



Red Hat OpenShift Virtualization with NetApp ONTAP

NetApp Solutions

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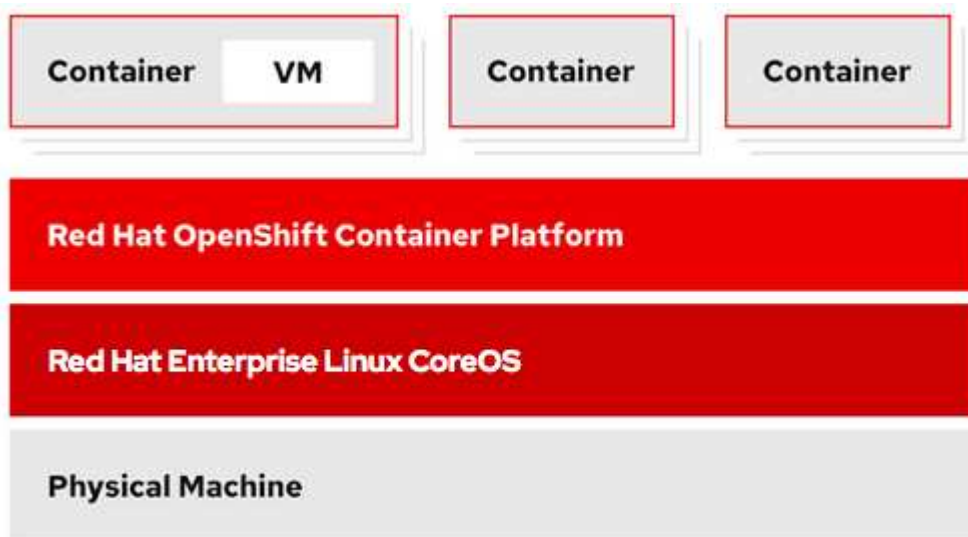
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Red Hat OpenShift Virtualization with NetApp ONTAP

Red Hat OpenShift Virtualization with NetApp ONTAP

Depending on the specific use case, both containers and virtual machines (VMs) can serve as optimal platforms for different types of applications. Therefore, many organizations run some of their workloads on containers and some on VMs. Often, this leads organizations to face additional challenges by having to manage separate platforms: a hypervisor for VMs and a container orchestrator for applications.

To address this challenge, Red Hat introduced OpenShift Virtualization (formerly known as Container Native Virtualization) starting from OpenShift version 4.6. The OpenShift Virtualization feature enables you to run and manage virtual machines alongside containers on the same OpenShift Container Platform installation, providing hybrid management capability to automate deployment and management of VMs through operators. In addition to creating VMs in OpenShift, with OpenShift Virtualization, Red Hat also supports importing VMs from VMware vSphere, Red Hat Virtualization, and Red Hat OpenStack Platform deployments.



Certain features like live VM migration, VM disk cloning, VM snapshots and so on are also supported by OpenShift Virtualization with assistance from Astra Trident when backed by NetApp ONTAP. Examples of each of these workflows are discussed later in this document in their respective sections.

To learn more about Red Hat OpenShift Virtualization, see the documentation [here](#).

Deployment for OpenShift Virtualization

Deploy Red Hat OpenShift Virtualization with NetApp ONTAP

This section details how to deploy Red Hat OpenShift Virtualization with NetApp ONTAP.

Prerequisites

- A Red Hat OpenShift cluster (later than version 4.6) installed on bare-metal infrastructure with RHCOS worker nodes
- The OpenShift cluster must be installed via installer provisioned infrastructure (IPI)
- Deploy Machine Health Checks to maintain HA for VMs
- A NetApp ONTAP cluster
- Astra Trident installed on the OpenShift cluster
- A Trident backend configured with an SVM on ONTAP cluster
- A StorageClass configured on the OpenShift cluster with Astra Trident as the provisioner
- Cluster-admin access to Red Hat OpenShift cluster
- Admin access to NetApp ONTAP cluster
- An admin workstation with tridentctl and oc tools installed and added to \$PATH

Because OpenShift Virtualization is managed by an operator installed on the OpenShift cluster, it imposes additional overhead on memory, CPU, and storage, which must be accounted for while planning the hardware requirements for the cluster. See the documentation [here](#) for more details.

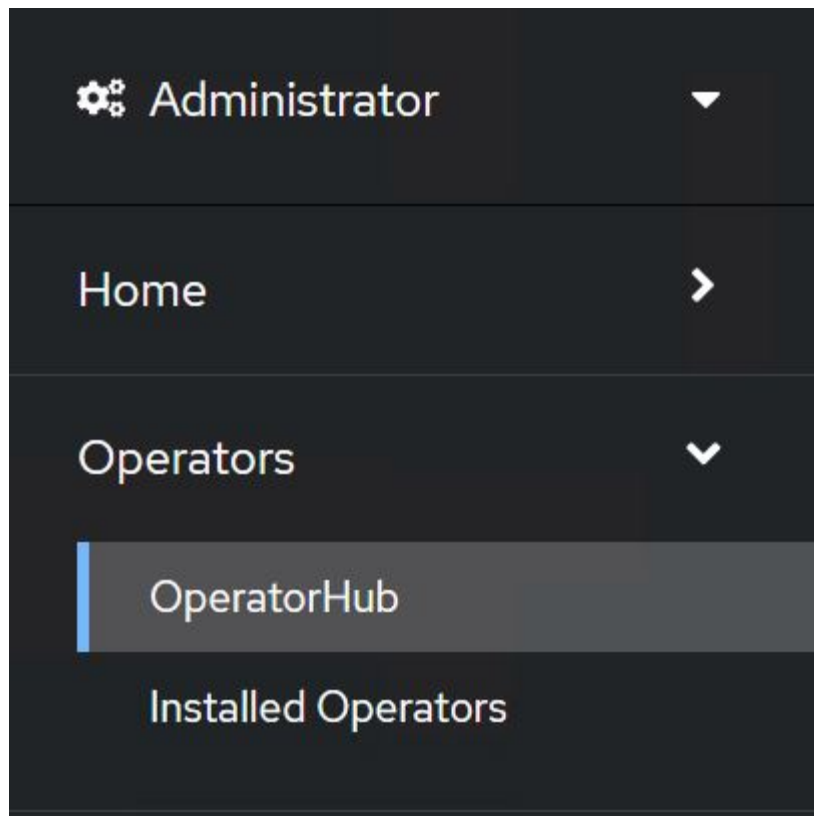
Optionally, you can also specify a subset of the OpenShift cluster nodes to host the OpenShift Virtualization operators, controllers, and VMs by configuring node placement rules. To configure node placement rules for OpenShift Virtualization, follow the documentation [here](#).

For the storage backing OpenShift Virtualization, NetApp recommends having a dedicated StorageClass that requests storage from a particular Trident backend, which in turn is backed by a dedicated SVM. This maintains a level of multitenancy with regard to the data being served for VM-based workloads on the OpenShift cluster.


Deploy Red Hat OpenShift Virtualization with NetApp ONTAP

To install OpenShift Virtualization, complete the following steps:

1. Log into the Red Hat OpenShift bare-metal cluster with cluster-admin access.
2. Select Administrator from the Perspective drop down.
3. Navigate to Operators > OperatorHub and search for OpenShift Virtualization.



4. Select the OpenShift Virtualization tile and click Install.



OpenShift Virtualization

2.6.2 provided by Red Hat

✕

Install

Latest version

2.6.2

Capability level

- ☒ Basic Install
- ☒ Seamless Upgrades
- ☒ Full Lifecycle
- ☐ Deep Insights
- ☐ Auto Pilot

Provider type

Red Hat

Provider

Red Hat

Requirements

Your cluster must be installed on bare metal infrastructure with Red Hat Enterprise Linux CoreOS workers.

Details

OpenShift Virtualization extends Red Hat OpenShift Container Platform, allowing you to host and manage virtualized workloads on the same platform as container-based workloads. From the OpenShift Container Platform web console, you can import a VMware virtual machine from vSphere, create new or clone existing VMs, perform live migrations between nodes, and more. You can use OpenShift Virtualization to manage both Linux and Windows VMs.

The technology behind OpenShift Virtualization is developed in the [KubeVirt](#) open source community. The KubeVirt project extends [Kubernetes](#) by adding additional virtualization resource types through [Custom Resource Definitions](#) (CRDs). Administrators can use Custom Resource Definitions to manage [VirtualMachine](#) resources alongside all other resources that Kubernetes provides.

5. On the Install Operator screen, leave all default parameters and click Install.

Update channel *

- ☐ 2.1
- ☐ 2.2
- ☐ 2.3
- ☐ 2.4
- ☒ stable

Installation mode *

- ☐ All namespaces on the cluster (default)
This mode is not supported by this Operator
- ☒ A specific namespace on the cluster
Operator will be available in a single Namespace only.

Installed Namespace *

- ☒ Operator recommended Namespace: **PR** openshift-cnv

i Namespace creation

Namespace **openshift-cnv** does not exist and will be created.


- ☐ Select a Namespace

Approval strategy *

- ☒ Automatic
- ☐ Manual

Install

Cancel

 OpenShift Virtualization
provided by Red Hat

Provided APIs

HC OpenShift
Virtualization
Deployment

Required

Represents the deployment of
OpenShift Virtualization

6. Wait for the operator installation to complete.



OpenShift Virtualization
2.6.2 provided by Red Hat



Installing Operator

The Operator is being installed. This may take a few minutes.

[View installed Operators in Namespace openshift-cnv](#)

7. After the operator has installed, click Create HyperConverged.



Installed operator – operand required

The Operator has installed successfully. Create the required custom resource to be able to use this Operator.



HyperConverged



Required

Creates and maintains an OpenShift Virtualization Deployment

Create HyperConverged

[View installed Operators in Namespace openshift-cnv](#)

- On the Create HyperConverged screen, click Create, accepting all default parameters. This step starts the installation of OpenShift Virtualization.

Name *

Labels

Infra >

infra HyperConvergedConfig influences the pod configuration (currently only placement) for all the infra components needed on the virtualization enabled cluster but not necessarily directly on each node running VMs/VMLs.

Workloads >

workloads HyperConvergedConfig influences the pod configuration (currently only placement) of components which need to be running on a node where virtualization workloads should be able to run. Changes to Workloads HyperConvergedConfig can be applied only without existing workload.

Bare Metal Platform

☒ true

BareMetalPlatform indicates whether the infrastructure is baremetal.

Feature Gates >

featureGates is a map of feature gate flags. Setting a flag to `true` will enable the feature. Setting `false` or removing the feature gate, disables the feature.

Local Storage Class Name





LocalStorageClassName the name of the local storage class.

- After all the pods move to the Running state in the openshift-cnv namespace and the OpenShift Virtualization operator is in the Succeeded state, the operator is ready to use. VMs can now be created on the OpenShift cluster.

Project: openshift-cnv ▾

Installed Operators

Installed Operators are represented by ClusterServiceVersions within this Namespace. For more information, see the [Understanding Operators documentation](#). Or create an Operator and ClusterServiceVersion using the [Operator SDK](#).

Name ▾	Search by name...	
Name ↑	Managed Namespaces ↓	Status
 OpenShift Virtualization 2.6.2 provided by Red Hat	 openshift-cnv	 Succeeded Up to date
		Last updated  May 18, 8:02 pm
		Provided APIs OpenShift Virtualization Deployment HostPathProvisioner deployment

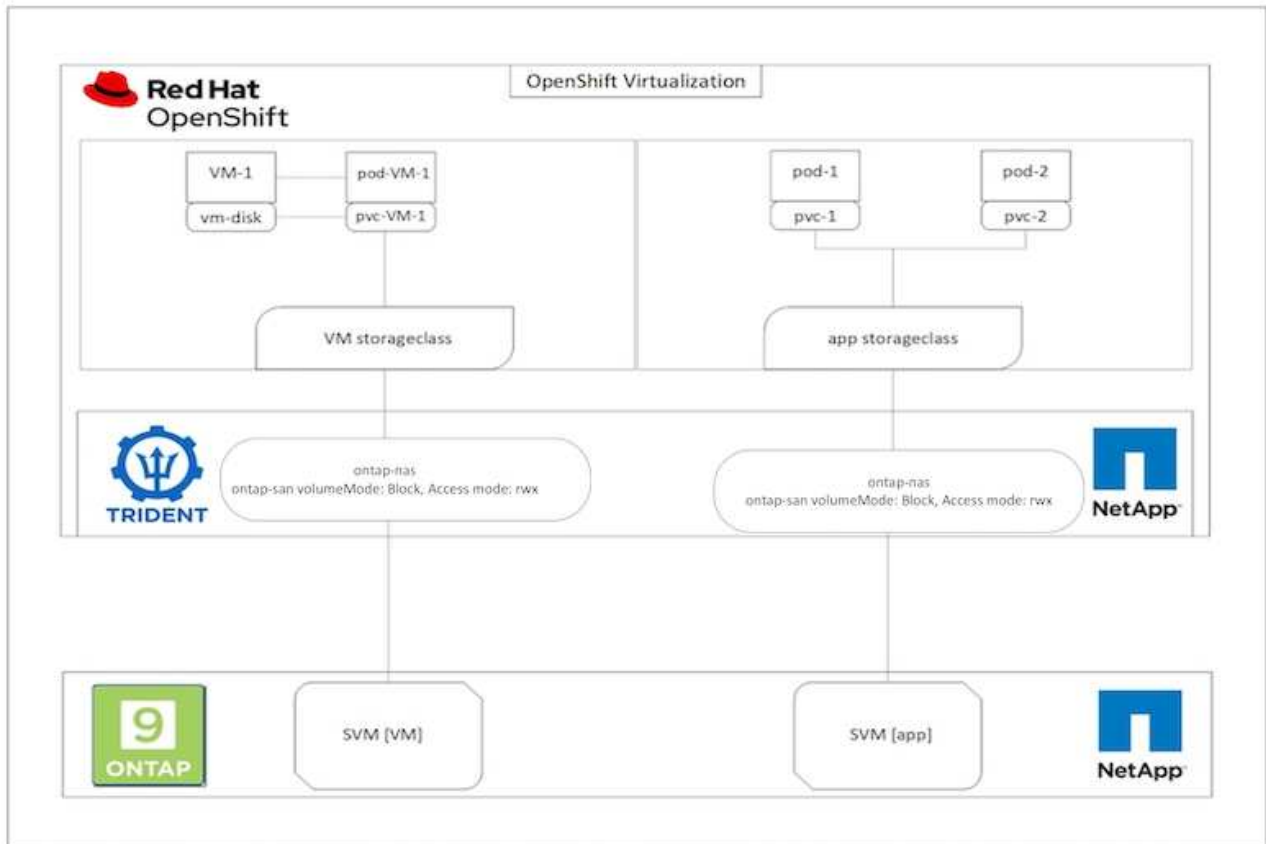
Workflows

Workflows: Red Hat OpenShift Virtualization with NetApp ONTAP

This section covers the how to create a virtual machine with Red Hat OpenShift Virtualization.

Create VM

VMs are stateful deployments that require volumes to host the operating system and data. With CNV, because the VMs are run as pods, the VMs are backed by PVs hosted on NetApp ONTAP through Trident. These volumes are attached as disks and store the entire filesystem including the boot source of the VM.



To quickly create a virtual machine on the OpenShift cluster, complete the following steps:

1. Navigate to Virtualization > Virtual Machines and click Create.
2. Select From template.
3. Select the desired operating system for which the boot source is available.
4. Check the checkbox Start the VirtualMachine after creation.
5. Click Quick create VirtualMachine.

The virtual machine is created and started and comes to the **Running** state. It automatically creates a PVC and a corresponding PV for the boot disk using the default storage class. In order to be able to live migrate the VM in the future, you must ensure that the storage class used for the disks can support RWX volumes. This is a requirement for live migration. **ontap-nas** and **ontap-san** (volumeMode block for iSCSI and NVMe/TCP protocols) can support RWX access modes for the volumes created using the respective storage classes.

To configure **ontap-san** storage class on the cluster see the [Section for Migrating a VM from VMware to OpenShift Virtualization](#).



You can set up ontap NAS or iSCSI as the default storage class for the cluster. Clicking on Quick create VirtualMachine will use the default storage class to create the PVC and PV for the bootable root disk for the VM. If your default storage class is not ontap-nas or ontap-san, you can select the storage class for the disk, by selecting **Customize VirtualMachine > Customize VirtualMachine parameters > Disks** and then editing the disk to use the required storage class.

Typically block access mode is preferred compared to file systems while provisioning the VM disks.

To customize the virtual machine creation after you have selected the OS template, click on **Customize VirtualMachine** instead of **Quick create**.

1. If the selected operating system has boot source configured, you can click on **Customize VirtualMachine parameters**.
2. If the selected operating system has no boot source configured, you must configure it. You can see details about the procedures shown in the [documentation](#).
3. After Configuring the boot disk, you can click on **Customize VirtualMachine parameters**.
4. You can customize the VM from the tabs on this page. For eg. click on the **Disks** tab and then click on **Add disk** to add another disk to the VM.
5. Click **Create Virtual Machine** to create the virtual machine; this spins up a corresponding pod in the background.



When a boot source is configured for a template or an operating system from an URL or from a registry, it creates a PVC in the `openshift-virtualization-os-images` project and downloads the KVM guest image to the PVC. You must make sure that template PVCs have enough provisioned space to accommodate the KVM guest image for the corresponding OS. These PVCs are then cloned and attached as rootdisk to virtual machines when they are created using the respective templates in any project.

The screenshot shows the OpenShift Virtualization console interface. On the left is a sidebar with navigation links: Administrator, Home, Operators, Workloads, Virtualization (selected), Overview, Catalog, VirtualMachines (active), Templates, and Instance Types. The main panel displays the 'VirtualMachines' page for the 'openshift-virtualization-os-images' project. It includes a table with columns: Name, Status, Conditions, Node, and IP address. There are four VMs listed, all with a status of 'Running'. A 'Create' button is visible in the top right corner, highlighted with a blue box. Below the 'Create' button, there are options: 'From template' and 'From volume With YAML'.

Name	Status	Conditions	Node	IP address
centos-stream8-hissing-artester	Running		ocp-worker3	10.130.0.143
centos-stream8-improved-kill	Running		ocp-worker3	10.130.0.145
centos-stream8-weary-toucan	Running		ocp-worker3	10.130.0.123
centos-stream8-zealous-anaconda	Running		ocp-worker3	10.130.0.117

Create new VirtualMachine

Select an option to create a VirtualMachine from.

Template catalog

InstanceTypes

Template project

All projects

All items

Default templates

User templates

☐ Boot source available

Operating system

☐ CentOS

☐ Fedora

☐ Other

☐ RHEL

☐ Windows

Workload

☐ Desktop

☐ High performance


☐ Server

Default templates

Q

Filter by keyword...


13 items



Source available

CentOS Stream 8 VM
centos-stream8-server-small


Project openshift
Boot source PVC (auto import)
Workload Server
CPU 1
Memory 2 GiB



Source available

CentOS Stream 9 VM
centos-stream9-server-small


Project openshift
Boot source PVC (auto import)
Workload Server
CPU 1
Memory 2 GiB



Source available

CentOS 7 VM
centos7-server-small


Project openshift
Boot source PVC (auto import)
Workload Server
CPU 1
Memory 2 GiB



Source available

Fedora VM
fedora-server-small


Project openshift
Boot source PVC (auto import)
Workload Server
CPU 1
Memory 2 GiB



Source available

Red Hat Enterprise Linux 7 VM
rhel7-server-small


Project openshift
Boot source PVC (auto import)
Workload Server
CPU 1
Memory 2 GiB



Source available

Red Hat Enterprise Linux 8 VM
rhel8-server-small


Project openshift
Boot source PVC (auto import)
Workload Server
CPU 1
Memory 2 GiB



Source available

Red Hat Enterprise Linux 9 VM
rhel9-server-small


Project openshift
Boot source PVC (auto import)
Workload Server
CPU 1
Memory 2 GiB



Source available

Microsoft Windows 10 VM
windows10-desktop-medium


Project openshift
Boot source PVC
Workload Desktop
CPU 1
Memory 4 GiB



Source available

Microsoft Windows 11 VM
windows11-desktop-medium

Project openshift
Boot source PVC
Workload Desktop
CPU 2
Memory 4 GiB



Source available

Microsoft Windows Server 2012 R2 VM
windows2k12r2-server-medium

Project openshift
Boot source PVC
Workload Server
CPU 1
Memory 4 GiB



CentOS Stream 9 VM

centos-stream9-server-small



Template info

Operating system

CentOS Stream 9 VM

Workload type

Server (default)

Description

Template for CentOS Stream 9 VM or newer. A PVC with the CentOS Stream disk image must be available.

Documentation

[Refer to documentation](#)

CPU | Memory

1 CPU | 2 GiB Memory

Network interfaces (1)

Name	Network	Type
default	Pod networking	Masquerade

Disks (2)

Name	Drive	Size
rootdisk	Disk	30 GiB
cloudinitdisk	Disk	-

Hardware devices (0)

GPU devices

Not available

Host devices

Not available

Quick create VirtualMachine

VirtualMachine name *

centos-stream9-pleased-ham...

Project

openshift-virtualization-os-images

☒ Start this VirtualMachine after creation

Quick create VirtualMachine

Customize VirtualMachine

Cancel

Activate Windows

Go to Settings to activate Windows.

Project: openshift-virtualization-os-images

Catalog > Customize template parameters > Customize VirtualMachine

Customize and create VirtualMachine

Template: CentOS Stream 9 VM

Overview YAML Scheduling Environment Network interfaces Disks Scripts Metadata

Name
centos-stream9-pleased-hamster

Namespace
openshift-virtualization-os-images

Description
Not available

Operating system
CentOS Stream 9 VM

CPU | Memory
1 CPU | 2 GiB Memory

Machine type
pc-q35-rhel9.2.0

Boot mode
BIOS

Start in pause mode
☐

Workload profile
Server

Network interfaces (1)

Name	Network	Type
default	Pod networking	Masquerade

Disks (2)

Name	Drive	Size
rootdisk	Disk	30 GiB
cloudinitdisk	Disk	-

Hardware devices

GPU devices
Not available

Host devices
Not available

Headless mode
☐

Hostname
centos-stream9-pleased-hamster

☒ Start this VirtualMachine after creation

Create VirtualMachine Cancel

VirtualMachines > VirtualMachine details

VM centos-stream9-zealous-anaconda Running

Overview Details Metrics YAML Configuration Events Console Snapshots Diagnostics

Disks

[Add disk](#)

Filter Search by name... Mount Windows drivers disk

Name	Source	Size	Drive	Interface	Storage class
cloudinitdisk	Other	-	Disk	virtio	-
data-disk1 (Persistent Hotplug)	PVC centos-stream9-zealous-anaconda-data-disk1	30.00 GiB	Disk	SCSI	ontap-san-block
rootdisk (bootable)	PVC centos-stream9-zealous-anaconda	30.00 GiB	Disk	virtio	ontap-san-block

File systems

Name	File system type	Mount point	Total bytes	Used bytes
vdal	xfs	/	29.94 GiB	1.30 GiB

Workflows: Red Hat OpenShift Virtualization with NetApp ONTAP

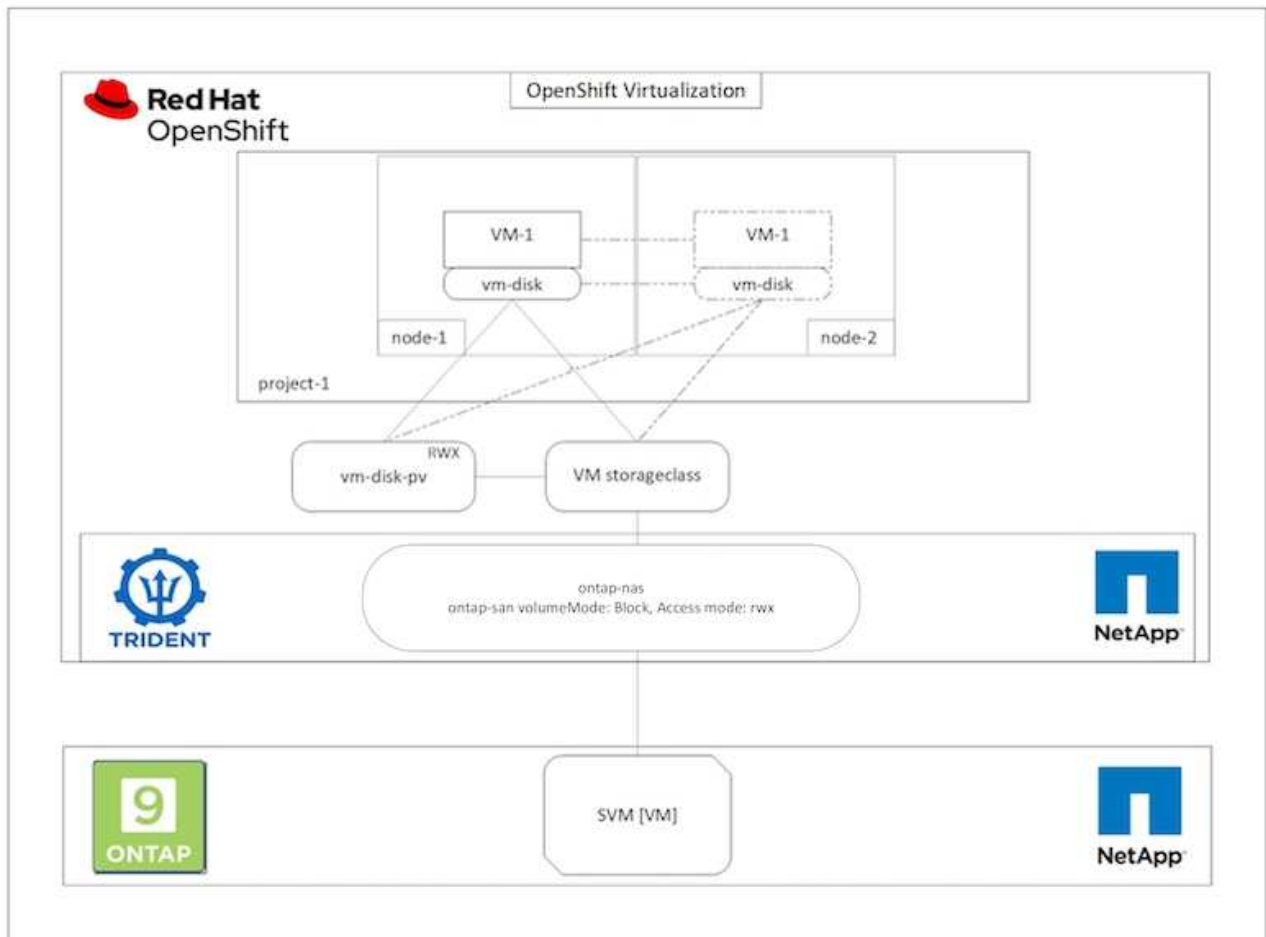
This section shows how to migrate a virtual machine in OpenShift Virtualization between nodes in the cluster .

VM Live Migration

Live Migration is a process of migrating a VM instance from one node to another in an OpenShift cluster with

no downtime. For live migration to work in an OpenShift cluster, VMs must be bound to PVCs with shared ReadWriteMany access mode. Astra Trident backends configured using ontap-nas drivers support RWX access mode for FileSystem protocols nfs and smb. Refer to the documentation [here](#). Astra Trident backends configured using ontap-san drivers support RWX access mode for block volumeMode for iSCSI and NVMe/TCP protocols. Refer to the documentation [here](#).

Therefore, for live migration to succeed, the VMs must be provisioned with disks (boot disks and additional hot plug disks) with PVCs using ontap-nas or ontap-san (volumeMode: Block) storage classes. When the PVCs are created, Trident creates ONTAP volumes in an SVM which is NFS-enabled or iSCSI enabled.



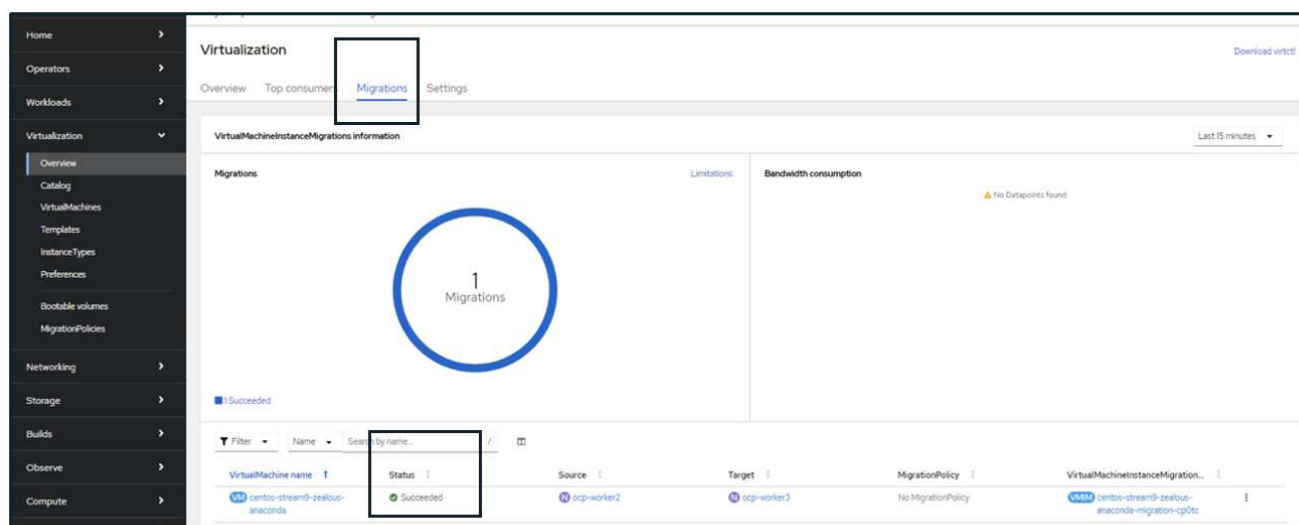
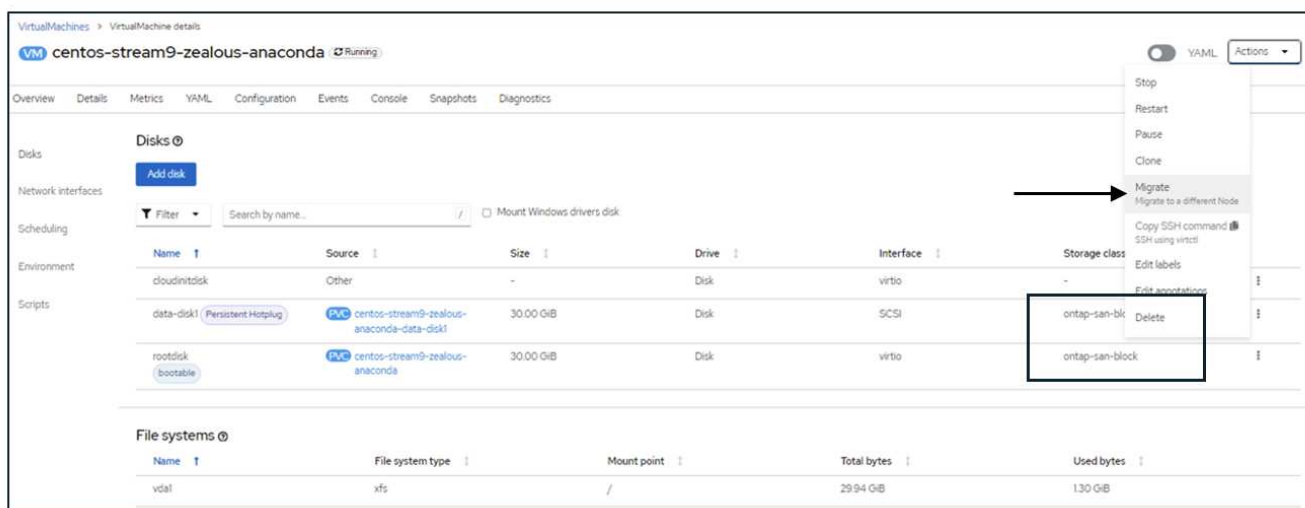
To perform a live migration of a VM that has been created previously and is in a Running state perform the following steps:

1. Select the VM that you want to live-migrate.
2. Click on **Configuration** tab.
3. Ensure that all the disks of the VM are created using Storage classes that can support RWX access mode.
4. Click on **Actions** on the right corner and then select **Migrate**.
5. To look at the progression of the Migration, go to Virtualization > Overview on the left hand side menu and then click on the **Migrations** tab.

The Migration of the VM will transition from **Pending** to **Scheduling** to **Succeeded**



A VM instance in an OpenShift cluster automatically migrates to another node when the original node is placed into maintenance mode if the evictionStrategy is set to LiveMigrate.

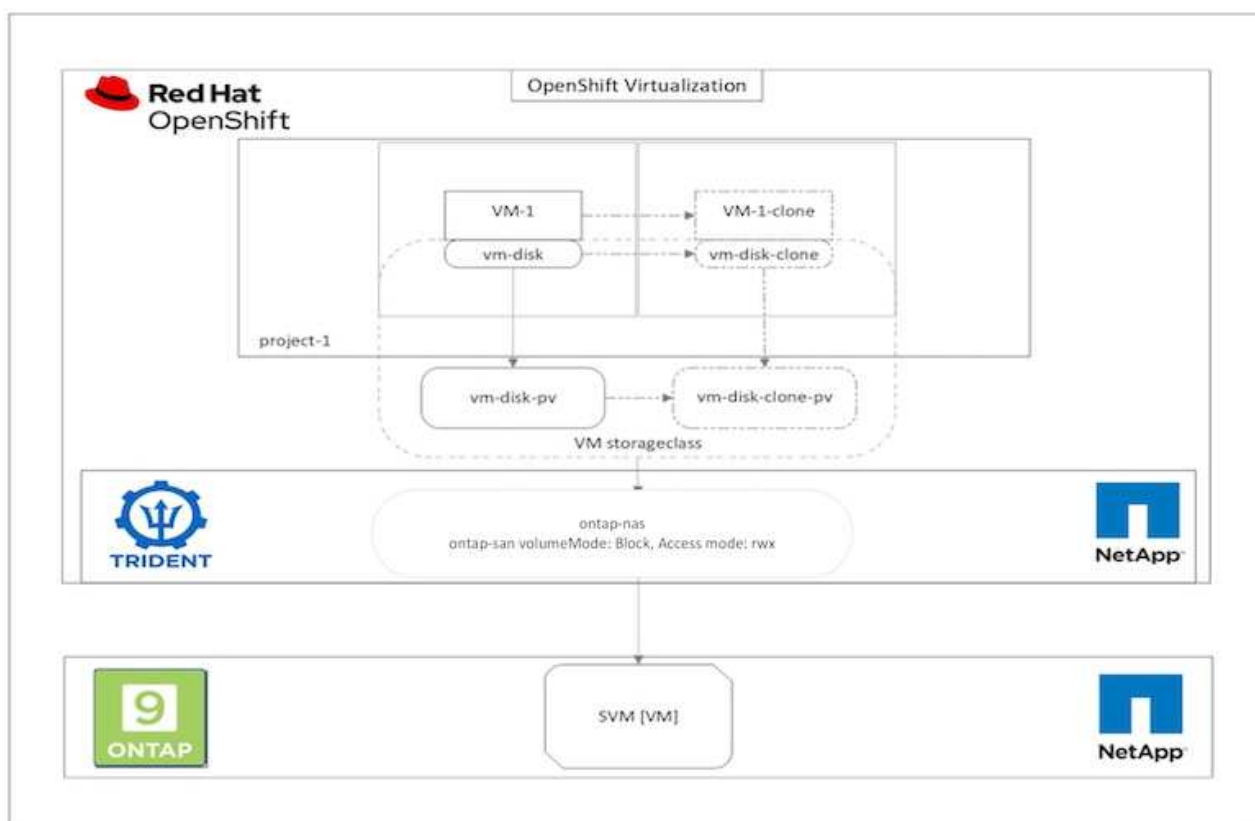


Workflows: Red Hat OpenShift Virtualization with NetApp ONTAP

This section covers the how to clone a virtual machine with Red Hat OpenShift Virtualization.

VM cloning

Cloning an existing VM in OpenShift is achieved with the support of Astra Trident's Volume CSI cloning feature. CSI volume cloning allows for creation of a new PVC using an existing PVC as the data source by duplicating its PV. After the new PVC is created, it functions as a separate entity and without any link to or dependency on the source PVC.



There are certain restrictions with CSI volume cloning to consider:

1. Source PVC and destination PVC must be in the same project.
2. Cloning is supported within the same storage class.
3. Cloning can be performed only when source and destination volumes use the same VolumeMode setting; for example, a block volume can only be cloned to another block volume.

VMs in an OpenShift cluster can be cloned in two ways:

1. By shutting down the source VM
2. By keeping the source VM live

By Shutting down the source VM

Cloning an existing VM by shutting down the VM is a native OpenShift feature that is implemented with support from Astra Trident. Complete the following steps to clone a VM.

1. Navigate to Workloads > Virtualization > Virtual Machines and click the ellipsis next to the virtual machine you wish to clone.
2. Click Clone Virtual Machine and provide the details for the new VM.

Clone Virtual Machine

Name *

rhel8-short-frog-clone

Description

Namespace *

default

☒ Start virtual machine on clone

Configuration

Operating System

Red Hat Enterprise Linux 8.0 or higher

Flavor

Small: 1 CPU | 2 GiB Memory

Workload Profile

server

NICs

default - virtio

Disks

cloudinitdisk - cloud-init disk

rootdisk - 20Gi - basic



The VM rhel8-short-frog is still running. It will be powered off while cloning.

Cancel

Clone Virtual Machine

3. Click Clone Virtual Machine; this shuts down the source VM and initiates the creation of the clone VM.
4. After this step is completed, you can access and verify the content of the cloned VM.

By keeping the source VM live

An existing VM can also be cloned by cloning the existing PVC of the source VM and then creating a new VM using the cloned PVC. This method does not require you to shut down the source VM. Complete the following steps to clone a VM without shutting it down.

1. Navigate to Storage > PersistentVolumeClaims and click the ellipsis next to the PVC that is attached to the source VM.
2. Click Clone PVC and furnish the details for the new PVC.

Clone

Name *

rhel8-short-frog-rootdisk-28dvv-clone

Access Mode *

☐ Single User (RWO) ☒ Shared Access (RWX) ☐ Read Only (ROX)

Size *

20

GiB



PVC details

Namespace

 default

Requested capacity

20 GiB

Access mode

Shared Access (RWX)

Storage Class

 basic

Used capacity

2.2 GiB

Volume mode

Filesystem

Cancel

Clone

3. Then click Clone. This creates a PVC for the new VM.
4. Navigate to Workloads > Virtualization > Virtual Machines and click Create > With YAML.
5. In the spec > template > spec > volumes section, attach the cloned PVC instead of the container disk. Provide all other details for the new VM according to your requirements.

```
- name: rootdisk
  persistentVolumeClaim:
    claimName: rhel8-short-frog-rootdisk-28dvv-clone
```

6. Click Create to create the new VM.
7. After the VM is created successfully, access and verify that the new VM is a clone of the source VM.

Workflows: Red Hat OpenShift Virtualization with NetApp ONTAP

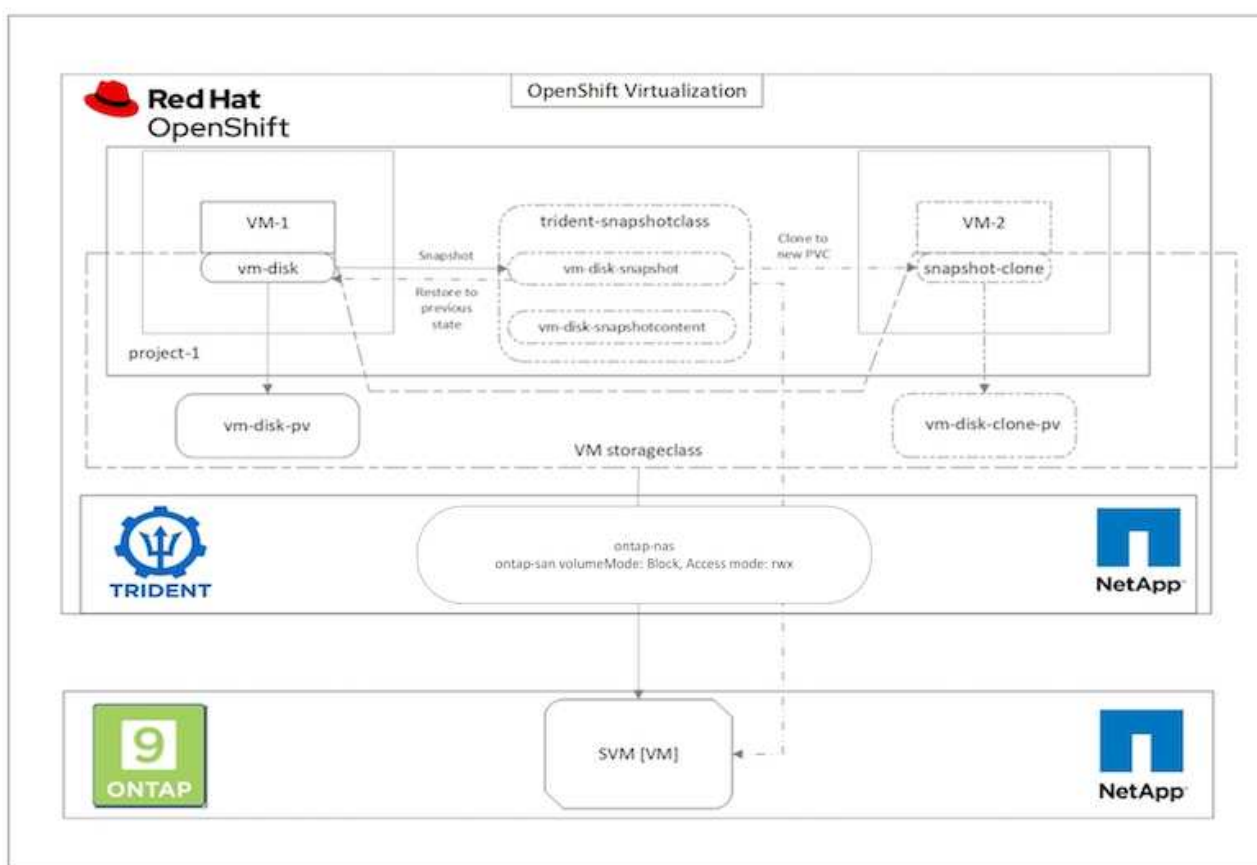
This section shows how to create a virtual machine from a Snapshot with Red Hat OpenShift Virtualization.

Create VM from a Snapshot

With Astra Trident and Red Hat OpenShift, users can take a snapshot of a persistent volume on Storage Classes provisioned by it. With this feature, users can take a point-in-time copy of a volume and use it to create a new volume or restore the same volume back to a previous state. This enables or supports a variety of use-cases, from rollback to clones to data restore.

For Snapshot operations in OpenShift, the resources `VolumeSnapshotClass`, `VolumeSnapshot`, and `VolumeSnapshotContent` must be defined.

- A `VolumeSnapshotContent` is the actual snapshot taken from a volume in the cluster. It is cluster-wide resource analogous to `PersistentVolume` for storage.
- A `VolumeSnapshot` is a request for creating the snapshot of a volume. It is analogous to a `PersistentVolumeClaim`.
- `VolumeSnapshotClass` lets the administrator specify different attributes for a `VolumeSnapshot`. It allows you to have different attributes for different snapshots taken from the same volume.



To create Snapshot of a VM, complete the following steps:

1. Create a VolumeSnapshotClass that can then be used to create a VolumeSnapshot. Navigate to Storage > VolumeSnapshotClasses and click Create VolumeSnapshotClass.
2. Enter the name of the Snapshot Class, enter `csi.trident.netapp.io` for the driver, and click Create.

```
1 apiVersion: snapshot.storage.k8s.io/v1
2 kind: VolumeSnapshotClass
3 metadata:
4   name: trident-snapshot-class
5 driver: csi.trident.netapp.io
6 deletionPolicy: Delete
7
```

[Create](#)[Cancel](#)[Download](#)

3. Identify the PVC that is attached to the source VM and then create a Snapshot of that PVC. Navigate to Storage > VolumeSnapshots and click Create VolumeSnapshots.
4. Select the PVC that you want to create the Snapshot for, enter the name of the Snapshot or accept the default, and select the appropriate VolumeSnapshotClass. Then click Create.

Create VolumeSnapshot

[Edit YAML](#)

PersistentVolumeClaim *

PVC rhel8-short-frog-rootdisk-28dvb

Name *

rhel8-short-frog-rootdisk-28dvb-snapshot

Snapshot Class *

VSC trident-snapshot-class

[Create](#)[Cancel](#)

5. This creates the snapshot of the PVC at that point in time.

Create a new VM from the snapshot

1. First, restore the Snapshot into a new PVC. Navigate to Storage > VolumeSnapshots, click the ellipsis next to the Snapshot that you wish to restore, and click Restore as new PVC.
2. Enter the details of the new PVC and click Restore. This creates a new PVC.

Restore as new PVC

When restore action for snapshot **rhel8-short-frog-rootdisk-28dvb-snapshot** is finished a new crash-consistent PVC copy will be created.

Name *

rhel8-short-frog-rootdisk-28dvb-snapshot-restore

Storage Class *

SC basic

Access Mode *

☐ Single User (RWO) ☒ Shared Access (RWX) ☐ Read Only (ROX)

Size *

20

GiB

VolumeSnapshot details

Created at

 May 21, 12:46 am

Namespace

 default

Status

 Ready

API version

snapshot.storage.k8s.io/v1

Size

20 GiB

3. Next, create a new VM from this PVC. Navigate to Virtualization > Virtual Machines and click Create > With YAML.
4. In the spec > template > spec > volumes section, specify the new PVC created from Snapshot instead of

from the container disk. Provide all other details for the new VM according to your requirements.

```
- name: rootdisk
  persistentVolumeClaim:
    claimName: rhel8-short-frog-rootdisk-28dvv-snapshot-restore
```

5. Click Create to create the new VM.

6. After the VM is created successfully, access and verify that the new VM has the same state as that of the VM whose PVC was used to create the snapshot at the time when the snapshot was created.

Workflows: Red Hat OpenShift Virtualization with NetApp ONTAP

This section covers the how to migrate a virtual machine between from VMware to an OpenShift Cluster using Red Hat OpenShift Virtualization migration toolkit.

Migration of VM from VMware to OpenShift Virtualization using Migration Toolkit for Virtualization

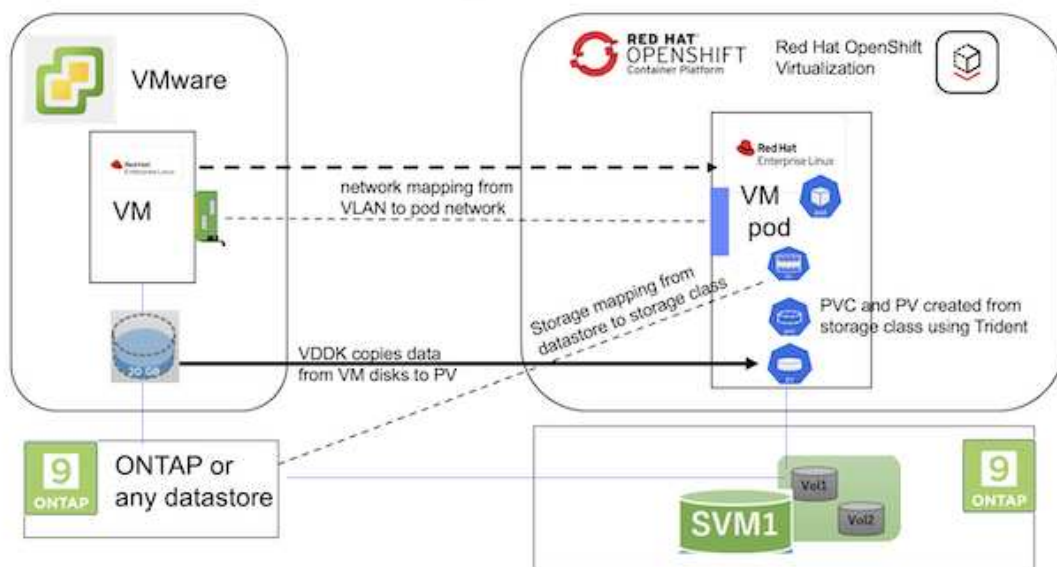
In this section, we will see how to use the Migration Toolkit for Virtualization (MTV) to migrate virtual machines from VMware to OpenShift Virtualization running on OpenShift Container platform and integrated with NetApp ONTAP storage using Astra Trident.

The following video shows a demonstration of the migration of a RHEL VM from VMware to OpenShift Virtualization using ontap-san storage class for persistent storage.

[Using Red Hat MTV to migrate VMs to OpenShift Virtualization with NetApp ONTAP Storage](#)

The following diagram shows a high level view of the migration of a VM from VMware to Red Hat OpenShift Virtualization.

Migration of VM from VMware to OpenShift Virtualization



Prerequisites for the sample migration

On VMware

- A RHEL 9 VM using rhel 9.3 with the following configurations were installed:
 - CPU: 2, Memory: 20 GB, Hard disk: 20 GB
 - user credentials: root user and an admin user credentials
- After the VM was ready, postgresql server was installed.
 - postgresql server was started and enabled to start on boot

```
systemctl start postgresql.service`  
systemctl enable postgresql.service  
The above command ensures that the server can start in the VM in  
OpenShift Virtualization after migration
```

- Added 2 databases, 1 table and 1 row in the table were added. Refer [here](#) for the instructions for installing postgresql server on RHEL and creating database and table entries.



Ensure that you start the postgresql server and enable the service to start at boot.

On OpenShift Cluster

The following installations were completed before installing MTV:

- OpenShift Cluster 4.13.34
- [Astra Trident 23.10](#)
- Multipath on the cluster nodes enabled for iSCSI (for ontap-san storage class). See the provided yaml to create a daemon set that enables iSCSI on each node in the cluster.
- Trident backend and Storage class for ontap SAN using iSCSI. See the provided yaml files for trident backend and storage class.
- [OpenShift Virtualization](#)

To install iscsi and multipath on the OpenShift Cluster nodes use the yaml file given below

Preparing the cluster nodes for iSCSI

```
apiVersion: apps/v1  
kind: DaemonSet  
metadata:  
  namespace: trident  
  name: trident-iscsi-init  
  labels:  
    name: trident-iscsi-init  
spec:  
  selector:  
    matchLabels:
```



```

    name: trident-iscsi-init
template:
  metadata:
    labels:
      name: trident-iscsi-init
  spec:
    hostNetwork: true
    serviceAccount: trident-node-linux
    initContainers:
      - name: init-node
        command:
          - nsenter
          - --mount=/proc/1/ns/mnt
          - --
          - sh
          - -c
        args: ["$(STARTUP_SCRIPT)"]
        image: alpine:3.7
        env:
          - name: STARTUP_SCRIPT
            value: |
              #! /bin/bash
              sudo yum install -y lsscsi iscsi-initiator-utils sg3_utils
device-mapper-multipath
              rpm -q iscsi-initiator-utils
              sudo sed -i 's/^\(node.session.scan\) .*/\1 = manual/'
/etc/iscsi/iscsid.conf
              cat /etc/iscsi/initiatorname.iscsi
              sudo mpathconf --enable --with_multipathd y --find_multipaths
n
              sudo systemctl enable --now iscsid multipathd
              sudo systemctl enable --now iscsi
    securityContext:
      privileged: true
    hostPID: true
    containers:
      - name: wait
        image: k8s.gcr.io/pause:3.1
    hostPID: true
    hostNetwork: true
    tolerations:
      - effect: NoSchedule
        key: node-role.kubernetes.io/master
  updateStrategy:
    type: RollingUpdate

```

Use the following yaml file to create trident backend configuration for using ontap san storage

Trident backend for iSCSI

```
apiVersion: v1
kind: Secret
metadata:
  name: backend-tbc-ontap-san-secret
type: Opaque
stringData:
  username: <username>
  password: <password>
---
apiVersion: trident.netapp.io/v1
kind: TridentBackendConfig
metadata:
  name: ontap-san
spec:
  version: 1
  storageDriverName: ontap-san
  managementLIF: <management LIF>
  backendName: ontap-san
  svm: <SVM name>
  credentials:
    name: backend-tbc-ontap-san-secret
```

Use the following yaml file to create trident storage class configuration for using ontap san storage

Trident storage class for iSCSI

```
apiVersion: storage.k8s.io/v1
kind: StorageClass
metadata:
  name: ontap-san
provisioner: csi.trident.netapp.io
parameters:
  backendType: "ontap-san"
  media: "ssd"
  provisioningType: "thin"
  snapshots: "true"
allowVolumeExpansion: true
```

Install MTV

Now you can install the Migration Toolkit for virtualization (MTV). Refer to the instructions provided [here](#) for help with the installation.

The Migration Toolkit for Virtualization (MTV) user interface is integrated into the OpenShift web console. You can refer [here](#) to start using the user interface for various tasks.

Create Source Provider

In order to migrate the RHEL VM from VMware to OpenShift Virtualization, you need to first create the source provider for VMware. Refer to the instructions [here](#) to create the source provider.

You need the following to create your VMware source provider:

- VCenter url
- VCenter Credentials
- VCenter server thumbprint
- VDDK image in a repository

Sample source provider creation:

Select provider type *

vm vSphere

Provider resource name *

vmware-source

Unique Kubernetes resource name identifier

URL *

URL of the vCenter SDK endpoint. Ensure the URL includes the "/sdk" path. For example: https://vCenter-host-example.com/sdk

VDDK init image

docker.repo.eng.netapp.com/banum/vddk:801

VDDK container image of the provider, when left empty some functionality will not be available

Username *

administrator@vsphere.local

vSphere REST API user name.

Password *

vSphere REST API password credentials.

SSHA-1 fingerprint *

The provider currently requires the SHA-1 fingerprint of the vCenter Server's TLS certificate in all circumstances. vSphere calls this the server's thumbprint.

Skip certificate validation

☒



The Migration Toolkit for Virtualization (MTV) uses the VMware Virtual Disk Development Kit (VDDK) SDK to accelerate transferring virtual disks from VMware vSphere. Therefore, creating a VDDK image, although optional, is highly recommended. To make use of this feature, you download the VMware Virtual Disk Development Kit (VDDK), build a VDDK image, and push the VDDK image to your image registry.

Follow the instructions provided [here](#) to create and push the VDDK image to a registry accessible from the OpenShift Cluster.

Create Destination provider

The host cluster is automatically added as the OpenShift virtualization provider is the source provider.

Create Migration Plan

Follow the instructions provided [here](#) to create a migration plan.

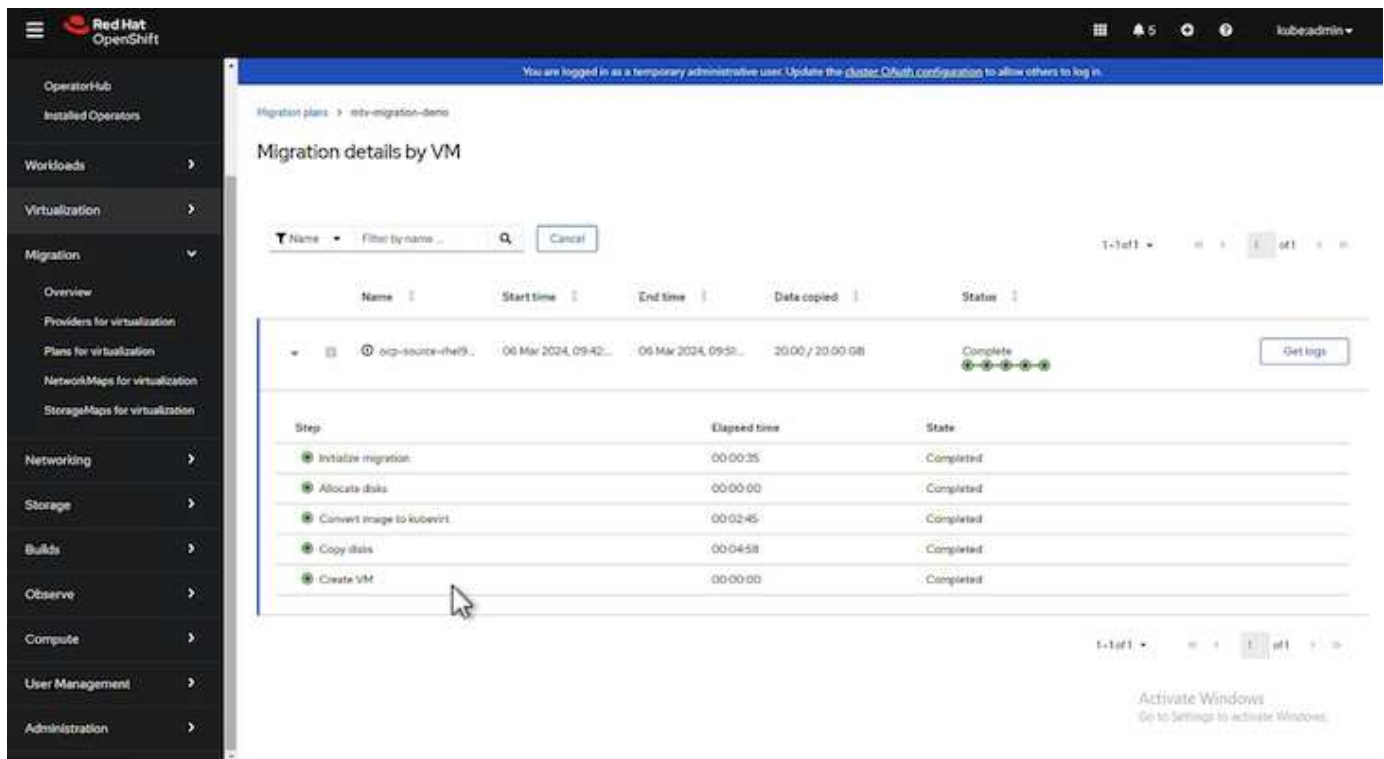
While creating a plan, you need to create the following if not already created:

- A network mapping to map the source network to the target network.
- A storage mapping to map the source datastore to the target storage class. For this you can choose ontap-san storage class.

Once the migration plan is created, the status of the plan should show **Ready** and you should now be able to **Start** the plan.

Name	Source	Target	VMs	Status	Description
mtv-migration-demo	vmware	host	1	Ready	Plan for migrating VM to OpenShift Virt...
vmware-ovs-migration	vmware2	host	1	Succeeded	Migrating RHEL 9 vm to OpenShift Virtu...
vmware-ovs-migration-plan1	vmware2	host	1	Succeeded	
vmware-ovs-migration-plan2	vmware2	host	1	Succeeded	migrating RHEL 9 vm using ONTAP NFS...

Clicking on **Start** will run through a sequence of steps to complete the migration of the VM.



When all steps are completed, you can see the migrated VMs by clicking on the **virtual machines** under **Virtualization** in the left-side navigation menu. Instructions to access the virtual machines are provided [here](#).

You can log into the virtual machine and verify the contents of the postgresql databases. The databases, tables and the entries in the table should be the same as what was created on the source VM.

Data Protection of VMs using Third Party Tools

Data protection for VMs in OpenShift Virtualization using OpenShift API for Data Protection (OADP)

Author: Banu Sundhar, NetApp

This section of the reference document provides details for creating backups of VMs using the OpenShift API for Data Protection (OADP) with Velero on NetApp ONTAP S3 or NetApp StorageGRID S3. The backups of Persistent Volumes(PVs) of the VM disks are created using CSI Astra Trident Snapshots.

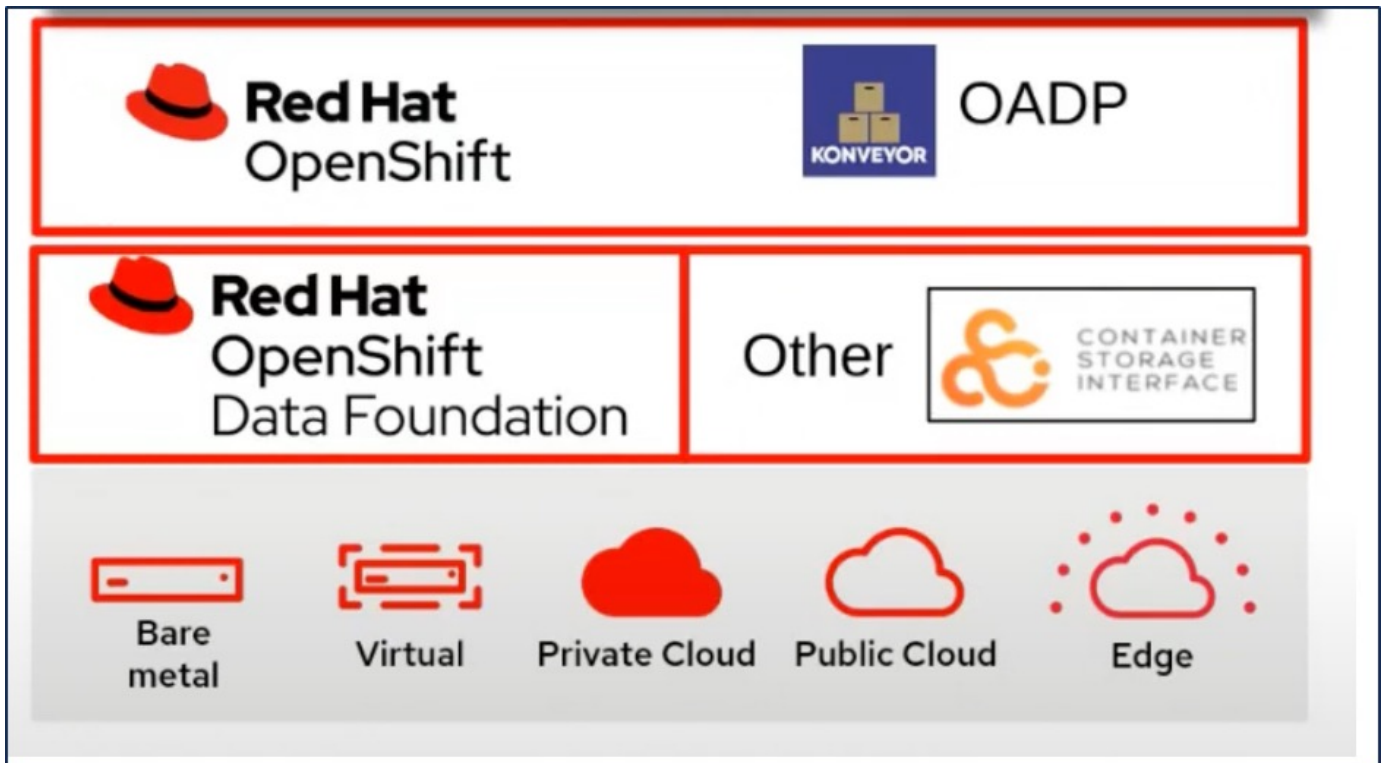
Virtual machines in the OpenShift Virtualization environment are containerized applications that run in the worker nodes of your OpenShift Container platform. It is important to protect the VM metadata as well as the persistent disks of the VMs, so that when they are lost or corrupted, you can recover them.

The persistent disks of the OpenShift Virtualization VMs can be backed by ONTAP storage integrated to the OpenShift Cluster using [Astra Trident CSI](#). In this section we use [OpenShift API for Data Protection \(OADP\)](#) to perform backup of VMs including its data volumes to

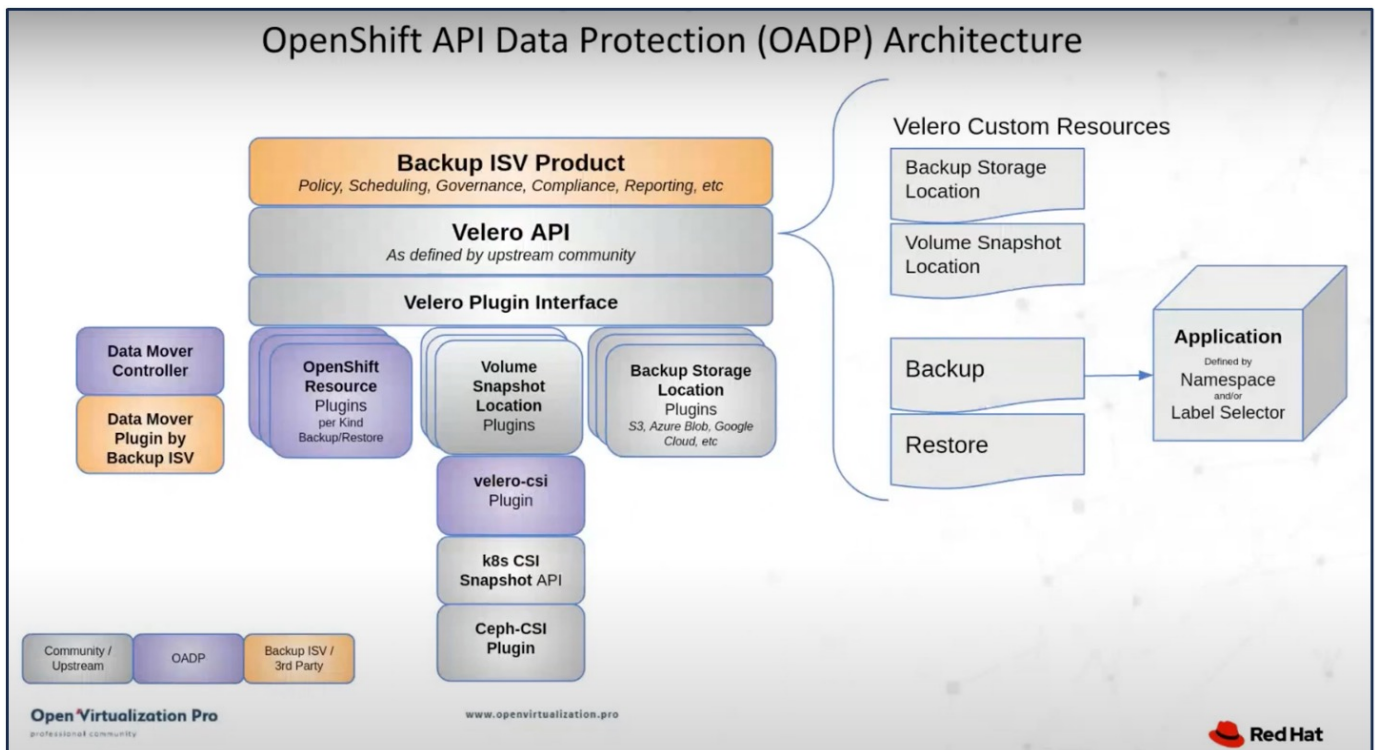
- ONTAP Object Storage
- StorageGrid

We then restore from the backup when needed.

OADP enables backup, restore, and disaster recovery of applications on an OpenShift cluster. Data that can be protected with OADP include Kubernetes resource objects, persistent volumes, and internal images.



Red Hat OpenShift has leveraged the solutions developed by the OpenSource communities for data protection. [Velero](#) is an open-source tool to safely backup and restore, perform disaster recovery, and migrate Kubernetes cluster resources and persistent volumes. To use Velero easily, OpenShift has developed the OADP operator and the Velero plugin to integrate with the CSI storage drivers. The core of the OADP APIs that are exposed are based on the Velero APIs. After installing the OADP operator and configuring it, the backup/restore operations that can be performed are based on the operations exposed by the Velero API.



OADP 1.3 is available from the operator hub of OpenShift cluster 4.12 and later. It has a built-in Data Mover that can move CSI volume snapshots to a remote object store. This provides portability and durability by moving snapshots to an object storage location during backup. The snapshots are then available for restoration after disasters.

The following are the versions of the various components used for the examples in this section

- OpenShift Cluster 4.14
- OpenShift Virtualization installed via OperatorOpenShift Virtualization Operator provided by Red Hat
- OADP Operator 1.13 provided by Red Hat
- Velero CLI 1.13 for Linux
- Astra Trident 24.02
- ONTAP 9.12

[Astra Trident CSI](#)
[OpenShift API for Data Protection \(OADP\)](#)
[Velero](#)

Installation of OpenShift API for Data Protection (OADP) Operator

This section outlines the installation of OpenShift API for Data Protection (OADP) Operator.

Prerequisites

- A Red Hat OpenShift cluster (later than version 4.12) installed on bare-metal infrastructure with RHCOS worker nodes
- A NetApp ONTAP cluster integrated with the cluster using Astra Trident

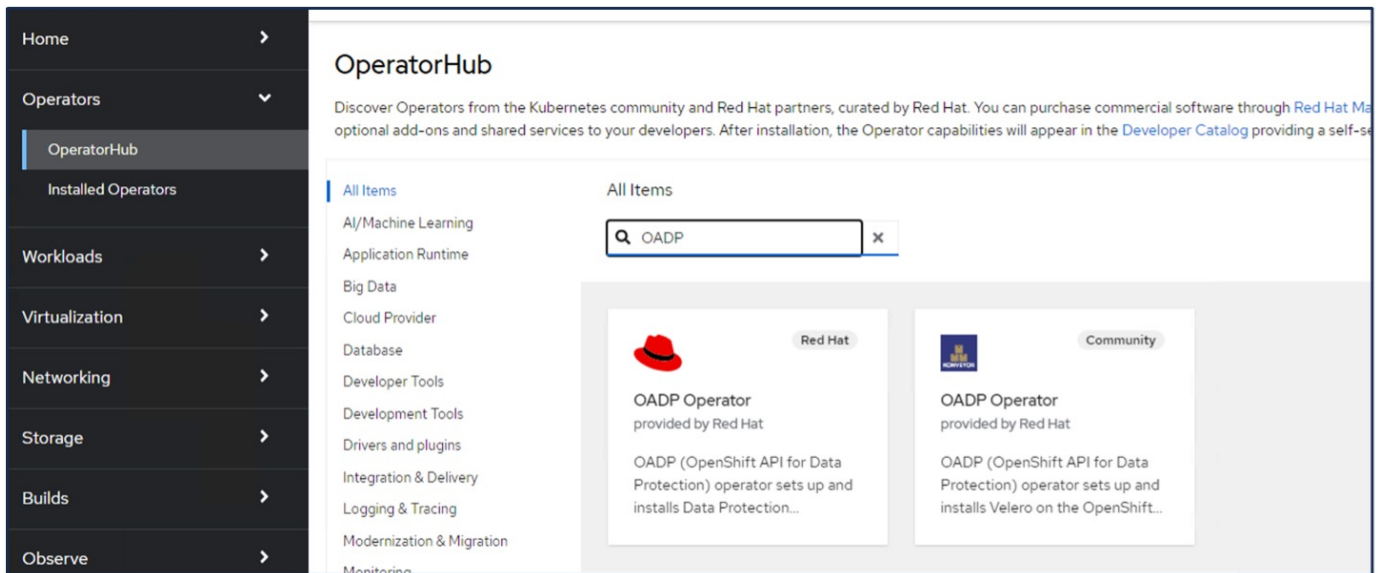
- A Trident backend configured with an SVM on ONTAP cluster
- A StorageClass configured on the OpenShift cluster with Astra Trident as the provisioner
- Trident Snapshot class created on the cluster
- Cluster-admin access to Red Hat OpenShift cluster
- Admin access to NetApp ONTAP cluster
- OpenShift Virtualization operator installed and configured
- VMs deployed in a Namespace on OpenShift Virtualization
- An admin workstation with tridentctl and oc tools installed and added to \$PATH



If you want to take a backup of a VM when it is in the Running state, then you must install the QEMU guest agent on that virtual machine. If you install the VM using an existing template, then QEMU agent is installed automatically. QEMU allows the guest agent to quiesce in-flight data in the guest OS during the snapshot process, and avoid possible data corruption. If you do not have QEMU installed, you can stop the virtual machine before taking a backup.

Steps to install OADP Operator

1. Go to the Operator Hub of the cluster and select Red Hat OADP operator. In the Install page, use all the default selections and click install. On the next page, again use all the defaults and click Install. The OADP operator will be installed in the namespace openshift-adp.





OADP Operator

1.3.0 provided by Red Hat

Install

Channel

stable-1.3

Version

1.3.0

Capability level

- ☒ Basic Install
- ☒ Seamless Upgrades
- ☐ Full Lifecycle
- ☐ Deep Insights
- ☐ Auto Pilot

Source

Red Hat

Provider

Red Hat

Infrastructure features

Disconnected

OpenShift API for Data Protection (OADP) operator sets up and installs Velero on the OpenShift platform, allowing users to backup and restore applications.

Backup and restore Kubernetes resources and internal images, at the granularity of a namespace, using a version of Velero appropriate for the installed version of OADP.

OADP backs up Kubernetes objects and internal images by saving them as an archive file on object storage. OADP backs up persistent volumes (PVs) by creating snapshots with the native cloud snapshot API or with the Container Storage Interface (CSI). For cloud providers that do not support snapshots, OADP backs up resources and PV data with Restic or Kopia.













- [Installing OADP for application backup and restore](#)
- [Installing OADP on a ROSA cluster and using STS, please follow the Getting Started Steps 1-3 in order to obtain the role ARN needed for using the standardized STS configuration flow via OLM](#)
- [Frequently Asked Questions](#)

Project: All Projects

Installed Operators

Installed Operators are represented by ClusterServiceVersions within this Namespace. For more information, see the [Understanding Operators documentation](#) Operator and ClusterServiceVersion using the [Operator SDK](#).

Name Search by name...

Name	Namespace	Managed Namespaces	Status
 OpenShift Virtualization 4.14.4 provided by Red Hat	 openshift-cnv	 openshift-cnv	 Succeeded Up to date
 OADP Operator 1.3.0 provided by Red Hat	 openshift-adp	 openshift-adp	 Succeeded Up to date
 Package Server 0.0.1-snapshot provided by	 openshift-operator-lifecycle-manager	 openshift-operator-lifecycle-manager	 Succeeded

Prerequisites for Velero configuration with Ontap S3 details

After the installation of the operator succeeds, configure the instance of Velero.

Velero can be configured to use S3 compatible Object Storage. Configure ONTAP S3 using the procedures shown in the [Object Storage Management section of ONTAP documentation](#). You will need the following information from your ONTAP S3 configuration to integrate with Velero.

- A Logical Interface (LIF) that can be used to access S3
- User credentials to access S3 that includes the access key and the secret access key
- A bucket name in S3 for backups with access permissions for the user
- For secure access to the Object storage, TLS certificate should be installed on the Object Storage server.

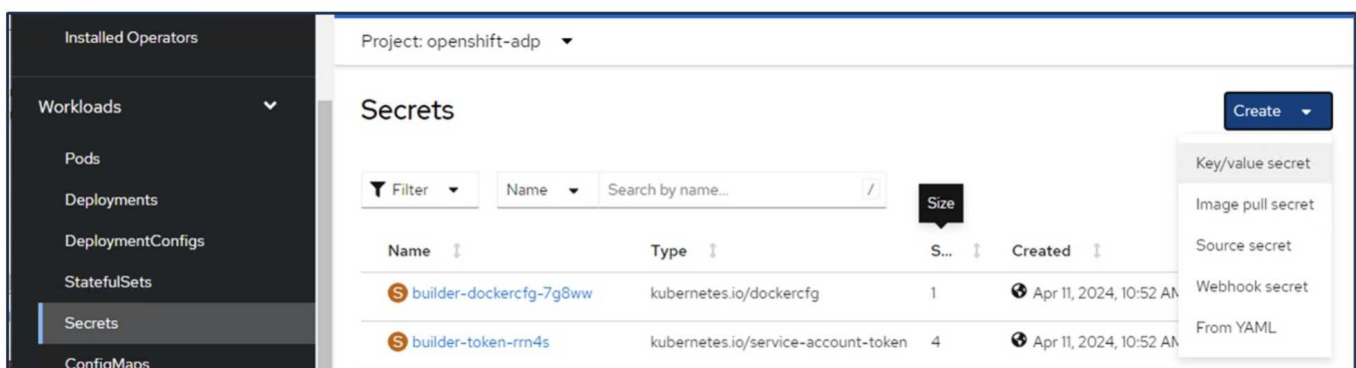
Prerequisites for Velero configuration with StorageGrid S3 details

Velero can be configured to use S3 compatible Object Storage. You can configure StorageGrid S3 using the procedures shown in the [StorageGrid documentation](#). You will need the following information from your StorageGrid S3 configuration to integrate with Velero.

- The endpoint that can be used to access S3
- User credentials to access S3 that includes the access key and the secret access key
- A bucket name in S3 for backups with access permissions for the user
- For secure access to the Object storage, TLS certificate should be installed on the Object Storage server.

Steps to configure Velero

- First, create a secret for an ONTAP S3 user credential or StorageGrid Tenant user credentials. This will be used to configure Velero later. You can create a secret from the CLI or from the web console. To create a secret from the web console, select Secrets, then click on Key/Value Secret. Provide the values for the credential name, key and the value as shown. Be sure to use the Access Key Id and Secret Access Key of your S3 user. Name the secret appropriately. In the sample below, a secret with ONTAP S3 user credentials named `ontap-s3-credentials` is created.



Project: openshift-adp ▼

Edit key/value secret

Key/value secrets let you inject sensitive data into your application as files or environment variables.

Secret name *

ontap-s3-credentials

Unique name of the new secret.

Key *

cloud

Value

Browse...

Drag and drop file with your value here or browse to upload it.

```
[default]
aws_access_key_id=
aws_secret_access_key=
```

+ Add key/value

Save Cancel





To create a secret named sg-s3-credentials from the CLI you can use the following command.

```
# oc create secret generic sg-s3-credentials --namespace openshift-adp --from-file
cloud=cloud-credentials.txt
```

Where credentials.txt file contains the Access Key Id and the Secret Access Key of the S3 user in the following format:

```
[default]
aws_access_key_id=< Access Key ID of S3 user>
aws_secret_access_key=<Secret Access key of S3 user>
```


- Next, to configure Velero, select Installed Operators from the menu item under Operators, click on OADP operator, and then select the DataProtectionApplication tab.

Home	Installed Operators				
Operators	Installed Operators are represented by ClusterServiceVersions within this Namespace. For more information, see the Understanding Operators documentation or create an Operator and ClusterServiceVersion using the Operator SDK .				
OperatorHub	<div> <div>Name</div> <div>Search by name...</div> </div>				
Installed Operators					
Workloads					
Virtualization					
Networking					
	Name	Managed Namespaces	Status	Last updated	Provided APIs
	 OADP Operator 1.3.0 provided by Red Hat	 openshift-adp	 Succeeded Up to date	 Apr 11, 2024, 10:53 AM	BackupRepository Backup BackupStorageLocation DeleteBackupRequest View 11 more...

Click on Create DataProtectionApplication. In the form view, provide a name for the DataProtection Application or use the default name.

Project: openshift-adp

Installed Operators > Operator details


OADP Operator
 1.3.0 provided by Red Hat

Actions

ServerStatusRequest
VolumeSnapshotLocation
DataDownload
DataUpload
CloudStorage
DataProtectionApplication

DataProtectionApplications

Create DataProtectionApplication

Now go to the YAML view and replace the spec information as shown in the yaml file examples below.

Sample yaml file for configuring Velero with ONTAP S3 as the backupLocation

```

spec:
  backupLocations:
    - velero:
        config:
          insecureSkipTLSVerify: 'false' ->use this for https
communication with ONTAP S3
          profile: default
          region: us-east-1
          s3ForcePathStyle: 'True' ->This allows use of IP in s3URL
          s3Url: 'https://10.xx.xx.xx' ->LIF to access S3. Ensure TLS
certificate for S3 is configured
          credential:
            key: cloud
            name: ontap-s3-credentials ->previously created secret
          default: true
          objectStorage:
            bucket: velero ->Your bucket name previously created in S3 for
backups
            prefix: demobackup ->The folder that will be created in the
bucket
            provider: aws
          configuration:
            nodeAgent:
              enable: true
              uploaderType: kopia
              #default Data Mover uses Kopia to move snapshots to Object Storage
            velero:
              defaultPlugins:
                - csi ->Add this plugin
                - openshift
                - aws
                - kubevirt ->Add this plugin

```

Sample yaml file for configuring Velero with StorageGrid S3 as the backupLocation and snapshotLocation

```
spec:
  backupLocations:
    - velero:
        config:
          insecureSkipTLSVerify: 'true'
          profile: default
          region: us-east-1 ->region of your StorageGrid system
          s3ForcePathStyle: 'True'
          s3Url: 'https://172.21.254.25:10443' ->the IP used to access S3
        credential:
          key: cloud
          name: sg-s3-credentials ->secret created earlier
        default: true
        objectStorage:
          bucket: velero
          prefix: demobackup
        provider: aws
  configuration:
    nodeAgent:
      enable: true
      uploaderType: kopia
    velero:
      defaultPlugins:
        - csi
        - openshift
        - aws
        - kubevirt
```

The spec section in the yaml file should be configured appropriately for the following parameters similar to the example above

backupLocations

ONTAP S3 or StorageGrid S3 (with its credentials and other information as shown in the yaml) is configured as the default BackupLocation for velero.

snapshotLocations

If you use Container Storage Interface (CSI) snapshots, you do not need to specify a snapshot location because you will create a VolumeSnapshotClass CR to register the CSI driver. In our example, you use Astra Trident CSI and you have previously created VolumeSnapShotClass CR using the Trident CSI driver.

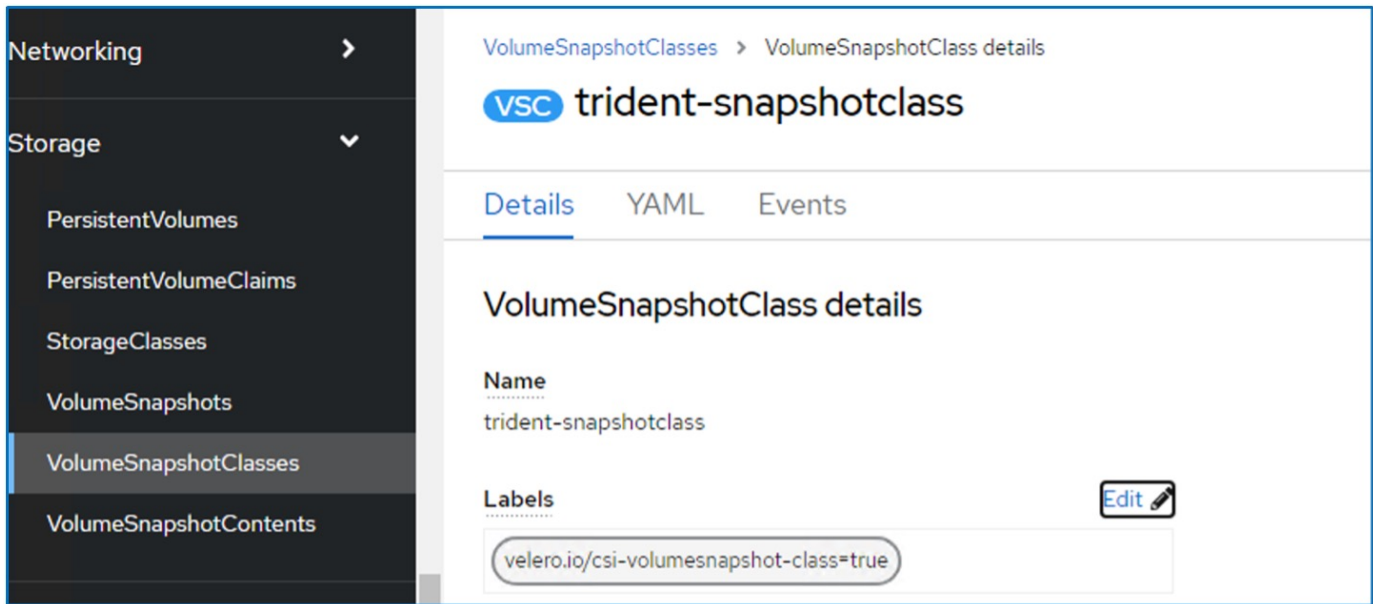
Enable CSI plugin

Add csi to the defaultPlugins for Velero to back up persistent volumes with CSI snapshots.

The Velero CSI plugins, to backup CSI backed PVCs, will choose the VolumeSnapshotClass in the cluster that has **velero.io/csi-volumesnapshot-class** label set on it. For this

- You must have the trident VolumeSnapshotClass created.
- Edit the label of the trident-snapshotclass and set it to

`velero.io/csi-volumesnapshot-class=true` as shown below.



Ensure that the snapshots can persist even if the VolumeSnapshot objects are deleted. This can be done by setting the **deletionPolicy** to Retain. If not, deleting a namespace will completely lose all PVCs ever backed up in it.

```
apiVersion: snapshot.storage.k8s.io/v1
kind: VolumeSnapshotClass
metadata:
  name: trident-snapshotclass
driver: csi.trident.netapp.io
deletionPolicy: Retain
```

VolumeSnapshotClasses > VolumeSnapshotClass details

VSC trident-snapshotclass

Details | YAML | Events

VolumeSnapshotClass details

Name
trident-snapshotclass

Labels [Edit](#)

velero.io/csi-volumesnapshot-class=true


Annotations
[1 annotation](#)

Driver
csi.trident.netapp.io

Deletion policy
Retain

Ensure that the DataProtectionApplication is created and is in condition:Reconciled.

Installed Operators > Operator details

 **OADP Operator**
1.3.0 provided by Red Hat


Actions

ServerStatusRequest | VolumeSnapshotLocation | DataDownload | DataUpload | CloudStorage | **DataProtectionApplication**

DataProtectionApplications

[Create DataProtectionApplication](#)


Name Search by name...

Name	Kind	Status	Labels
 velero-demo	DataProtectionApplication	Condition: Reconciled	No labels

The OADP operator will create a corresponding BackupStorageLocation. This will be used when creating a backup.

Project: openshift-adp ▾

[Installed Operators](#) > [Operator details](#)



OADP Operator
 1.3.0 provided by Red Hat

Actions ▾

[Repository](#)
[Backup](#)
[BackupStorageLocation](#)
[DeleteBackupRequest](#)
[DownloadRequest](#)
[PodVolumeBackup](#)
[PodVolumeRecovery](#)

BackupStorageLocations

Create BackupStorageLocation

Name ▾
 Search by name... /

Name ▴ ▾	Kind ▴ ▾	Status ▴ ▾	Labels ▴ ▾
BSL velero-demo-1	BackupStorageLocation	Phase: Available	<div>app.kubernetes.io/component=bsl</div> <div>app.kubernetes.io/instance=velero-demo-1</div> <div>app.kubernetes.io/managed-by=oadp-operator</div> <div>app.kubernetes.io/name=oadp-operator-velero</div> <div>openshift.io/oadp=True</div> <div>openshift.io/oadp-registry=True</div>

Creating on-demand backup for VMs in OpenShift Virtualization

This section outlines how to create on-demand backup for VMs in OpenShift Virtualization.

Steps to create a backup of a VM

To create an on-demand backup of the entire VM (VM metadata and VM disks), click on the **Backup** tab. This creates a Backup Custom Resource (CR). A sample yaml is provided to create the Backup CR. Using this yaml, the VM and its disks in the specified namespace will be backed up. Additional parameters can be set as shown in the [documentation](#).

A snapshot of the persistent volumes backing the disks will be created by the CSI. A backup of the VM along with the snapshot of its disks are created and stored in the backup location specified in the yaml. The backup will remain in the system for 30 days as specified in the ttl.

```

apiVersion: velero.io/v1
kind: Backup
metadata:
  name: backup1
  namespace: openshift-adp
spec:
  includedNamespaces:
  - virtual-machines-demo
  snapshotVolumes: true
  storageLocation: velero-demo-1 -->this is the backupStorageLocation
  previously created
                                when Velero is configured.

  ttl: 720h0m0s

```

Once the backup completes, its Phase will show as completed.

The screenshot shows the Velero UI interface. At the top, the project is set to 'openshift-adp'. Below this, the 'Installed Operators' section shows the 'OADP Operator' (version 1.3.0 provided by Red Hat). The 'Backup' tab is selected, displaying a table of backups. A single backup named 'backup1' is listed with a status of 'Completed' (indicated by a green checkmark). The table has columns for Name, Kind, Status, and Labels. A 'Create Backup' button is visible in the top right corner of the backup list.

Name	Kind	Status	Labels
backup1	Backup	Phase: ✔ Completed	velero.io/storage-location=velero-demo-1

You can inspect the backup in the Object storage with the help of an S3 browser application. The path of the backup shows in the configured bucket with the prefix name (velero/demobackup). You can see the contents of the backup includes the volume snapshots, logs, and other metadata of the virtual machine.



In StorageGrid, you can also use the S3 console that is available from the Tenant Manager to view the backup objects.

Path: / demobackup/ backups/ backup1/				
Name	Size	Type	Last Modified	Storage Class
..				
backup1.tar.gz	230.36 KB	GZ File	4/15/2024 10:26:29 PM	STANDARD
velero-backup.json	3.35 KB	JSON File	4/15/2024 10:26:29 PM	STANDARD
backup1-resource-list.json.gz	1.12 KB	GZ File	4/15/2024 10:26:29 PM	STANDARD
backup1-itemoperations.json.gz	600 bytes	GZ File	4/15/2024 10:26:28 PM	STANDARD
backup1-volumesnapshots.json.gz	29 bytes	GZ File	4/15/2024 10:26:28 PM	STANDARD
backup1-podvolumebackups.json.gz	29 bytes	GZ File	4/15/2024 10:26:28 PM	STANDARD
backup1-results.gz	49 bytes	GZ File	4/15/2024 10:26:28 PM	STANDARD
backup1-csi-volumesnapshotclasses.json.gz	426 bytes	GZ File	4/15/2024 10:26:28 PM	STANDARD
backup1-csi-volumesnapshotcontents.json.gz	1.43 KB	GZ File	4/15/2024 10:26:28 PM	STANDARD
backup1-csi-volumesnapshots.json.gz	1.34 KB	GZ File	4/15/2024 10:26:28 PM	STANDARD
backup1-logs.gz	13.49 KB	GZ File	4/15/2024 10:26:28 PM	STANDARD

Creating scheduled backups for VMs in OpenShift Virtualization

To create backups on a schedule, you need to create a Schedule CR.

The schedule is simply a Cron expression allowing you to specify the time at which you want to create the backup. A sample yaml to create a Schedule CR.

```
apiVersion: velero.io/v1
kind: Schedule
metadata:
  name: <schedule>
  namespace: openshift-adp
spec:
  schedule: 0 7 * * *
  template:
    hooks: {}
    includedNamespaces:
    - <namespace>
    storageLocation: velero-demo-1
    defaultVolumesToFsBackup: true
    ttl: 720h0m0s
```


The Cron expression 0 7 * * * means a backup will be created at 7:00 every day.

The namespaces to be included in the backup and the storage location for the backup are also specified. So instead of a Backup CR, Schedule CR is used to create a backup at the specified time and frequency.

Once the schedule is created, it will be Enabled.

Project: openshift-adp ▾



Installed Operators > Operator details

 **OADP Operator**
1.3.0 provided by Red Hat

storageLocation DeleteBackupRequest DownloadRequest PodVolumeBackup PodVolumeRestore Restore Schedule

Schedules


Name ▾ Search by name... /

Name	Kind	Status	Labels
 schedule1	Schedule	Phase:  Enabled	No labels

Backups will be created according to this schedule, and can be viewed from the Backup tab.

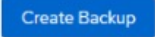
Project: openshift-adp ▾

Installed Operators > Operator details


 **OADP Operator**
1.3.0 provided by Red Hat

Events All instances BackupRepository Backup BackupStorageLocation DeleteBackupRequest DownloadRequest

Backups



Name ▾ Search by name... /

Name	Kind	Status	Labels
 schedule1-20240416140507	Backup	Phase: InProgress	<div>velero.io/schedule-name=schedule1</div> <div>velero.io/storage-location=velero-demo-1</div>

Restore a VM from a backup

This section describes how to restore virtual machine(s) from a backup.

Prerequisites


To restore from a backup, let us assume that the namespace where the virtual machine existed got accidentally deleted.

Restore to the same namespace

To restore from the backup that we just created, we need to create a Restore Custom Resource (CR). We need to provide it a name, provide the name of the backup that we want to restore from and set the restorePVs to true. Additional parameters can be set as shown in the [documentation](#). Click on Create button.

Project: openshift-adp ▾

Installed Operators > Operator details

 **OADP Operator**
1.3.0 provided by Red Hat

Actions ▾

est

DownloadRequest

PodVolumeBackup

PodVolumeRestore

Restore

Schedule

ServerStatusRequest

VolumeSnap

Restores


Create Restore

```
apiVersion: velero.io/v1
kind: Restore
metadata:
  name: restore1
  namespace: openshift-adp
spec:
  backupName: backup1
  restorePVs: true
```

When the phase shows completed, you can see that the virtual machines have been restored to the state when the snapshot was taken. (If the backup was created when the VM was running, restoring the VM from the backup will start the restored VM and bring it to a running state). The VM is restored to the same namespace.

Project: openshift-adp ▾

Installed Operators > Operator details

 **OADP Operator**
1.3.0 provided by Red Hat

Actions ▾

est

DownloadRequest

PodVolumeBackup

PodVolumeRestore

Restore

Schedule

ServerStatusRequest



VolumeSr

Restores

Create Restore

Name ▾

Search by name... /

Name ↑	Kind ↑	Status ↑	Labels ↑
 restore1	Restore	Phase:  Completed	No labels

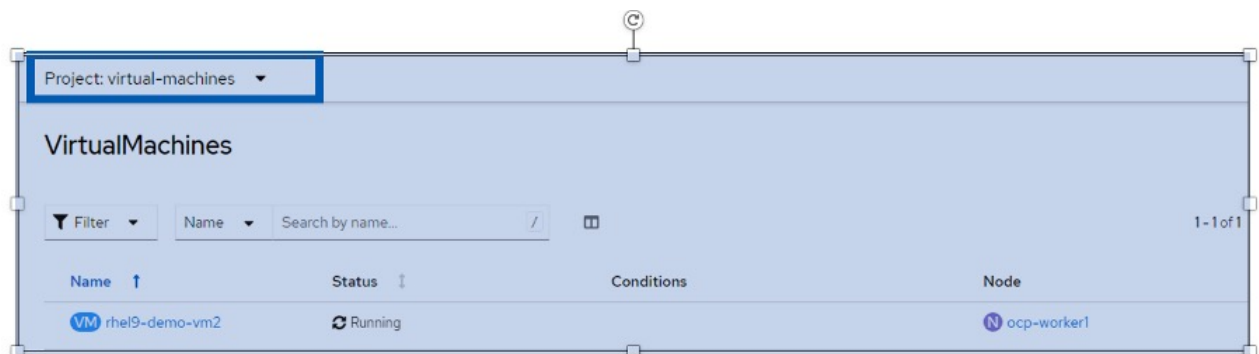
Restore to a different namespace

To restore the VM to a different namespace, you can provide a namespaceMapping in the yaml definition of the Restore CR.

The following sample yaml file creates a Restore CR to restore a VM and its disks in the virtual-machines-demo namespace when the backup was taken to the virtual-machines namespace.

```
apiVersion: velero.io/v1
kind: Restore
metadata:
  name: restore-to-different-ns
  namespace: openshift-adp
spec:
  backupName: backup
  restorePVs: true
  includedNamespaces:
  - virtual-machines-demo
  namespaceMapping:
    virtual-machines-demo: virtual-machines
```

When the phase shows completed, you can see that the virtual machines have been restored to the state when the snapshot was taken. (If the backup was created when the VM was running, restoring the VM from the backup will start the restored VM and bring it to a running state). The VM is restored to a different namespace as specified in the yaml.



Restore to a different storage class

Velero provides a generic ability to modify the resources during restore by specifying json patches. The json patches are applied to the resources before they are restored. The json patches are specified in a configmap and the configmap is referenced in the restore command. This feature enables you to restore using different storage class.

In the example below, the virtual machine, during creation uses ontap-nas as the storage class for its disks. A backup of the virtual machine named backup1 is created.

The screenshot shows the 'Configuration' tab of a virtual machine named 'rhel9-demo-vm1' in the 'virtual-machines-demo' project. The VM is in a 'Running' state. Under the 'Disks' section, there is a table listing the disks:

Name	Source	Size	Drive	Interface	Storage class
cloudinitdisk	Other	-	Disk	virtio	-
disk1	PVC rhel9-demo-vm1-disk1	31.75 GiB	Disk	virtio	ontap-nas
rootdisk	PVC rhel9-demo-vm1	31.75 GiB	Disk	virtio	ontap-nas

The screenshot shows the 'Backup' tab of the 'OADP Operator' in the 'openshift-adp' project. It displays a list of backups with the following details:

Name	Kind	Status
backup1	Backup	Phase: ✔ Completed

Simulate a loss of the VM by deleting the VM.

To restore the VM using a different storage class, for example, ontap-nas-eco storage class, you need to do the following two steps:

Step 1

Create a config map (console) in the openshift-adp namespace as follows:

Fill in the details as shown in the screenshot:

Select namespace : openshift-adp

Name: change-storage-class-config (can be any name)

Key: change-storage-class-config.yaml:

Value:

```
version: v1
resourceModifierRules:
- conditions:
    groupResource: persistentvolumeclaims
    resourceNameRegex: "^rhel*"
    namespaces:
    - virtual-machines-demo
patches:
- operation: replace
  path: "/spec/storageClassName"
  value: "ontap-nas-eco"
```

Project: openshift-adp

Edit ConfigMap

Config maps hold key-value pairs that can be used in pods to read application configuration.

Configure via: ☒ Form view ☐ YAML view

Name *

change-storage-class-config

A unique name for the ConfigMap within the project

☐ Immutable

Immutable, if set to true, ensures that data stored in the ConfigMap cannot be updated

Data

Data contains the configuration data that is in UTF-8 range

[Remove key/value](#)

Key *

change-storage-class-config.yaml

Value

[Browse...](#)

Drag and drop file with your value here or browse to upload it.

```
version: v1
resourceModifierRules:
- conditions:
    groupResource: persistentvolumeclaims
```

[Add key/value](#)

The resulting config map object should look like this (CLI):


```
# kubectl describe cm/change-storage-class-config -n openshift-
adp
Name:          change-storage-class-config
Namespace:     openshift-adp
Labels:        velero.io/change-storage-class=RestoreItemAction
                velero.io/plugin-config=
Annotations:   <none>

Data
====
change-storage-class-config.yaml:
----
version: v1
resourceModifierRules:
- conditions:
    groupResource: persistentvolumeclaims
    resourceNameRegex: "^rhel*"
    namespaces:
    - virtual-machines-demo
patches:
- operation: replace
  path: "/spec/storageClassName"
  value: "ontap-nas-eco"

BinaryData
====

Events:   <none>
```

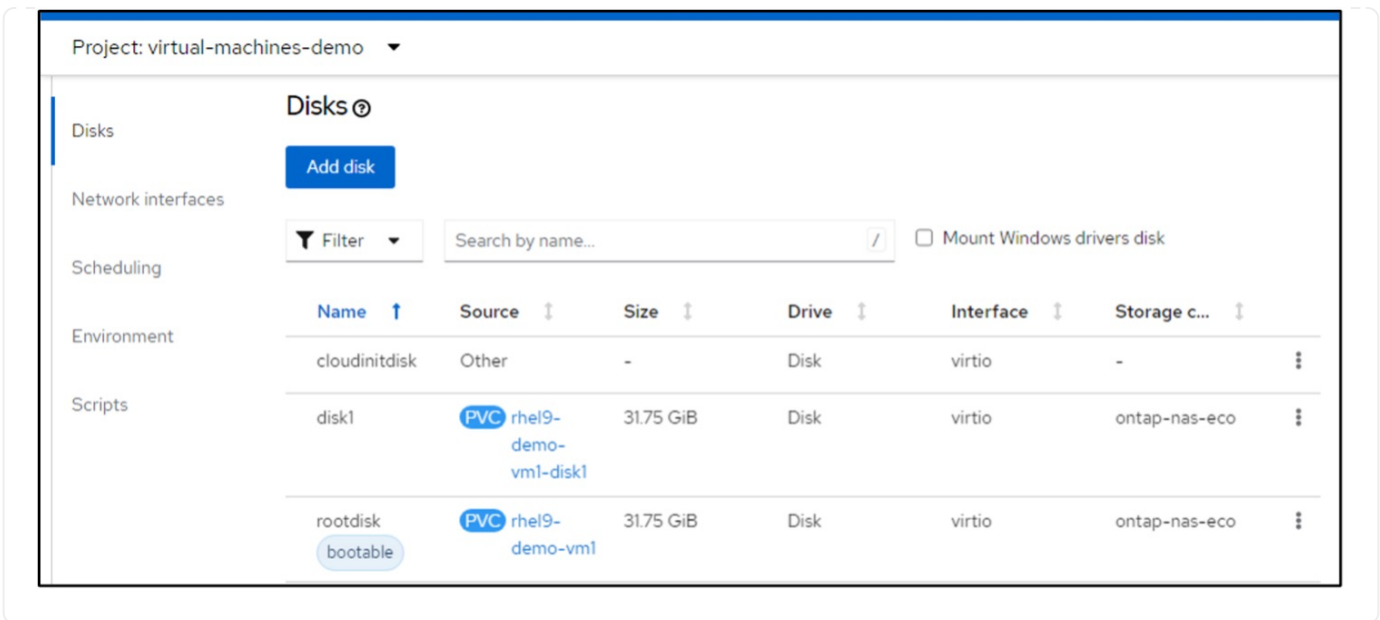
This config map will apply the resource modifier rule when the restore is created. A patch will be applied to replace the storage class name to ontap-nas-eco for all persistent volume claims starting with rhel.

Step 2

To restore the VM use the following command from the Velero CLI:

```
#velero restore create restore1 --from-backup backup1 --resource
-modifier-configmap change-storage-class-config -n openshift-adp
```

The VM is restored in the same namespace with the disks created using the storage class ontap-nas-eco.



Deleting backups and restores in using Velero

This section outlines how to delete backups and restores for VMs in OpenShift Virtualization using Velero.

Deleting a backup

You can delete a Backup CR without deleting the Object Storage data by using the OC CLI tool.

```
oc delete backup <backup_CR_name> -n <velero_namespace>
```

If you want to delete the Backup CR and delete the associated object storage data, you can do so by using the Velero CLI tool.

Download the CLI as given in the instructions in the [Velero documentation](#).

Execute the following delete command using the Velero CLI

```
velero backup delete <backup_CR_name> -n <velero_namespace>
```

Deleting a Restore

You can delete the Restore CR using the Velero CLI

```
velero restore delete restore --namespace openshift-adp
```

You can use oc command as well as the UI to delete the restore CR

```
oc delete backup <backup_CR_name> -n <velero_namespace>
```

Monitoring using Cloud Insights

Monitoring using Cloud Insights for VMs in Red Hat OpenShift Virtualization

Author: Banu Sundhar, NetApp

This section of the reference document provides details for integrating NetApp Cloud Insights with a Red Hat OpenShift Cluster to monitor OpenShift Virtualization VMs.

NetApp Cloud Insights is a cloud infrastructure monitoring tool that gives you visibility into your complete infrastructure. With Cloud Insights, you can monitor, troubleshoot, and optimize all your resources including your public clouds and your private data centers. For more information about NetApp Cloud Insights, refer to the [Cloud Insights documentation](#).

To start using Cloud Insights, you must sign up on the NetApp BlueXP portal. For details, refer to the [Cloud Insights Onboarding](#)

Cloud Insights has several features that enable you to quickly and easily find data, troubleshoot issues, and provide insights into your environment. You can find data easily with powerful queries, you can visualize data in dashboards, and send email alerts for data thresholds you set. Refer to the [video tutorials](#) to help you understand these features.

For Cloud Insights to start collecting data you need the following

Data Collectors

There are 3 types of Data Collectors:

- * Infrastructure (storage devices, network switches, compute infrastructure)
- * Operating Systems (such as VMware or Windows)
- * Services (such as Kafka)

Data Collectors discover information from the data sources, such as ONTAP storage device (infrastructure data collector). The information gathered is used for analysis, validation, monitoring, and troubleshooting.

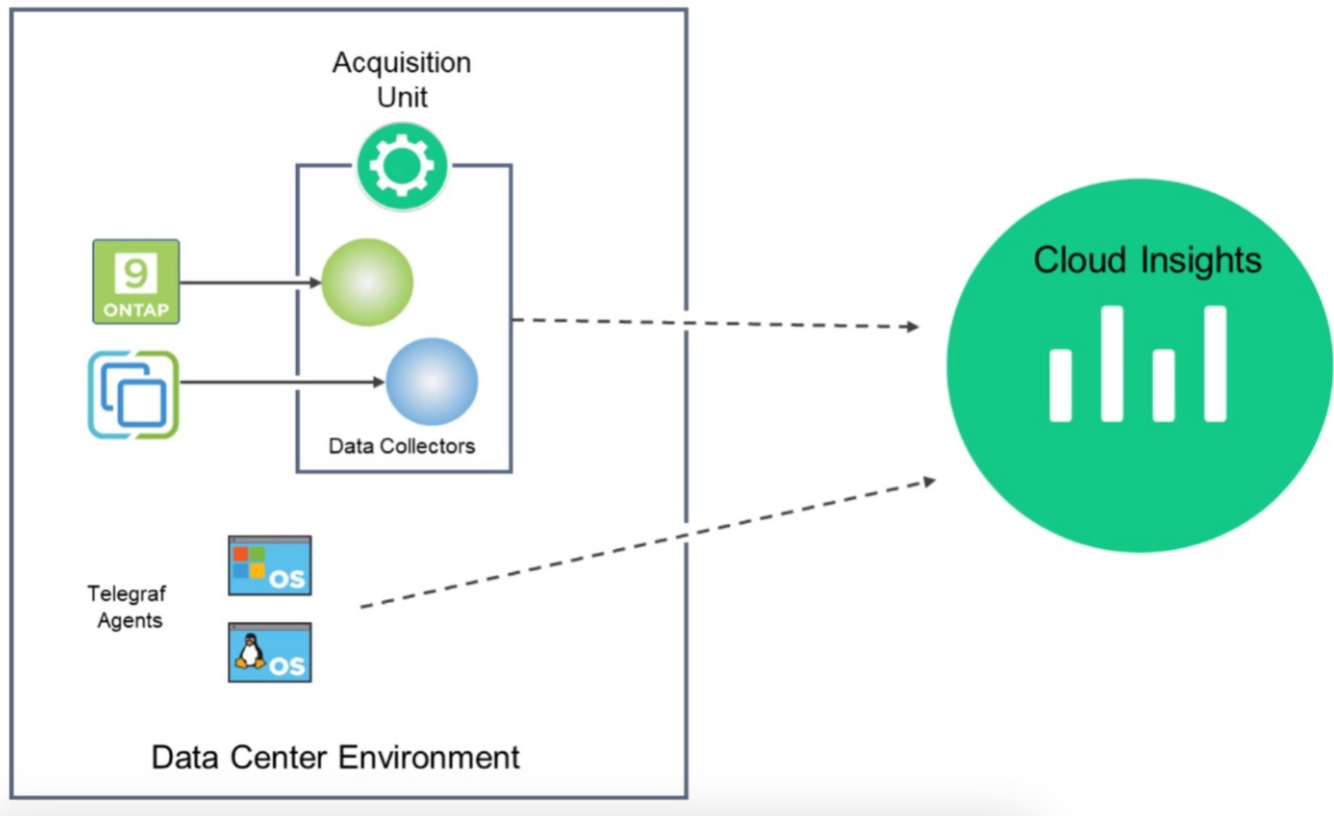
Acquisition Unit

If you are using an infrastructure Data Collector, you also need an Acquisition Unit to inject data into Cloud Insights. An Acquisition Unit is a computer dedicated to hosting data collectors, typically a Virtual Machine. This computer is typically located in the same data center/VPC as the monitored items.

Telegraf Agents

Cloud Insights also supports Telegraf as its agent for collection of integration data. Telegraf is a plugin-driven server agent that can be used to collect and report metrics, events, and logs.

Cloud Insights Architecture



Integration with Cloud Insights for VMs in Red Hat OpenShift Virtualization

To start collecting data for VMs in OpenShift Virtualization you will need to install:

1. A Kubernetes monitoring operator and data collector to collect Kubernetes data
For complete instructions, refer to the [documentation](#).
2. An acquisition unit to collect data from ONTAP storage that provides persistent storage for the VM disks
For complete instructions, refer to the [documentation](#).
3. A data collector for ONTAP
For complete instructions, refer to the [documentation](#)

Additionally, if you are using StorageGrid for VM backups, you need a data collector for the StorageGRID as well.

Sample Monitoring capabilities for VMs in Red Hat OpenShift Virtualization

This section discusses monitoring using Cloud Insights for VMs in Red Hat OpenShift Virtualization.

Monitoring based on events and creating Alerts

Here is a sample where the namespace that contains a VM in OpenShift Virtualization is monitored based on events. In this example, a monitor is created based on `logs.kubernetes.event` for the specified namespace in the cluster.

Observability

Explore

Alerts

Collectors

Log Queries

Enrich

Reporting

Kubernetes

Workload Security

ONTAP Essentials

Admin

NetApp PCS Sandbox / Observability / Alerts / Manage Monitors /

Monitor virtual-machines-demo-ns

Edit log monitor

Filter/Advanced Query and Group by in section 1 must not be empty. If alert resolution is based on log entry, section 3 filter/advanced query also must not be empty.

Select the log to monitor

Log Source

logs.kubernetes.event

Filter By

kubernetes_cluster

ocp-cluster4

involvedobject.namespace

virtual-machines-demo

Advanced Query

Group By

reason

27 items found

timestamp	type	source	message
04/19/2024 10:31:18 AM	logs.kubernetes.event	kubernetes_cluster:ocp-cluster4;namespace:cloudi nsights- monitoring;pod_name:net app-ci-event-exporter- 7f7c8d84c4-sk7t9;	VirtualMachineInstance started.
04/19/2024 10:31:18 AM	logs.kubernetes.event	kubernetes_cluster:ocp-cluster4;namespace:cloudi nsights- monitoring;pod_name:net app-ci-event-exporter- 7f7c8d84c4-sk7t9;	VirtualMachineInstance defined.

Define alert behavior

Create an alert at severity

Warning

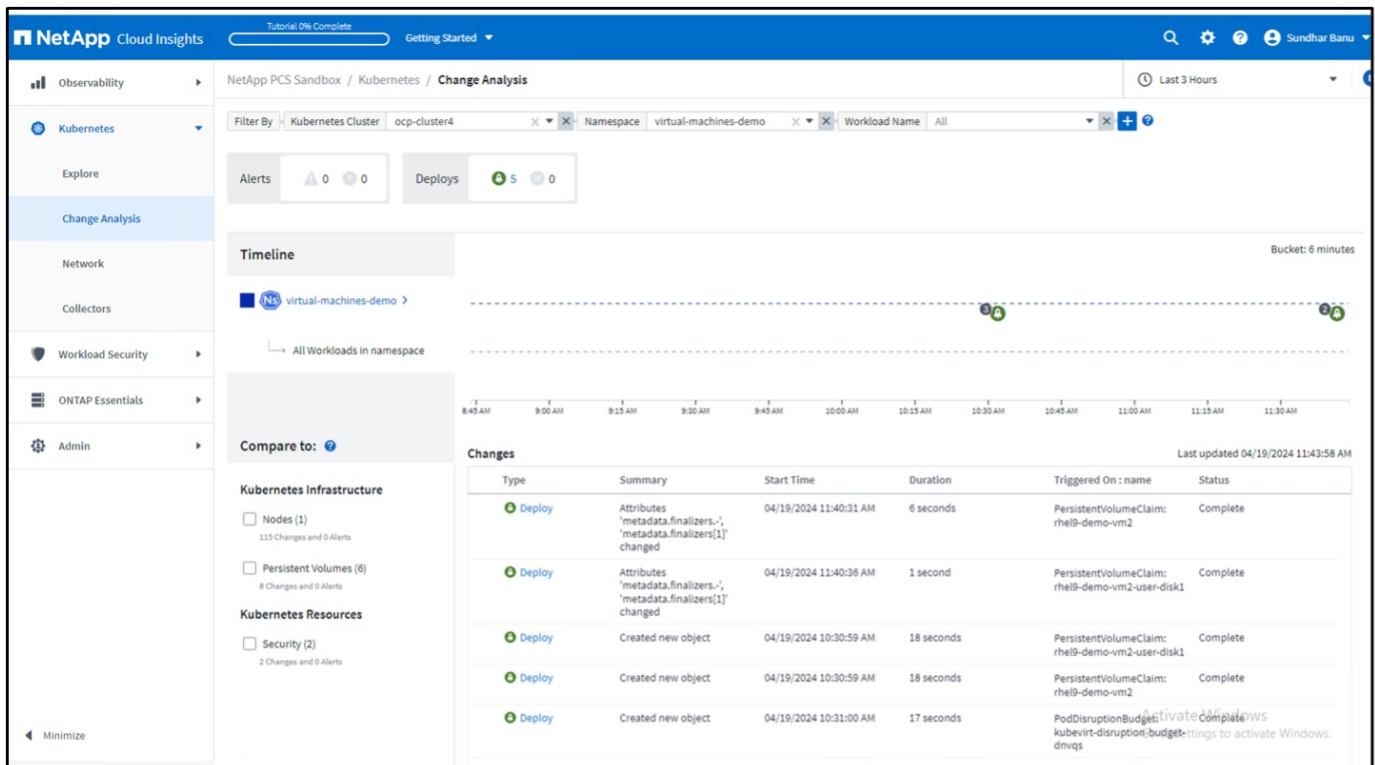
when the conditions above occur

1

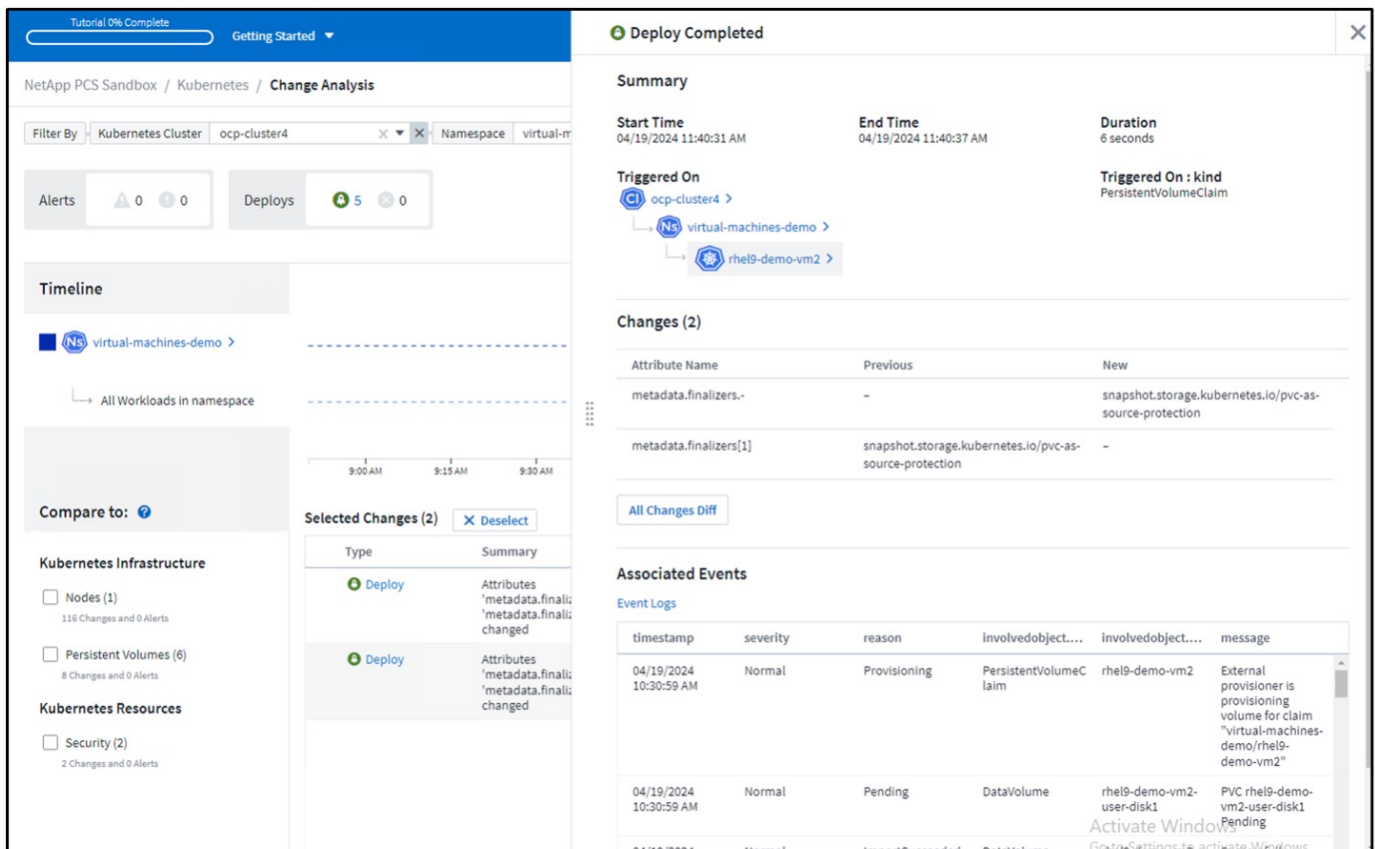
time

This query provides all the events for the virtual machine in the namespace. (There is only one virtual machine in the namespace). An advanced query can also be constructed to filter based on the event where the reason is “failed” or “FailedMount” These events are typically created when there is an issue in creating a PV or mounting the PV to a pod indicating issues in the dynamic provisioner for creating persistent volumes for the VM.

Change Analytics



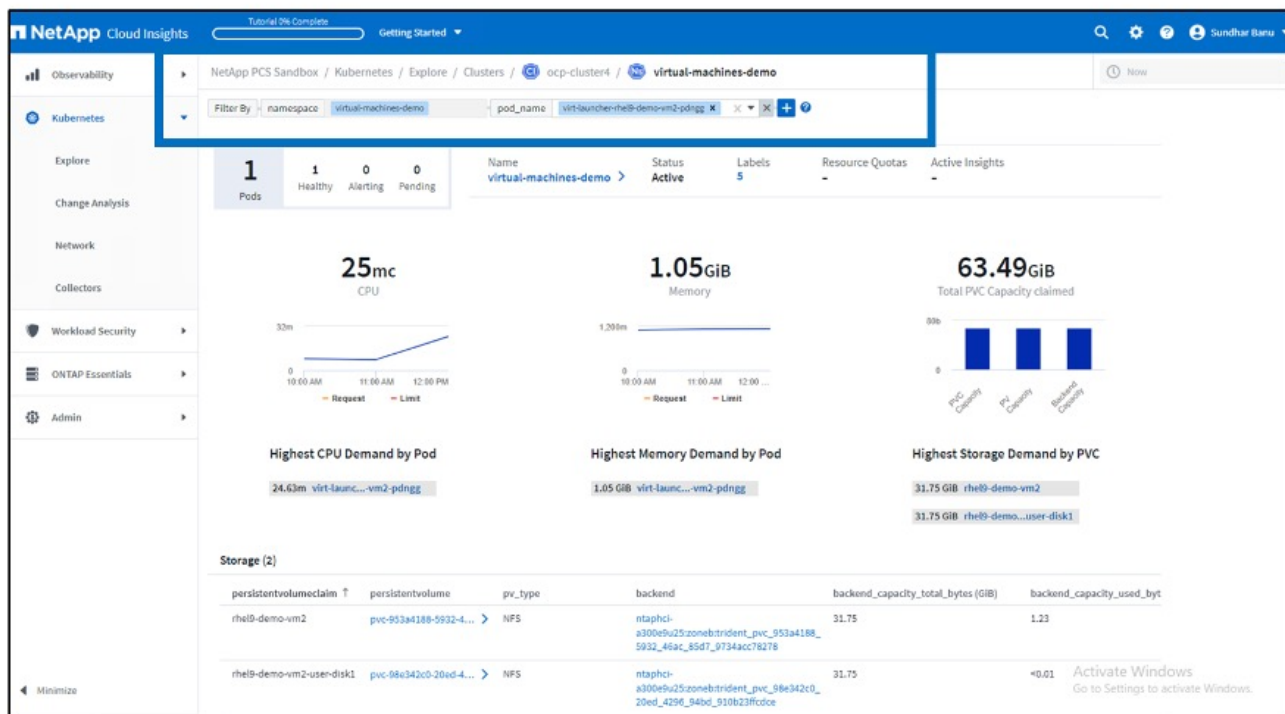
In the above example, Change Analysis is configured on the OpenShift cluster for the namespace that contains an OpenShift Virtualization VM. The dashboard shows changes against the timeline. You can drill down to see what changed and the click on All Changes Diff to see the diff of the manifests. From the manifest, you can see that a new backup of the persistent disks was created.



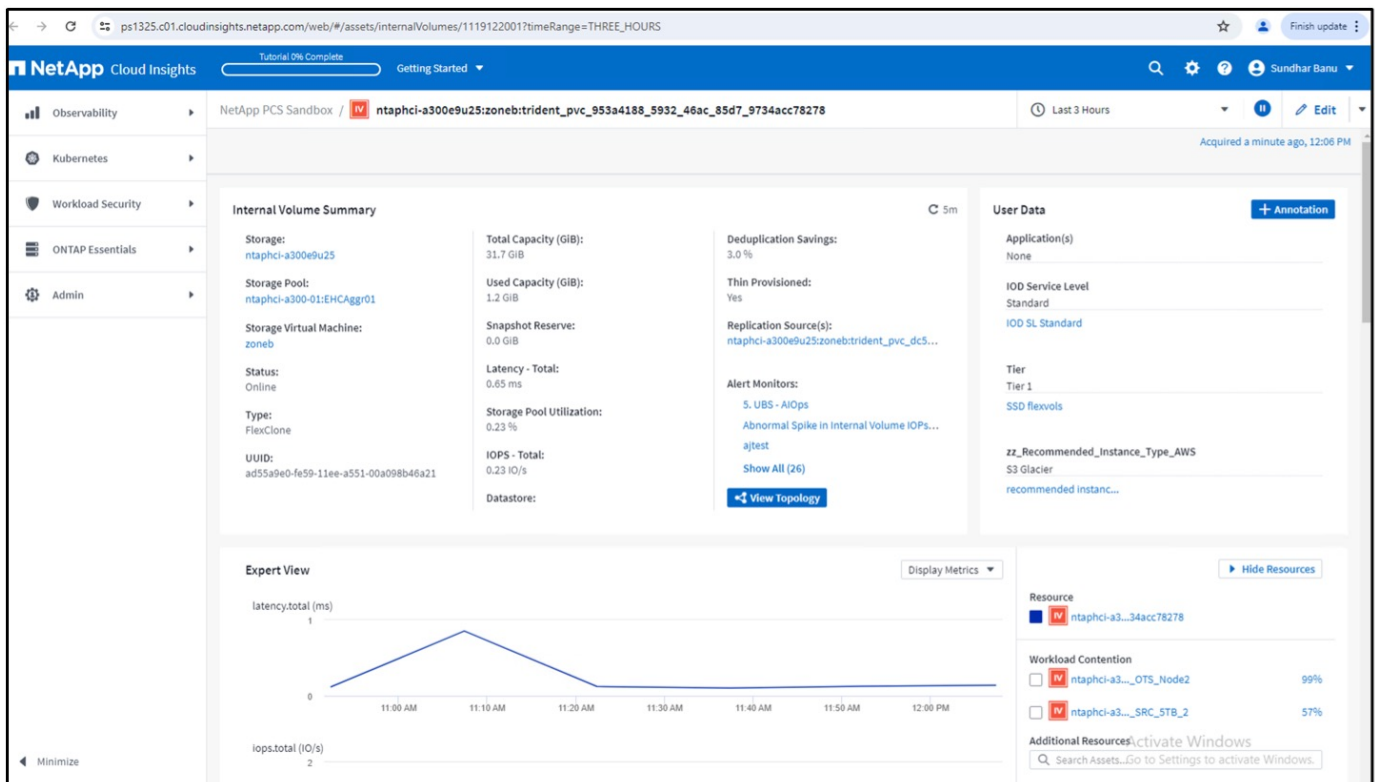
All Changes Diff				X
Previous		New		
	Expand 45 lines ...			
46	kind: DataVolume	46	kind: DataVolume	
47	name: rhel9-demo-vm2	47	name: rhel9-demo-vm2	
48	uid: dcf93b7a-71bc-409b-ad12-4916d05e0980	48	uid: dcf93b7a-71bc-409b-ad12-4916d05e0980	
49	- resourceVersion: "8569671"	49	+ resourceVersion: "8619670"	
50	uid: 953a4188-5932-46ac-85d7-9734acc78278	50	uid: 953a4188-5932-46ac-85d7-9734acc78278	
51	spec:	51	spec:	
52	accessModes:	52	accessModes:	
	Expand 15 lines ...			

Backend Storage Mapping

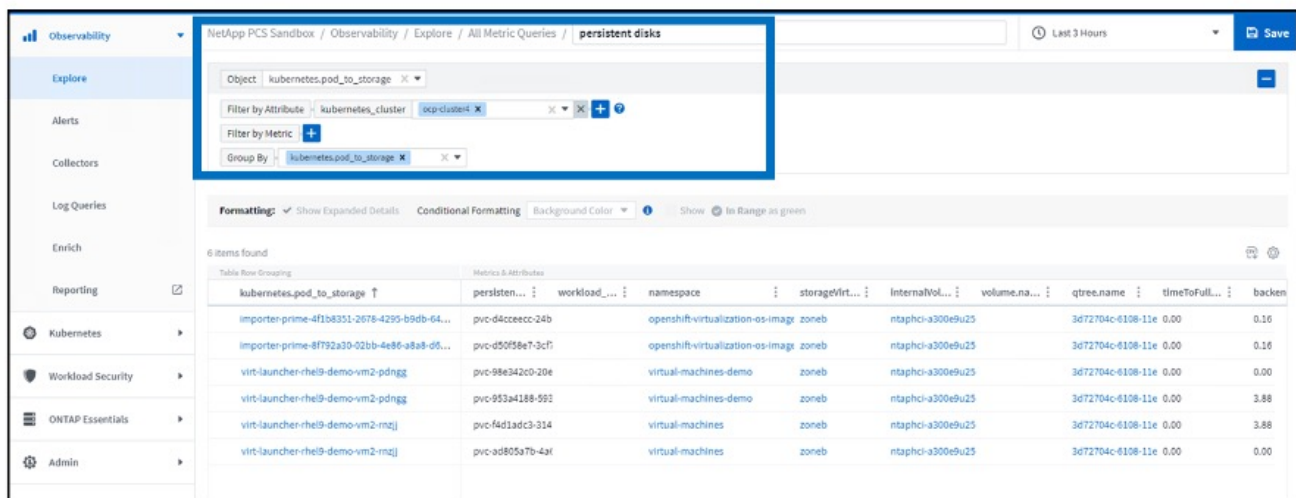
With Cloud Insights, you can easily see the backend storage of the VM disks and several statistics about the PVCs.



You can click on the links under the backend column, which will pull data directly from the backend ONTAP storage.

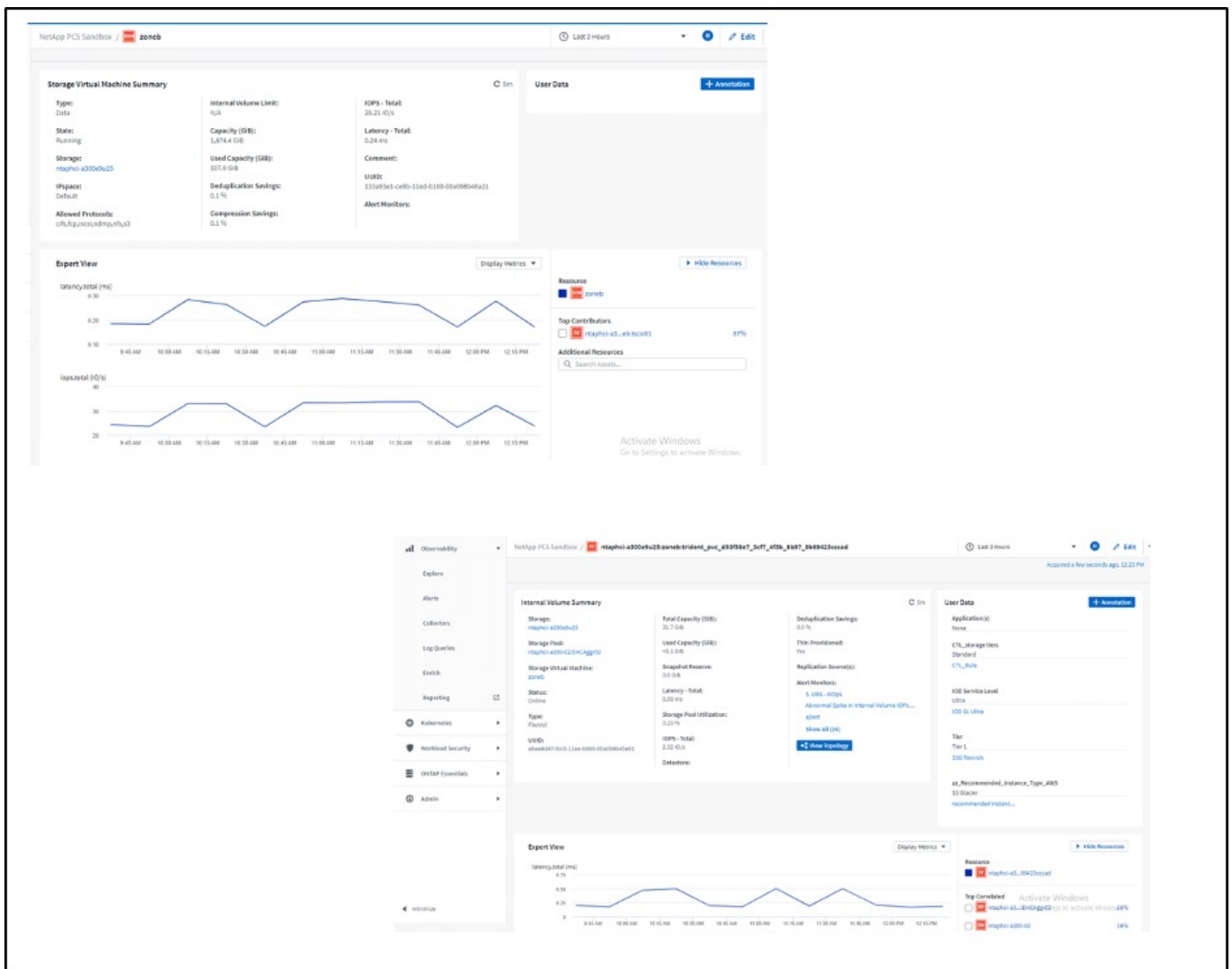


Another way to look at all the pod to storage mapping is creating an All Metrics query From Observability menu under Explore.



Clicking on any of the links will give you the corresponding details from ONTP storage. For example, clicking on an SVM name in the storageVirtualMachine column will pull details about the SVM from ONTAP. Clicking on an internal volume name will pull details about the volume in ONTAP.

	storageVirtualMachin...	internalVolume.name	volume.na..
zation-os-image	zoneb		ntaphci-a300e9u25:zoneb:trident_p
zation-os-image	zoneb		ntaphci-a300e9u25:zoneb:trident_p
demo	zoneb		ntaphci-a300e9u25:zoneb:trident_p
demo	zoneb		ntaphci-a300e9u25:zoneb:trident_p
	zoneb		ntaphci-a300e9u25:zoneb:trident_p
	zoneb		ntaphci-a300e9u25:zoneb:trident_p



Best Practices Recommendations

Best practices recommendations for VMs in Red Hat OpenShift Virtualization

Author: Banu Sundhar, NetApp

This section describes the different factors you should consider when deploying new VMs or when importing existing VMs from a VMware vSphere into OpenShift Virtualization on OpenShift Container Platform.

VM performance

When creating a new VM in OpenShift Virtualization, you need to consider the access pattern along with performance (IOPs and throughput) requirements of the workload that will run on the VM. This will influence the number of VMs you will need to run on the OpenShift Virtualization in an OpenShift Container platform and the type of storage that you need to use for the VM disks.

The type of storage you want to choose for your VM disks are influenced by the following factors:

- The protocol access you need for data access of your workloads
- The access modes you need (RWO vs RWX)
- The performance characteristics you need for your workloads

See the Storage Configuration section below for more details.

High Availability of VM workloads

OpenShift Virtualization supports Live migrations of a VM. Live migration allows a running Virtual Machine Instance (VMI) to move to another node without interrupting the workload. Migration can be helpful for a smooth transition during cluster upgrades or any time a node needs to be drained for maintenance or configuration changes.

Live migration requires the use of a shared storage solution that provides ReadWriteMany (RWX) access mode. The VM disks should be backed by storage option that provides RWX access mode. OpenShift Virtualization will check that a VMI is **live migratable** and if so the **evictionStrategy** will be set to **LiveMigrate**. See [About live migration section in Red Hat documentation](#) for details.

It is important that you use a driver that supports **RWX** access mode.

See the Storage Configuration section below for more details about what ONTAP drivers support RWX access mode.

Storage Configuration

Trident CSI provisioner provides several drivers (nas, nas-economy, nas-flexgroup, san and san-economy) for provisioning storage backed by NetApp storage options.

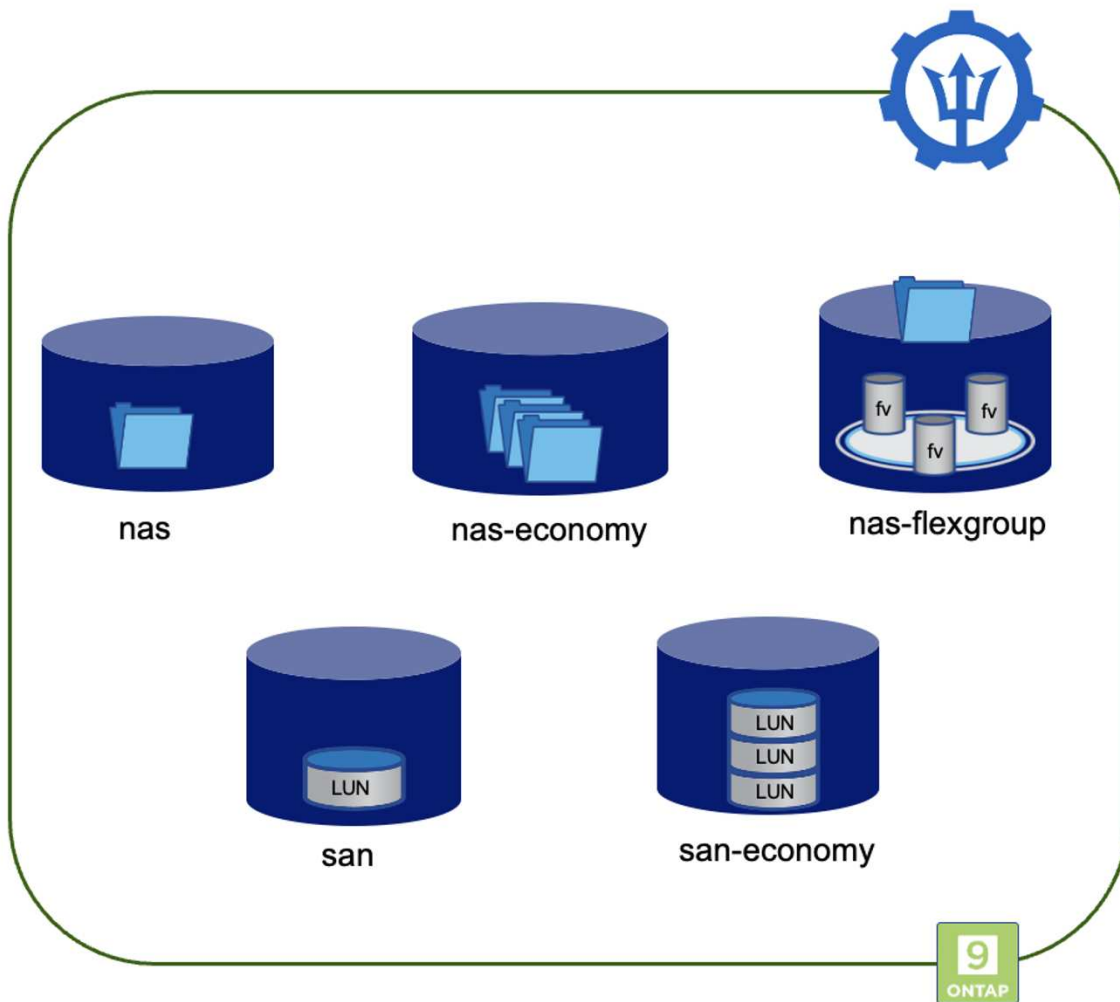
Protocols used:

- * nas drivers use NAS protocols (NFS and SMB)
- * san drivers use iSCSI or NVMe/TCP protocol

The following can help you decide how you want the storage configuration based on the workload requirements and storage utilization.

- **nas** driver creates one persistent volume (PV) on one FlexVolume.
- **nas-economy** driver creates one PV on a qtree on a shared FlexVolume. (one FlexVolume for every 200 PVs, configurable between 50 and 300)
- **nas-flexgroup** driver creates on one PV on one FlexGroup
- **san** driver creates one PV on LUN on a dedicated FlexVolume
- **san-economy** driver creates one PV on LUN on shared FlexVolume (one FlexVolume for every 100 PVs, configurable between 50 and 200)

The following diagram illustrates this.



Also, the access modes supported by the drivers differ.

ONTAP nas drivers support

- Filesystem access and RWO, ROX, RWX, RWOP access modes.

ONTAP san drivers support raw block as well as filesystem modes

- In the raw block mode, it can support RWO, ROX, RWX, RWOP access modes.
- In the filesystem mode, only RWO, RWOP access modes are permitted.

Live migration of OpenShift Virtualization VMs require the disks to have RWX access modes. So, it is important that you choose nas drivers or san drivers in raw block volume mode to create PVCs and PVs backed by ONTAP.

Storage Configuration Best Practices

Dedicated Storage Virtual Machines (SVMs)

Storage Virtual Machines (SVMs) provide isolation and administrative separation between tenants on an ONTAP system. Dedicating an SVM to OpenShift containers and to OpenShift Virtualization VMs enables the delegation of privileges and enables applying best practices for limiting resource consumption.

Limit the maximum volume count on the SVM

To prevent Trident from consuming all the available volumes on the storage system, you should set a limit on the SVM. You can do this from the command line:

```
vserver modify -vserver <svm_name> -max-volumes <num_of_volumes>
```

The max-volumes value is the total volumes provisioned across all the nodes in the ONTAP cluster, and not on an individual ONTAP node. As a result, you might encounter some conditions where an ONTAP cluster node might have far more or less Trident provisioned volumes than another node. To avoid this, ensure that equal number of aggregates from each node in the cluster are assigned to the SVM used by Trident.

Limit the maximum size of volumes created by Trident

You can set a maximum volume size limit on a per SVM basis in ONTAP:

1. Create the SVM with the vserver create command and set the storage limit:

```
vserver create -vserver vserver_name -aggregate aggregate_name -rootvolume  
root_volume_name -rootvolume-security-style {unix|ntfs|mixed} -storage  
-limit value
```

1. To modify the storage limit on an existing SVM:

```
vserver modify -vserver vserver_name -storage-limit value -storage-limit  
-threshold-alert percentage
```



Storage limits cannot be configured for any SVM that contains data protection volumes, volumes in a SnapMirror relationship, or in a MetroCluster configuration.

In addition to controlling the volume size at the storage array, you should also leverage Kubernetes capabilities.

1. To configure the maximum size for volumes that can be created by Trident, use the **limitVolumeSize** parameter in your backend.json definition.
2. To configure the maximum size for FlexVols used as pools for ontap-san-economy and ontap-nas-economy drivers, use the **limitVolumePoolSize** parameter in your backend.json definition.

Use SVM QOS policy

Apply Quality of service (QoS) policy to the SVM to limit the number of IOPS consumable by the Trident provisioned volumes. This helps to prevent workloads using Trident provisioned storage from affecting workloads outside of the Trident SVM.

ONTAP QoS policy groups provide QoS options for volumes and enable users to define the throughput ceiling for one or more workloads.

For more information about QoS policy groups, refer to [ONTAP 9.15 QoS commands](#)

Limit storage resource access to Kubernetes cluster members

Use Namespaces

Limiting access to the NFS volumes and iSCSI LUNs created by Trident is a critical component of the security posture for your Kubernetes deployment. Doing so prevents hosts that are not a part of the Kubernetes cluster from accessing the volumes and potentially modifying data unexpectedly.

Also, a process in a container can access storage mounted to the host, but which is not intended for the container. Using Namespaces to provide logical boundary for resources can avoid this issue. However,

It's important to understand that namespaces are the logical boundary for resources in Kubernetes. Thus, it is critical to ensure that namespaces are used to provide separation when appropriate. However, privileged containers run with substantially more host-level permissions than normal. So, disable this capability by using [pod security policies](#).

Use a dedicated export policy

For OpenShift deployments which have dedicated infrastructure nodes or other nodes which are unable to schedule user applications, separate export policies should be used to further limit access to storage resources. This includes creating an export policy for services which are deployed to those infrastructure nodes (for example, the OpenShift Metrics and Logging services), and standard applications which are deployed to non-infrastructure nodes.

Trident can automatically create and manage export policies. This way, Trident limits access to the volumes it provisions to the nodes in the Kubernetes cluster and simplifies the addition/deletion of nodes.

But if you choose to create an export policy manually, then populate it with one or more export rules that process each node access request.

Disable showmount for the application SVM

A pod deployed to the Kubernetes cluster can issue the showmount -e command against the data LIF and receive a list of available mounts, including those which it does not have access to. To prevent this, disable the showmount feature using the following CLI:

```
vserver nfs modify -vserver <svm_name> -showmount disabled
```



For additional details about Best Practices for Storage Configuration and Trident usage, review [Trident documentation](#)

OpenShift Virtualization - Tuning & Scaling Guide

Red Hat has documented [OpenShift Cluster Scaling Recommendations and limitations](#).

In addition, they have also documented [OpenShift Virtualization tuning guide](#) and [Supported Limits for OpenShift Virtualization 4.x](#).



An active Red Hat subscription is required to access the above content.

The tuning guide contains information about many tuning parameters including:

- Tuning parameters to create many VMs at once or in large batches
- Live migration of VMs
- [Configuring a dedicated network for live migration](#)
- Customizing a VM template by including a workload type

The supported limits document the tested object maximums when running VMs on OpenShift

Virtual Machine Maximums including

- Max virtual CPUs per VM
- Max and min memory per VM
- Max Single disk size per VM
- Max number of hot pluggable disk per VM

Host Maximums including

* Simultaneous live migrations (per node and per cluster)

Cluster Maximums including

* Maximum number of defined VMs

Migrating VMs from VMware environment

Migration ToolKit for OpenShift Virtualization is a Red Hat provided operator available from the OperatorHub of the OpenShift Container Platform. This tool can be used to migrate VMs from vSphere, Red Hat Virtualization, OpenStack, and OpenShift Virtualization.

Details about migrating VMs from VSphere can be found under [Workflows > Red Hat OpenShift Virtualization with NetApp ONTAP](#)

You can configure limits for various parameters either from the CLI or from the Migration web console. Some samples are given below

1. Max concurrent virtual machine migrations
Sets the maximum number of VMs that can be migrated simultaneously. The default value is 20 virtual machines.
2. Precopy interval (minutes)
Controls the interval at which a new snapshot is requested prior to initiating a warm migration. The default value is 60 minutes.
3. Snapshot polling interval (seconds)
Determines the frequency with which the system checks the status of snapshot creation or removal during

oVirt warm migration. The default value is 10 seconds.

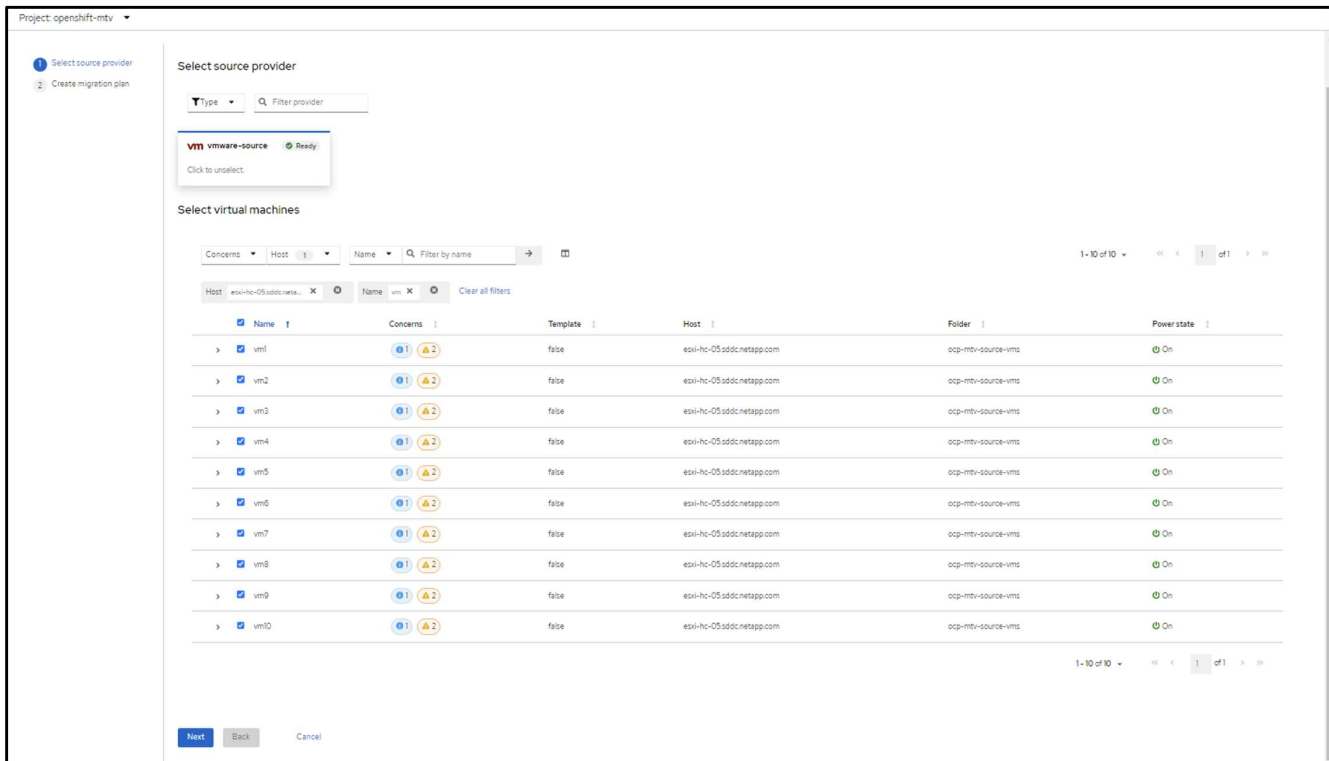
If you are migrating more than 10 VMs from an ESXi host in the same migration plan, you must increase the NFC service memory of the host. Otherwise, the migration will fail because the NFC service memory is limited to 10 parallel connections. For additional details see the Red Hat documentation: [Increasing the NFC service memory of an ESXi host](#)

Here is a successful parallel migration of 10 VMs from the same host in VSphere to OpenShift Virtualization using Migration Toolkit for Virtualization.

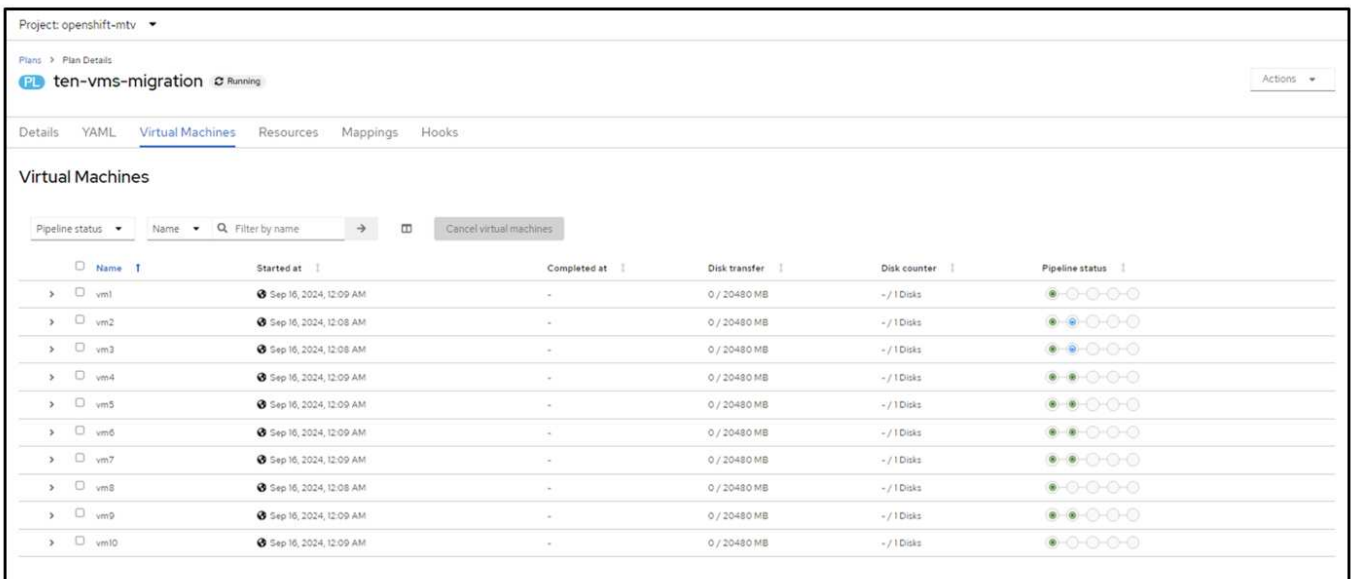
VMs on the same ESXi host

esxi-hc-05.sddc.netapp.com ACTIONS								
Summary Monitor Configure Permissions VMs Datastores Networks Updates								
Virtual Machines VM Templates								
Quick Filter <input type="text" value="vm"/>								
<input type="checkbox"/>	Name	↑	State	Status	Provisioned Space	Used Space	Host CPU	Host Mem
<input type="checkbox"/>	vm1		Powered On	✓ Normal	20 GB	5.21 GB	0 Hz	1.98 GB
<input type="checkbox"/>	vm1Q		Powered On	✓ Normal	46.6 GB	3.5 GB	0 Hz	2.01 GB
<input type="checkbox"/>	vm2		Powered On	✓ Normal	46.63 GB	5.31 GB	0 Hz	1.87 GB
<input type="checkbox"/>	vm3		Powered On	✓ Normal	46.62 GB	5.31 GB	0 Hz	2 GB
<input type="checkbox"/>	vm4		Powered On	✓ Normal	46.63 GB	5.15 GB	0 Hz	2 GB
<input type="checkbox"/>	vm5		Powered On	✓ Normal	46.63 GB	3.52 GB	22 MHz	1.98 GB
<input type="checkbox"/>	vm6		Powered On	✓ Normal	46.6 GB	3.5 GB	0 Hz	2.01 GB
<input type="checkbox"/>	vm7		Powered On	✓ Normal	46.62 GB	3.52 GB	22 MHz	1.99 GB
<input type="checkbox"/>	vm8		Powered On	✓ Normal	46.63 GB	3.52 GB	22 MHz	1.89 GB
<input type="checkbox"/>	vm9		Powered On	✓ Normal	46.63 GB	3.52 GB	0 Hz	1.9 GB

A plan is first created for migrating 10 VMs from VMware



Migration plan has started executing



All 10 VMs have successfully migrated

Project: openshift-mtv

Plans > Plan Details

ten-vms-from-same-host Succeeded

Actions

DetailsYAMLVirtual MachinesResourcesMappingsHooks

Virtual Machines

Pipeline status

Name

Filter by name

Remove virtual machines

Name	Started at	Completed at	Disk transfer	Disk counter	Pipeline status
vm1	Sep 16, 2024, 10:23 AM	Sep 16, 2024, 10:41 AM	20480 / 20480 MB	- / 1 Disks	
vm2	Sep 16, 2024, 10:23 AM	Sep 16, 2024, 10:41 AM	20480 / 20480 MB	- / 1 Disks	
vm3	Sep 16, 2024, 10:23 AM	Sep 16, 2024, 10:38 AM	20480 / 20480 MB	- / 1 Disks	
vm4	Sep 16, 2024, 10:23 AM	Sep 16, 2024, 10:42 AM	20480 / 20480 MB	- / 1 Disks	
vm5	Sep 16, 2024, 10:23 AM	Sep 16, 2024, 10:42 AM	20480 / 20480 MB	- / 1 Disks	
vm6	Sep 16, 2024, 10:23 AM	Sep 16, 2024, 10:37 AM	20480 / 20480 MB	- / 1 Disks	
vm7	Sep 16, 2024, 10:23 AM	Sep 16, 2024, 10:38 AM	20480 / 20480 MB	- / 1 Disks	
vm8	Sep 16, 2024, 10:23 AM	Sep 16, 2024, 10:37 AM	20480 / 20480 MB	- / 1 Disks	
vm9	Sep 16, 2024, 10:23 AM	Sep 16, 2024, 10:38 AM	20480 / 20480 MB	- / 1 Disks	
vm10	Sep 16, 2024, 10:23 AM	Sep 16, 2024, 10:37 AM	20480 / 20480 MB	- / 1 Disks	

All 10 VMs are in a running state in OpenShift Virtualization

Project: ten-vms-from-same-host

VirtualMachines

Create

Filter

Name

Search by name...

1 - 10 of 10

1 of 1

Name	Status	Conditions	Node	IP address
vm1	Running		ocp7-worker3	-
vm2	Running		ocp7-worker1	-
vm3	Running		ocp7-worker2	-
vm4	Running		ocp7-worker1	-
vm5	Running		ocp7-worker2	-
vm6	Running		ocp7-worker2	-
vm7	Running		ocp7-worker1	-
vm8	Running		ocp7-worker3	-
vm9	Running		ocp7-worker2	-
vm10	Running		ocp7-worker1	-

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