

SAP Data Intelligence 3 on Rancher Kubernetes Engine 2 using VMware vSAN and vSphere

SUSE Linux Enterprise Server for SAP Applications 15 SP4

Rancher Kubernetes Engine 2

SAP Data Intelligence 3

VMware vSAN

VMware vSphere

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SAP Data Intelligence 3 is the tool set to govern big amounts of data, and it runs fully containerized. This document describes the installation and configuration of SAP Data Intelligence 3 deployed on SUSE's RKE2 and VMWare vsphere and vsan.

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1 Introduction

This guide describes the on-premises installation of SAP Data Intelligence 3.3 on top of VMware vSphere/vSAN cluster and Rancher Kubernetes Engine (RKE) 2. This guide does not provide information on how to set up a VMware vSphere / vSAN cluster.

In a nutshell, the installation of SAP Data Intelligence 3.3 consists of the following steps:

- Installing VMware virtual machines in the vSphere cluster as dedicated nodes for the RKE 2 cluster
- Creating the configuration of the vSphere CPI/CSI drivers for the use with RKE 2
- Installing RKE 2 Kubernetes cluster on the dedicated nodes
- Deploying SAP Data Intelligence 3.3 on RKE 2 Kubernetes cluster
- Performing post-installation steps for SAP Data Intelligence 3.3
- Testing the installation of SAP Data Intelligence 3.3

To have a fully supported setup, there are two Kubernetes clusters required. One runs SUSE Rancher Management server and the other runs the actual workload, which for the purpose of this guide is SAP Data Intelligence.

2 Requirements

2.1 Hardware requirements

This chapter describes the hardware requirements for installing SAP Data Intelligence 3.3 on RKE 2 on top of SUSE Linux Enterprise Server 15 SP3. Only the AMD64/Intel 64 architecture is applicable for our use case.

2.1.1 Hardware Sizing

Correct hardware sizing is very important for setting up SAP Data Intelligence 3.3 on RKE 2.

2.1.1.1 Development systems

- Minimal hardware requirements for a generic SAP Data Intelligence 3 deployment:
 - At least 7 nodes are needed for the Kubernetes cluster.
 - Minimum sizing of the nodes needs to be as shown below:

Server Role	Count	RAM	CPU	Disk space
Management Workstation	1	16 GiB	4	> 100 GiB
Master Node	3	16 GiB	4	> 120 GiB
Worker Node	4	32 GiB	8	> 120 GiB

2.1.1.2 Production systems

- Minimal hardware requirements for an SAP Data Intelligence 3 deployment for production use:
 - At least seven nodes are needed for the Kubernetes cluster.
 - Minimum sizing of the nodes needs to be as shown below:

Server Role	Count	RAM	CPU	Disk space
Management Workstation	1	16 GiB	4	> 100 GiB
Master Node	3	16 GiB	4	> 120 GiB
Worker Node	4	64 GiB	16	> 120 GiB

2.2 Software requirements

The following list contains the software components needed to install SAP Data Intelligence 3.3 on RKE 2:

- SUSE Linux Enterprise Server 15 SP4
- Rancher Kubernetes Engine 2
- SAP Software Lifecycle Bridge
- SAP Data Intelligence 3.3
- Secure private registry for container images, for example <https://documentation.suse.com/sbp/all/single-html/SBP-Private-Registry/index.html>
- Access to a storage solution providing dynamically physical volumes
- If it is planned to use Vora's streaming tables checkpoint store, an S3 bucket like object store is needed
- If it is planned to enable backup of SAP Data Intelligence 3.3 during installation access to an S3-compatible object store is needed

3 Preparations

- Get a SUSE Linux Enterprise Server 15 SP4 subscription.
- Download the installer for SUSE Linux Enterprise Server 15 SP4.
- Check the storage requirements.
- Create a or get access to a private container registry.
- Get an SAP S-user to access software and documentation by SAP.
- Read the relevant SAP documentation:
 - Release Note for SAP DI 3 (<https://launchpad.support.sap.com/#/notes/2871970>) ↗
 - Release Note for SAP SLC Bridge (<https://launchpad.support.sap.com/#/notes/2589449>) ↗
 - Installation Guide at help.sap.com (<https://help.sap.com/viewer/a8d90a56d61a49718e-bcb5f65014bbe7/3.2.latest/en-US>) ↗

4 Installation of RKE 2 on top of VMware vSphere and VMware vSAN

4.1 Prerequisites:

- A running VMware vSphere / vSAN installation.
 - NOTE: The installation of the VMware vSphere / vSAN environment is not in the scope of this document.
- Create the virtual machines for the RKE 2 cluster with SUSE Linux Enterprise Server 15 SP4 as operating system in the vSphere environment. Make sure these virtual machines are sized according to the recommendations given above in this guide.
- Make sure that uuid creation for disks is enabled in the settings for the virtual machines.

- <https://rke.docs.rancher.com/config-options/cloud-providers/vsphere/enabling-uuid> 

4.2 Install RKE 2 cluster on top of the VMware virtual machines.

Before you start the installation of RKE 2, create the configuration below for the RKE 2 cluster. This is necessary to use the vSAN as backing storage for the storage class in RKE 2. You will need the following data:

- user on vSphere/vSAN with the necessary access rights
- vCenter hostname
- datacenter ID
- ClusterID
- vSAN url / datastorage url

You should obtain this information from the VMware vSphere/vSAN administrator.

These data will be used to configure the helm manifests for the vsphere CPI and CSI provider and to access the resources in the vSphere installation.

To use the vSphere CPI and CSI, RKE2 must be configured to use the rancher-vsphere cloud provider.

```
$ sudo mkdir -p /etc/rancher/rke2
$ sudo echo "cloud-provider-name: rancher-vsphere" > /etc/rancher/rke2/config.yaml"
```

This enables the deployment of the vSphere CPI and CSI from pre-packaged Helm charts in RKE 2. It will also deploy a storage class that makes use of the vSphere CPI/CSI drivers.

Create the configuration for the CPI vSphere provider Helm chart:

- Create the directory structure on first the master node

```
$ sudo mkdir -p /var/lib/rancher/rke2/server/manifests
$ cd /var/lib/rancher/rke2/server/manifests
```

Then create the file [rancher-vsphere-cpi-config.yaml](#) in the directory.

```
/var/lib/rancher/rke2/server/manifests
```

```

$ cat <<EOF >
apiVersion: helm.cattle.io/v1
kind: HelmChartConfig
metadata:
  name: rancher-vsphere-cpi
  labels:
  namespace: kube-system
spec:
  valuesContent: |-
    vCenter:
      host: "vcenterhostname"
      datacenters: "datacentername"
      username: "xxxxxxxxxxx"
      password: "xxxxxxxxxxx"
      insecure: true
      credentialsSecret:
        generate: true
    cloudControllerManager:
      nodeSelector:
        node-role.kubernetes.io/control-plane: "true"

EOF

```

In the same directory, the file rancher-vsphere-csi-config.yaml will be created.

```

$ cat <<EOF > /var/lib/rancher/rke2/server/manifests/rancher-vsphere-csi-config.yaml
apiVersion: helm.cattle.io/v1
kind: HelmChartConfig
metadata:
  name: rancher-vsphere-csi
  namespace: kube-system
spec:
  valuesContent: |-
    vCenter:
      host: "vcenter host"
      datacenters: "datacenter"
      username: "xxxxxxx"
      password: "xxxxxxxxx"
      clusterId: "vSANclusterID"
      insecure: true
      configSecret:
        configTemplate: |
          [Global]
          cluster-id = {{ required ".Values.vCenter.clusterId must be
provided" (default .Values.vCenter.clusterId .Values.global.cattle.clusterId) | quote }}
          user = {{ .Values.vCenter.username | quote }}
          password = {{ .Values.vCenter.password | quote }}

```

```

port = {{ .Values.vCenter.port | quote }}
insecure-flag = {{ .Values.vCenter.insecureFlag | quote }}
[VirtualCenter {{ .Values.vCenter.host | quote }}]
datacenters = {{ .Values.vCenter.datacenters | quote }}
[Labels]
storageClass:
  datastoreURL: "ds:///vmfs/volumes/vsan:XXXXXXXXXXXX/"
csiController:
  nodeSelector:
    node-role.kubernetes.io/control-plane: "true"
EOF

```

See the RKE 2 documentation here:

- <https://ranchermanager.docs.rancher.com/pages-for-subheaders/vsphere> ↗

Now you can deploy the RKE 2 cluster on the dedicated virtual machines.

- Connect to the nodes dedicated as master for the RKE 2 cluster
- Download and install RKE 2

```

$ export INSTALL_RKE2_TYPE=server
$ export INSTALL_RKE2_VERSION=<wanted version here>
$ curl -sfL https://get.rke2.io | sh -
$ systemctl enable --now rke2-server.service

```

- Connect to the nodes dedicated as workers of the RKE 2 cluster:

```

$ export INSTALL_RKE2_TYPE=agent
$ export INSTALL_RKE2_VERSION=<wanted version here>
$ curl -sfL https://get.rke2.io | sh -
$ systemctl enable --now rke2-agent.service

```

- More details can be found in the RKE 2 documentation:
- <https://docs.rke2.io/install/methods> ↗
- After the deployment of the RKE 2 cluster, check the availability of the storage class vsphere-csi-sc which should have been created.

```

$ kubectl get sc

```

NAME	PROVISIONER	RECLAIMPOLICY	VOLUMEBINDINGMODE
ALLOWVOLUMEEXPANSION	AGE		
vsphere-csi-sc (default)	csi.vsphere.vmware.com	Delete	Immediate
false	17m		

Now you can proceed with installing SAP Data Intelligence.

5 Installing SAP Data Intelligence 3.3

This section describes the installation of SAP Data Intelligence 3.3 on an RKE 2-powered Kubernetes cluster.

5.1 Preparation

The following steps need to be executed before the deployment of SAP Data Intelligence 3.3 can start:

- Create a namespace for SAP Data Intelligence 3.3.
- Create an access to a secure private registry.
- Download and install SAP SLC Bridge.
- Download the *stack.xml* file for provisioning the DI 3.3 installation.
- Check if the `nfsd` and `nfsv4` kernel modules are loaded and/or loadable on the Kubernetes nodes.

5.1.1 Creating namespace for SAP Data Intelligence 3.3 in the Kubernetes cluster

Log in to your management workstation and create the namespace in the Kubernetes cluster where DI 3.3 will be deployed.

```
$ kubectl create ns <NAMESPACE for DI 3.1>
$ kubectl get ns
```

5.1.2 Creating *cert* file to access the secure private registry

Create a file named *cert* that contains the SSL certificate chain for the secure private registry. This imports the certificates into SAP Data Intelligence 3.3. Make sure that the file does not contain DOS-type line endings. The commands listed below will remove the DOS-type line endings and create the necessary secret.

```
$ cat CA.pem > cert_with_cr
$ tr -d '\r' < cert_with_cr > cert
$ kubectl -n <NAMESPACE for DI 3> create secret generic cmcertificates --from-file=cert
```

5.2 Downloading the SLC Bridge

The SLC Bridge can be obtained:

- from the SAP software center at https://support.sap.com/en/tools/software-logistics-tools.html#section_622087154. Choose "Download SLC Bridge".
- via the information in the release notes of the SLC Bridge at <https://launchpad.support.sap.com/#/notes/2589449>.
- via <https://help.sap.com/viewer/a8d90a56d61a49718ebcb5f65014bbe7/3.3.latest/en-US/8ae38791d71046fab1f25ee0f682dc4c.html>.

Download the SLC Bridge software to the management workstation.

5.3 Installing the SLC Bridge

Rename the SLC Bridge binary to `slcb` and make it executable. Deploy the SLC Bridge to the Kubernetes cluster.

```
$ mv SLCB01_XX-70003322.EXE slcb
$ chmod 0700 slcb
$ export KUBECONFIG=<KUBE_CONFIG>
$ ./slcb init
```

During the interactive installation, the following information is needed:

- URL of secure private registry
- Choose **expert mode**
- Choose **NodePort** for the service

Take a note of the service port of the SLC Bridge. It is needed for the installation of SAP Data Intelligence 3.3 or for the reconfiguration of DI 3.3, for example to enable backup. If you forgot to note it down, the following command will list the service port:

```
$ kubectl -n sap-slcbridge get svc
```

5.4 Creating and downloading Stack XML for the SAP Data Intelligence installation

Follow the steps described in the chapter [Install SAP Data Intelligence with SLC Bridge in a Cluster with Internet Access \(https://help.sap.com/viewer/a8d90a56d61a49718ebcb5f65014bbe7/3.3.latest/en-US/7e4847e241c340b3a3c50a5db11b46e2.html\)](https://help.sap.com/viewer/a8d90a56d61a49718ebcb5f65014bbe7/3.3.latest/en-US/7e4847e241c340b3a3c50a5db11b46e2.html) of the SAP Data Intelligence 3.3 Installation Guide.

5.4.1 Creating Stack XML

You can create the Stack XML via the SAP Maintenance Planner. Access the tool via <https://support.sap.com/en/alm/solution-manager/processes-72/maintenance-planner.html>. Go to the Maintenance Planner at <https://apps.support.sap.com/sap/support/mp> published on the SAP Web site and generate a Stack XML file with the container image definitions of the SAP Data Intelligence release that you want to install. Download the Stack XML file to a local directory. Copy *stack.xml* to the management workstation.

5.5 Running the installation of SAP Data Intelligence

The installation of SAP Data Intelligence 3.3 is invoked by:

```
$ export KUBECONFIG=<path to kubeconfig>
$ ./slcb execute --useStackXML MP_Stack_XXXXXXXXXX_XXXXXXXXX.xml --url https://
<node>:<service port>/docs/index.html
```

This starts an interactive process for configuring and deploying SAP Data Intelligence 3.3.

The table below lists some parameters available for an SAP Data Intelligence 3.3 installation:

Parameter	Condition	Recommendation
Kubernetes Namespace	Always	set to namespace created beforehand
Installation Type	installation or update	either
Container Registry	Always	add the uri for the secure private registry

Parameter	Condition	Recommendation
Checkpoint Store Configuration	installation	whether to enable Checkpoint Store
Checkpoint Store Type	if Checkpoint Store is enabled	use S3 object store from SES
Checkpoint Store Validation	if Checkpoint is enabled	Object store access will be verified
Container Registry Settings for Pipeline Modeler	optional	used if a second container registry is used
StorageClass Configuration	optional, needed if a different StorageClass is used for some components	leave the default
Default StorageClass	detected by SAP Data Intelligence installer	The Kubernetes cluster shall have a storage class annotated as default SC
Enable Kaniko Usage	optional if running on Docker	enable
Container Image Repository Settings for SAP Data Intelligence Modeler	mandatory	
Container Registry for Pipeline Modeler	optional	Needed if a different container registry is used for the pipeline modeler images
Loading NFS Modules	optional	Make sure that nfsd and nfsv4 kernel modules are loaded on all worker nodes
Additional Installer Parameters	optional	

For more details about input parameters for an SAP Data Intelligence 3.3 installation, visit the section [Required Input Parameters \(https://help.sap.com/viewer/a8d90a56d61a49718e-bcb5f65014bbe7/3.3.latest/en-US/abfa9c73f7704de2907ea7ff65e7a20a.html\)](https://help.sap.com/viewer/a8d90a56d61a49718e-bcb5f65014bbe7/3.3.latest/en-US/abfa9c73f7704de2907ea7ff65e7a20a.html) of the SAP Data Intelligence Installation Guide.

5.6 Post-installation tasks

After the installation workflow is successfully finished, you need to carry out some additional tasks:

- Obtain or create an SSL certificate to securely access the SAP Data Intelligence installation:

- Create a certificate request using `openssl`, for example:

```
$ openssl req -newkey rsa:2048 -keyout <hostname>.key -out <hostname>.csr
```

- Decrypt the key:

```
$ openssl rsa -in <hostname>.key -out decrypted-<hostname>.key
```

- Let a CA sign the `<hostname>.csr`. You will receive a `<hostname>.crt`.
- Create a secret from the certificate and the key in the SAP Data Intelligence 3 namespace:

```
$ export NAMESPACE=<{di} 3 namespace>
```

```
$ kubectl -n $NAMESPACE create secret tls vsystem-tls-certs --key decrypted-  
<hostname>.key --cert <hostname>.cert
```

- Deploy an nginx-ingress controller:

- For more information, see <https://kubernetes.github.io/ingress-nginx/deploy/#bare-metal>.

- Create the nginx-ingress controller as a **nodePort** service according to the Ingress nginx documentation:

```
$ kubectl apply -f https://raw.githubusercontent.com/kubernetes/ingress-nginx/  
controller-v0.46.0/deploy/static/provider/baremetal/deploy.yaml
```

- Determine the port the nginx controller is redirecting HTTPS to:

```
$ kubectl -n ingress-nginx get svc ingress-nginx-controller
```

The output should be similar to the below:

```
kubectl -n ingress-nginx get svc ingress-nginx-controller  
NAME                                TYPE           CLUSTER-IP    EXTERNAL-IP    PORT(S)  
                                     AGE  
ingress-nginx-controller            NodePort       10.43.86.90   <none>         80:31963/  
TCP,443:{di_version}06/TCP        53d
```

In our example here, the TLS port is be 3.306. Note the port IP down as you will need it to access the SAP Data Intelligence installation from the outside.

- Create an Ingress to access the SAP Data Intelligence installation:

```
$ cat <<EOF > ingress.yaml  
apiVersion: extensions/v1beta1  
kind: Ingress  
metadata:  
  annotations:  
    kubernetes.io/ingress.class: nginx  
    nginx.ingress.kubernetes.io/force-ssl-redirect: "true"  
    nginx.ingress.kubernetes.io/secure-backends: "true"  
    nginx.ingress.kubernetes.io/backend-protocol: HTTPS  
    nginx.ingress.kubernetes.io/proxy-body-size: "0"  
    nginx.ingress.kubernetes.io/proxy-buffer-size: 16k  
    nginx.ingress.kubernetes.io/proxy-connect-timeout: "30"  
    nginx.ingress.kubernetes.io/proxy-read-timeout: "1800"  
    nginx.ingress.kubernetes.io/proxy-send-timeout: "1800"  
name: vsystem
```

```

spec:
  rules:
    - host: "<hostname FQDN must match SSL certificate>"
      http:
        paths:
          - backend:
              serviceName: vsystem
              servicePort: 8797
            path: /
      tls:
        - hosts:
            - "<hostname FQDN must match SSL certificate>"
          secretName: vsystem-tls-certs
EOF
$ kubectl apply -f ingress.yaml

```

- Connecting to `https://hostname:<ingress service port>` brings up the SAP Data Intelligence login dialog.

5.7 Testing the SAP Data Intelligence 3 installation

Finally, the SAP Data Intelligence 3 installation should be verified with some very basic tests:

- Log in to SAP Data Intelligence's launchpad
- Create example pipeline
- Create ML Scenario
- Test machine learning
- Download `vctl`

For details, see the [SAP Data Intelligence 3 Installation Guide \(https://help.sap.com/viewer/a8d90a56d61a49718ebcb5f65014bbe7/3.3.latest/en-US/1551785f3d7e4d37af7fe99185f7acb6.html\)](https://help.sap.com/viewer/a8d90a56d61a49718ebcb5f65014bbe7/3.3.latest/en-US/1551785f3d7e4d37af7fe99185f7acb6.html)

6 Maintenance tasks

This section provides some tips about what should and could be done to maintain the Kubernetes cluster, the operating system and the SAP Data Intelligence 3 deployment.

6.1 Backup

It is good practice to keep backups of all relevant data to be able to restore the environment in case of a failure. To perform regular backups, follow the instructions as outlined in the respective documentation below:

- For RKE 2, consult section [Backups and Disaster Recovery \(https://rancher.com/docs/rke/latest/en/etcd-snapshots/\)](https://rancher.com/docs/rke/latest/en/etcd-snapshots/) ↗
- SAP Data Intelligence 3 can be configured to create regular backups. For more information, visit [help.sap.com](https://help.sap.com/viewer/a8d90a56d61a49718ebcb5f65014bbe7/3.3.latest/en-US/e8d4c33e6cd648b0af9fd674dbf6e76c.html):
<https://help.sap.com/viewer/a8d90a56d61a49718ebcb5f65014bbe7/3.3.latest/en-US/e8d4c33e6cd648b0af9fd674dbf6e76c.html> ↗.

6.2 Upgrade or update

This section explains how you can keep your installation of SAP Data Intelligence, RKE 2 and SUSE Linux Enterprise Server up-to-date.

6.2.1 Updating the operating system

To obtain updates for SUSE Linux Enterprise Server 15 SP4, the installation must be registered either to SUSE Customer Center, an SMT or RMT server, or SUSE Manager with a valid subscription.

- SUSE Linux Enterprise Server 15 SP4 can be updated on the command line using `zypper`:

```
$ sudo zypper ref -s
$ sudo zypper lu
$ sudo zypper patch
```

- Other methods for updating SUSE Linux Enterprise Server 15 SP4 are described in the [product documentation \(https://documentation.suse.com/sles\)](https://documentation.suse.com/sles) ↗.

If an update requires a reboot of the server, make sure that this can be done safely.

- For example, block access to SAP Data Intelligence, and drain and cordon the Kubernetes node before rebooting:

```
$ kubectl edit ingress <put in some dummy port>
```

```
$ kubectl drain <node>
```

- Check the status of the node:

```
$ kubectl get node <node>
```

The node should be marked as **not schedulable**.

- On RKE 2 master nodes, run the command:

```
$ sudo systemctl stop rke2-server
```

- On RKE 2 worker nodes, run the command:

```
$ sudo systemctl stop rke2-agent
```

- Update SUSE Linux Enterprise Server 15 SP4:

```
$ ssh node  
$ sudo zypper patch
```

- Reboot the nodes if necessary or start the appropriate RKE 2 service.

- On master nodes, run the command:

```
$ sudo systemctl start rke2-server
```

- On worker nodes, run the command:

```
$ sudo systemctl start rke2-agent
```

- Check if the respective nodes are back and uncordon them.

```
$ kubectl get nodes  
$ kubectl uncordon <node>
```

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