

SAP Data Hub 2 on SUSE CaaS Platform 3

Installation Guide

SUSE CaaS Platform 3
SUSE Linux Enterprise Server for SAP Applications 12 SP5 and 15 SP1
SAP Data Hub 2

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Installation Guide

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SAP Data Hub 2 is a toolset to govern big amounts of data. SUSE CaaS Platform 3 is the Kubernetes base that makes deploying SAP Data Hub 2 easy. This document describes the installation and configuration of SUSE CaaS Platform 3 and SAP Data Hub 2.

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Today, more and more data is created in business and industry. Alongside data growth, there is an increasing necessity to manage and exploit this data. SAP Data Hub 2 is a tool that makes dealing with large amounts of data easier. SUSE Container as a Service Platform 3 (SUSE CaaS Platform 3) is the perfect foundation for SAP Data Hub 2.

1 Requirements

To install SAP Data Hub 2 on SUSE CaaS Platform 3, make sure to satisfy the following hardware and software requirements.

1.1 Hardware

1.1.1 SUSE CaaS Platform 3 Cluster

Hardware requirements (see [SAP Data Hub Install Guide \(https://help.sap.com/viewer/product/SAP_DATA_HUB/\)](https://help.sap.com/viewer/product/SAP_DATA_HUB/)) See SAP's sizing recommendations:

- SAP Data Hub 2.3 (<https://help.sap.com/viewer/e66c399612e84a83a8abe97c0ee-b443a/2.3.latest/en-US/79724de552db4b2b81c4a893f2c7ed18.html>)
- SAP Data Hub 2.4 (<https://help.sap.com/viewer/e66c399612e84a83a8abe97c0ee-b443a/2.4.latest/en-US/7e2a9bf62ec94e9694648e2b5d2ce882.html>)
- SAP Data Hub 2.5 (<https://help.sap.com/viewer/e66c399612e84a83a8abe97c0ee-b443a/2.5.latest/en-US>)
- SAP Data Hub 2.6 (<https://help.sap.com/viewer/e66c399612e84a83a8abe97c0ee-b443a/2.6.latest/en-US>)

The minimum hardware requirements for installing SAP Data Hub 2 on premise are:

- 4 Kubernetes cluster nodes (1 master node and 3 worker nodes)

- The master node should be a 4 core machine with > 32 GiB RAM
- The three Kubernetes worker nodes should be a machine with 4 cores and with > 64 GiB RAM
- Access to a SUSE Enterprise Storage 5 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))

1.1.2 Management Host ("Jump Host")

It is recommended to do the installation of SAP Data Hub Foundation from an external jump host and not from within the SUSE CaaS Platform Cluster.

The hardware and operating system specifications for the jump host can be for example as follows:

- SUSE Linux Enterprise Server 12 SP5 or SUSE Linux Enterprise Server 15 (or even openSUSE Leap 15.X)
- 2 Cores
- 8 GiB RAM
- Disk space: 50 GiB for `/`, including the space for the SAP Data Hub 2 software and at least 20 GiB for `/var/lib/docker` (necessary for the SAP Data Hub 2 installation)
- Network connectivity to the SUSE CaaS Platform cluster (1 GBit/s)

1.2 Software Requirements

The following software is needed

- SUSE CaaS Platform 3
- SAP Data Hub 2
- optional: SAP Maintenance Planner
- optional: SAP Host Agent
- optional: Hadoop/Spark (see Vora's Spark extensions)

2 Relevant Documentation:

- SUSE
 - SUSE CaaS Platform 3 (<https://documentation.suse.com/suse-caasp/3/>) ↗
 - SUSE Enterprise Storage 5.5 (<https://documentation.suse.com/ses/5.5/>) ↗
- SAP
 - SAP Data Hub (https://help.sap.com/viewer/product/SAP_DATA_HUB/2.6.latest/en-US) ↗
 - SAP Data Hub 2.6 release note (<https://launchpad.support.sap.com/#/notes/2764652>) ↗
 - Pre-requisites for installing SAP Data Hub (<https://launchpad.support.sap.com/#/notes/2686169>) ↗
 - SAP Data Hub 2: Specific Configurations for Installation on SUSE CaaS Platform (<https://launchpad.support.sap.com/#/notes/2776522>) ↗

3 Installing SUSE CaaS Platform 3

3.1 Downloading the Installation Media

All installation media can be found at <https://download.suse.com> ↗.

3.2 Acquiring a Subscription for SUSE CaaS Platform 3

To receive maintenance updates for SUSE products, you need a valid subscription for the respective products. For more information about subscriptions for SUSE CaaS Platform, see https://www.suse.com/support/?id=SUSE_CaaS_Platform ↗.

3.3 Read the Deployment Guide for SUSE CaaS Platform 3

SUSE CaaS Platform is designed to make the installation of Kubernetes easy. For more information on this topic, see the SUSE CaaS Platform 3 *Deployment Guide* from <https://documentation.suse.com> [↗](#). For further reference, a *Quick Start Guide* and an *Administrator's Guide* are available as well.

3.4 Installing SUSE CaaS Platform 3

This document describes the installation of SUSE CaaS Platform 3 from ISO images. Make sure that the host names you will use for the installation are resolvable via DNS. A static network setup is preferred.

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

From the GRUB menu, choose *Installation*.

3.4.1 Installing the Administration Node

1. After initializing the hardware, the YaST installer opens the network configuration dialog:

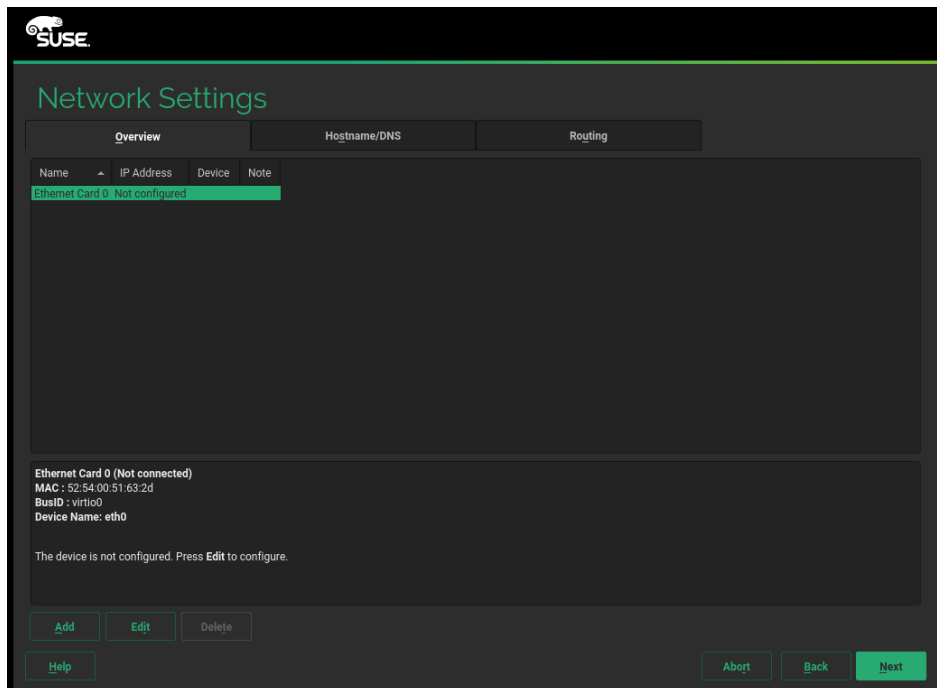


FIGURE 1: NETWORK CONFIGURATION ADMINISTRATION NODE

2. On the installation overview screen:
 - Select the keyboard layout and language according to your needs.
 - Specify your subscription credentials or the URL of your SMT/RMT server to register your installation.
 - Set the password for the root account.
 - Assign the role *Administration Node*.

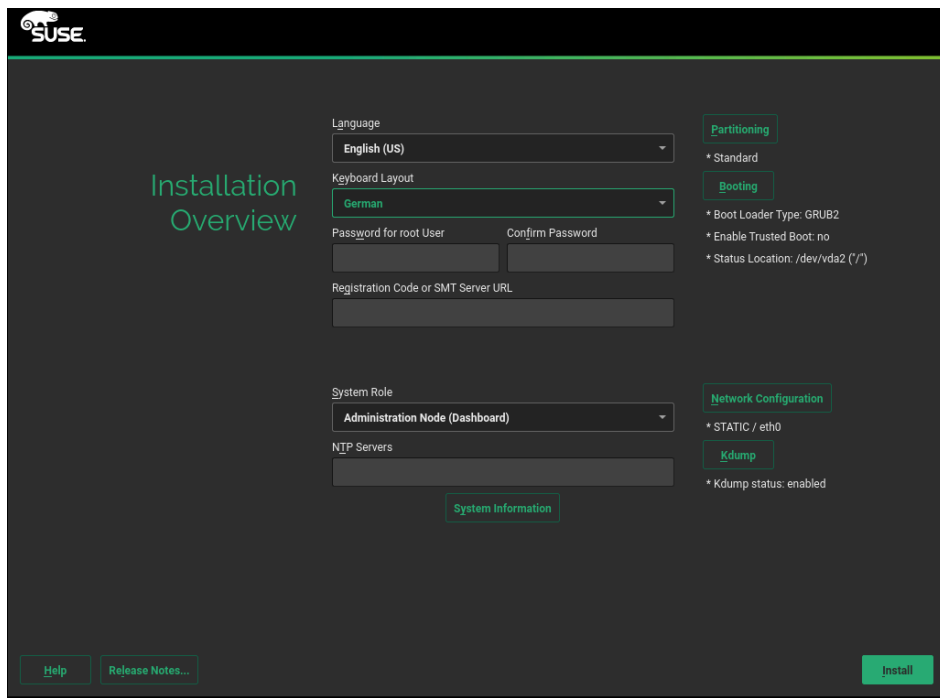


FIGURE 2: INSTALLATION OVERVIEW ADMINISTRATION NODE

3.4.2 Installing the Remaining Cluster Nodes

1. Boot the machine from the ISO image and select *Installation* from the GRUB boot menu.
2. The installer starts and the network configuration dialog is shown.

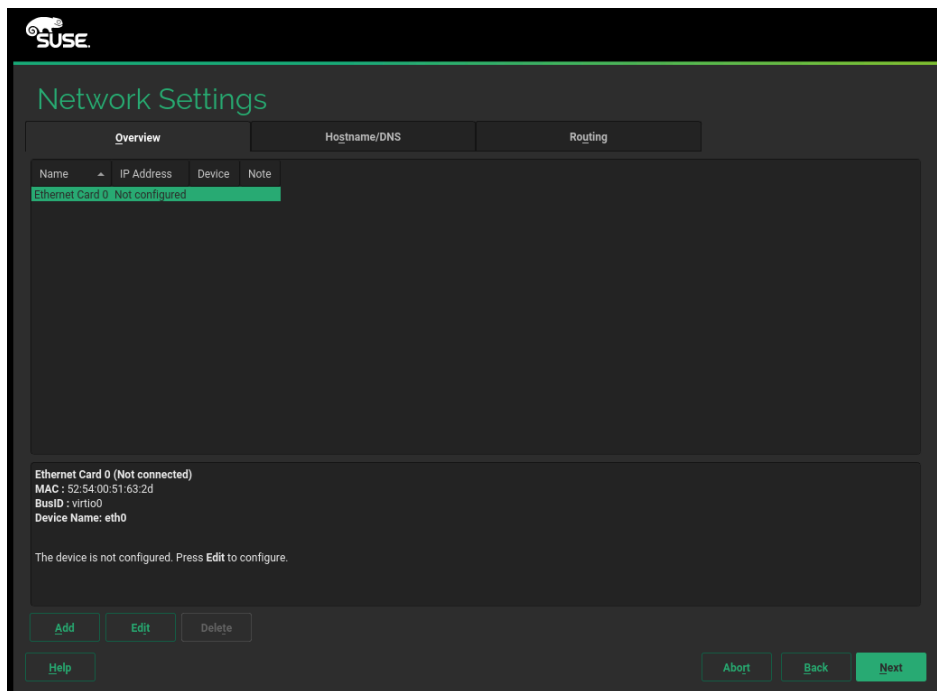


FIGURE 3: NETWORK CONFIGURATION CLUSTER NODES

3. Configure the network according to your needs.
4. On the installation overview screen:
 - Select the keyboard layout and language according to your needs.
 - Specify your subscription credentials or the URL of your SMT/RMT server to register your installation.
 - Set the password for the root account.
 - Assign the role *Cluster Node*.

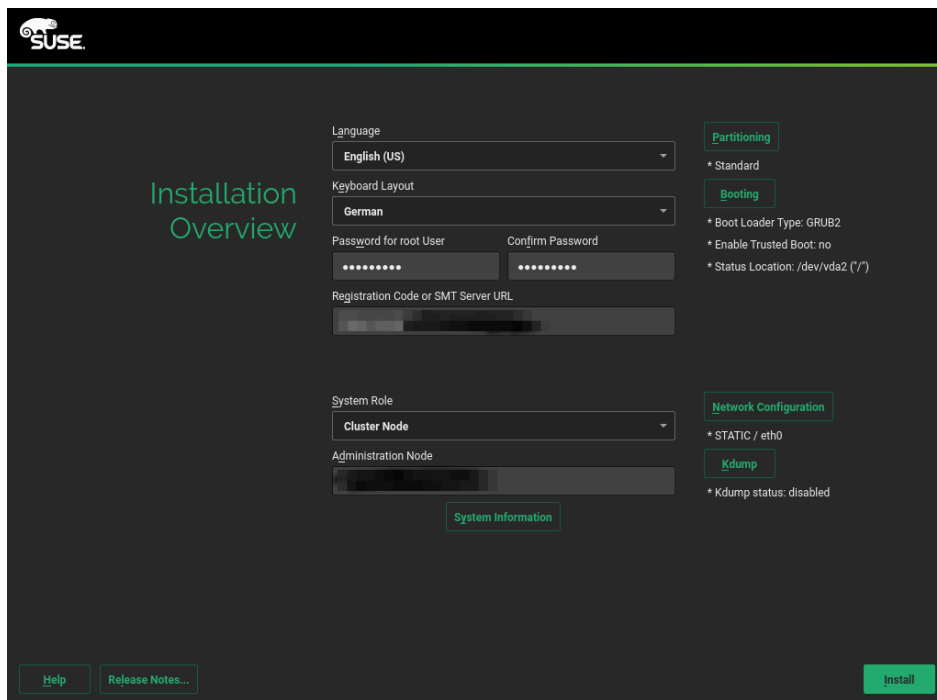


FIGURE 4: INSTALLATION OVERVIEW CLUSTER NODE

3.4.3 Bootstrapping the Kubernetes Cluster

1. After the installation of the administration node, open your browser and visit <https://name.domain.tld>.

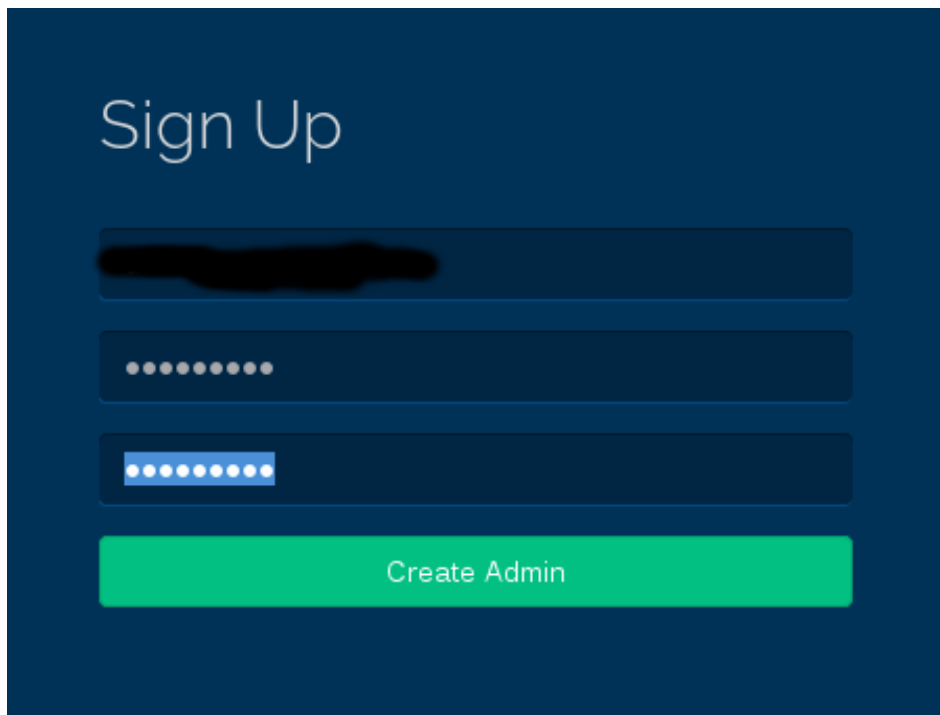


FIGURE 5: VELUM

2. Create the admin account and set the admin user name and password. Log in with the newly created admin credentials.

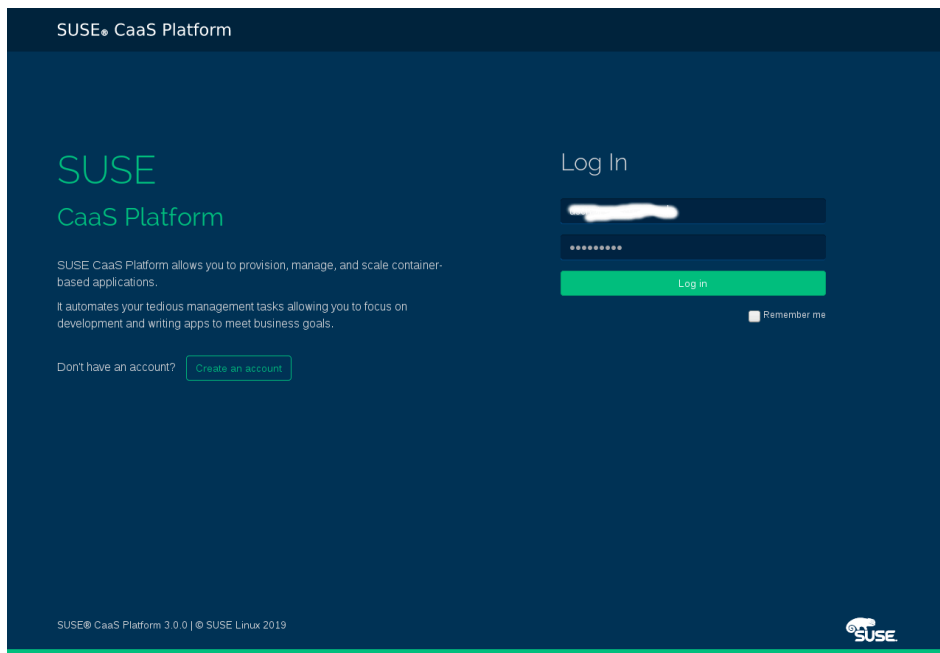


FIGURE 6: VELUM LOGIN

3. Configure SUSE CaaS Platform 3.

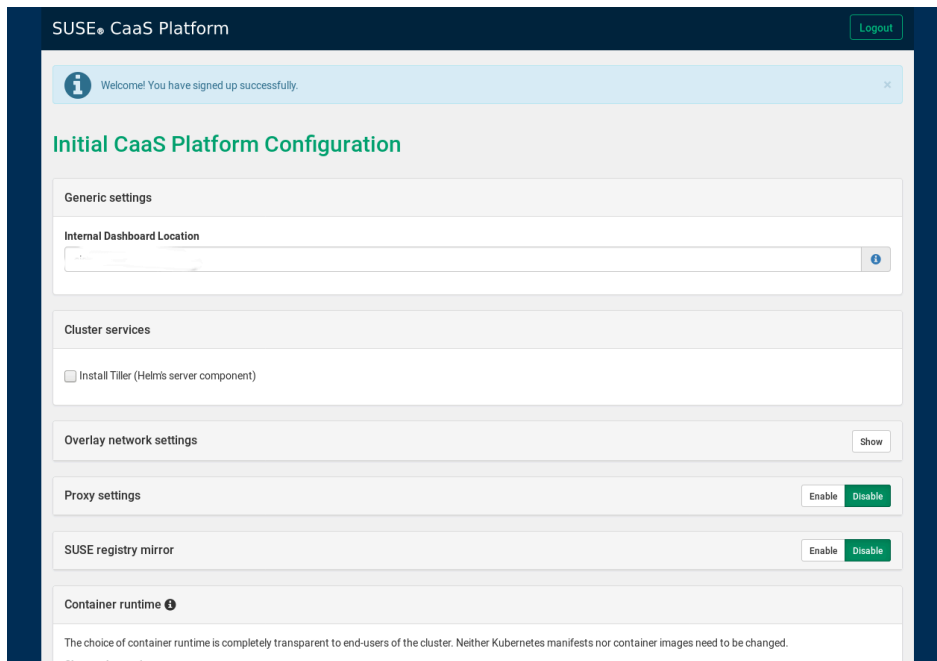


FIGURE 7: VELUM CLUSTER CONFIGURATION

4. Select the nodes to be included in the cluster.

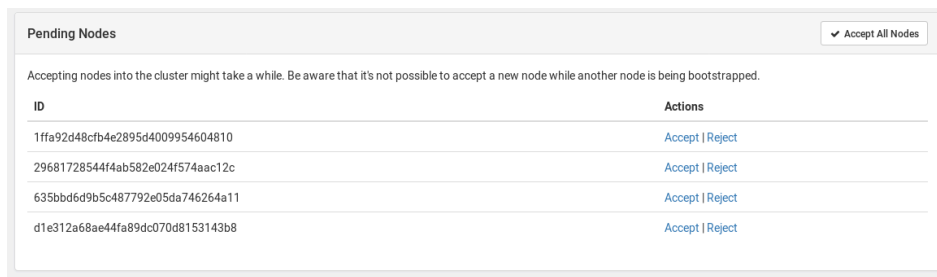


FIGURE 8: SELECT NODES AND ROLES 1

5. Assign roles (master/worker) according to your needs.

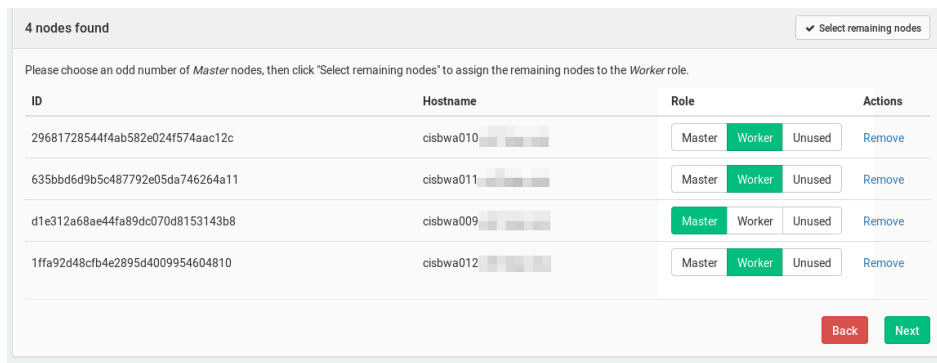


FIGURE 9: SELECT NODES AND ROLES 2

6. Bootstrap the Kubernetes cluster.

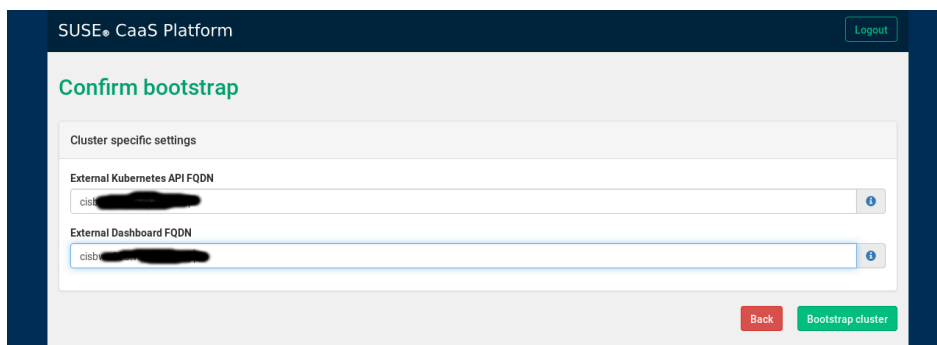


FIGURE 10: CONFIRM BOOTSTRAP

7. After a successful bootstrap, the screen below is shown.

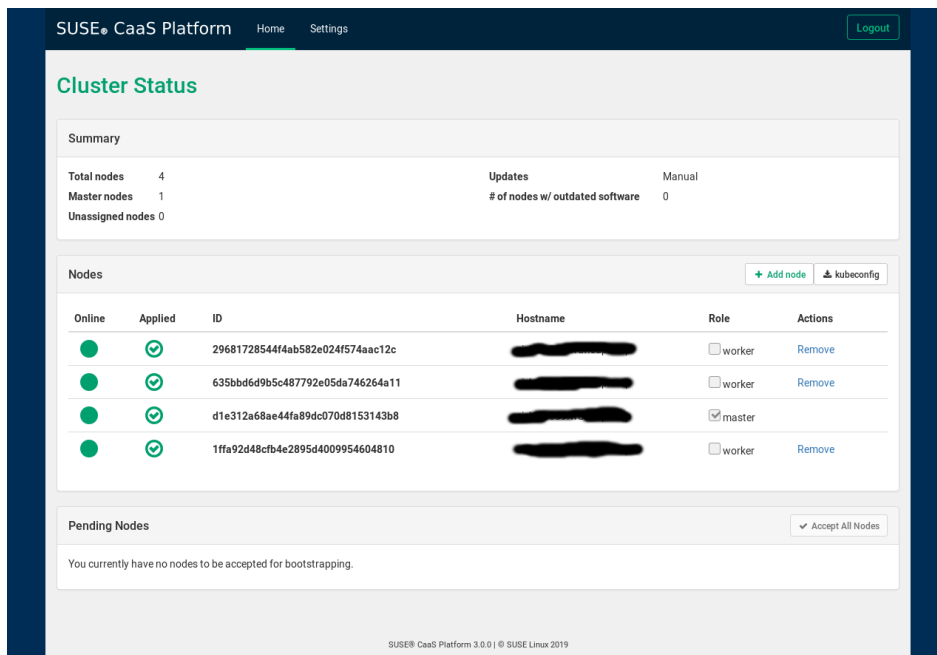


FIGURE 11: CLUSTER STATUS NODES

3.4.4 Installing the Jump Host

For further configuration and deployments on SUSE CaaS Platform it is highly recommended to install a jump host, also called a *management host*. This section describes installing the necessary tools to be able to deploy SAP Data Hub 2 on SUSE CaaS Platform.

1. Install SUSE Linux Enterprise Server 12 SP4+ or SUSE Linux Enterprise Server 15 as the operating system on the jump host.
2. Register your installation against the SUSE Customer Center (SCC) or your local SMT (Subscription Management Tool) or RMT (Repository Mirroring Tool).
3. Register the Container Module included in the SUSE Linux Enterprise Server subscription:

```
# SUSEConnect -p x86_64/SLE-Container-Module
```

4. Install Docker from the Container Module:

```
# zypper in docker
```

5. Download **kubectl** matching the Kubernetes version of your SUSE CaaS Platform installation. Download **kubectl 1.10.11** or higher.

```
$ curl -LO https://storage.googleapis.com/kubernetes-release/release/v1.10.11/bin/linux/amd64/kubectl
$ sudo mv kubectl /usr/bin/kubectl
$ sudo chmod a+x /usr/bin/kubectl
```

6. Download the `kubeconfig` file from the Velum Dashboard. Click the button `kubeconfig`, log in to CaaS Platform, and accept the file download.

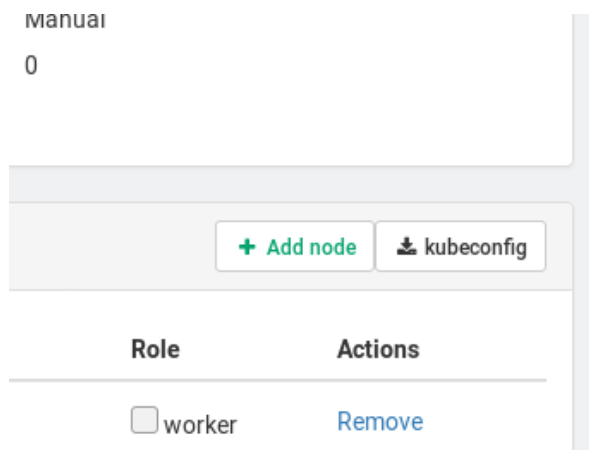


FIGURE 12: KUBECONFIG BUTTON

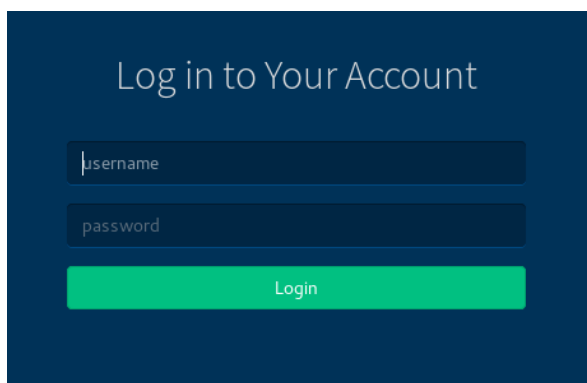


FIGURE 13: LOGGING IN TO CAAS PLATFORM

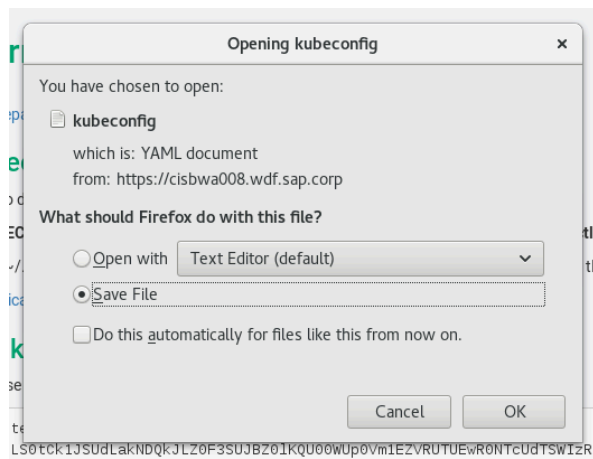


FIGURE 14: DOWNLOADING KUBECONFIG

7. Enable the downloaded `kubeconfig` by doing either of the following:

- Configure the `KUBECONFIG` environment variable:

```
$ export KUBECONFIG=<PATH/TO/YOUR/kubeconfig-file>/kubeconfig
```

- Move it to default path:

```
$ mv <PATH/TO/YOUR/kubeconfig-file>/kubeconfig ~/.kube/config
```

8. Connect to your Kubernetes cluster using `kubectl`:

```
$ kubectl get cluster-info

Kubernetes master is running at https://spwdfvml2054.example.com:6443
Dex is running at https://spwdfvml2054.example.com:6443/api/v1/namespaces/kube-system/services/dex:dex/proxy
KubeDNS is running at https://spwdfvml2054.example.com:6443/api/v1/namespaces/kube-system/services/kube-dns:dns/proxy
kubernetes-dashboard is running at https://spwdfvml2054.example.com:6443/api/v1/namespaces/kube-system/services/https:kubernetes-dashboard:https/proxy
Tiller is running at https://spwdfvml2054.example.com:6443/api/v1/namespaces/kube-system/services/tiller:tiller/proxy

To further debug and diagnose cluster problems, use 'kubectl cluster-info dump'.
```

```
$ kubectl get nodes

NAME           STATUS    ROLES    AGE   VERSION
spwdfvml2054  Ready    master   301d  v1.10.11
```

```
spwdfvml2055    Ready    <none>    301d    v1.10.11
spwdfvml2056    Ready    <none>    301d    v1.10.11
spwdfvml2082    Ready    <none>    301d    v1.10.11
```

9. Download Helm from <https://helm.sh>. Install and configure the Helm client. The version should match the Tiller version deployed on your SUSE CaaS Platform installation.

```
$ curl https://raw.githubusercontent.com/helm/helm/master/scripts/get > get_helm.sh
$ chmod 700 get_helm.sh
$ ./get_helm.sh --version 2.8.2
$ mv helm ~/bin/helm
$ helm init --client-only
```

3.4.5 Deploying Optional Components in the SUSE CaaS Platform 3 Cluster

You can deploy some useful optional applications in your SUSE CaaS Platform 3 cluster:

- Heapster allows analyzing cluster performance
- The Kubernetes dashboard allows administrating and basic monitoring of the Kubernetes cluster

See also <https://documentation.suse.com/suse-caasp/3/html/caasp-admin/>.

1. Install Heapster:

```
$ helm install --name heapster-default --namespace=kube-system stable/heapster \
--version=0.2.7 --set rbac.create=true
```

2. Install the Kubernetes dashboard:

```
$ helm install --namespace=kube-system \
--name=kubernetes-dashboard stable/kubernetes-dashboard \
--version=0.6.1
```

3. Start the Kubernetes API proxy:

```
$ kubectl proxy
```

4. Extract the **id-token** from the **kubeconfig** file:

```
$ grep id-token $KUBECONFIG | awk '{ print $2 }'
```

This token will allow you to log in in the next step.

5. In your browser, open <http://127.0.0.1:8001/api/v1/namespaces/kube-system/services/https:kubernetes-dashboard:/proxy/>.

Use the ID you found in **kubeconfig** to log in to the Kubernetes dashboard.

4 Installing SAP Data Hub 2

The following sections describe the preparation and installation of SAP Data Hub 2 on the SUSE CaaS Platform 3 Cluster.

4.1 Preparing the SAP Data Hub 2 Installation

To install SAP Data Hub on SUSE CaaS Platform successfully, perform the actions detailed below.

4.1.1 Downloading the SAP Data Hub 2 Software Archive

1. Log in to SAP Launchpad Software Center at <https://launchpad.support.sap.com/#/software-center>, select *Installations and Downloads*, select alphabetical order, and choose the letter *D*. Scroll down in the list to the folder *SAP Data Hub*, open it and select the version to be installed.
2. Download the SAP Data Hub Foundation file, for example: [DHFOUNDATION03_3-80004015.ZIP](#) (SAP DATA HUB - FOUNDATION 2.3) or [DHFOUNDATION06_1-80004015.ZIP](#) (SAP DATA HUB - FOUNDATION 2.6)
3. Unzip the software archive onto your jump host.

There are two ways to install SAP Data Hub 2:

- Use the SL Plugin. There are two variants of doing so:
 - SL Plugin with Maintenance Planner (mpsl)
 - SL Plugin only (mpfree)
- Use the command line `install.sh` script.

This document will focus on the latter installation method.

4.1.2 Prerequisites on the SUSE CaaS Platform 3 Cluster

Where not stated otherwise, all of the following steps need to be performed on the jump host.

1. Create the namespace in the Kubernetes cluster to install SAP Data Hub 2:

```
$ kubectl create namespace datahub
```

2. On SUSE Enterprise Storage, create the storage class to provide volumes for SAP Data Hub 2.
3. 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 Enterprise Storage
 - A data pool created (data hub in this example) on your SUSE Enterprise Storage for the use with SAP Data Hub 2
4. 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
```

5. Create the secrets needed to access the storage.

a. From SUSE Enterprise Storage, obtain the keys located in `ceph.admin.keyring` and `ceph.user.keyring`.

b. Base64-encode the keys as follows:

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

c. Configure the encoded secrets:

```
$ 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 Installation of SAP Data Hub 2 Using the Maintenance Planner with SL Plugin (mpsl Method)

The installation method via SL plugin is a Web-based installation method recommended by SAP, offering you an option to send analytics data and feedback to SAP. All necessary prerequisites are met by applying all the steps described above.

Important

You need to install the latest SAP Host Agent on the jump host. You can use the RPM package which can be downloaded from the SAP Software Download Center.

4.3 Installing SAP Data Hub 2 Using the SL Plugin (mpfree Method)

The Installation of SAP Data Hub 2 using the SL plugin is an alternative command-line-based installation method. Refer to the SAP Data Hub documentation (2.3) / (2.4) / (2.5) / (2.6) for more information and the exact procedure.

4.4 Installing SAP Data Hub 2 from the Command Line (Manual Installation)

1. Unpack the SAP Data Hub 2.6 software archive on the jump host with the following command:

```
$ unzip DHFOUNDATION06_1-80004015.ZIP
```

2. Run the install command as described in SAP Data Hub 2 install guide at <https://help.sap.com/viewer/e66c399612e84a83a8abe97c0eeb443a/2.6.latest/en-US>.

```
$ cd SAP-Datahub-2.4.63-Foundation
$ export DOCKER_REGISTRY=<URI of your registry>
$ export NAMESPACE=datahub
$ ./install.sh
```

This interactive script configures the installation of SAP Data Hub. You should have the following information at a 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, identify the service IP and port of the SAP Data Hub UI:

```
$ kubectl get services
$ kubectl describe service
```

Point your browser to the IP and port you received from the commands above.

Use the login data you defined during the installation.

4.5.1 Post-Installation Work

Follow the documentation provided by SAP (<https://help.sap.com/viewer/e66c399612e84a83a8abe97c0eeb443a/2.6.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 necessary CAs, for example, the CA that signed the certificate of the secure registry.

5 Upgrading SAP Data Hub 2

To upgrade an existing SAP Data Hub 2 installation to a higher version (for example 2.3 to 2.4), follow the official instructions from SAP. You can choose between the following 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 Installing a Secure Private Docker Registry

To meet the Data Hub requirements you also need a Docker Registry. The Portus project provides an easy way to build and manage an own Docker Registry. For more information, see the project homepage at <http://port.us.org/>.

To set up Portus in a dedicated virtual machine, do:

1. Create a suitable a virtual machine:

```
# 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'
```

2. In this example, the Portus server will be connected to a local bridge providing common services (DNS, SMT, and Docker Registry) for the SAP Data Hub 2 stack. Our Portus deployment is container-based and orchestrated locally with `docker-compose`. Portus `docker-compose` deployment requires an up-to-date release of `docker-compose`. To install `docker-compose`, use:

```
# 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
```

3. Clone the Portus Git repository:

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

4. Adapt the configuration in the `.env`. As an example, a valid configuration may look like this:

```
# cat .env
```



```
MACHINE_FQDN=portus-dr.suse-sap.net
SECRET_KEY_BASE=b494a25faa8d22e430e843e220e424e10ac84d2ce0e64231f5b636d21251
eb6d267adb042ad5884cbff0f3891bcf911bdf8abb3ce719849ccda9a4889249e5c2
PORTUS_PASSWORD=XXXXXXXXX
DATABASE_PASSWORD=YYYYYYYYY
```

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

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

6. Download the latest `docker-compose.yml` for Portus:

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

7. To secure your Docker Registry configuration, add TLS 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
```

8. Make the servers aware of the new 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
```

9. Update the certificate on all servers that will need to interact with the Docker registry:

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

10. Start your Portus setup with the following command:

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

11. Log in to Portus and set up the registry as shown below:

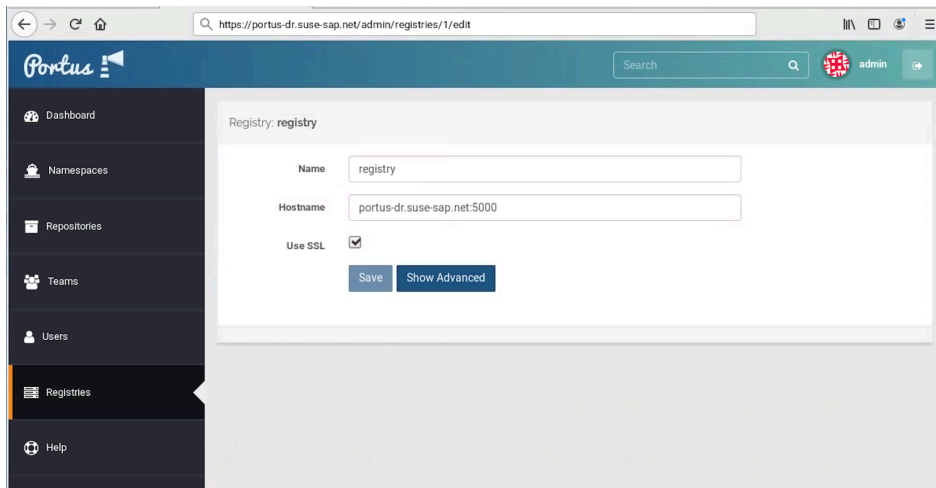


FIGURE 15: PORTUS REGISTRY

12. To install and configure a secure private registry using SUSE Linux Enterprise Server with the Container Module, the necessary components are Docker, Docker Registry, and Portus. Create SSL certificates as needed. Distribute the CA certificate to all your Kubernetes nodes. Run the command:

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

13. 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

6.2 SUSE Enterprise Storage

An SAP Data Hub 2 installation on premise 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, reserve enough resources to address [etcd](https://github.com/etcd-io/etcd/blob/master/Documentation/op-guide/hardware.md) requirements regarding [etcd Hardware](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 show a minimalist, virtualized, test-oriented deployment of SUSE Enterprise Storage 5.5.

In the following example, we are going to build a 4 nodes (1 admin + 3 OSD) Ceph Cluster.

Before you start, be sure to:

- Collect your SUSE Linux Enterprise Server 12 SP3 and SUSE Enterprise Storage 5 registration code from <https://scc.suse.com> [↗](#). Alternatively, have an SMT/RMT properly set up and already mirroring these products.
 - SCC (<https://scc.suse.com>) [↗](#)
 - SMT (<https://documentation.suse.com/sles-12/html/SLES-all/book-smt.html>) [↗](#)

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Products > SUSE Linux Enterprise Server 15 SP1 x86_64 **released**

Available Architectures: aarch64, ppc64le, s390x, **x86_64**

Release schedule: **beta** (Dec 14 2018), **released** (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/productlicense/

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.

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**

FIGURE 16: SUSE CUSTOMER CENTER PRODUCTS

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Products > SUSE Linux Enterprise Server 15 SP1 x86_64 **released**

Available Architectures: aarch64, ppc64le, s390x, **x86_64**

Release schedule: **beta** (Dec 14 2018), **released** (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/productlicense/

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.

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
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- 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
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- 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 17: SUSE CUSTOMER CENTER REGISTRATION CODE

- Your DNS zone should already be set. In our example, where all Data Hub components are in the same DNS zone and subnet, it should look similar to the following:

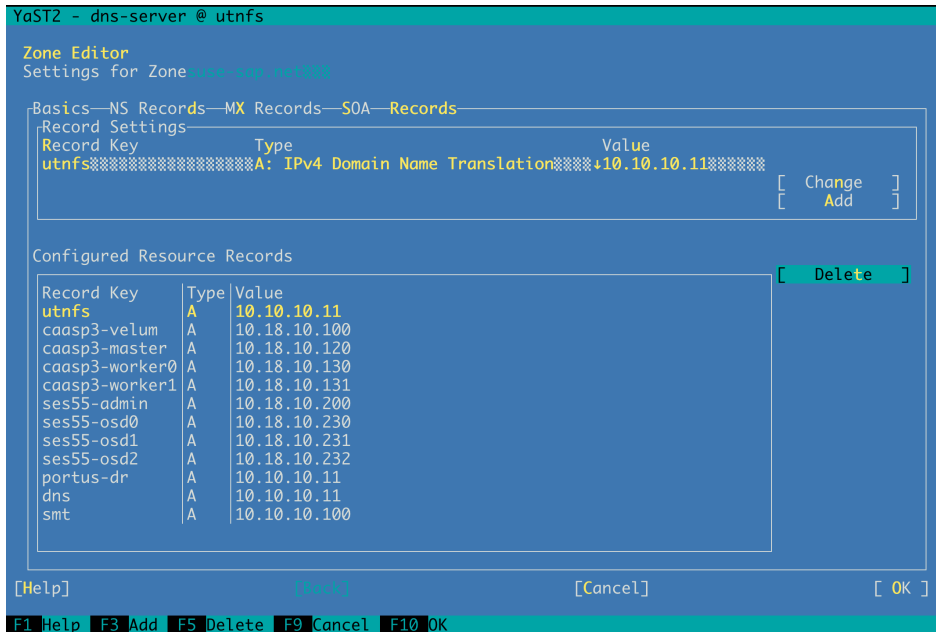


FIGURE 18: DNS SERVER

- Also, to be as efficient as possible when using an interactive shell-scripted infrastructure deployment, we recommend using an advanced terminal client or multiplexer which allows addressing multiple shells at once.



FIGURE 19: ADVANCED TERMINAL CLIENT - MULTI-SHELL

1. Create virtual machines:

```
# 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'
```

```
# 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://10.10.101/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'
```

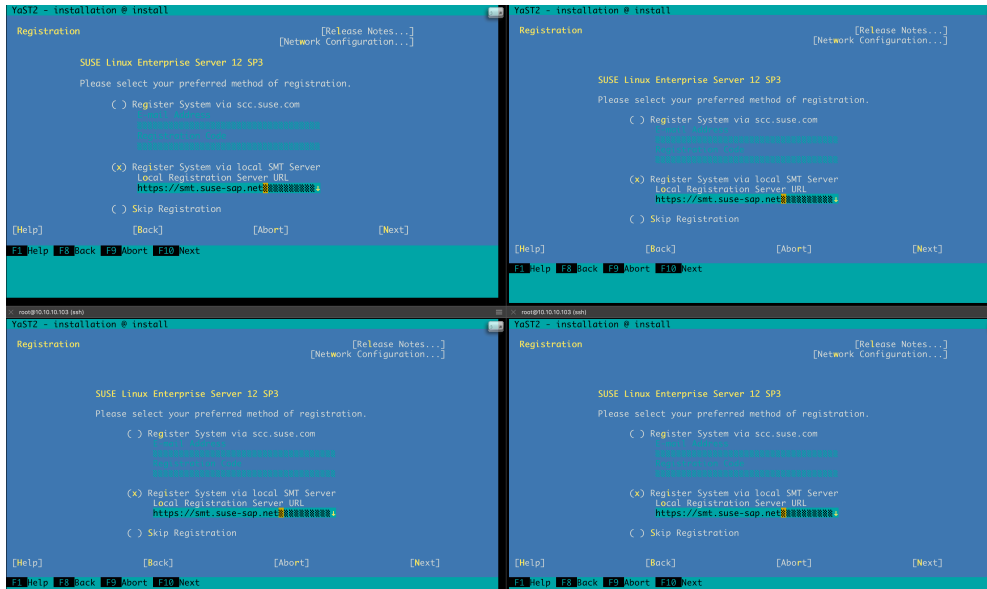


FIGURE 20: MULTI SHELL SMT

2. Select the SUSE Enterprise Storage 5 Extension.

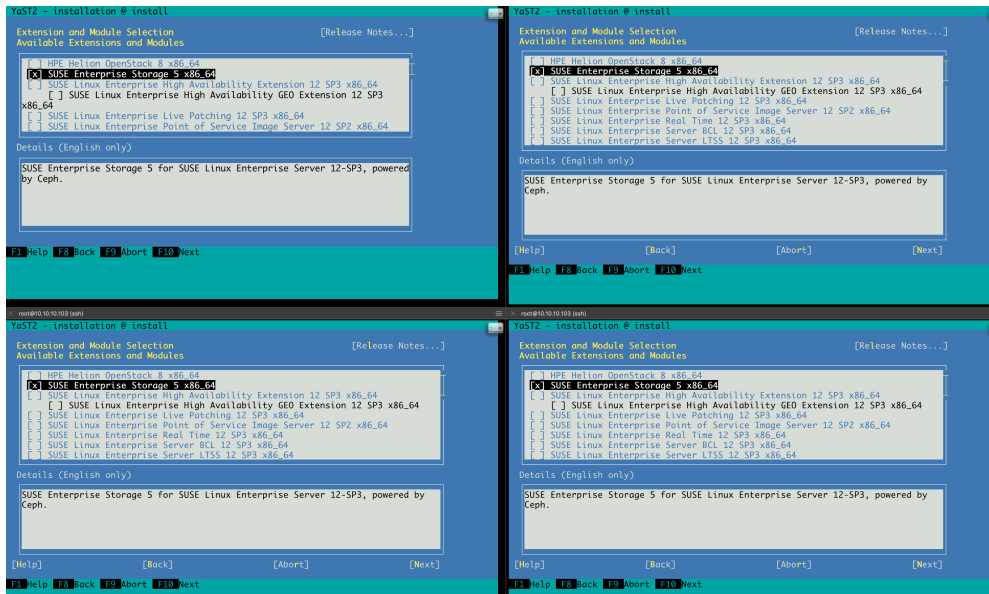


FIGURE 21: MULTI SHELL EXTENSIONS AND MODULES

3. On the hypervisor, you should also be able to route or bridge (either a traditional bridge using `brctl` or a virtual bridge) your upcoming SUSE Enterprise Storage 5.5 network segment. In our example, for simplicity, we are using the same bridge and network address as the SUSE CaaS Platform cluster, `--network bridge=caasp3`.
4. In the following example, each node is powered by 16 GB of RAM, 4 VCPU, 40 GB for the root disk, 4 * 20GB OSDB disk.

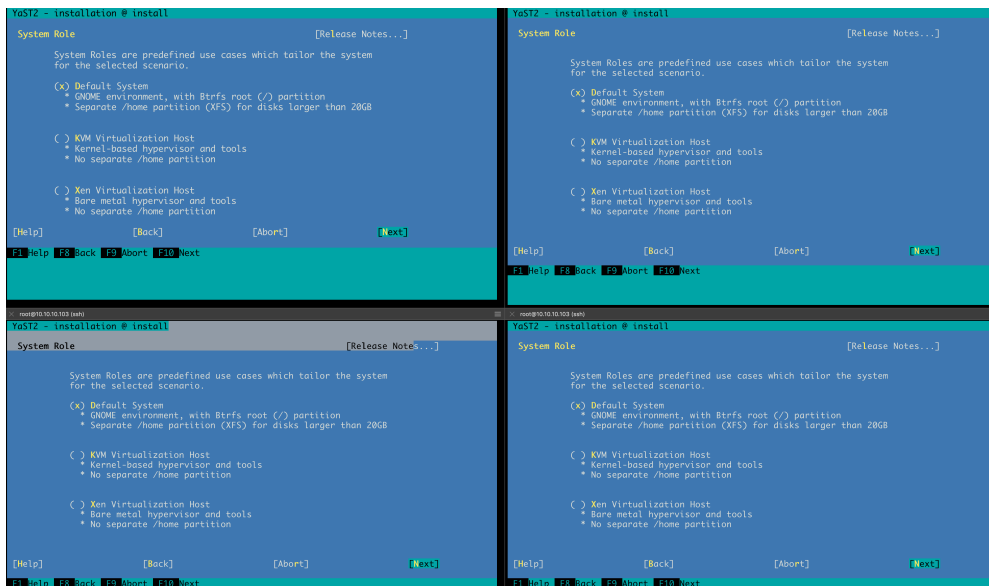


FIGURE 22: MULTI-SHELL DEFAULT SYSTEM

5. NTP must be configured on each node.

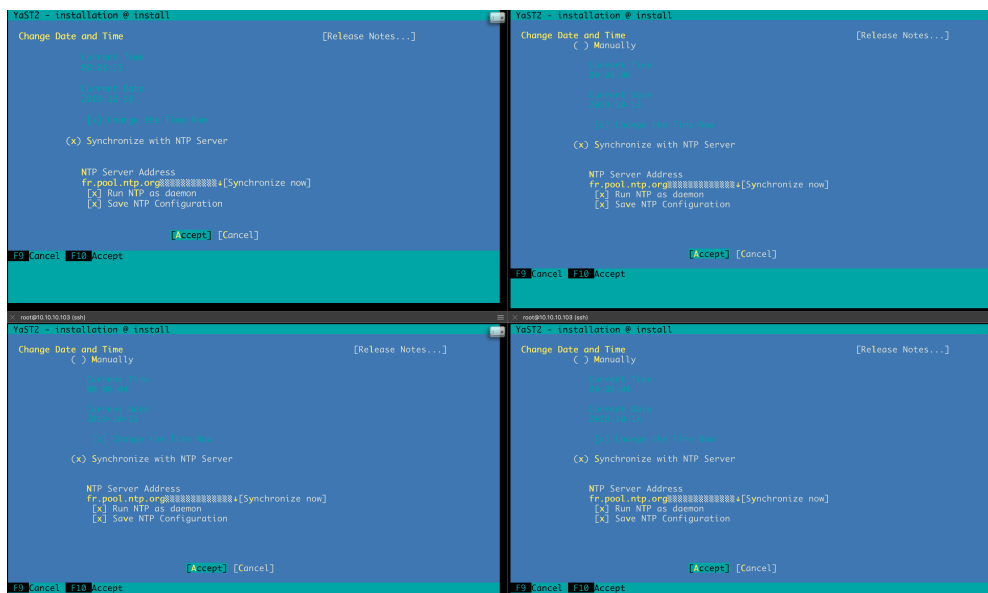


FIGURE 23: MULTI-SHELL NTP SERVER

6. Deselect AppArmor and unnecessary X and GNOME Patterns, but select the SUSE Enterprise Storage pattern.

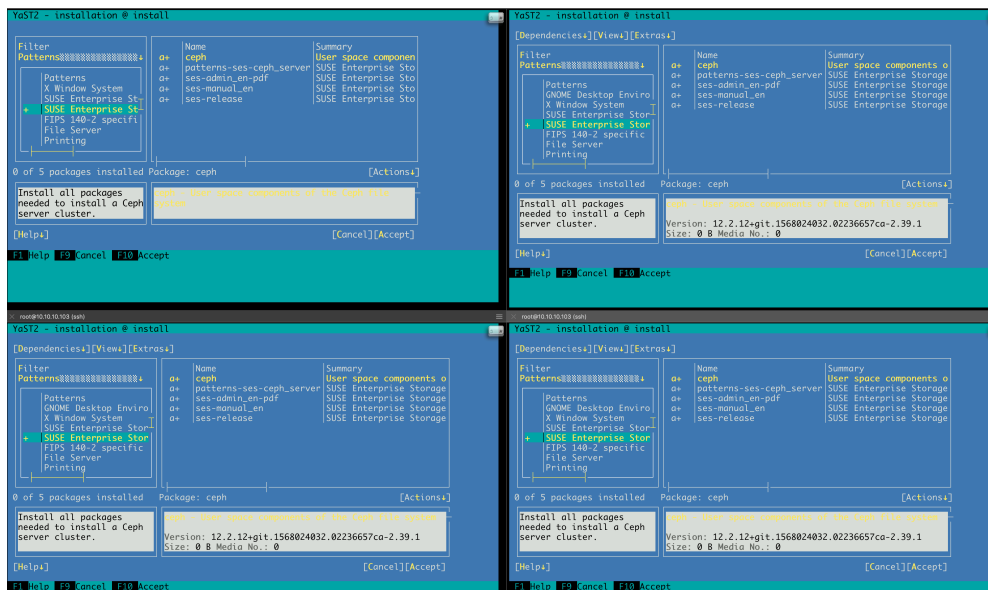


FIGURE 24: MULTI-SHELL PATTERNS

7. Deactivate the firewall on the nodes. Start the installation on all nodes.

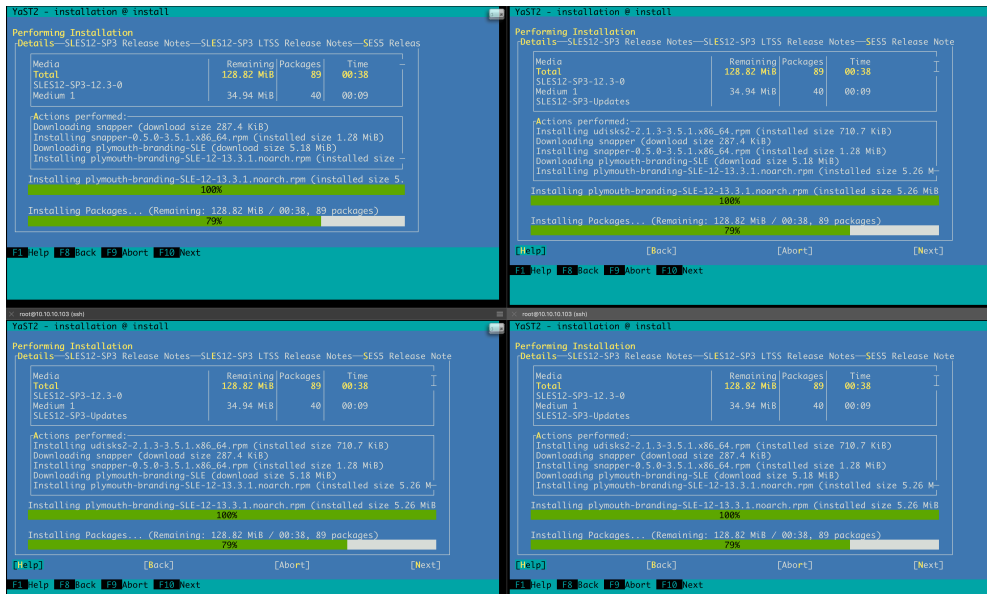


FIGURE 25: MULTI-SHELL INSTALLATION

- When the nodes are 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.

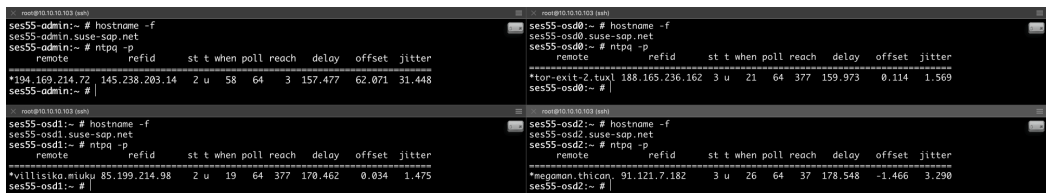
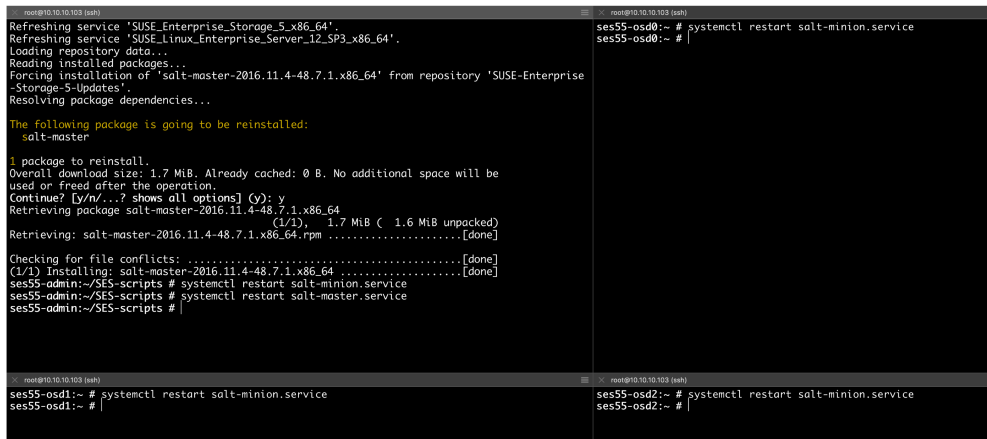


FIGURE 26: MULTI-SHELL HOST NAME

- Using `ssh-keygen` and then `ssh-copy-id`, send your SUSE Enterprise Storage administration node SSH public key to all other nodes.
- Verify that the drives you are going to allocate for SUSE Enterprise Storage OSDs are clean by wiping them. For more information, see [SES Deployment Guide, section 4.3, step 12, Wipe disk](https://documentation.suse.com/ses/5.5/html/ses-all/ceph-install-saltstack.html#ceph-install-stack) (<https://documentation.suse.com/ses/5.5/html/ses-all/ceph-install-saltstack.html#ceph-install-stack>).
- Install `salt-minion` on all nodes (including the administration node).
- On the administration node (in our example, `ses55-admin.suse-sap.net`), additionally install `salt-master` and `deepsea`.

- Restart `salt-minion` on all nodes and `salt-master` on the administration node.



```
root@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 (1/1), 1.7 MiB ( 1.6 MiB unpacked)
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 #

root@10.10.103 (ssh) ses55-osd0:~ # systemctl restart salt-minion.service
ses55-osd0:~ #

root@10.10.103 (ssh) ses55-osd1:~ # systemctl restart salt-minion.service
ses55-osd1:~ #

root@10.10.103 (ssh) ses55-osd2:~ # systemctl restart salt-minion.service
ses55-osd2:~ #
```

FIGURE 27: MULTI-SHELL SALT INSTALLATION

- Accept related pending Salt keys:

```
# salt-key -L

Accepted keys:
ses55-admin.suse-sap.net
ses55-osd0.suse-sap.net
ses55-osd1.suse-sap.net
ses55-osd2.suse-sap.net
Denied keys:
Unaccepted keys:
Rejected keys:
```

Verify that `/srv/pillar/ceph/master_minion.sls` points to your administration 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

Starting stage: ceph.stage.0
Parsing ceph.stage.0 steps... #

Parsing ceph.stage.0 steps... ✓

[...]
```

```
[14/14] ceph.updates on
      ses55-osd1.suse-sap.net..... ✓ (8s)
      ses55-admin.suse-sap.net..... ✓ (8s)
      ses55-osd0.suse-sap.net..... ✓ (9s)
      ses55-osd2.suse-sap.net..... ✓ (7s)

Ended stage: ceph.stage.0 succeeded=14/14 time=57.7s
```

16. Collect information about the nodes:

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

Starting stage: ceph.stage.1
Parsing ceph.stage.1 steps... #

Parsing ceph.stage.1 steps... ✓

[...]

[4/4]  proposal.populate..... ✓ (3s)

Ended stage: ceph.stage.1 succeeded=4/4 time=24.0s
```

17. 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 information:

```
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
```

18. Prepare the final state of the configuration files set:

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

Starting stage: ceph.stage.2
Parsing ceph.stage.2 steps... #

Parsing ceph.stage.2 steps... ✓

[...]

[15/15] advise.osds..... ✓
      (0.5s)

Ended stage: ceph.stage.2 succeeded=15/15 time=40.7s
```

19. You can now deploy your configuration:

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

Starting stage: ceph.stage.3
Parsing ceph.stage.3 steps... #

Parsing ceph.stage.3 steps... ✓

[...]

[50/50] ceph.osd.restart on
        ses55-osd2.suse-sap.net..... ✓ (2s)

Ended stage: ceph.stage.3 succeeded=50/50 time=246.1s
```

20. When the stage 3 has been successfully passed, check the cluster health to ensure that everything is running properly:

```
# ceph -s

cluster:
  id:      <UUID>
  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:
```

21. To benefit from the OpenAttic Web UI you have to initiate the **ceph.stage.4** which will install the OpenAttic service:

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

Starting stage: ceph.stage.4
Parsing ceph.stage.4 steps... #

Parsing ceph.stage.4 steps... ✓

[...]

[7/7]  ceph.openattic.restart on
      ses55-admin.suse-sap.net..... ✓ (3s)

Ended stage: ceph.stage.4 succeeded=7/7 time=105.2s
```

22. You can now manage your cluster through the Web UI:

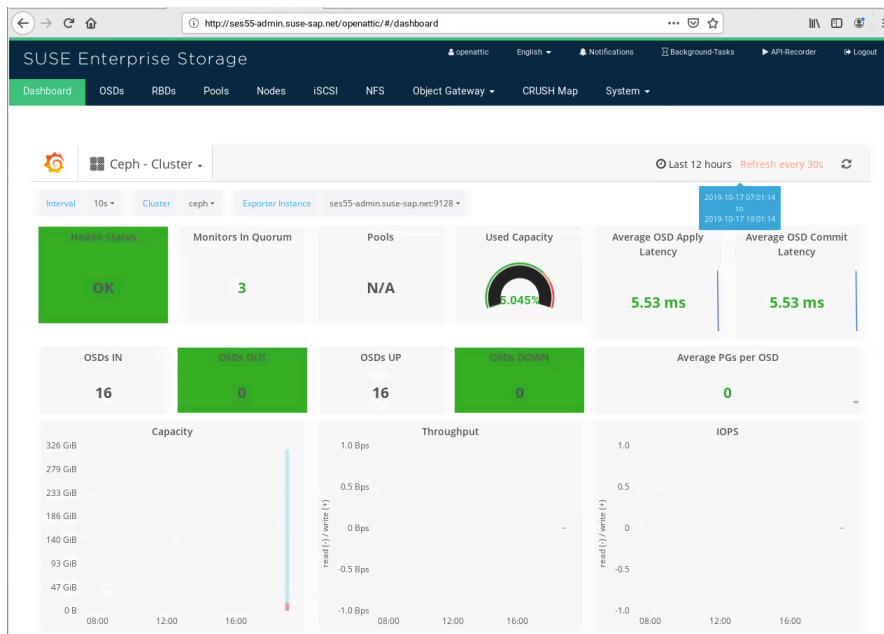


FIGURE 28: SUSE ENTERPRISE STORAGE WEB UI

23. To provide a SAP Data Hub RBD device, create a pool for it:

The screenshot shows the SUSE Enterprise Storage admin interface. The browser address bar displays `http://ses55-admin.suse-sap.net/openattic/#/...`. The navigation menu includes Dashboard, OSDs, RBDs, Pools, Nodes, iSCSI, NFS, and Object Gateway. The breadcrumb trail is `Ceph Pools >> Add`. The main form is titled "Create Ceph pool: sapdh26" and contains the following fields:

- Name ***: `sapdh26`
- Pool type ***: `Replicated pool`
- Crush ruleset ***: `replicated_rule`
- Replicated size ***: `3` (Minimum: 1, Maximum: 10)
- Placement groups ***: `512` (Calculation help)
- Compression Mode ***: `none`
- Applications ***: `rd`

Buttons for `Create` and `Back` are located at the bottom right of the form.

FIGURE 29: CEPH POOL

24. Now provide access to this pool through an RBD device.

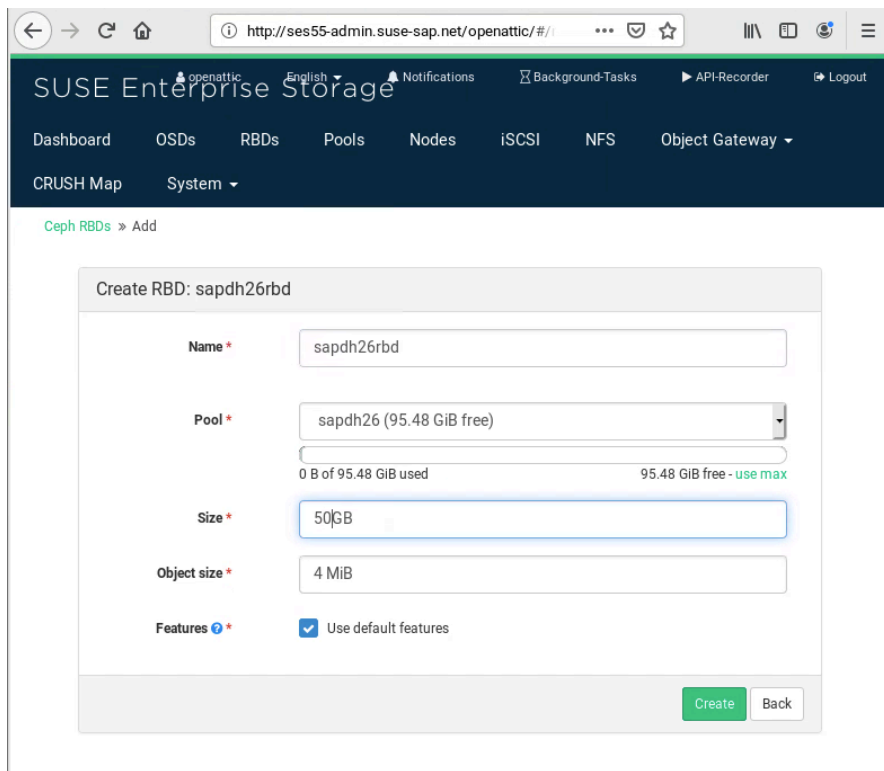



FIGURE 30: CEPH RBD

25. You can now proceed to [Section 4.1.2, “Prerequisites on the SUSE CaaS Platform 3 Cluster”](#).

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