SUSE Virtualization v1.6, Hitachi Vantara Virtual Storage Platform One

SUSE Virtualization with Hitachi VSP Storage

Deploy SUSE Virtualization and Hitachi VSP Storage for cloud native virtualization infrastructure

SUSE Virtualization v1.6+
Hitachi Vantara Virtual Storage Platform One

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SUSE

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Date: 2026-01-23

Summary

This guide describes how to integrate Hitachi Storage with SUSE Virtualization using the Hitachi Storage Plug-in for Containers (HSPC CSI driver). It covers prerequisites, multipath configuration, CSI operator installation, and the creation of Kubernetes resources (Secret, StorageClass, PVC, SnapshotClass), along with validation steps using both CLI and the SUSE Virtualization UI. This guide is intended for platform engineers, systems administrators, and others who design, deploy, and manage enterprise, cloud native, and virtualization infrastructure.

Contents

1 Introduction

As organizations evolve toward modernized hybrid infrastructures, unified virtualization and enterprise storage become critical for reliability, scalability, and efficiency. SUSE Virtualization (https://www.suse.com/products/rancher/virtualization/) ↗, built on Harvester and powered by Kubernetes, provides a robust foundation for running both virtual machines and containerized workloads on a single platform. When deployed with Hitachi Vantara Virtual Storage Platform One (https://www.hitachivantara.com/) ↗ (Hitachi VSP), enterprises can access data management, high performance storage, and data protection for mission-critical workloads.

This document offers technical guidance for integrating SUSE Virtualization and Hitachi VSP using the Hitachi Storage Plug-in for Containers.

1.1 Scope

This guide provides detailed instructions for integrating Hitachi Vantara Virtual Storage Platform One with SUSE Virtualization clusters. It includes steps for configuring multipath I/O, installing the Hitachi Storage Plug-in for Containers, creating Kubernetes resources (Secrets, StorageClass, PVC, SnapshotClass), and validating the deployment using SUSE Virtualization UI and CLI.

1.2 Audience

This guide is intended for platform teams, systems and storage administrators, and DevOps engineers supporting modern virtualization, featuring SUSE Virtualization and Hitachi Vantara Virtual Storage Platform One.

The reader should have basic familiarity with Linux, Kubernetes, storage networking protocols (iSCSI (https://en.wikipedia.org/wiki/ISCSI) ↗ or FC (https://en.wikipedia.org/wiki/Fibre_Channel) ↗), SUSE Virtualization, and Hitachi Vantara Virtual Storage Platform One.

1.3 Acknowledgments

The author wishes to acknowledge contributions from Hitachi Vantara engineering teams for validation and joint testing of the Hitachi Storage Plug-in for Containers integration with SUSE Virtualization.

2 Overview

In this guide, you learn how to enable Hitachi Vantara Virtual Storage Platform One to provide enterprise storage backing for virtual machines and containers in your SUSE Virtualization environment.

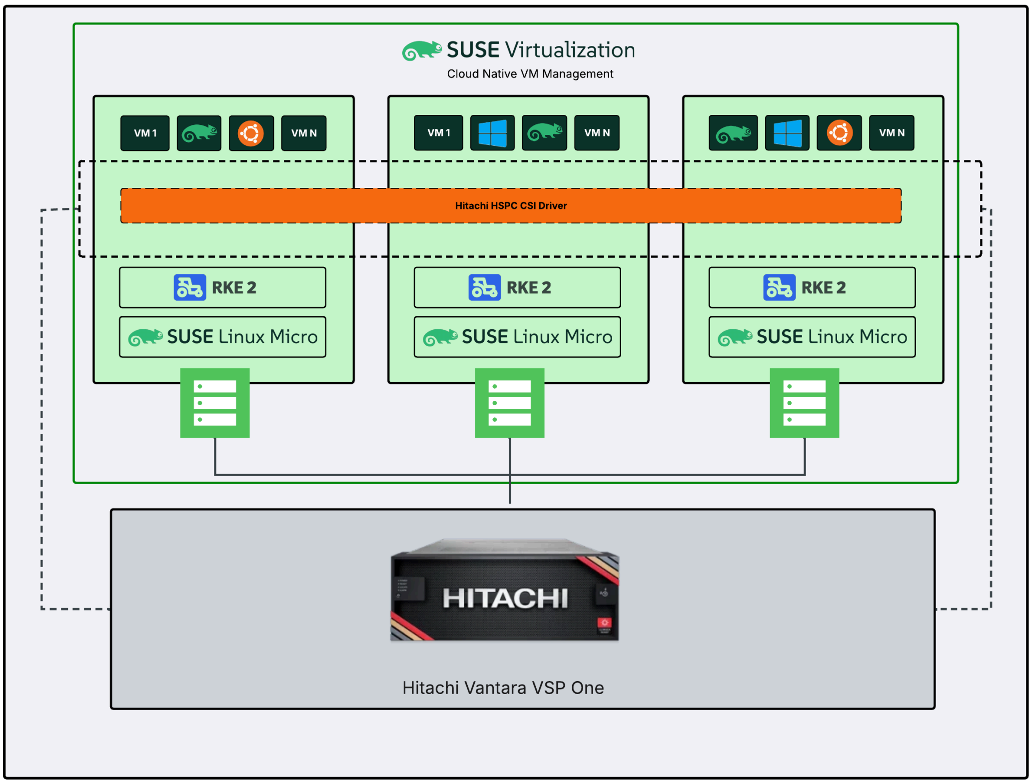


FIGURE 1: GENERAL IMPLEMENTATION ARCHITECTURE

Key elements of this solution include:

SUSE Virtualization

SUSE Virtualization (https://www.suse.com/products/rancher/virtualization/) delivers a fully integrated, cloud-native virtualization platform built on modern Kubernetes technologies. It simplifies VM lifecycle management, enhances platform resiliency, and provides a secure foundation for enterprise workloads. SUSE Virtualization brings the advantages of container orchestration into traditional virtualization environments, enabling organizations to modernize infrastructure without complexity.
Key SUSE Virtualization features include:

- High Availability

High Availability (HA) in SUSE Virtualization is grounded in a combination of Kubernetes-native resilience and enterprise storage capabilities. Rancher Kubernetes Engine 2 (RKE2) (https://documentation.suse.com/cloudnative/rke2/latest/en/introduction.html) ↗ provides an HA control plane and manages cluster health, automatically restarting or relocating workloads if nodes become unresponsive. When paired with storage using multipath I/O, VM disks remain accessible across multiple storage paths, protecting against network, node, and controller failures. This ensures uninterrupted operations for critical applications.

- Enhanced Security
  SUSE Virtualization is a secure, pre-hardened appliance.
  At its foundation is SUSE Linux Micro (SL Micro) (https://www.suse.com/products/micro/) ↗, the lightweight, enterprise, real-time Linux operating system, and Rancher Kubernetes Engine 2 (RKE2) (https://documentation.suse.com/cloudnative/rke2/latest/en/introduction.html) ↗, the secure-by-default Kubernetes distribution. SL Micro's reduced attack surface, immutable file system, and transactional updates with system rollbacks make it an ideal host for Kubernetes. SL Micro is complemented by RKE2, the secure-by-default Kubernetes distribution, which delivers the security-hardened control plane that enables robust orchestration while meeting strict government and industry compliance standards.
  Additional security features of SUSE Virtualization include:
  - advanced network security with microsegmentation, traffic isolation, and mutual TLS (mTLS) support
  - secure secrets management
  - support for volume encryption
  - role-based access control (RBAC) through SUSE Rancher Prime integration
  - air-gapped upgrades for use in highly regulated and secure facilities
- SUSE Virtualization UI
  The SUSE Virtualization user interface reduces complexity and simplifies operations. It offers an intuitive, centralized dashboard for managing VMs, networks, storage, and snapshots. Administrators can easily create, clone, and migrate virtual machines without requiring deep Kubernetes knowledge.
- External Storage Compatibility

SUSE Virtualization enables seamless integration with enterprise SANs like Hitachi VSP through container storage interface (CSI) (https://documentation.suse.com/cloudnative/virtualization/v1.6/en/storage/csidriver.html) drivers. Third-party storage integrations empower enterprises with choice, supporting centralized storage administration and a tailored storage experience for meeting business and technical requirements, including scaling, availability, performance, and data protection.

This guide references SUSE Virtualization v1.6 and later.

Hitachi Vantara Virtual Storage Platform One

Hitachi VSP (https://www.hitachivantara.com/) provides enterprise storage for backing container and virtual machine workloads. Hitachi VSP platforms are designed for mission-critical environments, delivering scalable storage solutions with unparalleled reliability. Supported platforms include Hitachi VSP, VSP One Block as well as VSP One SDS in Azure, AWS, and GCP public clouds.

Hitachi Storage Plug-in for Containers (HSPC)

HSPC (https://www.hitachivantara.com/en-us/pdf/datasheet/storage-plug-in-for-containers-datasheet.pdf) is a CSI driver (https://documentation.suse.com/cloudnative/virtualization/v1.6/en/storage/csidriver.html) that provides integration between Hitachi VSP and SUSE Virtualization, enabling you to create and use Hitachi storage volumes for stateful container applications and virtual machines. Installation, configuration, and lifecycle management of the CSI driver is handled by the HSPC CSI Operator.

This guide references HSPC v3.16.1 and later.

After implementing this integration in your SUSE Virtualization environment, you can deploy virtual machines and containers backed by Hitachi VSP storage.

3 Preparing the SUSE Virtualization environment

In this section you prepare your environment to use Hitachi VSP storage with SUSE Virtualization.

Although you can deploy SUSE Virtualization in a single-node configuration, this is not recommended for production-grade environments where scalability, performance, and availability are important considerations. Production environments should feature at least three controller/worker nodes (https://documentation.suse.com/cloudnative/virtualization/v1.6/en/introduction/deploy-ha-cluster.html) and a dedicated storage network.

1. If you have not already done so, install SUSE Virtualization.
   You can access the SUSE Virtualization documentation (https://documentation.suse.com/cloudnative/virtualization/v1.6/en/introduction/overview.html) for step-by-step installation guidance, hardware and network requirements, and further technical details.

   > **Tip**
   >
   > This guide is developed with SUSE Virtualization v1.6, but you should always use the latest, supported version to avoid vulnerabilities and access the latest features.

2. Configure multipathd on all SUSE Virtualization worker nodes.
   The multipathd (https://documentation.suse.com/cloudnative/virtualization/v1.6/en/storage/csidriver.html#_2_multipath_support) service provides redundant I/O paths (iSCSI (https://en.wikipedia.org/wiki/ISCSI) or Fibre Channel (https://en.wikipedia.org/wiki/Fibre_Channel)) from SUSE Virtualization worker nodes to Hitachi VSP to ensure high availability and fail-over. To configure and start multipathd, you must log in to each SUSE Virtualization node and perform the following operations on the command line:

   a. Enable and start multipathd.

   ```
   systemctl enable multipathd
   systemctl start multipathd
   systemctl status multipathd
   ```

   b. Create the file, `/etc/multipath.conf`.
   Be sure vendor and product rules match your array.

   ```
   defaults {
       user_friendly_names yes
       find_multipaths yes

   }

   blacklist {
   }

   devices {
       device {
           vendor "(HITACHI|HP)"
           product "OPEN-.*"
           path_grouping_policy "multibus"
   ```

```
        path_checker "tur"
        features "0"
        failback immediate
        features "0"
        hardware_handler "0"
        prio "const"
        rr_weight uniform
        no_path_retry 10
    }
}
```

c. With `/etc/multipath.conf` created, restart the `multipathd` service.

```
systemctl restart multipathd
```

4 Implementing the integration

Integration of Hitachi VSP involves deployment of the HSPC CSI driver into your SUSE Virtualization environment. This process is described in the following sections.

> **Note**
> You can perform the steps described here on any of the SUSE Virtualization nodes.

4.1 Installing Hitachi Storage Plug-in for Containers

1. Clone the HSPC CSI Operator repository and change directory.

```
git clone https://github.com/hitachi-vantara/csi-operator-hitachi
cd csi-operator-hitachi/hspc/<version>/operator
```

Be sure to replace `<version>` in the above command with the desired, available version.

2. Create the operator namespace.

```
kubectl apply -f hspc-operator-namespace.yaml
```

3. Deploy the operator.

```
kubectl apply -f hspc-operator.yaml
```

4. Verify deployment of the operator.

```
kubectl get deployment -n hspc-operator-system
```

```
hspc-node1:~ # kubectl get deployment -n hspc-operator-system
NAME                               READY   UP-TO-DATE   AVAILABLE   AGE
hspc-operator-controller-manager   1/1     1            1           5h40m
```

4.2 Deploying the HSPC instance

Deploy the HSPC pods and operator controller.

1. Customize the file, `hspc_v1_hspc.yaml`, with your namespace and settings.
   For example, you can set the namespace to `vspone` as follows:

```
apiVersion: csi.hitachi.com/v1
kind: HSPC
metadata:
  name: hspc
  namespace: vspone
spec: {}
```

2. Deploy the HSPC instance.

```
kubectl apply -f hspc_v1_hspc.yaml
```

3. Verify HSPC pods and operator controller status.

```
kubectl -n vspone get hspc
kubectl -n vspone get pods | egrep 'hspc-csi-controller|hspc-csi-node'
kubectl -n hspc-operator-system get deploy hspc-operator-controller-manager
```

```
hspc-node1:~ # kubectl -n vspone get hspc
NAME   READY   AGE
hspc   true    109s
hspc-node1:~ # kubectl -n kube-system get pods | egrep 'hspc-csi-controller|hspc-csi-node'
hspc-node1:~ # vi hspc_v1_hspc_vspone.yaml
hspc-node1:~ # kubectl -n vspone get pods | egrep 'hspc-csi-controller|hspc-csi-node'
hspc-csi-controller-d8b476f66-j9frb   6/6     Running     0          3m24s
hspc-csi-node-54jz8                   2/2     Running     0          3m24s
hspc-csi-node-c25pf                   2/2     Running     0          3m24s
hspc-csi-node-q772m                   2/2     Running     0          3m24s
hspc-node1:~ # kubectl -n hspc-operator-system get deploy hspc-operator-controller-manager
NAME                               READY   UP-TO-DATE   AVAILABLE   AGE
hspc-operator-controller-manager   1/1     1            1           2d4h
hspc-node1:~ #
```

4.3 Defining a Kubernetes Secret with Hitachi VSP credentials

For authentication, you need to provide your Hitachi VSP credentials as a Kubernetes Secret.

1. Encode credentials to base64 and define the Secret in `secret-vsp-112.yaml`.

```
apiVersion: v1
kind: Secret
metadata:
  name: secret-vsp-112
  namespace: vspone
type: Opaque
data:
  url: <base64-url>
  user: <base64-username>
  password: <base64-password>
```

2. Create the Secret.

```
kubectl apply -f secret-vsp-112.yaml
```

4.4 Creating the StorageClass

This provides an HSPC CSI StorageClass (https://documentation.suse.com/cloudnative/storage/latest/en/introduction/terminology.html#_storageclass) ↗ that can be used for PersistentVolumeClaims (https://documentation.suse.com/cloudnative/storage/latest/en/introduction/terminology.html#_persistentvolumeclaim) ↗.

1. Modify the StorageClass YAML.

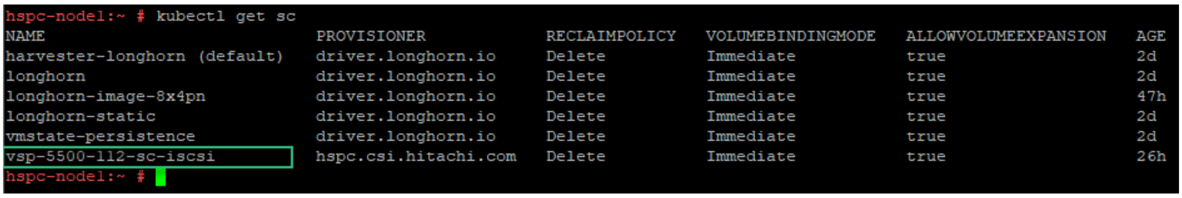
```
apiVersion: storage.k8s.io/v1
kind: StorageClass
metadata:
  name: vsp-5500-112-sc-iscsi
provisioner: hspc.csi.hitachi.com
reclaimPolicy: Delete
volumeBindingMode: Immediate
parameters:
  poolID: "<pool-id>"
  csi.storage.k8s.io/provisioner-secret-name: secret-vsp-112
  csi.storage.k8s.io/provisioner-secret-namespace: vspone
```

2. Activate the StorageClass.

```
kubectl apply -f storageclass.yaml
```

3. Verify the StorageClass.

```
kubectl get sc
```



```
hspc-node1:~ # kubectl get sc
NAME                          PROVISIONER          RECLAIMPOLICY   VOLUMEBINDINGMODE   ALLOWVOLUMEEXPANSION   AGE
harvester-longhorn (default)  driver.longhorn.io   Delete          Immediate           true                   2d
longhorn                      driver.longhorn.io   Delete          Immediate           true                   2d
longhorn-image-8x4pn          driver.longhorn.io   Delete          Immediate           true                   47h
longhorn-static               driver.longhorn.io   Delete          Immediate           true                   2d
vmstate-persistence           driver.longhorn.io   Delete          Immediate           true                   2d
vsp-5500-112-sc-iscsi         hspc.csi.hitachi.com Delete          Immediate           true                   26h
hspc-node1:~ #
```

4.5 Creating a PersistentVolumeClaim (PVC)

1. Create the file, `hitachi-pvc-50g.yaml` to specify the desired storage capacity, such as 50GiB, as follows:

```
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: hitachi-pvc-50g
  namespace: vspone
spec:
  accessModes:
  - ReadWriteOnce
  resources:
    requests:
      storage: 50Gi
```

```
  storageClassName: vsp-5500-112-sc-iscsi
```

2. Activate the PVC.

```
kubectl apply -f hitachi-pvc-50g.yaml
```

3. Verify the PVC binding.

```
kubectl get pvc -n vspone
```

4.6 Validating the configuration

Attach the PVC to a pod to verify that storage is accessible.

Note

This test only verifies PVC provisioning and I/O pathing. In SUSE Virtualization, volumes are attached directly to virtual machines.

1. Create the file, `pod.yaml`, to validate mount and I/O.

```
apiVersion: v1
kind: Pod
metadata:
name: hitachi-test-pod
namespace: vspone
spec:
restartPolicy: Never
containers:
- name: app
   image: busybox
   command: ['sh', '-c', 'echo Hello Hitachi VSP > /data/out.txt && sleep 3600']
   volumeMounts:
   - mountPath: /data
      name: hitachi-vol
volumes:
- name: hitachi-vol
   persistentVolumeClaim:
```

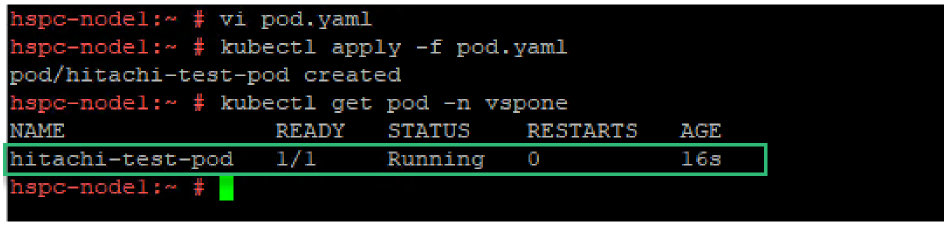
```
      claimName: hitachi-pvc-50g
```

2. Deploy the test pod.

```
kubectl apply -f pod.yaml
```

3. Verify that the test pod is running.

```
kubectl get pods -n vspone
```



5 Enabling snapshots

In this section, you enable snapshots to be stored on Hitachi VSP storage.

1. Define a VolumeSnapshotClass in the file, `volumesnapshotclass-hspc.yaml`.

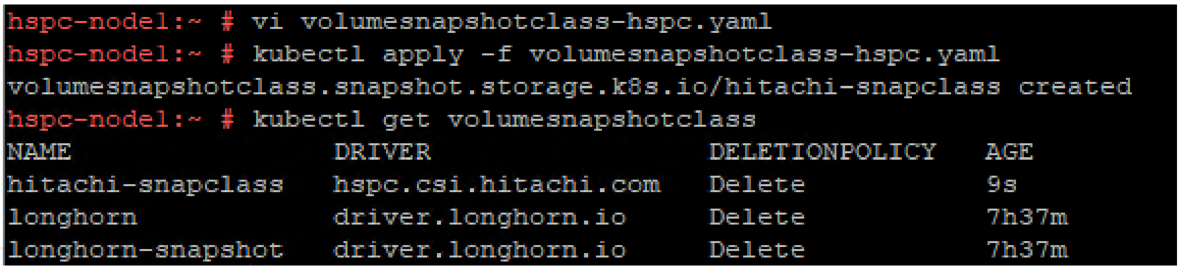
```
apiVersion: snapshot.storage.k8s.io/v1
kind: VolumeSnapshotClass
metadata:
  name: hitachi-snapclass
driver: hspc.csi.hitachi.com
deletionPolicy: Delete
parameters:
  poolID: "2"
  csi.storage.k8s.io/snapshotter-secret-name: secret-vsp-112
  csi.storage.k8s.io/snapshotter-secret-namespace: vspone
```

2. Apply the VolumeSnapshotClass.

```
kubectl apply -f hitachi-snapclass.yaml
```

3. Verify the VolumeSnapshotClass.

```
kubectl get VolumeSnapshotClass
```


```
hspc-nodel:~ # vi volumesnapshotclass-hspc.yaml
hspc-nodel:~ # kubectl apply -f volumesnapshotclass-hspc.yaml
volumesnapshotclass.snapshot.storage.k8s.io/hitachi-snapclass created
hspc-nodel:~ # kubectl get volumesnapshotclass
NAME                 DRIVER                 DELETIONPOLICY   AGE
hitachi-snapclass    hspc.csi.hitachi.com   Delete           9s
longhorn             driver.longhorn.io     Delete           7h37m
longhorn-snapshot    driver.longhorn.io     Delete           7h37m
```

4. Define a VolumeSnapshot resource referencing the PVC in the file, `hitachi-snap-example.yaml`.

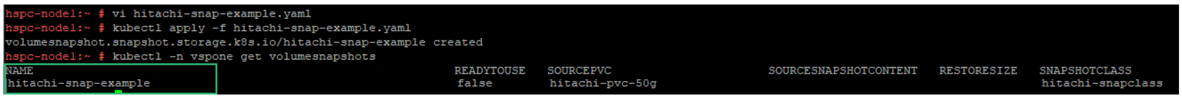
```
apiVersion: snapshot.storage.k8s.io/v1
kind: VolumeSnapshot
metadata:
  name: hitachi-snap-example
  namespace: vspone
spec:
  volumeSnapshotClassName: hitachi-snapclass
  source:
    persistentVolumeClaimName: hitachi-pvc-50g
```

5. Apply the VolumeSnapshot resource.

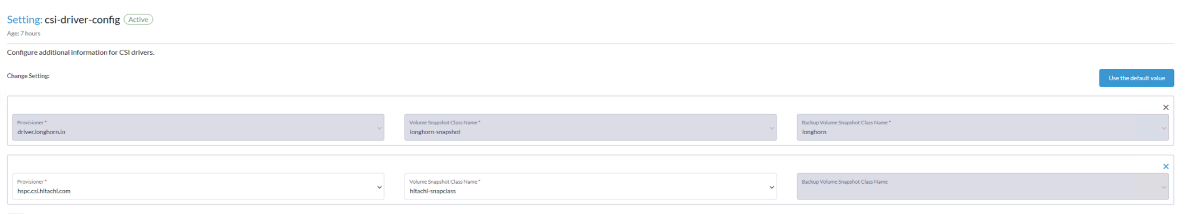
```
kubectl apply -f hitachi-snap-example.yaml
```

6. Verify the VolumeSnapshot resource.

```
kubectl -n vspone get volumesnapshot
```


```
hspc-nodel:~ # vi hitachi-snap-example.yaml
hspc-nodel:~ # kubectl apply -f hitachi-snap-example.yaml
volumesnapshot.snapshot.storage.k8s.io/hitachi-snap-example created
hspc-nodel:~ # kubectl -n vspone get volumesnapshots
NAME                   READYTOUSE   SOURCEPVC         SOURCESNAPSHOTCONTENT   RESTORESIZE   SNAPSHOTCLASS
hitachi-snap-example   false        hitachi-pvc-50g                                         hitachi-snapclass
```

7. Configure SUSE Virtualization CSI Settings for snapshots.



   a. In the SUSE Virtualization UI, select *Advanced* → *Settings* → *csi-driver-config* → *Edit*.

   b. Click *Add*.

c. For *Provisioner*, choose or type: `hspc.csi.hitachi.com`.

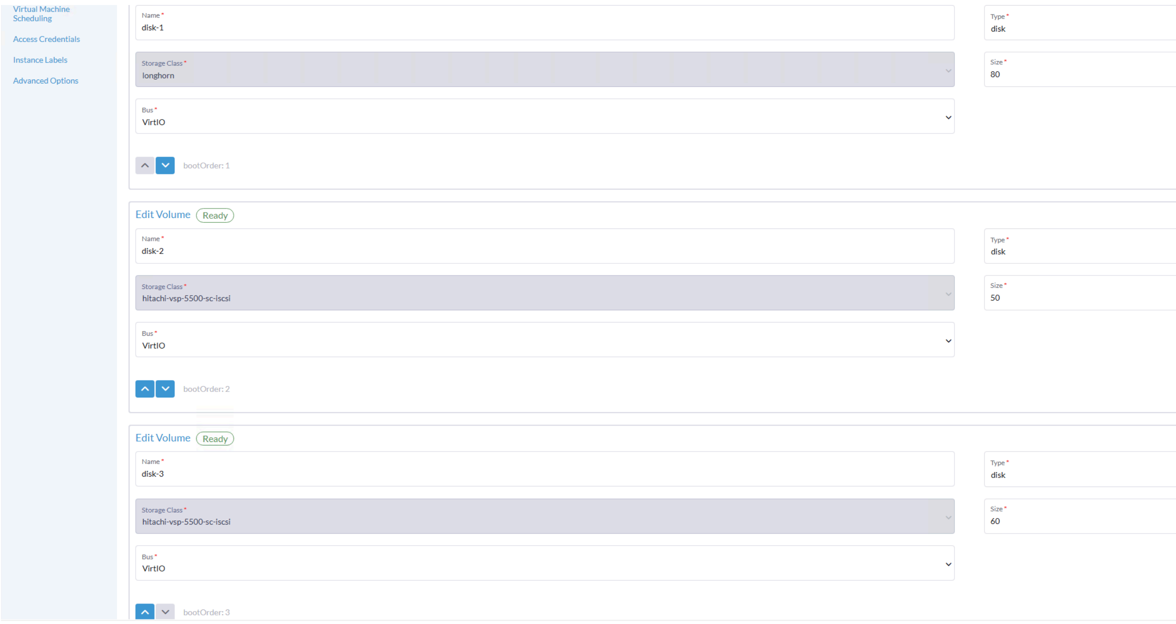
d. For *Volume Snapshot Class Name*, enter: `hitachi-snapclass`.

e. Leave *Backup Volume Snapshot Class Name* blank.

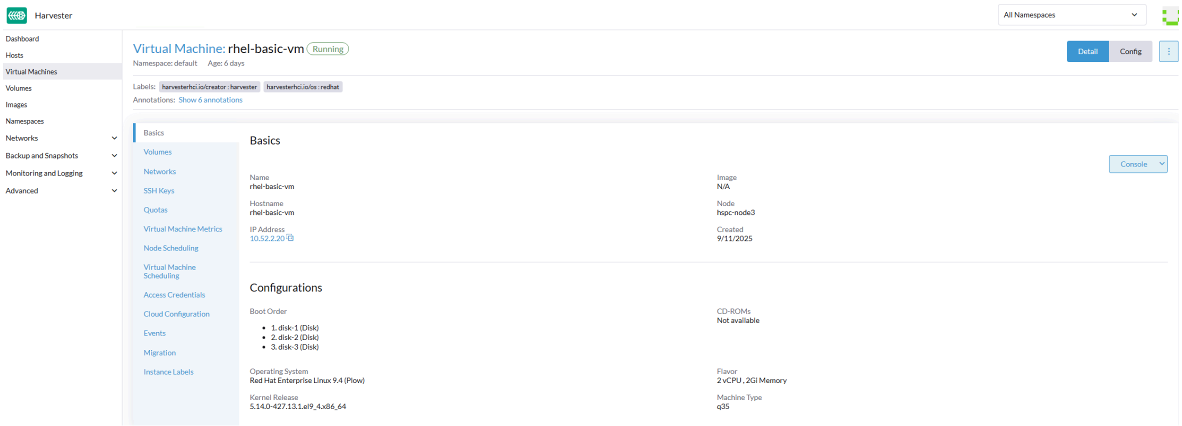
f. Save the changes.

6 Validating Hitachi VSP storage with a VM in SUSE Virtualization

1. Create or edit a VM in SUSE Virtualization and choose the Hitachi StorageClass when adding disks.



2. Power on the VM and verify the guest OS sees the attached disk and that I/O works.



7 Troubleshooting tips

If the PV remains in a pending state:

1. Check HSPC controller logs and CSI driver pods for errors.
2. Make sure multipathd is enabled on all SUSE Virtualization nodes.
3. Use the `multipath -ll` command on the nodes to verify that configured paths and LUNs are present.
4. Confirm base64-encoded credentials are correct and the Hitachi REST endpoint is reachable.

8 Summary

This guide demonstrates the process for integrating Hitachi Vantara Virtual Storage Platform One (https://www.hitachivantara.com/) ↗ with SUSE Virtualization (https://www.suse.com/products/rancher/virtualization/) ↗ using the Hitachi Storage Plug-in for Containers (https://www.hitachivantara.com/en-us/pdf/datasheet/storage-plug-in-for-containers-datasheet.pdf) ↗. The integration enables consistent storage services across workloads by delivering enterprise-grade reliability, dynamic storage provisioning, and snapshot capabilities.

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