78s)
        mon1.example.com..... ✓ (69s)

[5/17]  ceph.monitoring.prometheus.exporters.ceph_rgw_exporter on
        admin.example.com..... ✓ (31s)

[6/17]  ceph.wait on
        admin.example.com..... ✓ (7s)

[7/17]  ceph.processes.rgw on
        mon3.example.com..... ✓ (0.5s)
        admin.example.com..... ✓ (0.5s)
        mon2.example.com..... ✓ (0.5s)
        mon1.example.com..... ✓ (0.4s)

[8/17]  ceph.rgw.restart on
        admin.example.com..... ✓ (3s)

[9/17]  ceph.wait on
        admin.example.com..... ✓ (6s)

[10/17] ceph.processes.rgw on
        mon3.example.com..... ✓ (0.4s)
        admin.example.com..... ✓ (0.4s)
        mon2.example.com..... ✓ (0.5s)
        mon1.example.com..... ✓ (0.4s)

[11/17] ceph.rgw.restart on
        mon1.example.com..... ✓ (3s)

[12/17] ceph.wait on
        admin.example.com..... ✓ (7s)

[13/17] ceph.processes.rgw on
        mon3.example.com..... ✓ (0.4s)
        admin.example.com..... ✓ (0.5s)
        mon2.example.com..... ✓ (0.4s)
        mon1.example.com..... ✓ (0.5s)

[14/17] ceph.rgw.restart on
        mon2.example.com..... ✓ (3s)

[15/17] ceph.wait on
        admin.example.com..... ✓ (7s)

[16/17] ceph.processes.rgw on
        mon3.example.com..... ✓ (0.8s)
        admin.example.com..... ✓ (0.6s)
        mon2.example.com..... ✓ (0.7s)
        mon1.example.com..... ✓ (0.7s)

[17/17] ceph.rgw.restart on
        mon3.example.com..... ✓ (3s)

Ended stage: ceph.stage.services succeeded=17/17 time=206.8s

```

- You can now manage your cluster through the WebUI:

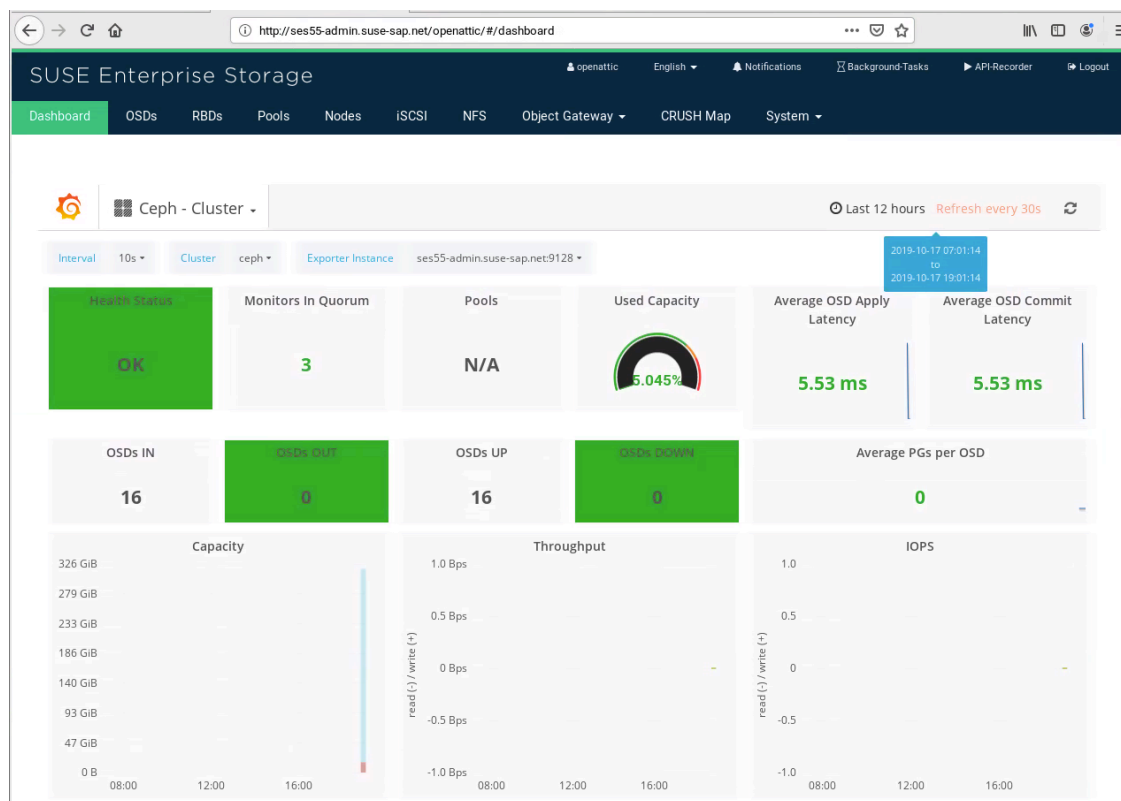


FIGURE 20: SUSE ENTERPRISE STORAGE WEBUI

- To provide a Data Hub RBD device, you first need to create a related pool:

The screenshot shows the SUSE Enterprise Storage web interface. The top navigation bar includes links for Dashboard, OSDs, RBDs, Pools, Nodes, iSCSI, NFS, Object Gateway, CRUSH Map, and System. The main content area is titled 'Ceph Pools » Add' and contains a form to 'Create Ceph pool: sapdh26'. The form fields are as follows:

- Name ***: sapdh26
- Pool type ***: Replicated pool
- Crush ruleset ***: replicated_rule
- Replicated size ***: 3 (Minimum: 1, Maximum: 10)
- Placement groups ***: 512 (Calculation help)
- Compression**: Mode is none
- Applications**: Add applications dropdown shows '- Select an application to use -'. The Applications list shows 'rbd' with a delete icon.

At the bottom right of the form are 'Create' and 'Back' buttons.

FIGURE 21: CREATING CEPH POOL

- Then provide access to this pool through an RBD device:

The screenshot shows the SUSE Enterprise Storage web interface. The top navigation bar includes links for Dashboard, OSDs, RBDs, Pools, Nodes, iSCSI, NFS, and Object Gateway. Below this, there's a section for 'Ceph RBDs' with an 'Add' button. The main content area displays a form titled 'Create RBD: sapdh26rbd'. The form has the following fields:

- Name ***: sapdh26rbd
- Pool ***: sapdh26 (95.48 GiB free). Below the dropdown, a progress bar shows '0 B of 95.48 GiB used' and '95.48 GiB free - use max'.
- Size ***: 50GB
- Object size ***: 4 MiB
- Features ***: ☒ Use default features

At the bottom right of the form are 'Create' and 'Back' buttons.

FIGURE 22: PROVIDING ACCESS TO POOL

You can now go to [Section 4.1.2, “Prerequisites on the SUSE CaaS Platform 4 cluster”](#) and follow the prerequisites for a SUSE CaaS Platform cluster.

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