



# VMware Cloud Foundation

## NetApp Solutions

NetApp  
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# VMware Cloud Foundation

VMware Cloud Foundation (VCF) is an integrated software defined data center (SDDC) platform that provides a complete stack of software-defined infrastructure for running enterprise applications in a hybrid cloud environment. It combines compute, storage, networking, and management capabilities into a unified platform, offering a consistent operational experience across private and public clouds.

Author: Josh Powell

## VMware Cloud Foundation with NetApp All-Flash SAN Arrays

This document provides information on storage options available for VMware Cloud Foundation using the NetApp All-Flash SAN Array. Supported storage options are covered with specific instruction for deploying iSCSI datastores as supplemental storage for management domains and both vVol (iSCSI) and NVMe/TCP datastores as supplemental datastores for workload domains. Also covered is data protection of VMs and datastores using SnapCenter for VMware vSphere.

### Use Cases

Use cases covered in this documentation:

- Storage options for customers seeking uniform environments across both private and public clouds.
- Automated solution for deploying virtual infrastructure for workload domains.
- Scalable storage solution tailored to meet evolving needs, even when not aligned directly with compute resource requirements.
- Deploy supplemental storage to management and VI workload domains using ONTAP Tools for VMware vSphere.
- Protect VMs and datastores using the SnapCenter Plug-in for VMware vSphere.

### Audience

This solution is intended for the following people:

- Solution architects looking for more flexible storage options for VMware environments that are designed to maximize TCO.
- Solution architects looking for VCF storage options that provide data protection and disaster recovery options with the major cloud providers.
- Storage administrators wanting specific instruction on how to configure VCF with principal and supplemental storage.
- Storage administrators wanting specific instruction on how to protect VMs and datastores residing on ONTAP storage.

## Technology Overview

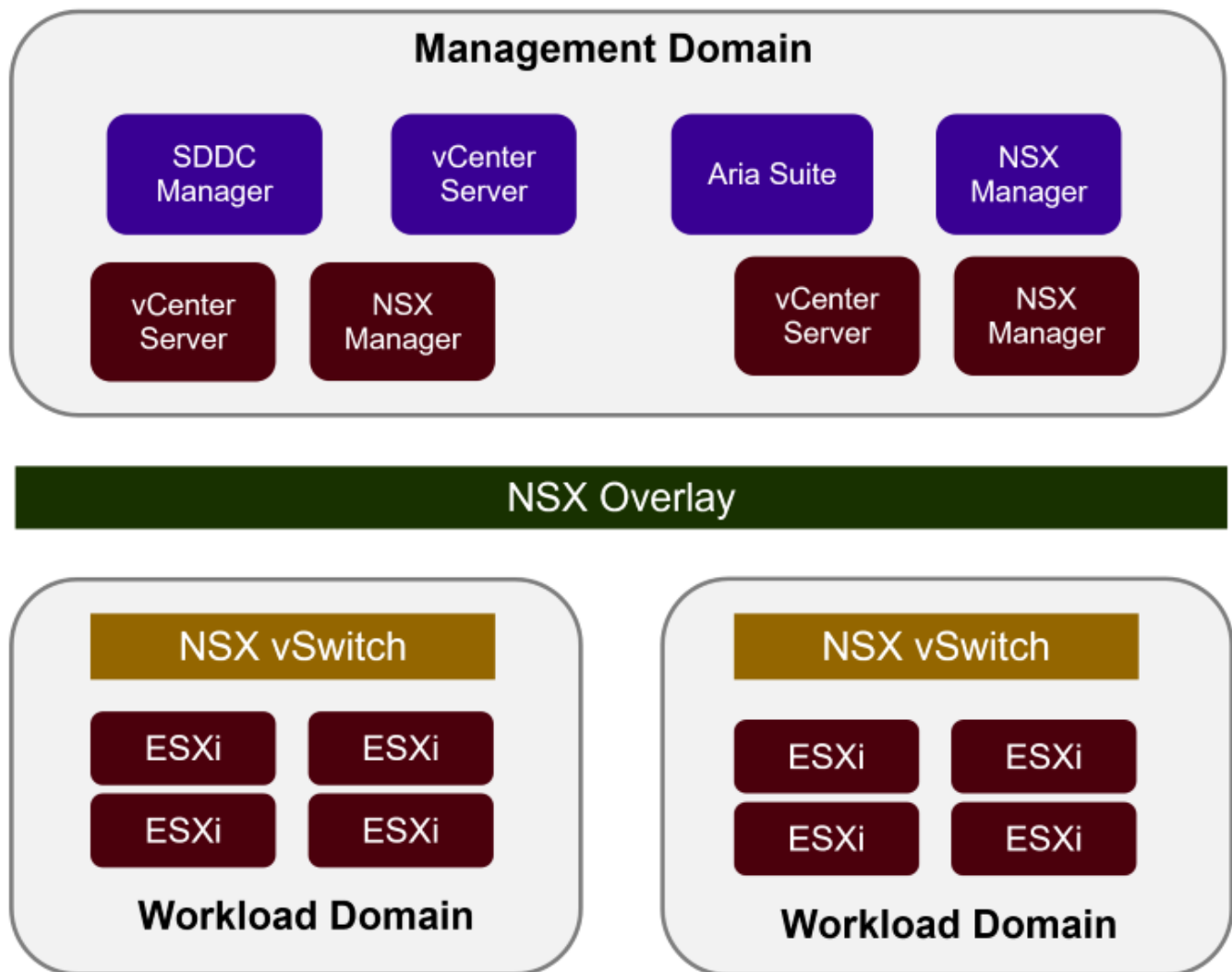
The VCF with NetApp ASA solution is comprised of the following major components:

## VMware Cloud Foundation

VMware Cloud Foundation extends VMware's vSphere hypervisor offerings by combining key components such as SDDC Manager, vSphere, vSAN, NSX, and VMware Aria Suite to create a software-defined datacenter.

The VCF solution supports both native Kubernetes and virtual machine-based workloads. Key services such as VMware vSphere, VMware vSAN, VMware NSX-T Data Center, and VMware Aria Cloud Management are integral components of the VCF package. When combined, these services establish a software-defined infrastructure capable of efficiently managing compute, storage, networking, security, and cloud management.

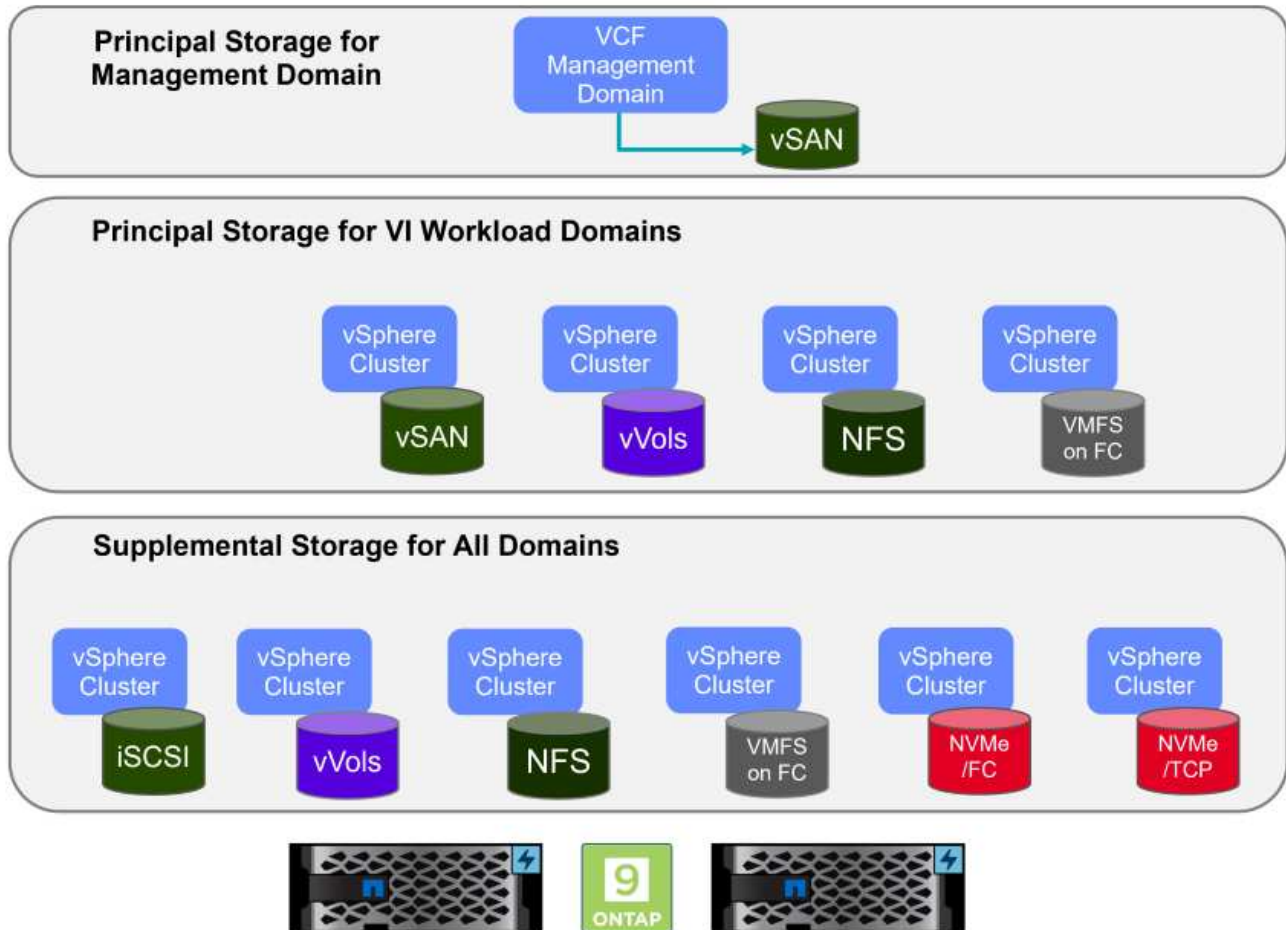
VCF is comprised of a single management domain and up to 24 VI workload domains that each represent a unit of application-ready infrastructure. A workload domain is comprised of one or more vSphere clusters managed by a single vCenter instance.



For more information on VCF architecture and planning, refer to [Architecture Models and Workload Domain Types in VMware Cloud Foundation](#).

## VCF Storage Options

VMware divides storage options for VCF into **principal** and **supplemental** storage. The VCF management domain must use vSAN as its principal storage. However, there are many supplemental storage options for the management domain and both principal and supplemental storage options available for VI workload domains.



### Principal Storage for Workload Domains

Principal storage refers to any type of storage that can be directly connected to a VI workload domain during the setup process within SDDC Manager. Principal storage is deployed with SDDC manager as part of cluster creation orchestration and is the first datastore configured for a workload domain. It includes vSAN, vVols (VMFS), NFS and VMFS on Fibre Channel.

### Supplemental Storage for Management and Workload Domains

Supplemental storage is the storage type that can be added to the management or workload domains at any time after the cluster has been created. Supplemental storage represents the widest range of supported storage options, all of which are supported on NetApp ASA arrays. Supplemental storage can be deployed using ONTAP Tools for VMware vSphere for most storage protocol types.

Additional documentation resources for VMware Cloud Foundation:

- \* [VMware Cloud Foundation Documentation](#)
- \* [Supported Storage Types for VMware Cloud Foundation](#)
- \* [Managing Storage in VMware Cloud Foundation](#)

## NetApp All-Flash SAN Arrays

The NetApp All-Flash SAN Array (ASA) is a high-performance storage solution designed to meet the demanding requirements of modern data centers. It combines the speed and reliability of flash storage with NetApp's advanced data management features to deliver exceptional performance, scalability, and data protection.

The ASA lineup is comprised of both A-Series and C-Series models.

The NetApp A-Series all-NVMe flash arrays are designed for high-performance workloads, offering ultra-low latency and high resiliency, making them suitable for mission-critical applications.



C-Series QLC flash arrays are aimed at higher-capacity use cases, delivering the speed of flash with the economy of hybrid flash.



For detailed information see the [NetApp ASA landing page](#).

### Storage Protocol Support

The ASA supports all standard SAN protocols including, iSCSI, Fibre Channel (FC), Fibre Channel over Ethernet (FCoE), and NVME over fabrics.

**iSCSI** - NetApp ASA provides robust support for iSCSI, allowing block-level access to storage devices over IP networks. It offers seamless integration with iSCSI initiators, enabling efficient provisioning and management of iSCSI LUNs. ONTAP's advanced features, such as multi-pathing, CHAP authentication, and ALUA support.

For design guidance on iSCSI configurations refer to the [SAN Configuration reference documentation](#).

**Fibre Channel** - NetApp ASA offers comprehensive support for Fibre Channel (FC), a high-speed network technology commonly used in storage area networks (SANs). ONTAP seamlessly integrates with FC

infrastructure, providing reliable and efficient block-level access to storage devices. It offers features like zoning, multi-pathing, and fabric login (FLOGI) to optimize performance, enhance security, and ensure seamless connectivity in FC environments.

For design guidance on Fibre Channel configurations refer to the [SAN Configuration reference documentation](#).

**NVMe over Fabrics** - NetApp ONTAP and ASA support NVMe over fabrics. NVMe/FC enables the use of NVMe storage devices over Fibre Channel infrastructure, and NVMe/TCP over storage IP networks.

For design guidance on NVMe refer to [NVMe configuration, support and limitations](#)

### **Active-active technology**

NetApp All-Flash SAN Arrays allows for active-active paths through both controllers, eliminating the need for the host operating system to wait for an active path to fail before activating the alternative path. This means that the host can utilize all available paths on all controllers, ensuring active paths are always present regardless of whether the system is in a steady state or undergoing a controller failover operation.

Furthermore, the NetApp ASA offers a distinctive feature that greatly enhances the speed of SAN failover. Each controller continuously replicates essential LUN metadata to its partner. As a result, each controller is prepared to take over data serving responsibilities in the event of a sudden failure of its partner. This readiness is possible because the controller already possesses the necessary information to start utilizing the drives that were previously managed by the failed controller.

With active-active pathing, both planned and unplanned takeovers have IO resumption times of 2-3 seconds.

For more information see [TR-4968, NetApp All-SAS Array – Data Availability and Integrity with the NetApp ASA](#).

### **Storage guarantees**

NetApp offers a unique set of storage guarantees with NetApp All-flash SAN Arrays. The unique benefits include:

**Storage efficiency guarantee:** Achieve high performance while minimizing storage cost with the Storage Efficiency Guarantee. 4:1 for SAN workloads.

**6 Nines (99.9999%) data availability guarantee:** Guarantees remediation for unplanned downtime in excess of 31.56 seconds per year.

**Ransomware recovery guarantee:** Guaranteed data recovery in the event of a ransomware attack.

See the [NetApp ASA product portal](#) for more information.

### **NetApp ONTAP Tools for VMware vSphere**

ONTAP Tools for VMware vSphere allows administrators to manage NetApp storage directly from within the vSphere Client. ONTAP Tools allows you to deploy and manage datastores, as well as provision vVol datastores.

ONTAP Tools allows mapping of datastores to storage capability profiles which determine a set of storage system attributes. This allows the creation of datastores with specific attributes such as storage performance

and QoS.

ONTAP Tools also includes a **VMware vSphere APIs for Storage Awareness (VASA) Provider** for ONTAP storage systems, which enables the provisioning of VMware Virtual Volumes (vVols) datastores, creation and use of storage capability profiles, compliance verification, and performance monitoring.

For more information on NetApp ONTAP tools see the [ONTAP tools for VMware vSphere Documentation](#) page.

## SnapCenter Plug-in for VMware vSphere

The SnapCenter Plug-in for VMware vSphere (SCV) is a software solution from NetApp that offers comprehensive data protection for VMware vSphere environments. It is designed to simplify and streamline the process of protecting and managing virtual machines (VMs) and datastores. SCV uses storage based snapshot and replication to secondary arrays to meet lower recovery time objectives.

The SnapCenter Plug-in for VMware vSphere provides the following capabilities in a unified interface, integrated with the vSphere client:

**Policy-Based Snapshots** - SnapCenter allows you to define policies for creating and managing application-consistent snapshots of virtual machines (VMs) in VMware vSphere.

**Automation** - Automated snapshot creation and management based on defined policies help ensure consistent and efficient data protection.

**VM-Level Protection** - Granular protection at the VM level allows for efficient management and recovery of individual virtual machines.

**Storage Efficiency Features** - Integration with NetApp storage technologies provides storage efficiency features like deduplication and compression for snapshots, minimizing storage requirements.

The SnapCenter Plug-in orchestrates the quiescing of virtual machines in conjunction with hardware-based snapshots on NetApp storage arrays. SnapMirror technology is utilized to replicate copies of backups to secondary storage systems including in the cloud.

For more information refer to the [SnapCenter Plug-in for VMware vSphere documentation](#).

BlueXP integration enables 3-2-1 backup strategies that extend copies of data to object storage in the cloud.

For more information on 3-2-1 backup strategies with BlueXP visit [3-2-1 Data Protection for VMware with SnapCenter Plug-in and BlueXP backup and recovery for VMs](#).

## Solution Overview

The scenarios presented in this documentation will demonstrate how to use ONTAP storage systems as supplemental storage for management and workload domains. In addition, the SnapCenter Plug-in for VMware vSphere is used to protect VMs and datastores.

Scenarios covered in this documentation:

- **Use Ontap Tools to deploy iSCSI datastores in a VCF management domain.** Click [here](#) for deployment steps.
- **Use Ontap Tools to deploy vVols (iSCSI) datastores in a VI workload domain.** Click [here](#) for deployment steps.



- **Configure NVMe over TCP datastores for use in a VI workload domain.** Click [here](#) for deployment steps.
- **Deploy and use the SnapCenter Plug-in for VMware vSphere to protect and restore VMs in a VI workload domain.** Click [here](#) for deployment steps.

In this scenario we will demonstrate how to deploy and use ONTAP Tools for VMware vSphere (OTV) to configure an iSCSI datastore for a VCF management domain.

Author: Josh Powell

## **Use ONTAP Tools to configure supplemental storage for VCF Management Domains**

### **Scenario Overview**

This scenario covers the following high level steps:

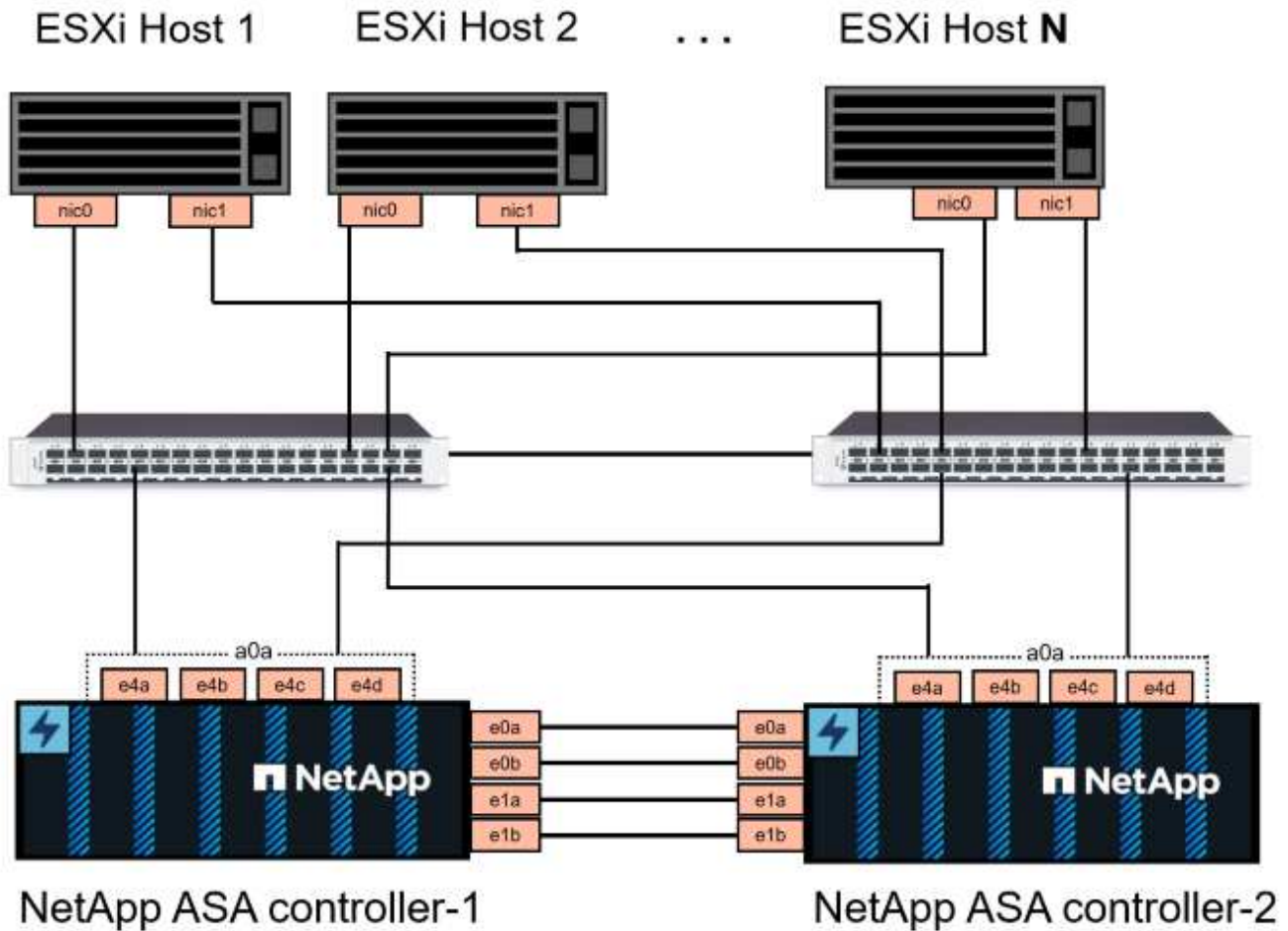
- Create a storage virtual machine (SVM) with logical interfaces (LIFs) for iSCSI traffic.
- Create distributed port groups for iSCSI networks on the VCF management domain.
- Create vmkernel adapters for iSCSI on the ESXi hosts for the VCF management domain.
- Deploy ONTAP Tools on the VCF management domain.
- Create a new VMFS datastore on the VCF management domain.

### **Prerequisites**

This scenario requires the following components and configurations:

- An ONTAP ASA storage system with physical data ports on ethernet switches dedicated to storage traffic.
- VCF management domain deployment is complete and the vSphere client is accessible.

NetApp recommends fully redundant network designs for iSCSI. The following diagram illustrates an example of a redundant configuration, providing fault tolerance for storage systems, switches, networks adapters and host systems. Refer to the NetApp [SAN configuration reference](#) for additional information.



For multipathing and failover across multiple paths, NetApp recommends having a minimum of two LIFs per storage node in separate ethernet networks for all SVMs in iSCSI configurations.

This documentation demonstrates the process of creating a new SVM and specifying the IP address information to create multiple LIFs for iSCSI traffic. To add new LIFs to an existing SVM refer to [Create a LIF \(network interface\)](#).

For additional information on using VMFS iSCSI datastores with VMware refer to [vSphere VMFS Datastore - iSCSI Storage backend with ONTAP](#).



In situations where multiple VMkernel adapters are configured on the same IP network, it is recommended to use software iSCSI port binding on the ESXi hosts to ensure that load balancing across the adapters occurs. Refer to KB article [Considerations for using software iSCSI port binding in ESX/ESXi \(2038869\)](#).

### Deployment Steps

To deploy ONTAP Tools and use it to create a VMFS datastore on the VCF management domain, complete the following steps:

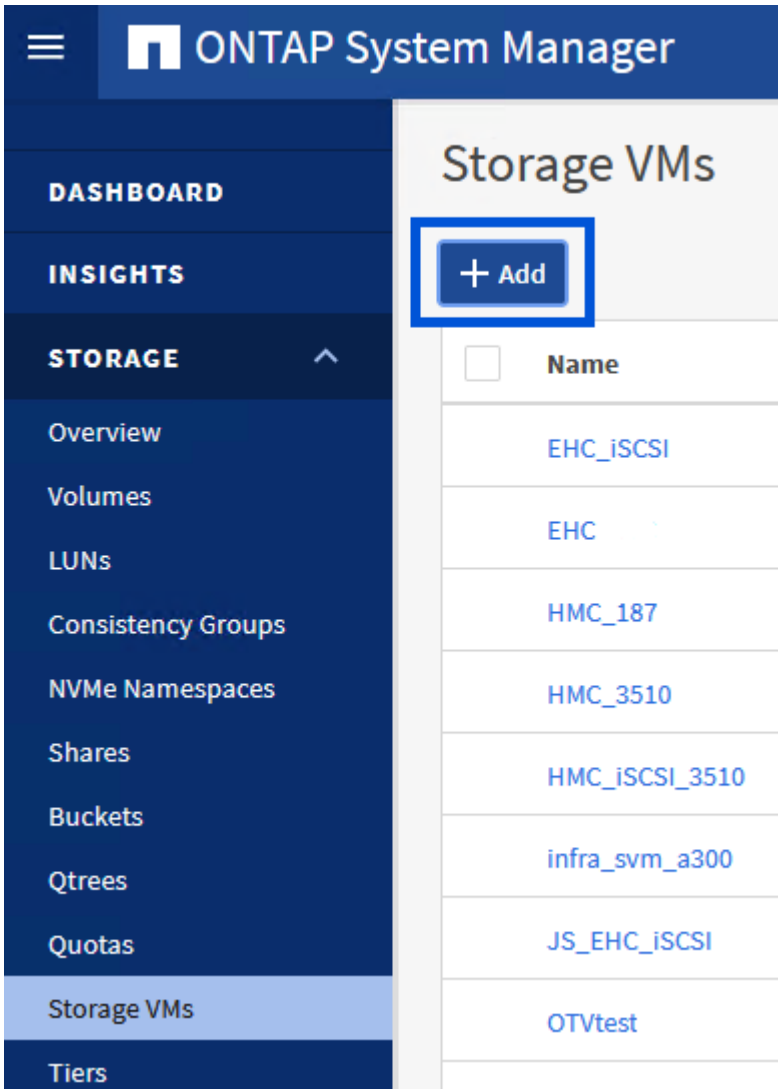
**Create SVM and LIFs on ONTAP storage system**

The following step is is performed in ONTAP System Manager.

## Create the storage VM and LIFs

Complete the following steps to create an SVM together with multiple LIFs for iSCSI traffic.

1. From ONTAP System Manager navigate to **Storage VMs** in the left-hand menu and click on **+ Add** to start.



2. In the **Add Storage VM** wizard provide a **Name** for the SVM, select the **IP Space** and then, under **Access Protocol**, click on the **\*iSCSI** tab and check the box to **Enable iSCSI**.

## Add Storage VM



STORAGE VM NAME

SVM\_ISCSI

IPSPACE

Default

### Access Protocol

SMB/CIFS, NFS, S3

iSCSI

FC

NVMe

Enable iSCSI

3. In the **Network Interface** section fill in the **IP address**, **Subnet Mask**, and **Broadcast Domain and Port** for the first LIF. For subsequent LIFs the checkbox may be enabled to use common settings across all remaining LIFs or use separate settings.



For multipathing and failover across multiple paths, NetApp recommends having a minimum of two LIFs per storage node in separate Ethernet networks for all SVMs in iSCSI configurations.

## NETWORK INTERFACE

ntaphci-a300-01

IP ADDRESS

172.21.118.179

SUBNET MASK

24

GATEWAY

[Add optional gateway](#)

BROADCAST DOMAIN AND PORT

NFS\_iSCSI

Use the same subnet mask, gateway, and broadcast domain for all of the following interfaces

IP ADDRESS

172.21.119.179

PORT

a0a-3375

ntaphci-a300-02

IP ADDRESS

172.21.118.180

PORT

a0a-3374

IP ADDRESS

172.21.119.180

PORT

a0a-3375

4. Choose whether to enable the Storage VM Administration account (for multi-tenancy environments) and click on **Save** to create the SVM.

## Storage VM Administration

Manage administrator account

**Save**

Cancel

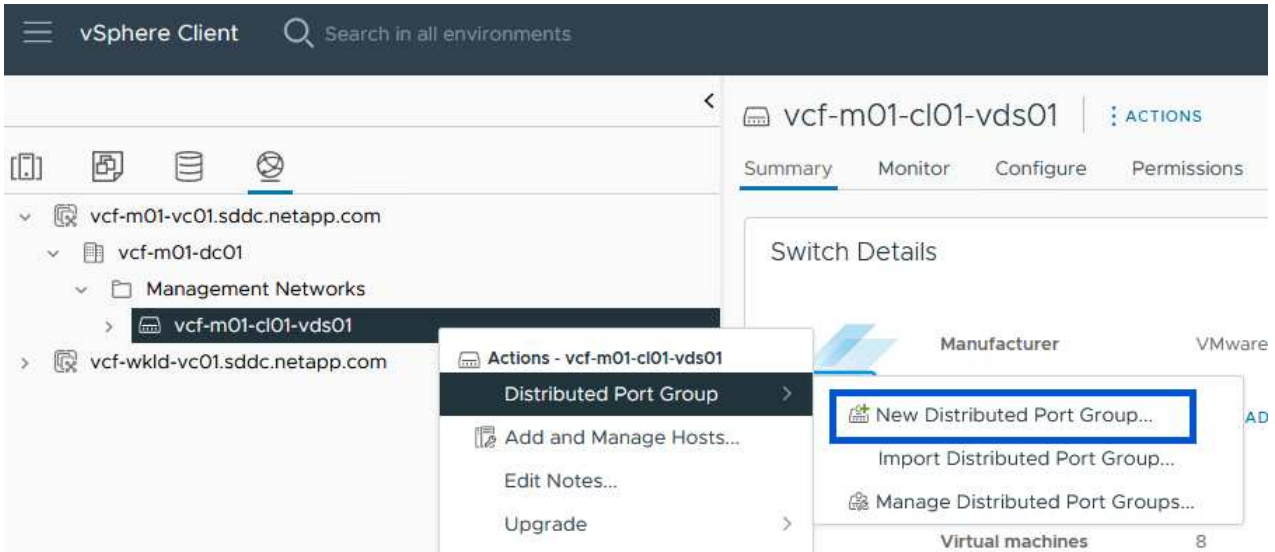
### Set up networking for iSCSI on ESXi hosts

The following steps are performed on the VCF management domain cluster using the vSphere client.

## Create Distributed Port Groups for iSCSI traffic

Complete the following to create a new distributed port group for each iSCSI network:

1. From the vSphere client for the management domain cluster, navigate to **Inventory > Networking**. Navigate to the existing Distributed Switch and choose the action to create **New Distributed Port Group....**



2. In the **New Distributed Port Group** wizard fill in a name for the new port group and click on **Next** to continue.
3. On the **Configure settings** page fill out all settings. If VLANs are being used be sure to provide the correct VLAN ID. Click on **Next** to continue.

## New Distributed Port Group

- 1 Name and location
- 2 Configure settings
- 3 Ready to complete

## Configure settings

Set general properties of the new port group.

Port binding	Static binding
Port allocation	Elastic
Number of ports	8
Network resource pool	(default)
VLAN	
VLAN type	VLAN
VLAN ID	3374
Advanced	
<input type="checkbox"/> Customize default policies configuration	

CANCEL BACK NEXT

4. On the **Ready to complete** page, review the changes and click on **Finish** to create the new distributed port group.
5. Repeat this process to create a distributed port group for the second iSCSI network being used and ensure you have input the correct **VLAN ID**.
6. Once both port groups have been created, navigate to the first port group and select the action to **Edit settings....**

The screenshot shows the vSphere Client interface. The top navigation bar includes the vSphere Client logo and a search bar. The main content area displays a tree view of the environment. The selected item is 'vcf-m01-cl01-vds01-pg-iscsi-a'. The right-hand pane shows the 'Distributed Port Group Details' for this port group, with the following configuration:

Port binding	Static binding
Port allocation	Elastic
VLAN ID	3374
Distributed switch	vcf-m01-cl01-vds01
Network protocol profile	--
Network resource pool	--
Hosts	4

An action menu is open over the selected port group, with 'Edit Settings...' highlighted. Other actions visible include 'Actions - vcf-m01-cl01-vds01-pg-iscsi-a', 'Export Configuration...', and 'Restore Configuration...'.



7. On **Distributed Port Group - Edit Settings** page, navigate to **Teaming and failover** in the left-hand menu and click on **uplink2** to move it down to **Unused uplinks**.

Distributed Port Group - Edit Settings | vcf-m01-cl01-vds01-pg-iscsi-a ×

General	<b>Load balancing</b>	Route based on originating virtual por ▾
Advanced	<b>Network failure detection</b>	Link status only ▾
VLAN	<b>Notify switches</b>	Yes ▾
Security	<b>Failback</b>	Yes ▾
Traffic shaping		
<b>Teaming and failover</b>		
Monitoring		
Miscellaneous		

**Failover order** ⓘ

MOVE UP MOVE DOWN

**Active uplinks**

uplink1

**Standby uplinks**

**Unused uplinks**

uplink2

8. Repeat this step for the second iSCSI port group. However, this time move **uplink1** down to **Unused uplinks**.

# Distributed Port Group - Edit Settings | vcf-m01-cl01-vds01-pg-iscsi-b

General

Advanced

VLAN

Security

Traffic shaping

**Teaming and failover**

Monitoring

Miscellaneous

## Load balancing

Route based on originating virtual por ▼

## Network failure detection

Link status only ▼

## Notify switches

Yes ▼

## Failback

Yes ▼

## Failover order ⓘ


MOVE UP MOVE DOWN

### Active uplinks

 uplink2

### Standby uplinks

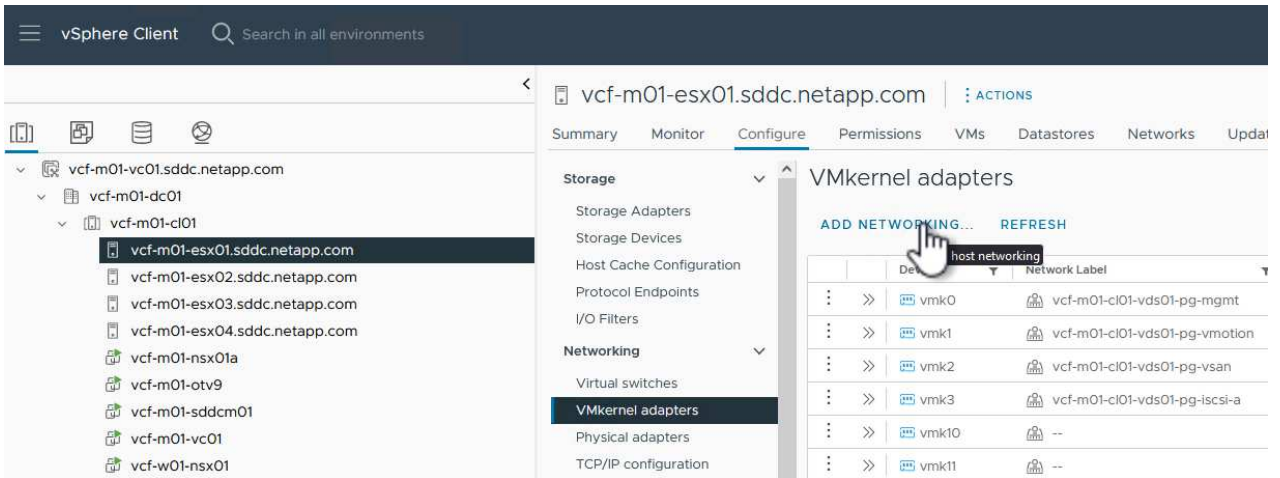
### Unused uplinks

 uplink1

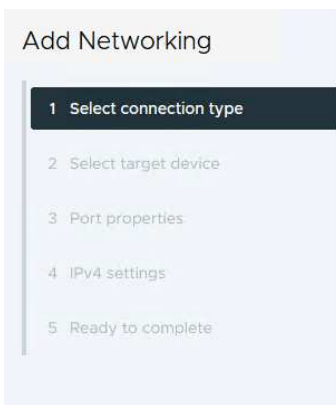
## Create VMkernel adapters on each ESXi host

Repeat this process on each ESXi host in the management domain.

1. From the vSphere client navigate to one of the ESXi hosts in the management domain inventory. From the **Configure** tab select **VMkernel adapters** and click on **Add Networking...** to start.



2. On the **Select connection type** window choose **VMkernel Network Adapter** and click on **Next** to continue.



### Select connection type

Select a connection type to create.

- VMkernel Network Adapter**  
The VMkernel TCP/IP stack handles traffic for ESXi services such as vSphere vMotion, iSCSI, NFS, FCoE, Fault Tolerance, vSAN, host management and etc.
- Virtual Machine Port Group for a Standard Switch**  
A port group handles the virtual machine traffic on standard switch.
- Physical Network Adapter**  
A physical network adapter handles the network traffic to other hosts on the network.

3. On the **Select target device** page, choose one of the distributed port groups for iSCSI that was created previously.

### Add Networking

- 1 Select connection type
- 2 Select target device
- 3 Port properties
- 4 IPv4 settings
- 5 Ready to complete

### Select target device

Select a target device for the new connection.

Select an existing network  
 Select an existing standard switch  
 New standard switch

Quick Filter

	Name	NSX Port Group ID	Distributed Switch
<input type="radio"/>	SDDC-DPortGroup-VM-Mgmt	--	vcf-m01-cl01-vds01
<input checked="" type="radio"/>	vcf-m01-cl01-vds01-pg-iscsi-a	--	vcf-m01-cl01-vds01
<input type="radio"/>	vcf-m01-cl01-vds01-pg-iscsi-b	--	vcf-m01-cl01-vds01
<input type="radio"/>	vcf-m01-cl01-vds01-pg-mgmt	--	vcf-m01-cl01-vds01
<input type="radio"/>	vcf-m01-cl01-vds01-pg-vmotion	--	vcf-m01-cl01-vds01
<input type="radio"/>	vcf-m01-cl01-vds01-pg-vsan	--	vcf-m01-cl01-vds01

Manage Columns 6 items

CANCEL BACK NEXT

4. On the **Port properties** page keep the defaults and click on **Next** to continue.

### Add Networking

- 1 Select connection type
- 2 Select target device
- 3 Port properties
- 4 IPv4 settings
- 5 Ready to complete

### Port properties

Specify VMkernel port settings.

Network label

MTU

TCP/IP stack

Available services

Enabled services

- vMotion
- vSphere Replication NFC
- NVMe over RDMA
- Provisioning
- vSAN
- Fault Tolerance logging
- vSAN Witness
- Management
- vSphere Backup NFC
- vSphere Replication
- NVMe over TCP

5. On the **IPv4 settings** page fill in the **IP address**, **Subnet mask**, and provide a new Gateway IP address (only if required). Click on **Next** to continue.

### Add Networking

- 1 Select connection type
- 2 Select target device
- 3 Port properties
- 4 IPv4 settings
- 5 Ready to complete

### IPv4 settings

Specify VMkernel IPv4 settings.

Obtain IPv4 settings automatically  
 Use static IPv4 settings

**IPv4 address**

**Subnet mask**

**Default gateway**  Override default gateway for this adapter

**DNS server addresses**

6. Review the your selections on the **Ready to complete** page and click on **Finish** to create the VMkernel adapter.

### Add Networking

- 1 Select connection type
- 2 Select target device
- 3 Port properties
- 4 IPv4 settings
- 5 Ready to complete

### Ready to complete

Review your selections before finishing the wizard

- ▼ Select target device

Distributed port group vcf-m01-cl01-vds01-pg-iscsi-a

Distributed switch vcf-m01-cl01-vds01
- ▼ Port properties

New port group vcf-m01-cl01-vds01-pg-iscsi-a (vcf-m01-cl01-vds01)

MTU 9000

vMotion Disabled

Provisioning Disabled

Fault Tolerance logging Disabled

Management Disabled

vSphere Replication Disabled

vSphere Replication NFC Disabled

vSAN Disabled

vSAN Witness Disabled

vSphere Backup NFC Disabled

NVMe over TCP Disabled

NVMe over RDMA Disabled
- ▼ IPv4 settings

IPv4 address 172.21.118.114 (static)

Subnet mask 255.255.255.0

CANCEL
BACK
FINISH

7. Repeat this process to create a VMkernel adapter for the second iSCSI network.

## **Deploy and use ONTAP Tools to configure storage**

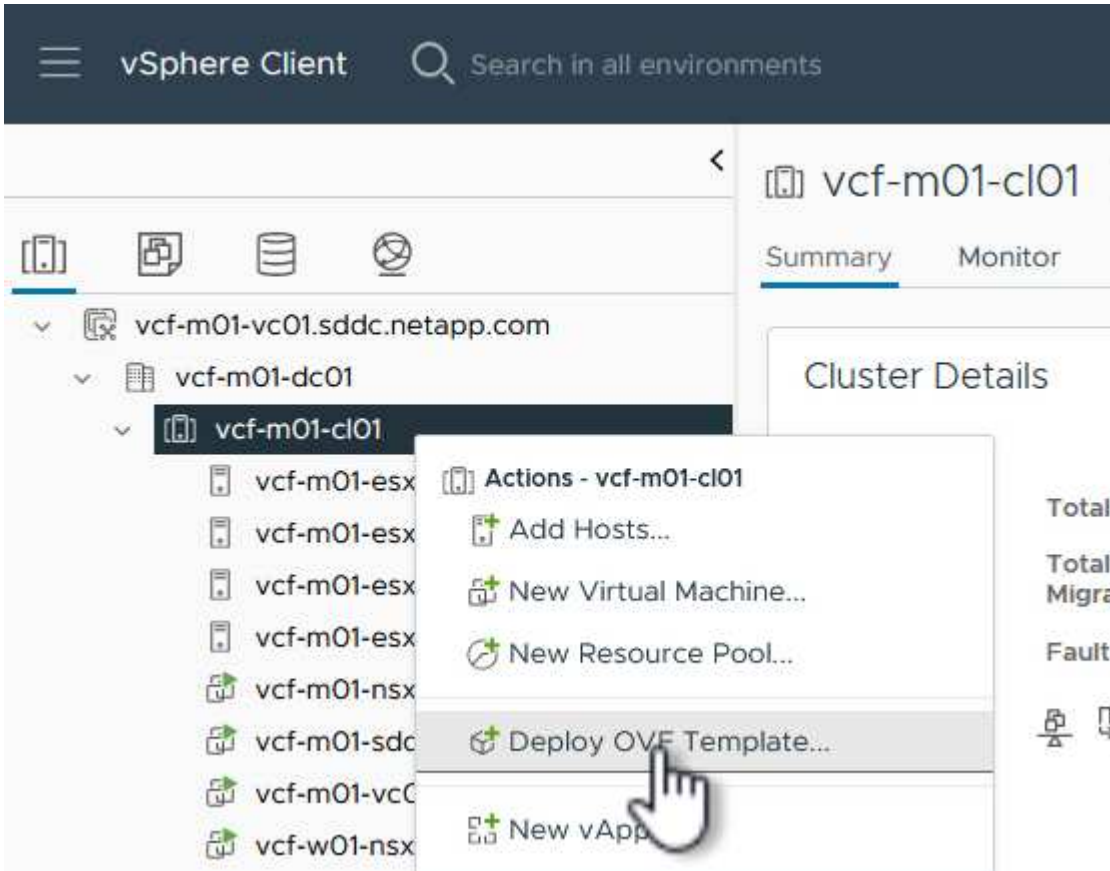
The following steps are performed on the VCF management domain cluster using the vSphere client and involve deploying OTV, creating a VMFS iSCSI datastore, and migrating management VM's to the new datastore.

## Deploy ONTAP tools for VMware vSphere

ONTAP tools for VMware vSphere (OTV) is deployed as a VM appliance and provides an integrated vCenter UI for managing ONTAP storage.

Complete the following to Deploy ONTAP tools for VMware vSphere:

1. Obtain the ONTAP tools OVA image from the [NetApp Support site](#) and download to a local folder.
2. Log into the vCenter appliance for the VCF management domain.
3. From the vCenter appliance interface right-click on the management cluster and select **Deploy OVF Template...**



4. In the **Deploy OVF Template** wizard click the **Local file** radio button and select the ONTAP tools OVA file downloaded in the previous step.

## Deploy OVF Template

### 1 Select an OVF template

- 2 Select a name and folder
- 3 Select a compute resource
- 4 Review details
- 5 Select storage
- 6 Ready to complete

## Select an OVF template

Select an OVF template from remote URL or local file system

Enter a URL to download and install the OVF package from the Internet, or browse to a location accessible from your computer, such as a local hard drive, a network share, or a CD/DVD drive.

URL

Local file

netapp-ontap-tools-for-vmware-vsphere-9.13-9554.ova

5. For steps 2 through 5 of the wizard select a name and folder for the VM, select the compute resource, review the details, and accept the license agreement.
6. For the storage location of the configuration and disk files, select the vSAN datastore of the VCF management domain cluster.

## Deploy OVF Template

### 1 Select an OVF template

2 Select a name and folder

3 Select a compute resource

4 Review details

5 License agreements

### 6 Select storage

7 Select networks

8 Customize template

9 Ready to complete

## Select storage

Select the storage for the configuration and disk files

Encrypt this virtual machine [i](#)

Select virtual disk format As defined in the VM storage policy

VM Storage Policy Datastore Default

Disable Storage DRS for this virtual machine

	Name	Storage Compatibility	Capacity	Provisioned	Free	T
<input checked="" type="radio"/>	vcf-m01-c01-ds-vsan01	--	999.97 GB	7.17 TB	225.72 GB	v
<input type="radio"/>	vcf-m01-esx01-esx-install-datastore	--	25.75 GB	4.56 GB	21.19 GB	v
<input type="radio"/>	vcf-m01-esx02-esx-install-datastore	--	25.75 GB	4.56 GB	21.19 GB	v
<input type="radio"/>	vcf-m01-esx03-esx-install-datastore	--	25.75 GB	4.56 GB	21.19 GB	v
<input type="radio"/>	vcf-m01-esx04-esx-install-datastore	--	25.75 GB	4.56 GB	21.19 GB	v

Manage Columns Items per page 10 5 items

7. On the Select network page select the network used for management traffic.



### Deploy OVF Template

- 1 Select an OVF template
- 2 Select a name and folder
- 3 Select a compute resource
- 4 Review details
- 5 License agreements
- 6 Select storage
- 7 Select networks

### Select networks

Select a destination network for each source network.

Source Network	Destination Network
nat	vcf-m01-cl01-vds01-pg-vsant

Manage Columns

IP Allocation Settings

IP allocation: Static - Manual

IP protocol: IPv4

8. On the Customize template page fill out all required information:

- Password to be used for administrative access to OTV.
- NTP server IP address.
- OTV maintenance account password.
- OTV Derby DB password.
- Do not check the box to **Enable VMware Cloud Foundation (VCF)**. VCF mode is not required for deploying supplemental storage.
- FQDN or IP address of the vCenter appliance and provide credentials for vCenter.
- Provide the required network properties fields.

Click on **Next** to continue.

### Deploy OVF Template

- 1 Select an OVF template
- 2 Select a name and folder
- 3 Select a compute resource
- 4 Review details
- 5 License agreements
- 6 Select storage
- 7 Select networks
- 8 Customize template
- 9 Ready to complete

### Customize template

Customize the deployment properties of this software solution.

! 2 properties have invalid values

System Configuration 4 settings

**Application User Password (\*)** Password to assign to the administrator account. For security reasons, it is recommended to use a password that is of eight to thirty characters and contains a minimum of one upper, one lower, one digit, and one special character.

Password

Confirm Password

**NTP Servers** A comma-separated list of hostnames or IP addresses of NTP Servers. If left blank, VMware tools based time synchronization will be used.

**Maintenance User Password (\*)** Password to assign to maint user account.

Password

Confirm Password

## Deploy OVF Template

- 1 Select an OVF template
- 2 Select a name and folder
- 3 Select a compute resource
- 4 Review details
- 5 License agreements
- 6 Select storage
- 7 Select networks
- 8 Customize template**
- 9 Ready to complete

## Customize template

Configure vCenter or Enable VCF		5 settings
<b>Enable VMware Cloud Foundation (VCF)</b>	vCenter server and user details are ignored when VCF is enabled. <input type="checkbox"/>	
<b>vCenter Server Address (*)</b>	Specify the IP address/hostname of an existing vCenter to register to. 172.21.166.140	
<b>Port (*)</b>	Specify the HTTPS port of an existing vCenter to register to. 443	
<b>Username (*)</b>	Specify the username of an existing vCenter to register to. administrator@vsphere.local	
<b>Password (*)</b>	Specify the password of an existing vCenter to register to. Password: ..... <input type="checkbox"/>	
	Confirm Password: ..... <input type="checkbox"/>	
Network Properties		8 settings
<b>Host Name</b>	Specify the hostname for the appliance. (Leave blank if DHCP is desired) vcf-m01-otv9	
<b>IP Address</b>	Specify the IP address for the appliance. (Leave blank if DHCP is	

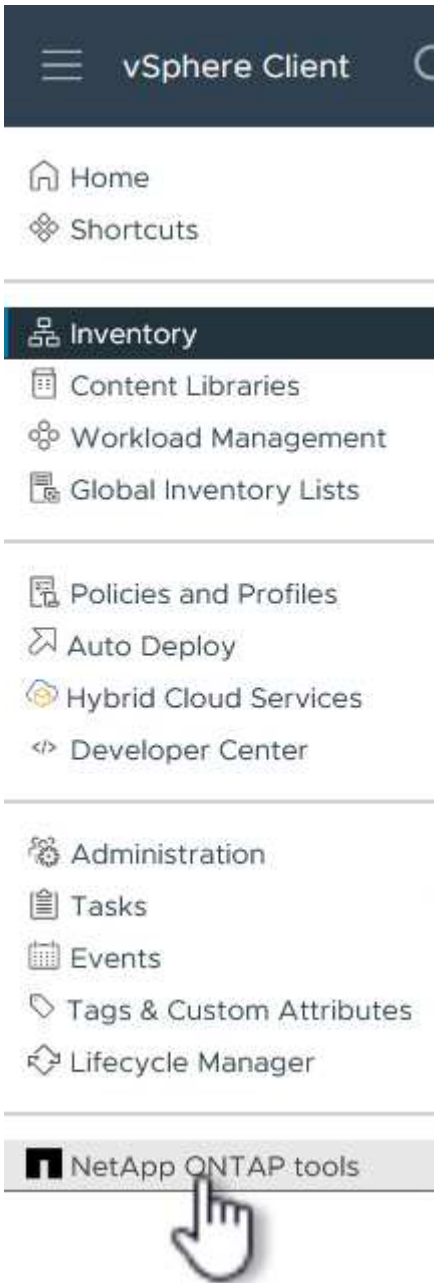
CANCEL BACK NEXT

9. Review all information on the Ready to complete page and the click Finish to begin deploying the OTV appliance.

## Configure a VMFS iSCSI datastore on Management Domain using OTV

Complete the following to use OTV to configure a VMFS iSCSI datastore as supplemental storage on the management domain:

1. In the vSphere client navigate to the main menu and select **NetApp ONTAP Tools**.



2. Once in **ONTAP Tools**, from the Getting Started page (or from **Storage Systems**), click on **Add** to add a new storage system.

vSphere Client Search in all environments

NetApp ONTAP tools INSTANCE 172.21.166.139:8443

Overview

- Storage Systems
- Storage capability profile
- Storage Mapping
- Settings
- Reports
  - Datastore Report
  - Virtual Machine Report
  - vVols Datastore Report
  - vVols Virtual Machine Report
  - Log Integrity Report


### ONTAP tools for VMware vSphere

Getting Started Traditional Dashboard vVols Dashboard

ONTAP tools for VMware vSphere is a vCenter Server plug-in that provides end-to-end lifecycle management for virtual machines in VMware environments using NetApp storage systems.


**Add Storage System**

Add storage systems to ONTAP tools for VMware vSphere.




**Provision Datastore**


Create traditional or vVols datastores.



**Next Steps**

 [View Dashboard](#)

View and monitor the datastores in ONTAP tools for VMware vSphere.

 [Settings](#)

Configure administrative settings such as credentials, alarm thresholds.

[What's new?](#)  
September 4, 2023

- Qualified and supported with ONTAP 9.13.1
- Supports and interoperates with VMware vSphere 8.x releases
- Includes newer enhanced SCPs that efficiently map workloads to the newer All SAN Array platforms through policy based management



**Resources**

- [ONTAP tools for VMware vSphere Documentation Resources](#)
- [RBAC User Creator for Data ONTAP](#)
- [ONTAP tools for VMware vSphere REST API Documentation](#)

3. Provide the IP address and credentials of the ONTAP storage system and click on **Add**.

## Add Storage System

 Any communication between ONTAP tools plug-in and the storage system should be mutually authenticated.

vCenter server	vcf-m01-vc01.sddc.netapp.com 
Name or IP address:	172.16.9.25
Username:	admin
Password:	●●●●●●●●
Port:	443
Advanced options	


CANCEL

SAVE & ADD MORE

ADD 

4. Click on **Yes** to authorize the cluster certificate and add the storage system.

## Add Storage System

 Any communication between ONTAP tools plug-in and the storage system should be mutually authenticated.

vCenter server

vcf-m01-vc01.sddc.netapp.com

### Authorize Cluster Certificate

Host 172.16.9.25 has identified itself with a self-signed certificate.

[Show certificate](#)

Do you want to trust this certificate?

NO

YES



CANCEL

SAVE & ADD MORE

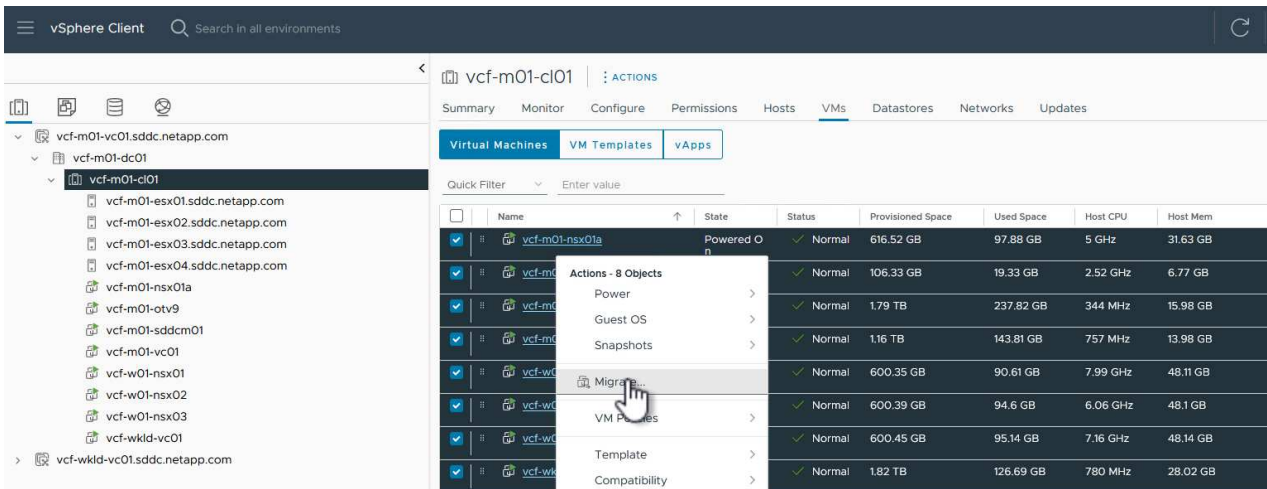
ADD

## Migrate management VM's to iSCSI Datastore

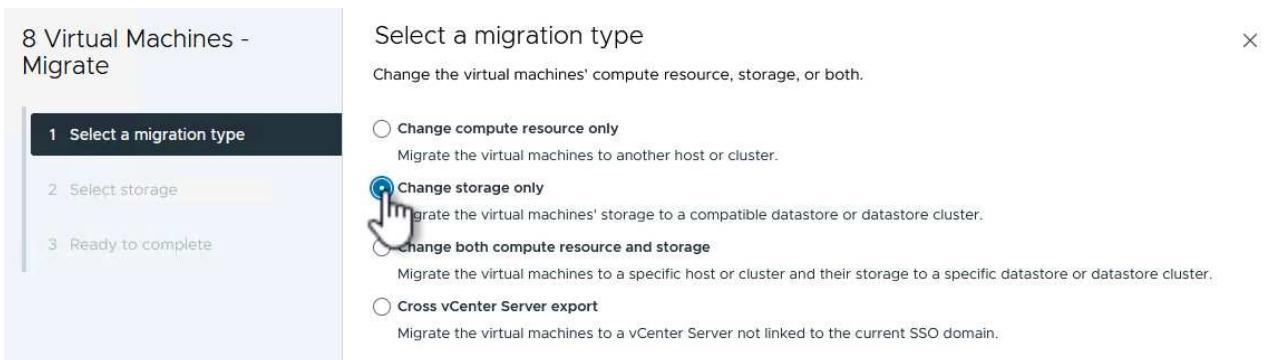
In cases where it is preferred to use ONTAP storage to protect the VCF management VM's vMotion can be used to migrate the VM's to the newly created iSCSI datastore.

Complete the following steps to migrate the VCF management VM's to the iSCSI datastore.

1. From the vSphere Client navigate to the management domain cluster and click on the **VMs** tab.
2. Select the VMs to be migrated to the iSCSI datastore, right click and select **Migrate...**



3. In the **Virtual Machines - Migrate** wizard, select **Change storage only** as the migration type and click on **Next** to continue.



4. On the **Select storage** page, select the iSCSI datastore and select **Next** to continue.

## 8 Virtual Machines - Migrate

1 Select a migration type

2 Select storage

3 Ready to complete

### Select storage

Select the destination storage for the virtual machine migration.

**BATCH CONFIGURE** CONFIGURE PER DISK

Select virtual disk format Same format as source

VM Storage Policy Datastore Default

Disable Storage DRS for this virtual machine

	Name	Storage Compatibility	Capacity	Provisioned	Free
<input checked="" type="radio"/>	mgmt_01_iscsi	--	3 TB	1.46 GB	3 TB
<input type="radio"/>	vcf-m01-cl01-ds-vsan01	--	999.97 GB	7.28 TB	52.38 GB

Manage Columns Items per page 10 2 items

#### Compatibility

✓ Compatibility checks succeeded.

CANCEL

BACK

NEXT

5. Review the selections and click on **Finish** to start the migration.

6. The relocation status can be viewed from the **Recent Tasks** pane.

Task Name	Target	Status	Details
Relocate virtual machine	<a href="#">vcf-w01-nsx03</a>	38%	Migrating Virtual Machine active state
Relocate virtual machine	<a href="#">vcf-wkld-vc01</a>	42%	Migrating Virtual Machine active state
Relocate virtual machine	<a href="#">vcf-m01-otv9</a>	36%	Migrating Virtual Machine active state
Relocate virtual machine	<a href="#">vcf-m01-nsx01a</a>	49%	Migrating Virtual Machine active state
Relocate virtual machine	<a href="#">vcf-w01-nsx02</a>	47%	Migrating Virtual Machine active state
Relocate virtual machine	<a href="#">vcf-m01-sddcm01</a>	39%	Migrating Virtual Machine active state
Relocate virtual machine	<a href="#">vcf-w01-nsx01</a>	42%	Migrating Virtual Machine active state
Relocate virtual machine	<a href="#">vcf-m01-vc01</a>	44%	Migrating Virtual Machine active state



## Additional information

For information on configuring ONTAP storage systems refer to the [ONTAP 9 Documentation](#) center.

For information on configuring VCF refer to [VMware Cloud Foundation Documentation](#).

## Video demo for this solution

### [iSCSI Datastores as Supplemental Storage for VCF Management Domains](#)

In this scenario we will demonstrate how to deploy and use ONTAP Tools for VMware vSphere (OTV) to configure a **vVols datastore** for a VCF workload domain.

**iSCSI** is used as the storage protocol for the vVols datastore.

Author: Josh Powell

## Use ONTAP Tools to configure supplemental storage (vVols) for VCF Workload Domains

### Scenario Overview

This scenario covers the following high level steps:

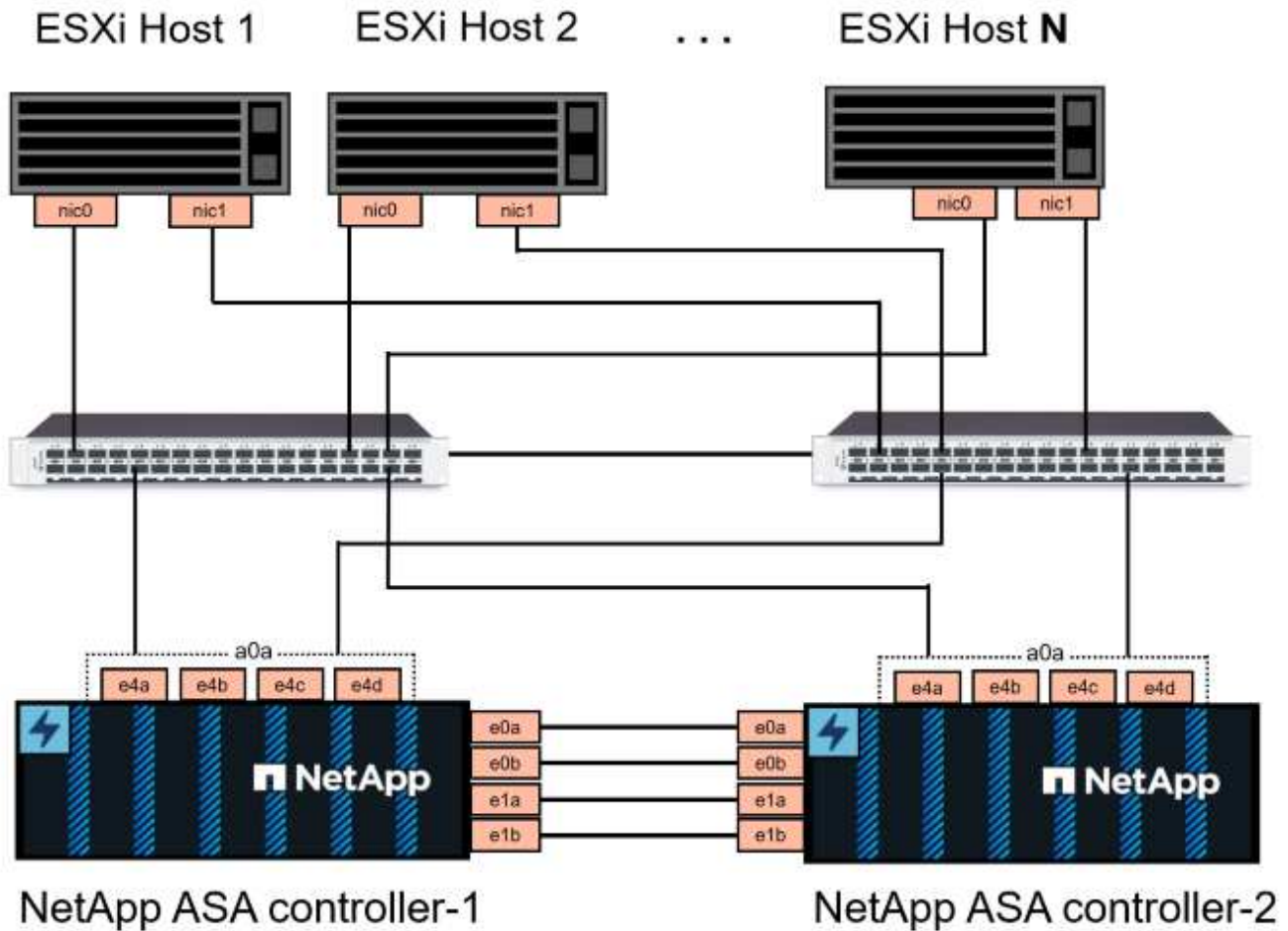
- Create a storage virtual machine (SVM) with logical interfaces (LIFs) for iSCSI traffic.
- Create distributed port groups for iSCSI networks on the VI workload domain.
- Create vmkernel adapters for iSCSI on the ESXi hosts for the VI workload domain.
- Deploy ONTAP Tools on the VI workload domain.
- Create a new vVols datastore on the VI workload domain.

### Prerequisites

This scenario requires the following components and configurations:

- An ONTAP ASA storage system with physical data ports on ethernet switches dedicated to storage traffic.
- VCF management domain deployment is complete and the vSphere client is accessible.
- A VI workload domain has been previously deployed.

NetApp recommends fully redundant network designs for iSCSI. The following diagram illustrates an example of a redundant configuration, providing fault tolerance for storage systems, switches, networks adapters and host systems. Refer to the NetApp [SAN configuration reference](#) for additional information.



For multipathing and failover across multiple paths, NetApp recommends having a minimum of two LIFs per storage node in separate ethernet networks for all SVMs in iSCSI configurations.

This documentation demonstrates the process of creating a new SVM and specifying the IP address information to create multiple LIFs for iSCSI traffic. To add new LIFs to an existing SVM refer to [Create a LIF \(network interface\)](#).



In situations where multiple VMkernel adapters are configured on the same IP network, it is recommended to use software iSCSI port binding on the ESXi hosts to ensure that load balancing across the adapters occurs. Refer to KB article [Considerations for using software iSCSI port binding in ESX/ESXi \(2038869\)](#).

For additional information on using VMFS iSCSI datastores with VMware refer to [vSphere VMFS Datastore - iSCSI Storage backend with ONTAP](#).

### Deployment Steps

To deploy ONTAP Tools and use it to create a vVols datastore on the VCF management domain, complete the following steps:

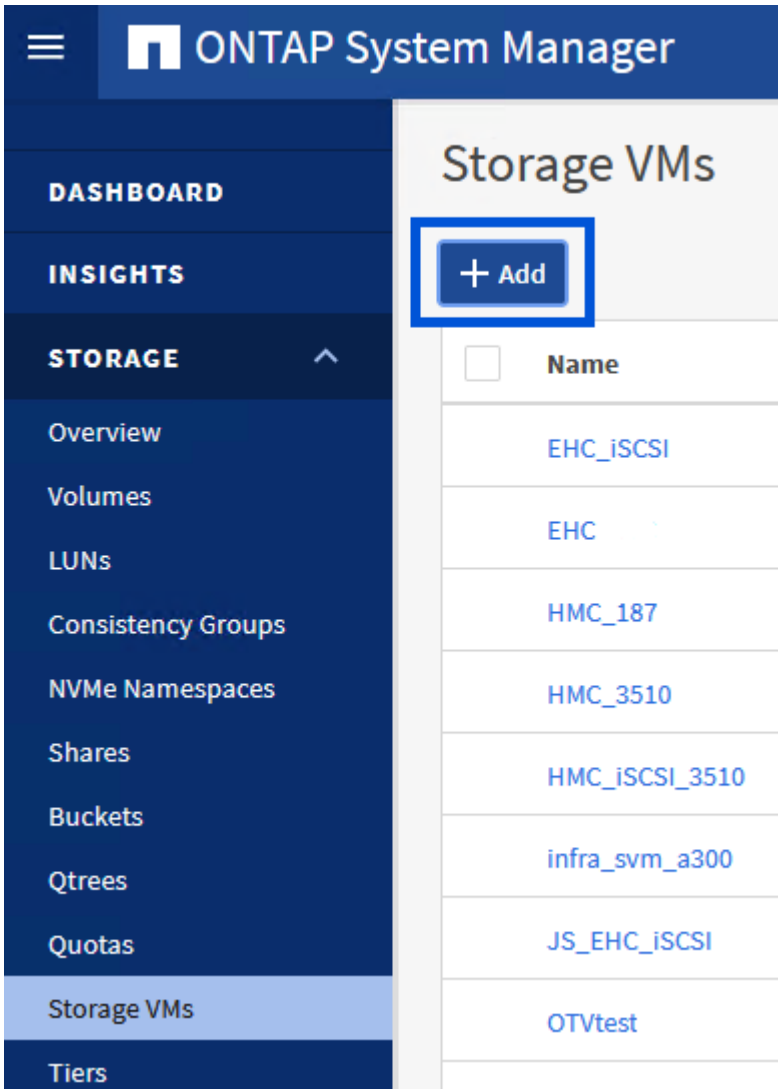
**Create SVM and LIFs on ONTAP storage system**

The following step is performed in ONTAP System Manager.

## Create the storage VM and LIFs

Complete the following steps to create an SVM together with multiple LIFs for iSCSI traffic.

1. From ONTAP System Manager navigate to **Storage VMs** in the left-hand menu and click on **+ Add** to start.



2. In the **Add Storage VM** wizard provide a **Name** for the SVM, select the **IP Space** and then, under **Access Protocol**, click on the **iSCSI** tab and check the box to **Enable iSCSI**.

## Add Storage VM



STORAGE VM NAME

SVM\_ISCSI

IPSPACE

Default

### Access Protocol

SMB/CIFS, NFS, S3

iSCSI

FC

NVMe

Enable iSCSI

3. In the **Network Interface** section fill in the **IP address**, **Subnet Mask**, and **Broadcast Domain and Port** for the first LIF. For subsequent LIFs the checkbox may be enabled to use common settings across all remaining LIFs or use separate settings.



For multipathing and failover across multiple paths, NetApp recommends having a minimum of two LIFs per storage node in separate Ethernet networks for all SVMs in iSCSI configurations.

## NETWORK INTERFACE

ntaphci-a300-01

IP ADDRESS

172.21.118.179

SUBNET MASK

24

GATEWAY

Add optional gateway

BROADCAST DOMAIN AND PORT

NFS\_iSCSI

Use the same subnet mask, gateway, and broadcast domain for all of the following interfaces

IP ADDRESS

172.21.119.179

PORT

a0a-3375

ntaphci-a300-02

IP ADDRESS

172.21.118.180

PORT

a0a-3374

IP ADDRESS

172.21.119.180

PORT

a0a-3375

4. Choose whether to enable the Storage VM Administration account (for multi-tenancy environments) and click on **Save** to create the SVM.

## Storage VM Administration

Manage administrator account

Save

Cancel

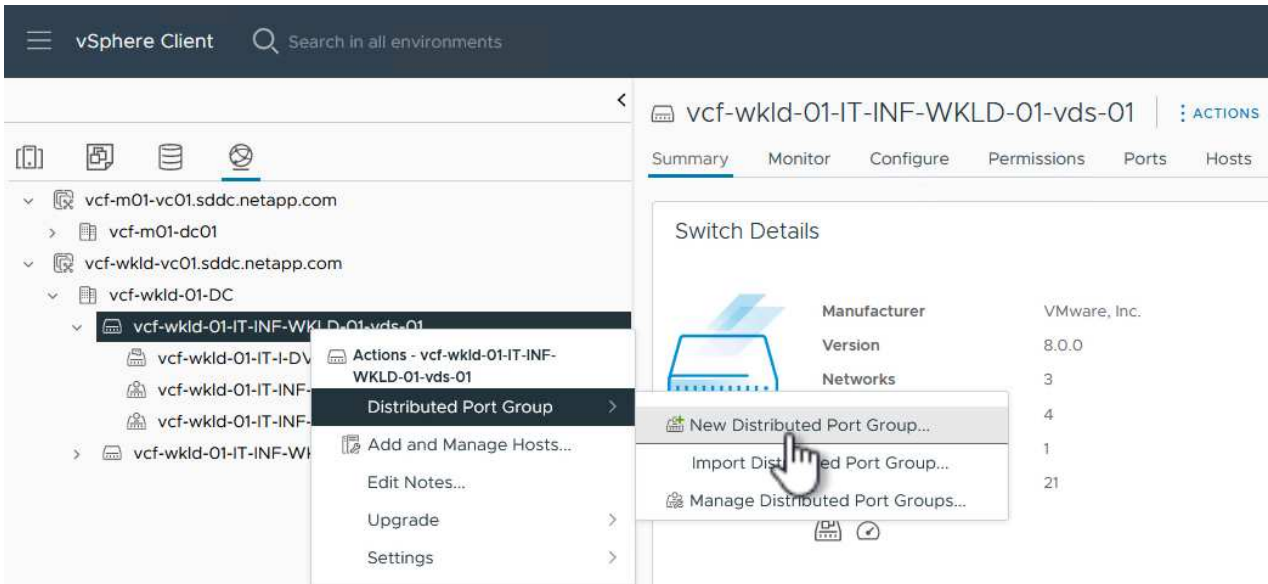
### Set up networking for iSCSI on ESXi hosts

The following steps are performed on the VI Workload Domain cluster using the vSphere client. In this case vCenter Single Sign-On is being used so the vSphere client is common across the management and workload domains.

## Create Distributed Port Groups for iSCSI traffic

Complete the following to create a new distributed port group for each iSCSI network:

1. From the vSphere client , navigate to **Inventory > Networking** for the workload domain. Navigate to the existing Distributed Switch and choose the action to create **New Distributed Port Group....**



2. In the **New Distributed Port Group** wizard fill in a name for the new port group and click on **Next** to continue.
3. On the **Configure settings** page fill out all settings. If VLANs are being used be sure to provide the correct VLAN ID. Click on **Next** to continue.

## New Distributed Port Group

1 Name and location

2 **Configure settings**

3 Ready to complete

## Configure settings

Set general properties of the new port group.

Port binding	Static binding
Port allocation	Elastic ⓘ
Number of ports	8
Network resource pool	(default)
VLAN	
VLAN type	VLAN
VLAN ID	3374
Advanced	
<input type="checkbox"/> Customize default policies configuration	

CANCEL

BACK

NEXT

4. On the **Ready to complete** page, review the changes and click on **Finish** to create the new distributed port group.
5. Repeat this process to create a distributed port group for the second iSCSI network being used and ensure you have input the correct **VLAN ID**.
6. Once both port groups have been created, navigate to the first port group and select the action to **Edit settings...**

The screenshot shows the vSphere Client interface. On the left, a tree view displays the environment structure, with the port group 'vcf-wkld-01-iscsi-a' selected. A context menu is open over this port group, showing options like 'Actions - vcf-wkld-01-iscsi-a', 'Edit Settings...', and 'Delete Configuration...'. On the right, the 'Distributed Port Group Details' panel is visible, showing the following configuration:

Port binding	Static binding
Port allocation	Elastic
VLAN ID	3374
Distributed switch	<a href="#">vcf-wkld-01-IT-INF-WKLD-01-vds-01</a>
Network protocol profile	--



7. On **Distributed Port Group - Edit Settings** page, navigate to **Teaming and failover** in the left-hand menu and click on **uplink2** to move it down to **Unused uplinks**.

Distributed Port Group - Edit Settings | vcf-wkld-01-iscsi-a

General | Load balancing | Route based on originating virtual por

Advanced | Network failure detection | Link status only

VLAN | Notify switches | Yes

Security | Failback | Yes

Traffic shaping

**Teaming and failover**

Monitoring

Miscellaneous

Failover order ⓘ

MOVE UP MOVE DOWN

Active uplinks

uplink1

Standby uplinks

Unused uplinks

uplink2

CANCEL OK

8. Repeat this step for the second iSCSI port group. However, this time move **uplink1** down to **Unused uplinks**.

Distributed Port Group - Edit Settings | vcf-wkld-01-iscsi-b

General | Load balancing | Route based on originating virtual por

Advanced | Network failure detection | Link status only

VLAN | Notify switches | Yes

Security | Failback | Yes

Traffic shaping

**Teaming and failover**

Monitoring

Miscellaneous

Failover order ⓘ

MOVE UP MOVE DOWN

Active uplinks

uplink2

Standby uplinks

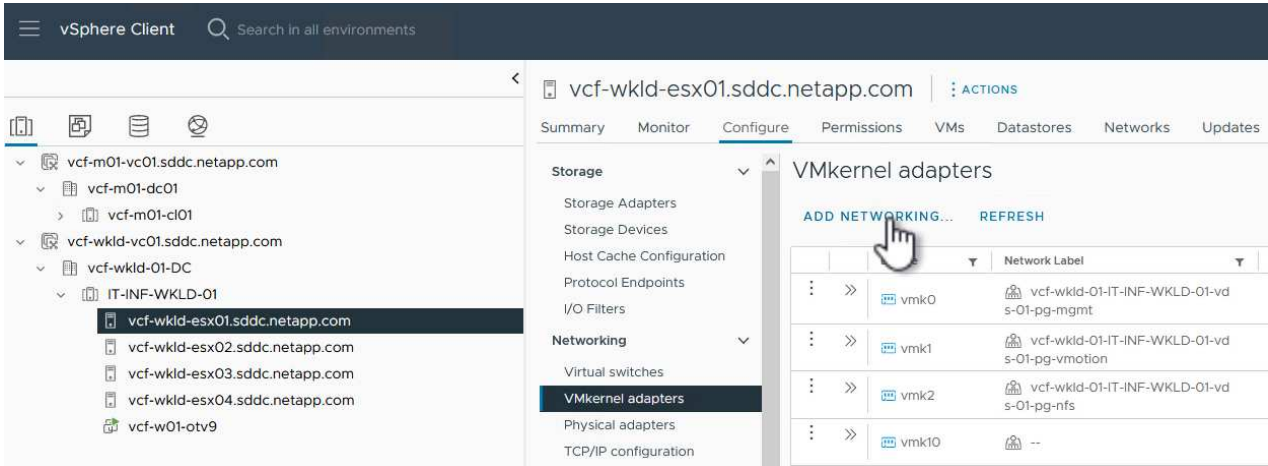
Unused uplinks

uplink1

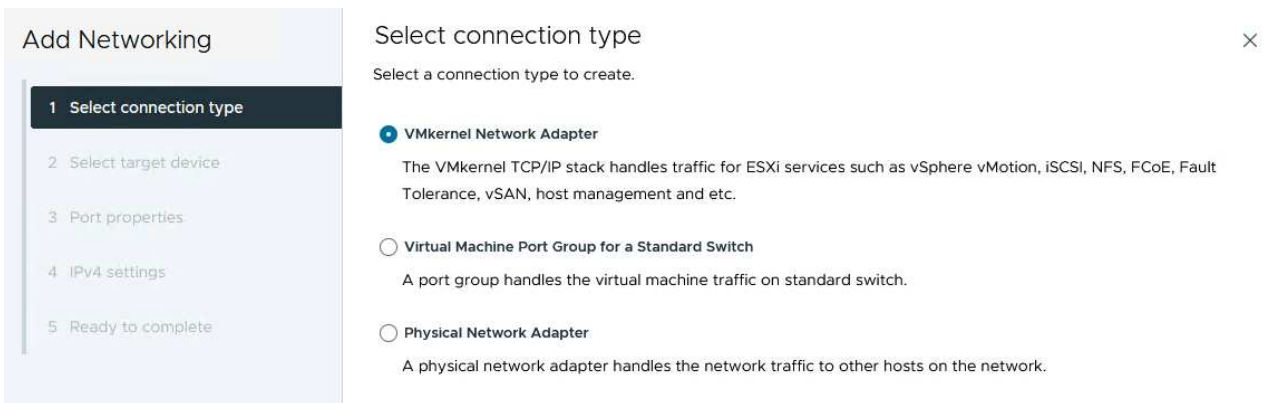
## Create VMkernel adapters on each ESXi host

Repeat this process on each ESXi host in the workload domain.

1. From the vSphere client navigate to one of the ESXi hosts in the workload domain inventory. From the **Configure** tab select **VMkernel adapters** and click on **Add Networking...** to start.



2. On the **Select connection type** window choose **VMkernel Network Adapter** and click on **Next** to continue.



3. On the **Select target device** page, choose one of the distributed port groups for iSCSI that was created previously.

## Add Networking

- 1 Select connection type
- 2 Select target device
- 3 Port properties
- 4 IPv4 settings
- 5 Ready to complete






## Select target device

Select a target device for the new connection.

- Select an existing network
- Select an existing standard switch
- New standard switch

### Quick Filter

Enter value

	Name	NSX Port Group ID	Distributed Switch
<input checked="" type="radio"/>	 vcf-wkld-01-iscsi-a	--	vcf-wkld-01-IT-INF-WKLD-01-vds-01
<input type="radio"/>	 vcf-wkld-01-iscsi-b	--	vcf-wkld-01-IT-INF-WKLD-01-vds-01
<input type="radio"/>	 vcf-wkld-01-IT-INF-WKLD-01-vds-01-pg-mgmt	--	vcf-wkld-01-IT-INF-WKLD-01-vds-01
<input type="radio"/>	 vcf-wkld-01-IT-INF-WKLD-01-vds-01-pg-nfs	--	vcf-wkld-01-IT-INF-WKLD-01-vds-02
<input type="radio"/>	 vcf-wkld-01-IT-INF-WKLD-01-vds-01-pg-vmotion	--	vcf-wkld-01-IT-INF-WKLD-01-vds-01

Manage Columns 5 items

CANCEL

BACK

NEXT

4. On the **Port properties** page keep the defaults and click on **Next** to continue.

## Add Networking

- 1 Select connection type
- 2 Select target device
- 3 Port properties
- 4 IPv4 settings
- 5 Ready to complete

## Port properties

Specify VMkernel port settings.

**Network label** vcf-wkld-01-iscsi-a (vcf-wkld-01-IT-INF-WKLD-01-vds-01)

**MTU** Get MTU from switch 9000

**TCP/IP stack** Default

### Available services

- Enabled services**
- vMotion
  - Provisioning
  - Fault Tolerance logging
  - Management
  - vSphere Replication
  - vSphere Replication NFC
  - vSAN
  - vSAN Witness
  - vSphere Backup NFC
  - NVMe over TCP
  - NVMe over RDMA

5. On the **IPv4 settings** page fill in the **IP address**, **Subnet mask**, and provide a new Gateway IP address (only if required). Click on **Next** to continue.

### Add Networking

- 1 Select connection type
- 2 Select target device
- 3 Port properties
- 4 IPv4 settings
- 5 Ready to complete

### IPv4 settings

Specify VMkernel IPv4 settings.

Obtain IPv4 settings automatically  
 Use static IPv4 settings

**IPv4 address**

**Subnet mask**

**Default gateway**  Override default gateway for this adapter

**DNS server addresses**

6. Review the your selections on the **Ready to complete** page and click on **Finish** to create the VMkernel adapter.

### Add Networking

- 1 Select connection type
- 2 Select target device
- 3 Port properties
- 4 IPv4 settings
- 5 Ready to complete

### Ready to complete

Review your selections before finishing the wizard

- ▼ **Select target device**

Distributed port group vcf-wkld-01-iscsi-a

Distributed switch vcf-wkld-01-IT-INF-WKLD-01-vds-01
- ▼ **Port properties**

New port group vcf-wkld-01-iscsi-a (vcf-wkld-01-IT-INF-WKLD-01-vds-01)

MTU 9000

vMotion Disabled

Provisioning Disabled

Fault Tolerance logging Disabled

Management Disabled

vSphere Replication Disabled

vSphere Replication NFC Disabled

vSAN Disabled

vSAN Witness Disabled

vSphere Backup NFC Disabled

NVMe over TCP Disabled

NVMe over RDMA Disabled
- ▼ **IPv4 settings**

IPv4 address 172.21.118.127 (static)

Subnet mask 255.255.255.0

CANCEL
BACK
FINISH

7. Repeat this process to create a VMkernel adapter for the second iSCSI network.

## **Deploy and use ONTAP Tools to configure storage**

The following steps are performed on the VCF management domain cluster using the vSphere client and involve deploying OTV, creating a vVols iSCSI datastore, and migrating management VM's to the new datastore.

For VI workload domains, OTV is installed to the VCF Management Cluster but registered with the vCenter associated with the VI workload domain.

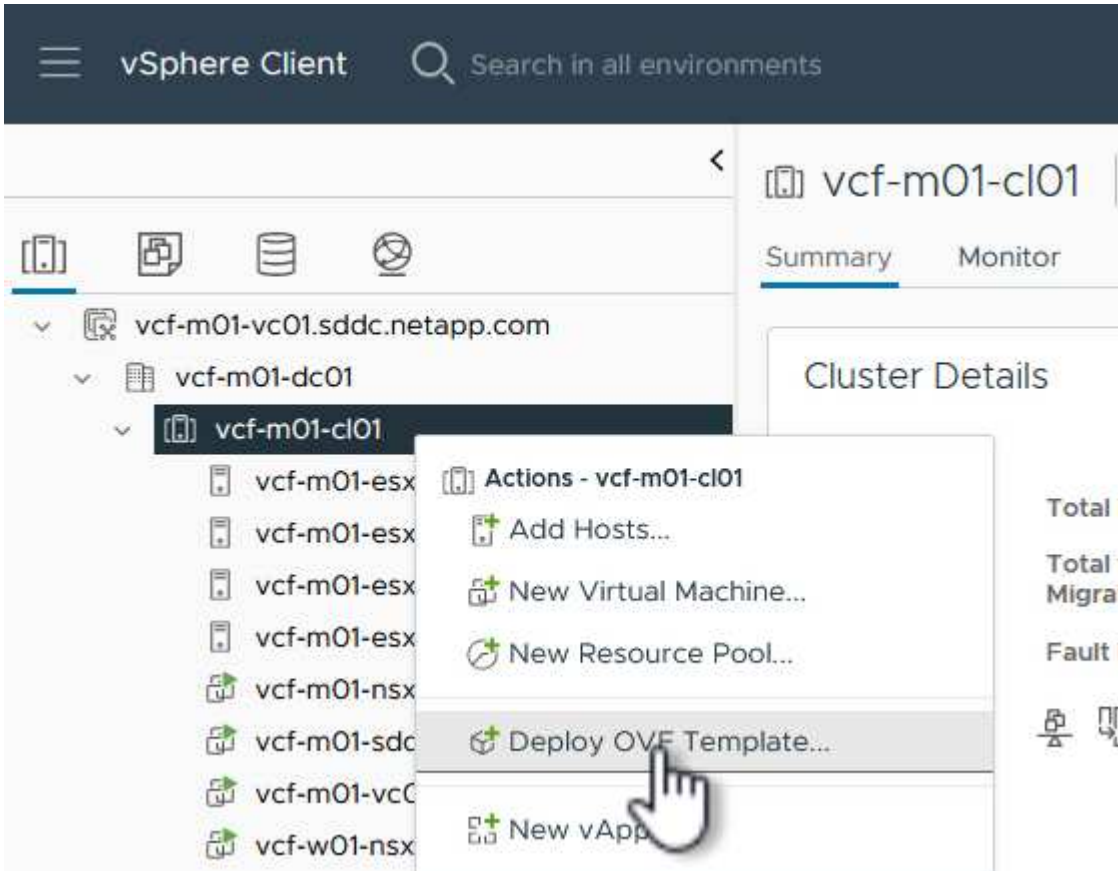
For additional information on deploying and using ONTAP Tools in a multiple vCenter environment refer to [Requirements for registering ONTAP tools in multiple vCenter Servers environment](#).

## Deploy ONTAP tools for VMware vSphere

ONTAP tools for VMware vSphere (OTV) is deployed as a VM appliance and provides an integrated vCenter UI for managing ONTAP storage.

Complete the following to Deploy ONTAP tools for VMware vSphere:

1. Obtain the ONTAP tools OVA image from the [NetApp Support site](#) and download to a local folder.
2. Log into the vCenter appliance for the VCF management domain.
3. From the vCenter appliance interface right-click on the management cluster and select **Deploy OVF Template...**



4. In the **Deploy OVF Template** wizard click the **Local file** radio button and select the ONTAP tools OVA file downloaded in the previous step.

## Deploy OVF Template

### 1 Select an OVF template

- 2 Select a name and folder
- 3 Select a compute resource
- 4 Review details
- 5 Select storage
- 6 Ready to complete

## Select an OVF template

Select an OVF template from remote URL or local file system

Enter a URL to download and install the OVF package from the Internet, or browse to a location accessible from your computer, such as a local hard drive, a network share, or a CD/DVD drive.

URL

Local file

netapp-ontap-tools-for-vmware-vsphere-9.13-9554.ova

5. For steps 2 through 5 of the wizard select a name and folder for the VM, select the compute resource, review the details, and accept the license agreement.
6. For the storage location of the configuration and disk files, select the vSAN datastore of the VCF management domain cluster.

## Deploy OVF Template

- 1 Select an OVF template
- 2 Select a name and folder
- 3 Select a compute resource
- 4 Review details
- 5 License agreements
- 6 Select storage**
- 7 Select networks
- 8 Customize template
- 9 Ready to complete

## Select storage

Select the storage for the configuration and disk files

Encrypt this virtual machine [?](#)

Select virtual disk format As defined in the VM storage policy

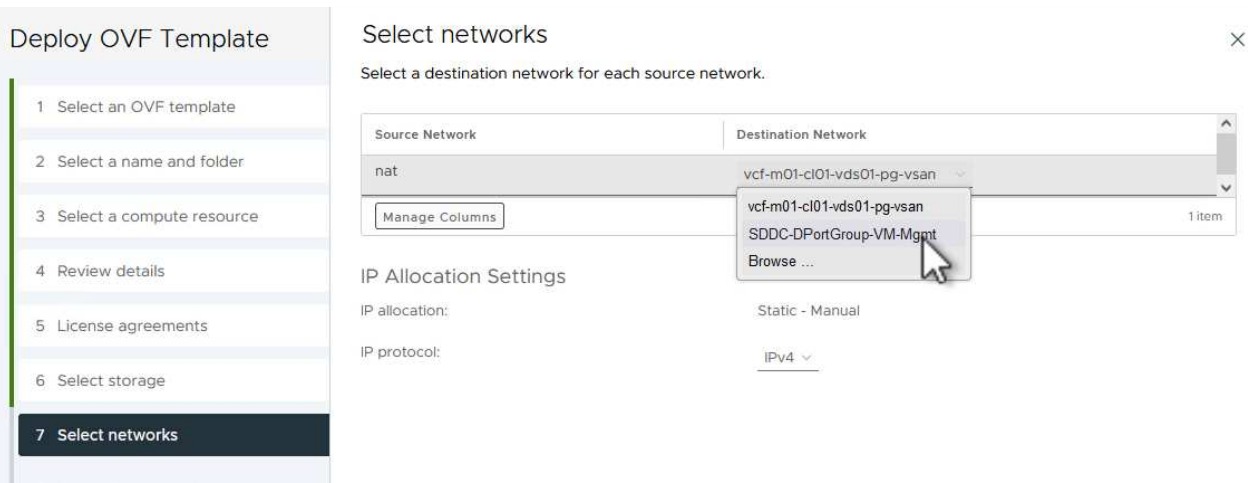
VM Storage Policy Datastore Default

Disable Storage DRS for this virtual machine

	Name	Storage Compatibility	Capacity	Provisioned	Free	
<input checked="" type="radio"/>	vcf-m01-c01-ds-vsan01	--	999.97 GB	7.17 TB	225.72 GB	v
<input type="radio"/>	vcf-m01-esx01-esx-install-datastore	--	25.75 GB	4.56 GB	21.19 GB	v
<input type="radio"/>	vcf-m01-esx02-esx-install-datastore	--	25.75 GB	4.56 GB	21.19 GB	v
<input type="radio"/>	vcf-m01-esx03-esx-install-datastore	--	25.75 GB	4.56 GB	21.19 GB	v
<input type="radio"/>	vcf-m01-esx04-esx-install-datastore	--	25.75 GB	4.56 GB	21.19 GB	v

Manage Columns Items per page 10 5 items

7. On the Select network page select the network used for management traffic.



8. On the Customize template page fill out all required information:

- Password to be used for administrative access to OTV.
- NTP server IP address.
- OTV maintenance account password.
- OTV Derby DB password.
- Do not check the box to **Enable VMware Cloud Foundation (VCF)**. VCF mode is not required for deploying supplemental storage.
- FQDN or IP address of the vCenter appliance for the **VI Workload Domain**
- Credentials for the vCenter appliance of the **VI Workload Domain**
- Provide the required network properties fields.

Click on **Next** to continue.



## Deploy OVF Template

- 1 Select an OVF template
- 2 Select a name and folder
- 3 Select a compute resource
- 4 Review details
- 5 License agreements
- 6 Select storage
- 7 Select networks
- 8 Customize template**
- 9 Ready to complete

## Customize template

Customize the deployment properties of this software solution.

! 2 properties have invalid values X

System Configuration 4 settings

**Application User Password (\*)** Password to assign to the administrator account. For security reasons, it is recommended to use a password that is of eight to thirty characters and contains a minimum of one upper, one lower, one digit, and one special character.

Password

Confirm Password

**NTP Servers** A comma-separated list of hostnames or IP addresses of NTP Servers. If left blank, VMware tools based time synchronization will be used.

**Maintenance User Password (\*)** Password to assign to maint user account.

Password

Confirm Password

## Deploy OVF Template

- 1 Select an OVF template
- 2 Select a name and folder
- 3 Select a compute resource
- 4 Review details
- 5 License agreements
- 6 Select storage
- 7 Select networks
- 8 Customize template**
- 9 Ready to complete

## Customize template

Configure vCenter or Enable vCenter 3 settings

**Enable VMware Cloud Foundation (VCF)** vCenter server and user details are ignored when VCF is enabled.

**vCenter Server Address (\*)** Specify the IP address/hostname of an existing vCenter to register to.

**Port (\*)** Specify the HTTPS port of an existing vCenter to register to.

**Username (\*)** Specify the username of an existing vCenter to register to.

**Password (\*)** Specify the password of an existing vCenter to register to.

Password

Confirm Password

Network Properties 8 settings

**Host Name** Specify the hostname for the appliance. (Leave blank if DHCP is desired)

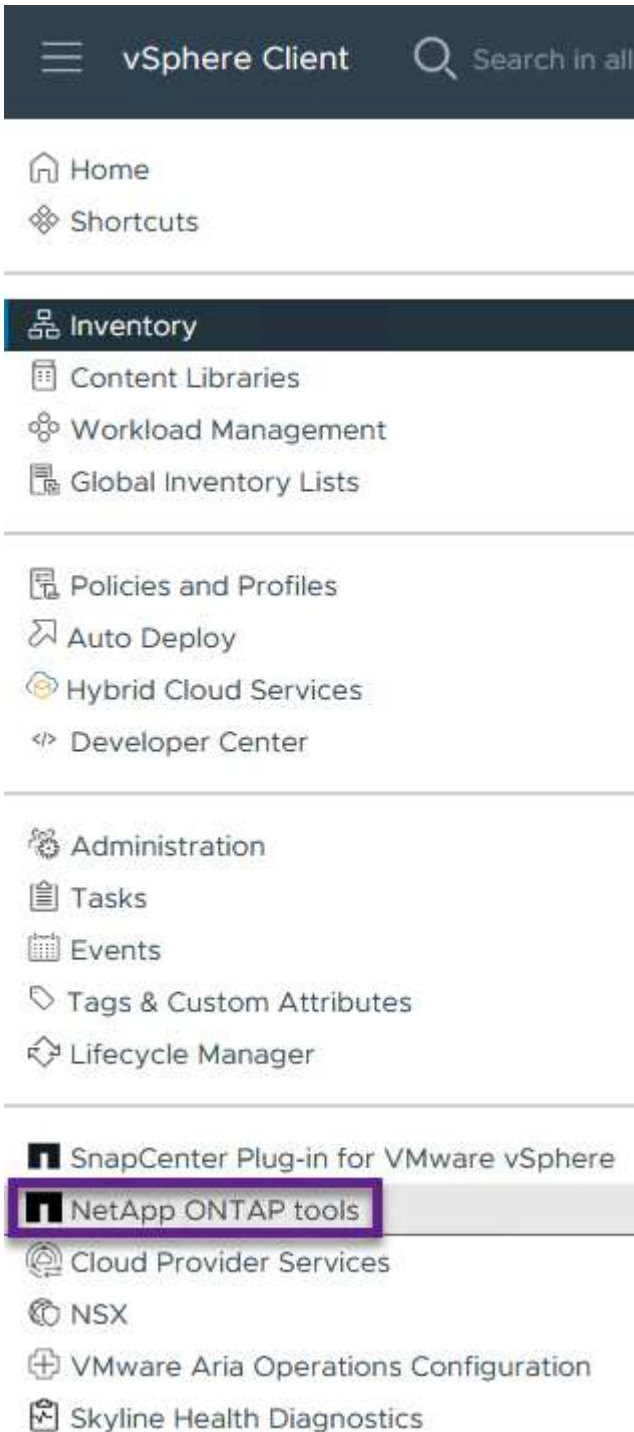
**IP Address** Specify the IP address for the appliance. (Leave blank if DHCP is desired)

CANCEL BACK NEXT

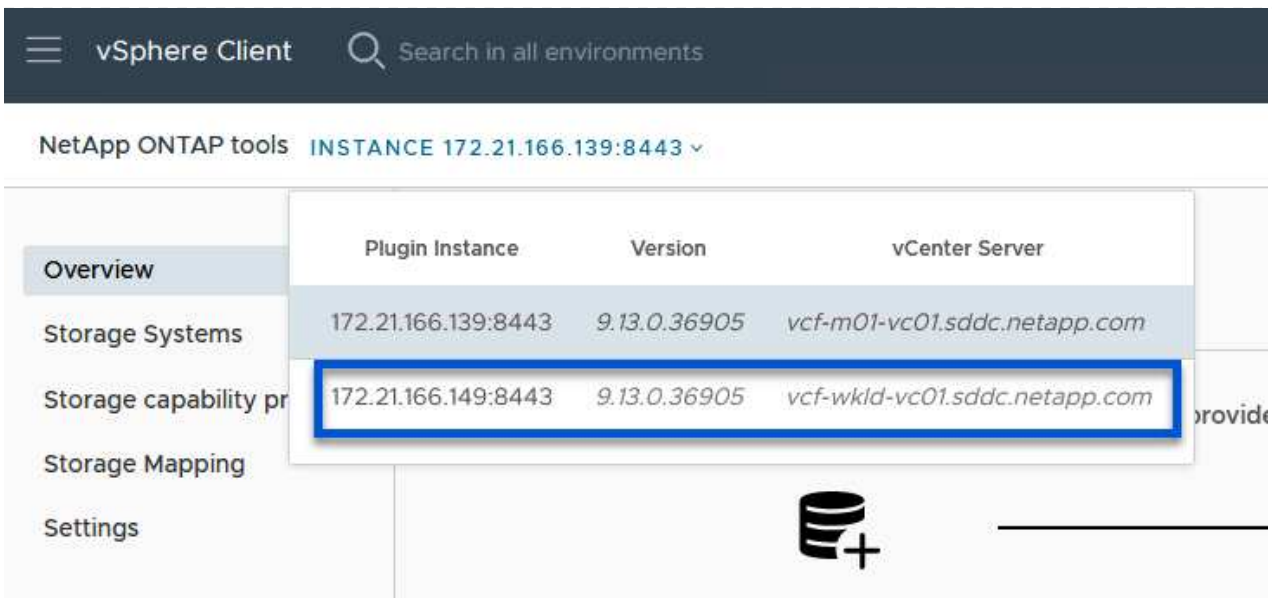
9. Review all information on the Ready to complete page and the click Finish to begin deploying the OTV appliance.

**Add a storage system to ONTAP Tools.**

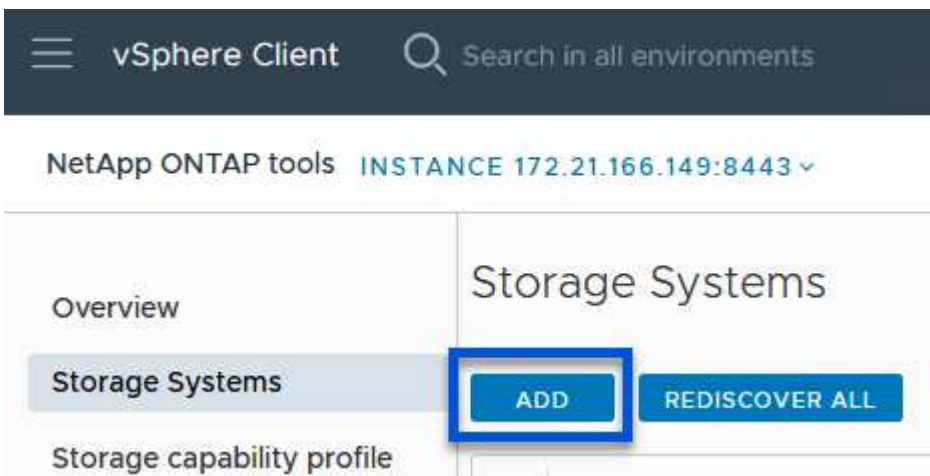
1. Access NetApp ONTAP Tools by selecting it from the main menu in the vSphere client.



2. From the **INSTANCE** drop down menu in the ONTAP Tool interface, select the OTV instance associated with the workload domain to be managed.



3. In ONTAP Tools select **Storage Systems** from the left hand menu and then press **Add**.





4. Fill out the IP Address, credentials of the storage system and the port number. Click on **Add** to start the discovery process.



vVol requires ONTAP cluster credentials rather than SVM credentials. For more information refer to [Add storage systems](#) In the ONTAP Tools documentation.

## Add Storage System

 Any communication between ONTAP tools plug-in and the storage system should be mutually authenticated.

vCenter server vcf-m01-vc01.sddc.netapp.com 

**Name or IP address:** 172.16.9.25

**Username:** admin

**Password:** ●●●●●●●●

**Port:** 443

Advanced options 

**ONTAP Cluster Certificate:**  Automatically fetch  Manually upload

CANCEL

SAVE & ADD MORE

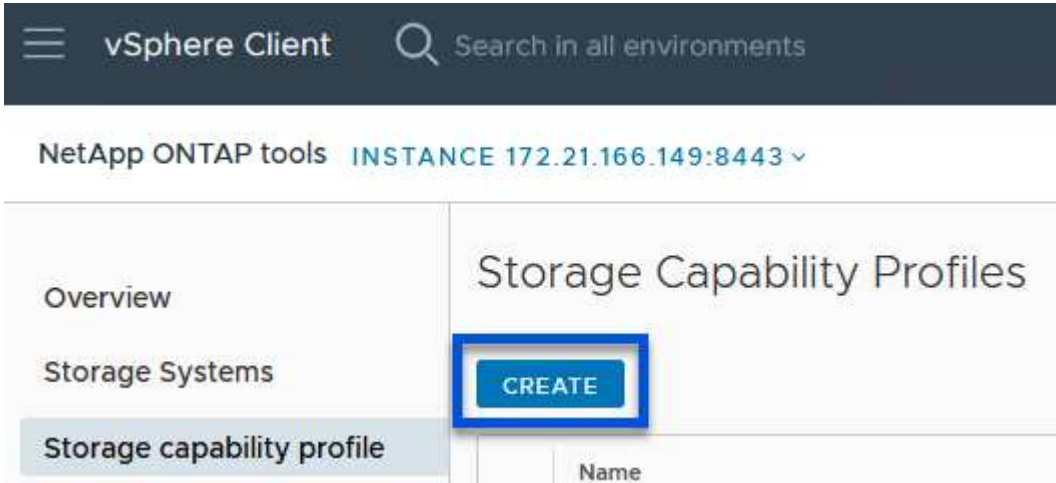
ADD

## Create a storage capability profile in ONTAP Tools

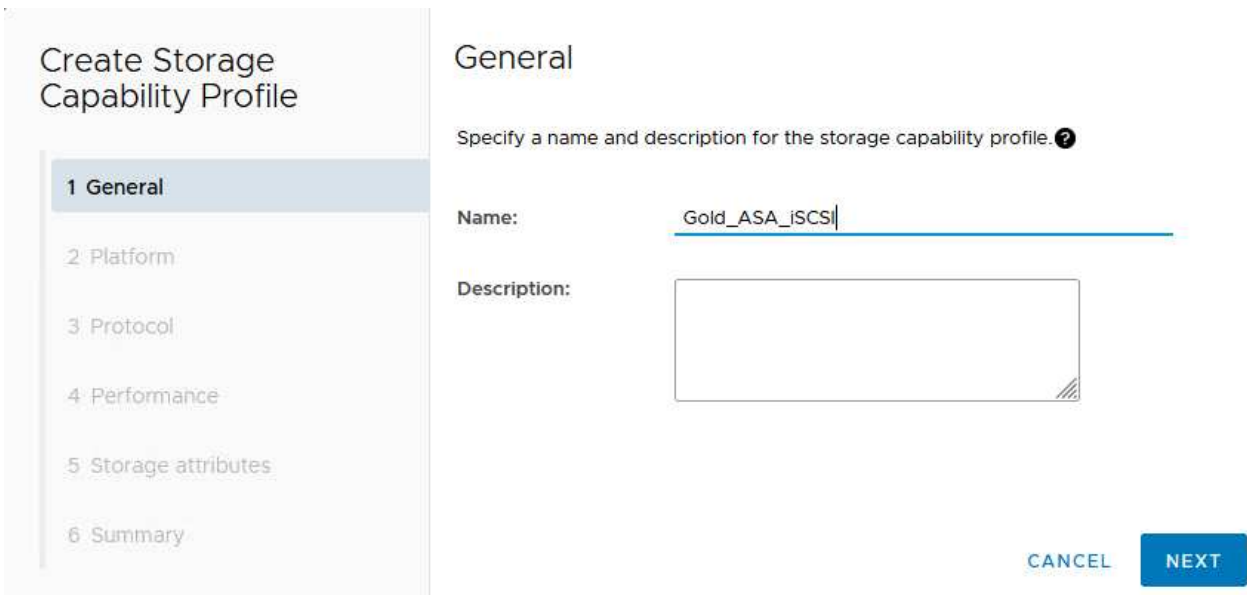
Storage capability profiles describe the features provided by a storage array or storage system. They include quality of service definitions and are used to select storage systems that meet the parameters defined in the profile. One of the provided profiles can be used or new ones can be created.

To create a storage capability profile in ONTAP Tools complete the following steps:

1. In ONTAP Tools select **Storage capability profile** from the left-hand menu and then press **Create**.



2. In the **Create Storage Capability profile** wizard provide a name and description of the profile and click on **Next**.



3. Select the platform type and to specify the storage system is to be an All-Flash SAN Array set **Asymmetric** to false.

## Create Storage Capability Profile

- 1 General
- 2 Platform**
- 3 Protocol
- 4 Performance
- 5 Storage attributes
- 6 Summary

### Platform

Platform: Performance

Asymmetric:

CANCEL

BACK

NEXT

4. Next, select choice of protocol or **Any** to allow all possible protocols. Click **Next** to continue.

## Create Storage Capability Profile

- 1 General
- 2 Platform
- 3 Protocol**
- 4 Performance
- 5 Storage attributes
- 6 Summary

### Protocol

Protocol: Any

- Any
- FCP
- iSCSI
- NVMe/FC

CANCEL

BACK

NEXT

5. The **performance** page allows setting of quality of service in form of minimum and maximum IOPs allowed.

## Create Storage Capability Profile

1 General

2 Platform

3 Protocol

4 Performance

5 Storage attributes

6 Summary

## Performance

None ⓘ

QoS policy group ⓘ

Min IOPS:

\_\_\_\_\_

Max IOPS:

6000

Unlimited

CANCEL

BACK

NEXT

6. Complete the **storage attributes** page selecting storage efficiency, space reservation, encryption and any tiering policy as needed.

## Create Storage Capability Profile

1 General

2 Platform

3 Protocol

4 Performance

5 Storage attributes

6 Summary

## Storage attributes

Deduplication:

Yes

Compression:

Yes

Space reserve:

Thin

Encryption:

No

Tiering policy (FabricPool):

None

CANCEL

BACK

NEXT

7. Finally, review the summary and click on Finish to create the profile.

## Create Storage Capability Profile

- 1 General
- 2 Platform
- 3 Protocol
- 4 Performance
- 5 Storage attributes
- 6 Summary**

## Summary

Name:	ASA_Gold_iSCSI
Description:	N/A
Platform:	Performance
Asymmetric:	No
Protocol:	Any
Max IOPS:	6000 IOPS
Space reserve:	Thin
Deduplication:	Yes
Compression:	Yes
Encryption:	Yes
Tiering policy (FabricPool):	None

CANCEL

BACK

FINISH

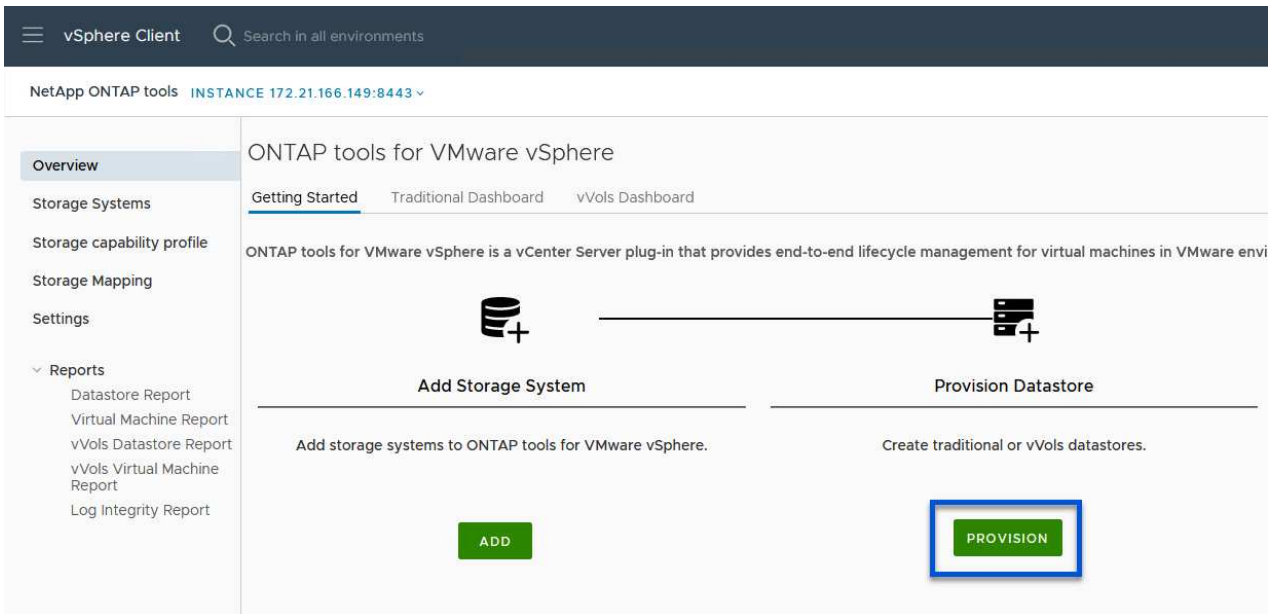




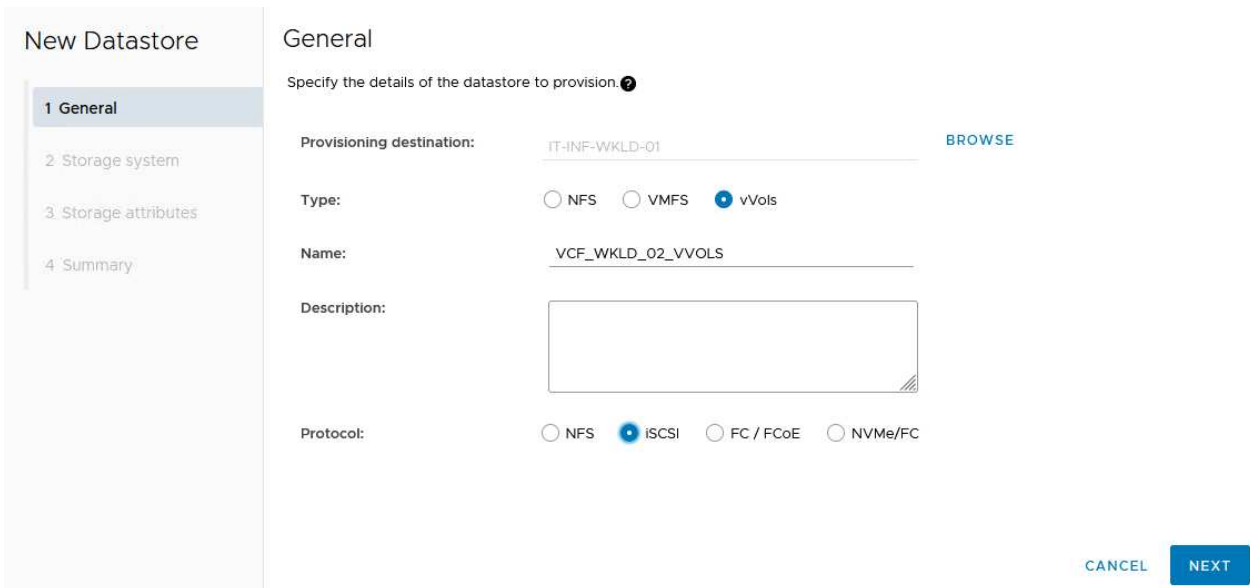
## Create a vVols datastore in ONTAP Tools

To create a vVols datastore in ONTAP Tools complete the following steps:

1. In ONTAP Tools select **Overview** and from the **Getting Started** tab click on **Provision** to start the wizard.



2. On the **General** page of the New Datastore wizard select the vSphere datacenter or cluster destination. Select **vVols** as the datastore type, fill out a name for the datastore, and select **iSCSI** as the protocol. Click on **Next** to continue.



3. On the **Storage system** page select the select a storage capability profile, the storage system and SVM. Click on **Next** to continue.

## New Datastore

- 1 General
- 2 Storage system
- 3 Storage attributes
- 4 Summary

### Storage system

Specify the storage capability profiles and the storage system you want to use.

Storage capability profiles:

- AFF\_Encrypted\_Min50\_ASA\_A
- FAS\_Default
- FAS\_Max20
- Custom profiles
- ASA\_Gold\_iSCSI

Storage system: ntaphci-a300e9u25 (172.16.9.25)

Storage VM: VCF\_iSCSI

CANCEL BACK NEXT

4. On the **Storage attributes** page select to create a new volume for the datastore and fill out the storage attributes of the volume to be created. Click on **Add** to create the volume and then **Next** to continue.

## New Datastore

- 1 General
- 2 Storage system
- 3 Storage attributes
- 4 Summary

### Storage attributes

Specify the storage details for provisioning the datastore.

Volumes:  Create new volumes  Select volumes

Create new volumes

Name	Size	Storage Capability Profile	Aggregate
 FlexVol volumes are not added.			

Name	Size(GB) ⓘ	Storage capability profile	Aggregates	Space reserve
f_wkld_02_vvols	3000	ASA_Gold_iSCSI	EHCaggr02 - (27053.3 GE)	Thin

CANCEL ADD BACK NEXT

5. Finally, review the summary and click on **Finish** to start the vVol datastore creation process.

### New Datastore

- 1 General
- 2 Storage system
- 3 Storage attributes
- 4 Summary

### Summary

**Datastore type:** vVols  
**Protocol:** iSCSI  
**Storage capability profile:** ASA\_Gold\_iSCSI

**Storage system details**  
**Storage system:** ntaphcl-a300e9u25  
**SVM:** VCF\_iSCSI

**Storage attributes**

New FlexVol Name	New FlexVol Size	Aggregate	Storage Capability Profile
vcf_wkld_02_vvols	3000 GB	EHCAggr02	ASA_Gold_iSCSI

Click 'Finish' to provision this datastore.

CANCEL BACK FINISH

#### Additional information

For information on configuring ONTAP storage systems refer to the [ONTAP 9 Documentation](#) center.

For information on configuring VCF refer to [VMware Cloud Foundation Documentation](#).

In this scenario we will demonstrate how to configure NVMe/TCP supplemental storage for a VCF workload domain.

Author: Josh Powell

### Configure NVMe/TCP supplemental storage for VCF Workload Domains

#### Scenario Overview

This scenario covers the following high level steps:

- Create a storage virtual machine (SVM) with logical interfaces (LIFs) for NVMe/TCP traffic.
- Create distributed port groups for iSCSI networks on the VI workload domain.
- Create vmkernel adapters for iSCSI on the ESXi hosts for the VI workload domain.
- Add NVMe/TCP adapters on ESXi hosts.
- Deploy NVMe/TCP datastore.

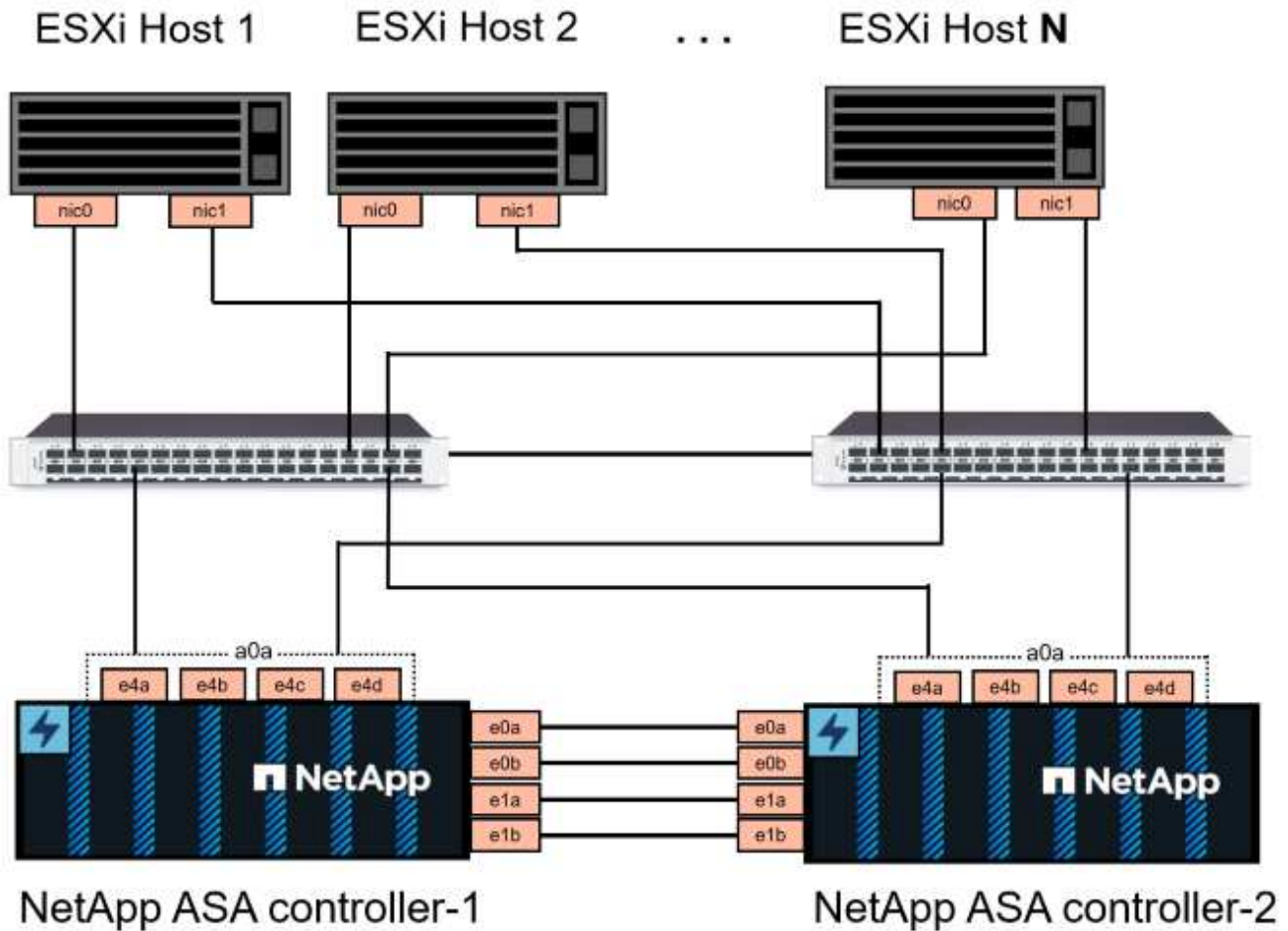
#### Prerequisites

This scenario requires the following components and configurations:

- An ONTAP ASA storage system with physical data ports on ethernet switches dedicated to storage traffic.
- VCF management domain deployment is complete and the vSphere client is accessible.
- A VI workload domain has been previously deployed.

NetApp recommends fully redundant network designs for NVMe/TCP. The following diagram illustrates an

example of a redundant configuration, providing fault tolerance for storage systems, switches, networks adapters and host systems. Refer to the NetApp [SAN configuration reference](#) for additional information.



For multipathing and failover across multiple paths, NetApp recommends having a minimum of two LIFs per storage node in separate ethernet networks for all SVMs in NVMe/TCP configurations.

This documentation demonstrates the process of creating a new SVM and specifying the IP address information to create multiple LIFs for NVMe/TCP traffic. To add new LIFs to an existing SVM refer to [Create a LIF \(network interface\)](#).

For additional information on NVMe design considerations for ONTAP storage systems, refer to [NVMe configuration, support and limitations](#).

### Deployment Steps

To create a VMFS datastore on a VCF workload domain using NVMe/TCP, complete the following steps.

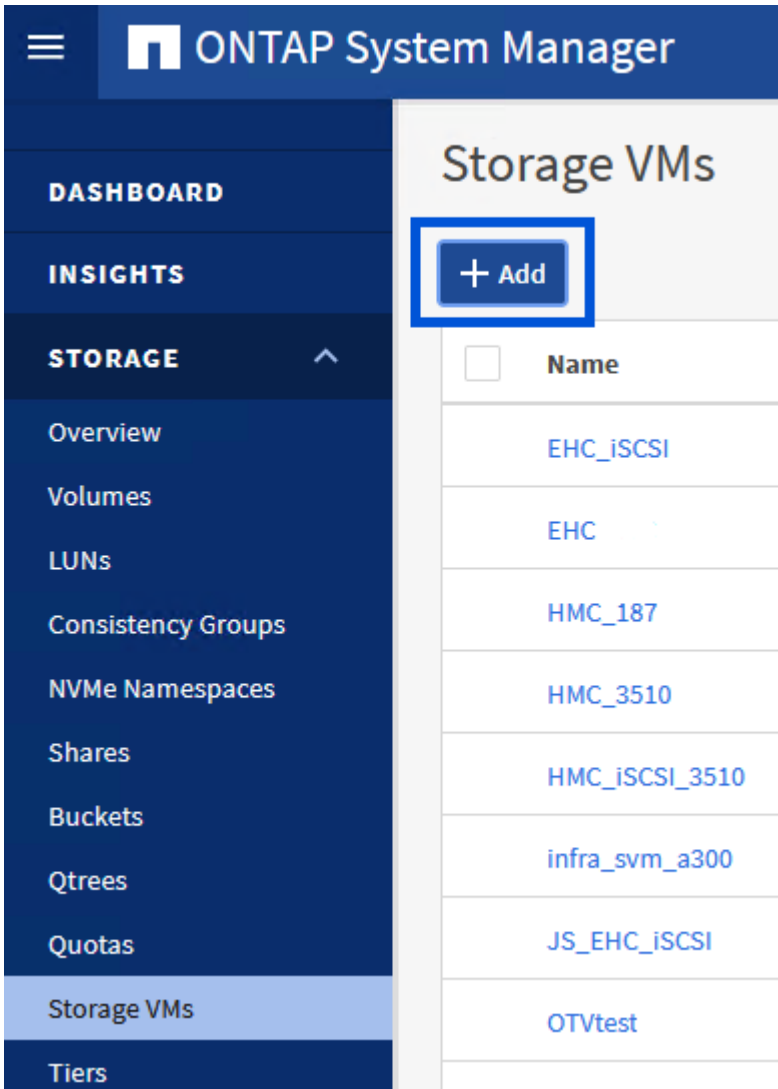
### Create SVM, LIFs and NVMe Namespace on ONTAP storage system

The following step is performed in ONTAP System Manager.

## Create the storage VM and LIFs

Complete the following steps to create an SVM together with multiple LIFs for NVMe/TCP traffic.

1. From ONTAP System Manager navigate to **Storage VMs** in the left-hand menu and click on **+ Add** to start.



2. In the **Add Storage VM** wizard provide a **Name** for the SVM, select the **IP Space** and then, under **Access Protocol**, click on the **NVMe** tab and check the box to **Enable NVMe/TCP**.

## Add Storage VM



STORAGE VM NAME

VCF\_NVMe

IPSPACE

Default

### Access Protocol

SMB/CIFS, NFS, S3

iSCSI

FC

NVMe

Enable NVMe/FC

Enable NVMe/TCP

3. In the **Network Interface** section fill in the **IP address**, **Subnet Mask**, and **Broadcast Domain and Port** for the first LIF. For subsequent LIFs the checkbox may be enabled to use common settings across all remaining LIFs, or use separate settings.



For multipathing and failover across multiple paths, NetApp recommends having a minimum of two LIFs per storage node in separate Ethernet networks for all SVMs in NVMe/TCP configurations.

## NETWORK INTERFACE

### ntaphci-a300-01

IP ADDRESS

172.21.118.189

SUBNET MASK

24

GATEWAY

[Add optional gateway](#)

BROADCAST DOMAIN AND PORT

NFS\_iSCSI

Use the same subnet mask, gateway, and broadcast domain for all of the following interfaces

IP ADDRESS

172.21.119.189

PORT

a0a-3375

### ntaphci-a300-02

IP ADDRESS

172.21.118.190

PORT

a0a-3374

IP ADDRESS

172.21.119.190

PORT

a0a-3375

## Storage VM Administration

Manage administrator account

Save

Cancel

4. Choose whether to enable the Storage VM Administration account (for multi-tenancy environments) and click on **Save** to create the SVM.

## Storage VM Administration

Manage administrator account

Save

Cancel



## Create the NVMe Namespace

NVMe namespaces are analogous to LUNs for iSCSI or FC. The NVMe Namespace must be created before a VMFS datastore can be deployed from the vSphere Client. To create the NVMe namespace, the NVMe Qualified Name (NQN) must first be obtained from each ESXi host in the cluster. The NQN is used by ONTAP to provide access control for the namespace.

Complete the following steps to create an NVMe Namespace:

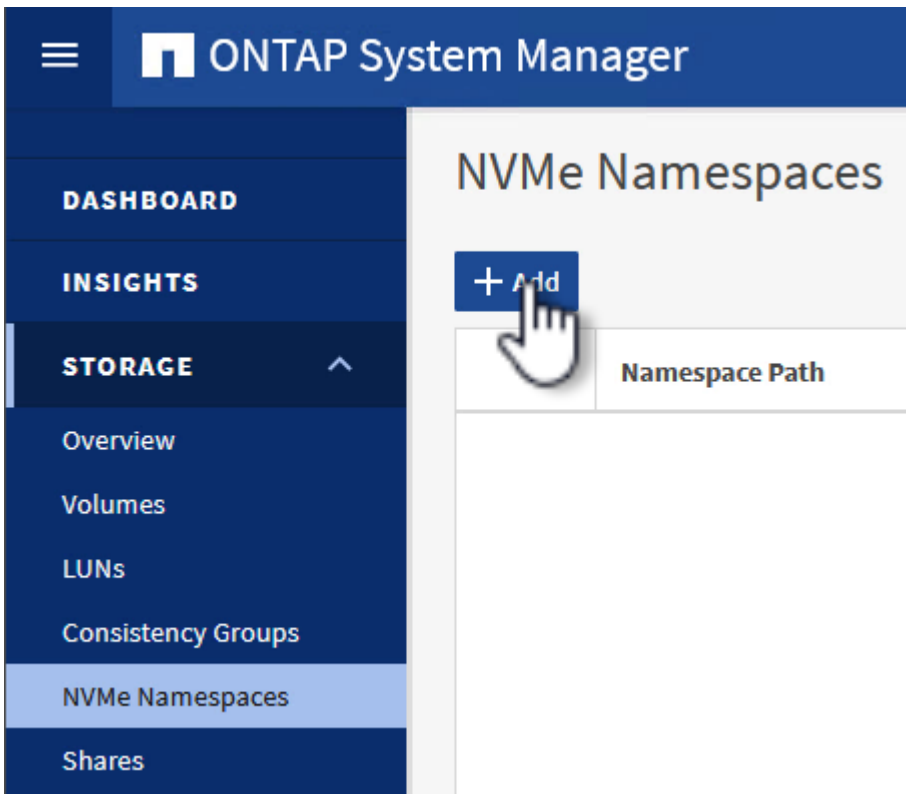
1. Open an SSH session with an ESXi host in the cluster to obtain its NQN. Use the following command from the CLI:

```
esxcli nvme info get
```

An output similar to the following should be displayed:

```
Host NQN: nqn.2014-08.com.netapp.sddc:nvme:vcf-wkld-esx01
```

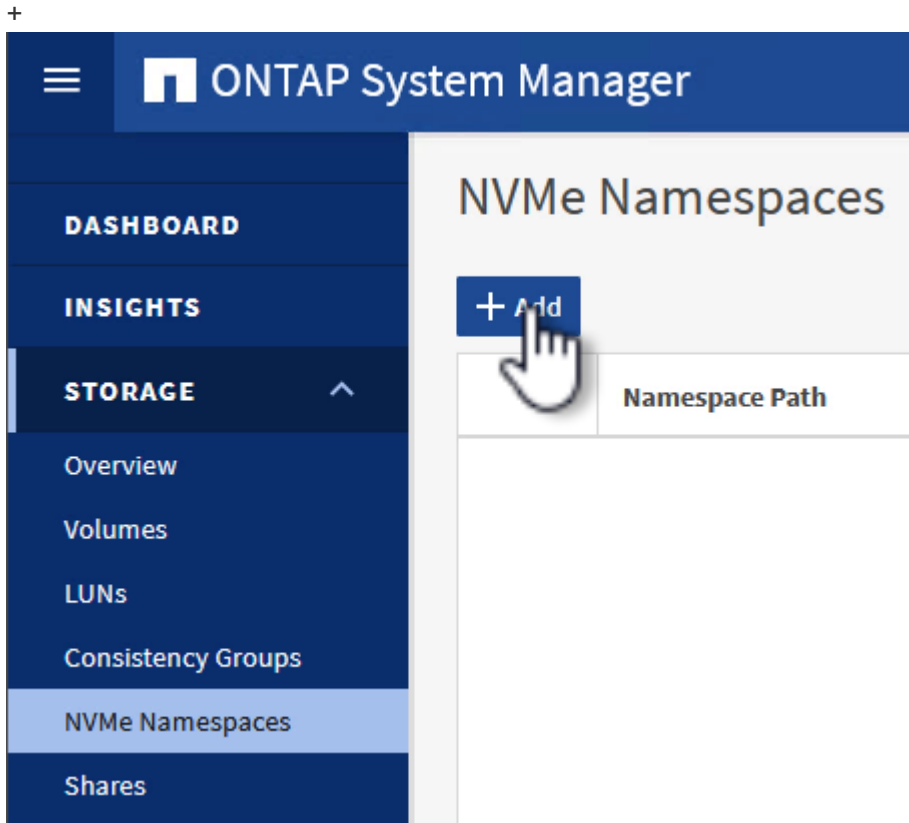
2. Record the NQN for each ESXi host in the cluster
3. From ONTAP System Manager navigate to **NVMe Namespaces** in the left-hand menu and click on **+ Add** to start.



4. On the **Add NVMe Namespace** page, fill in a name prefix, the number of namespaces to create, the size of the namespace, and the host operating system that will be accessing the namespace. In the

**Host NQN** section create a comma separated list of the NQN's previously collected from the ESXi hosts that will be accessing the namespaces.

Click on **More Options** to configure additional items such as the snapshot protection policy. Finally, click on **Save** to create the NVMe Namespace.



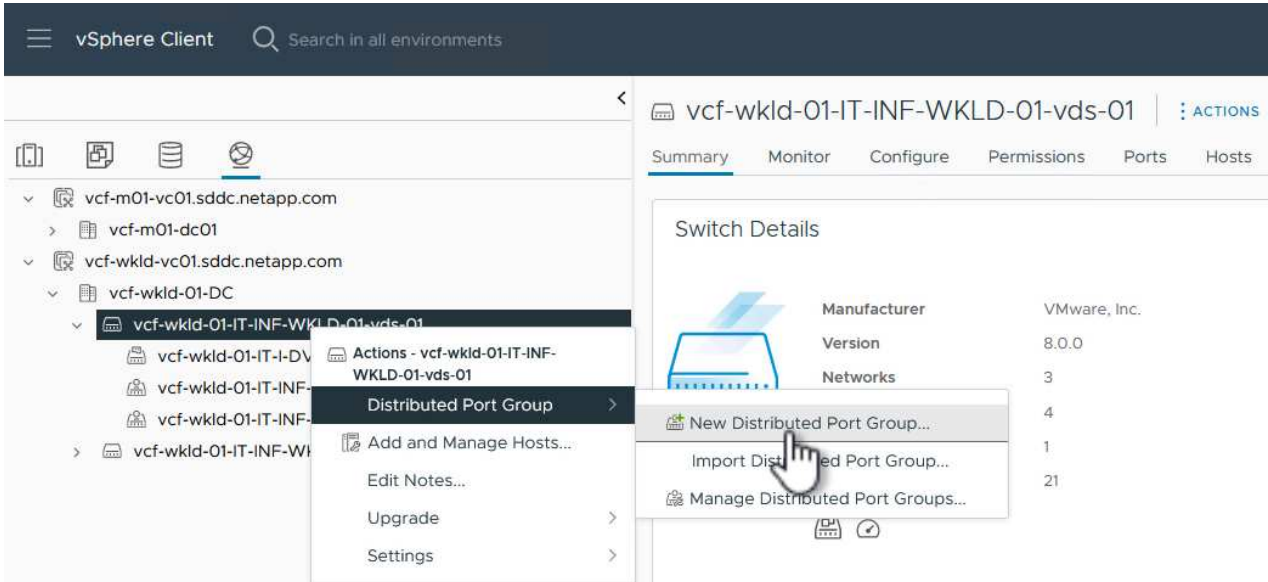
### Set up networking and NVMe software adapters on ESXi hosts

The following steps are performed on the VI workload domain cluster using the vSphere client. In this case vCenter Single Sign-On is being used so the vSphere client is common to both the management and workload domains.

## Create Distributed Port Groups for NVMe/TCP traffic

Complete the following to create a new distributed port group for each NVMe/TCP network:

1. From the vSphere client , navigate to **Inventory > Networking** for the workload domain. Navigate to the existing Distributed Switch and choose the action to create **New Distributed Port Group....**



2. In the **New Distributed Port Group** wizard fill in a name for the new port group and click on **Next** to continue.
3. On the **Configure settings** page fill out all settings. If VLANs are being used be sure to provide the correct VLAN ID. Click on **Next** to continue.

## New Distributed Port Group

1 Name and location

2 **Configure settings**

3 Ready to complete

### Configure settings

Set general properties of the new port group.

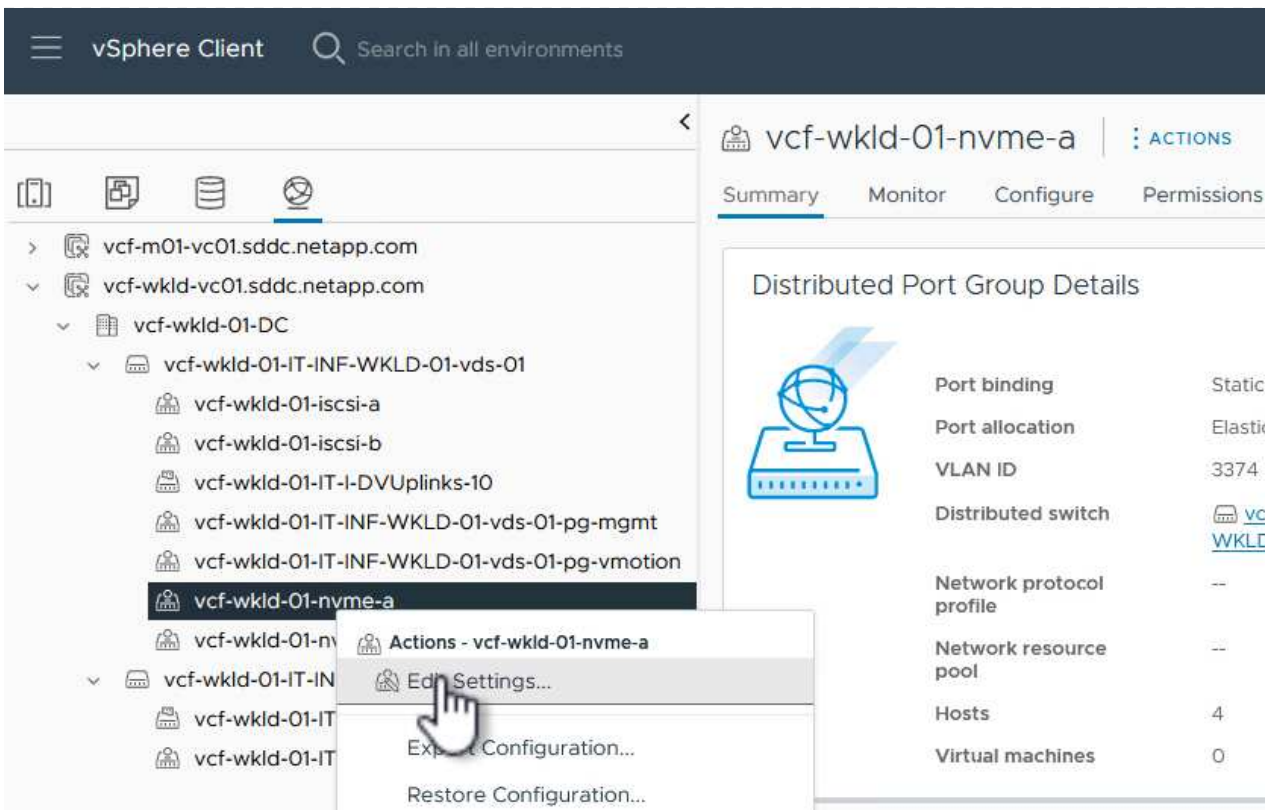
Port binding	Static binding
Port allocation	Elastic <span>?</span>
Number of ports	8
Network resource pool	(default)
VLAN	
VLAN type	VLAN
VLAN ID	3374
Advanced	
<input type="checkbox"/> Customize default policies configuration	

CANCEL

BACK

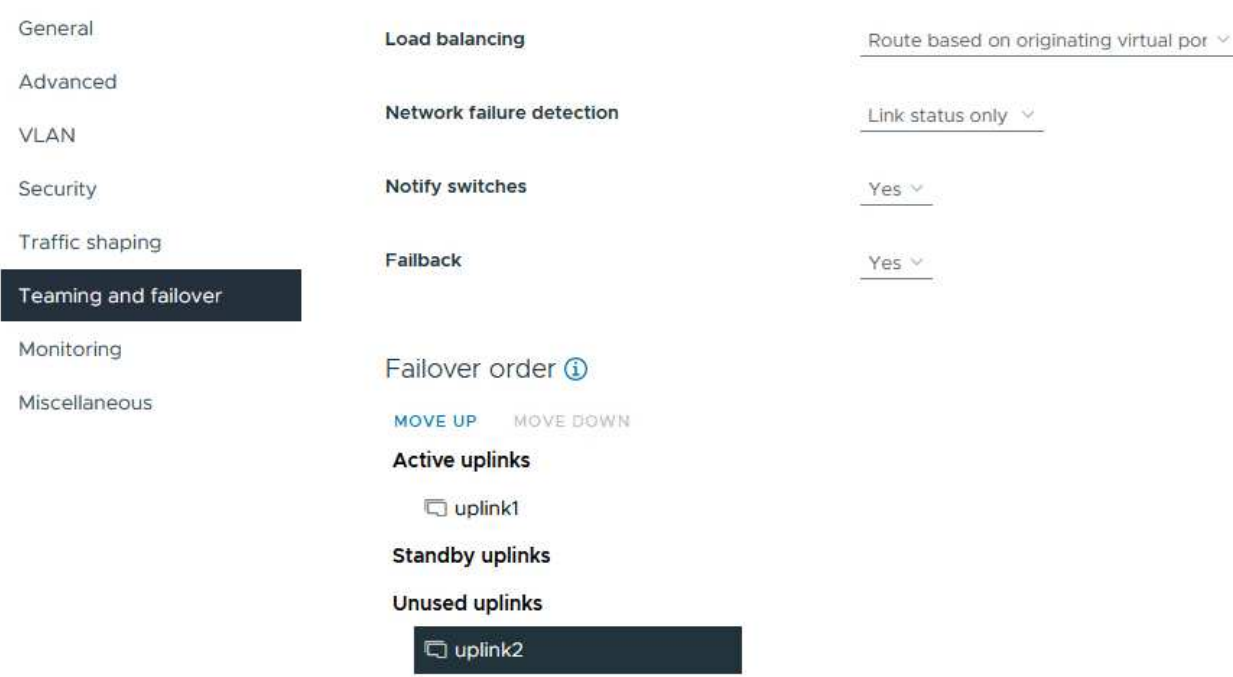
NEXT

4. On the **Ready to complete** page, review the changes and click on **Finish** to create the new distributed port group.
5. Repeat this process to create a distributed port group for the second NVMe/TCP network being used and ensure you have input the correct **VLAN ID**.
6. Once both port groups have been created, navigate to the first port group and select the action to **Edit settings....**



7. On **Distributed Port Group - Edit Settings** page, navigate to **Teaming and failover** in the left-hand menu and click on **uplink2** to move it down to **Unused uplinks**.

## Distributed Port Group - Edit Settings | vcf-wkld-01-nvme-a



8. Repeat this step for the second NVMe/TCP port group. However, this time move **uplink1** down to

## Unused uplinks.

### Distributed Port Group - Edit Settings | vcf-wkld-01-nvme-b

General

Advanced

VLAN

Security

Traffic shaping

**Teaming and fallover**

Monitoring

Miscellaneous

**Load balancing**

Route based on originating virtual port

**Network failure detection**


Link status only

**Notify switches**

Yes

**Fallback**

Yes

Failover order 

[MOVE UP](#) [MOVE DOWN](#)

**Active uplinks**

 uplink2

**Standby uplinks**

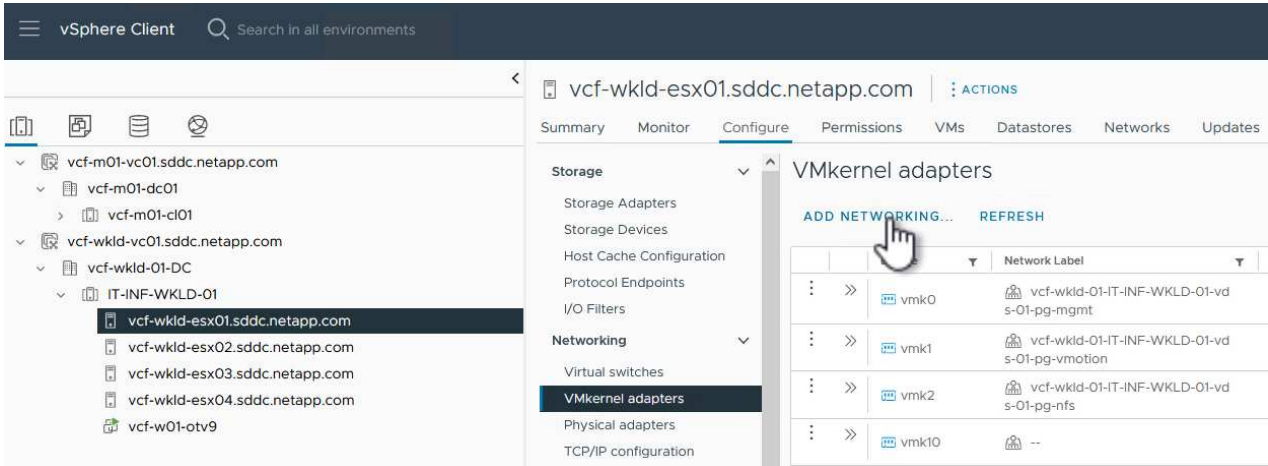
**Unused uplinks**

 uplink1

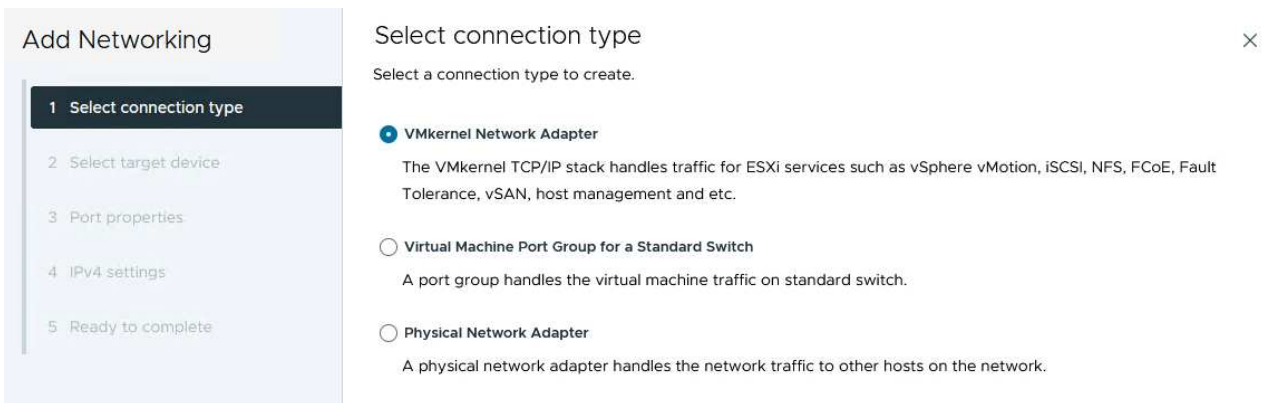
## Create VMkernel adapters on each ESXi host

Repeat this process on each ESXi host in the workload domain.

1. From the vSphere client navigate to one of the ESXi hosts in the workload domain inventory. From the **Configure** tab select **VMkernel adapters** and click on **Add Networking...** to start.



2. On the **Select connection type** window choose **VMkernel Network Adapter** and click on **Next** to continue.



3. On the **Select target device** page, choose one of the distributed port groups for iSCSI that was created previously.

## Add Networking

1 Select connection type

2 Select target device

3 Port properties

4 IPv4 settings

5 Ready to complete

## Select target device








×

Select a target device for the new connection.

- Select an existing network
- Select an existing standard switch
- New standard switch

Quick Filter

Enter value

	Name	NSX Port Group ID	Distributed Switch
<input type="radio"/>	 vcf-wkld-01-iscsi-a	--	vcf-wkld-01-IT-INF-WKLD-01-vds-01
<input type="radio"/>	 vcf-wkld-01-iscsi-b	--	vcf-wkld-01-IT-INF-WKLD-01-vds-01
<input type="radio"/>	 vcf-wkld-01-IT-INF-WKLD-01-vds-01-pg-mgmt	--	vcf-wkld-01-IT-INF-WKLD-01-vds-01
<input type="radio"/>	 vcf-wkld-01-IT-INF-WKLD-01-vds-01-pg-nfs	--	vcf-wkld-01-IT-INF-WKLD-01-vds-02
<input type="radio"/>	 vcf-wkld-01-IT-INF-WKLD-01-vds-01-pg-vmotion	--	vcf-wkld-01-IT-INF-WKLD-01-vds-01
<input checked="" type="radio"/>	 vcf-wkld-01-nvme-a	--	vcf-wkld-01-IT-INF-WKLD-01-vds-01
<input type="radio"/>	 vcf-wkld-01-nvme-b	--	vcf-wkld-01-IT-INF-WKLD-01-vds-01

Manage Columns 7 Items

CANCEL

BACK

NEXT

Packages

4. On the **Port properties** page click the box for **NVMe over TCP** and click on **Next** to continue.



### Add Networking

- 1 Select connection type
- 2 Select target device
- 3 Port properties
- 4 IPv4 settings
- 5 Ready to complete

### Port properties

Specify VMkernel port settings.

**Network label**

**MTU**

**TCP/IP stack**

**Available services**

**Enabled services**

<input checked="" type="checkbox"/> vMotion	<input type="checkbox"/> vSphere Replication NFC	<input type="checkbox"/> NVMe over RDMA
<input type="checkbox"/> Provisioning	<input type="checkbox"/> vSAN	
<input type="checkbox"/> Fault Tolerance logging	<input type="checkbox"/> vSAN Witness	
<input type="checkbox"/> Management	<input type="checkbox"/> vSphere Backup NFC	
<input type="checkbox"/> vSphere Replication	<input checked="" type="checkbox"/> NVMe over TCP	

CANCEL BACK NEXT

5. On the **IPv4 settings** page fill in the **IP address**, **Subnet mask**, and provide a new Gateway IP address (only if required). Click on **Next** to continue.

### Add Networking

- 1 Select connection type
- 2 Select target device
- 3 Port properties
- 4 IPv4 settings
- 5 Ready to complete

### IPv4 settings

Specify VMkernel IPv4 settings.

Obtain IPv4 settings automatically

Use static IPv4 settings

**IPv4 address**

**Subnet mask**

**Default gateway**  Override default gateway for this adapter

**DNS server addresses**

6. Review the your selections on the **Ready to complete** page and click on **Finish** to create the VMkernel adapter.

## Add Networking

- 1 Select connection type
- 2 Select target device
- 3 Port properties
- 4 IPv4 settings
- 5 Ready to complete

## Ready to complete

Review your selections before finishing the wizard

### ▼ Select target device

Distributed port group	vcf-wkld-01-nvme-a
Distributed switch	vcf-wkld-01-IT-INF-WKLD-01-vds-01

### ▼ Port properties

New port group	vcf-wkld-01-nvme-a (vcf-wkld-01-IT-INF-WKLD-01-vds-01)
MTU	9000
vMotion	Disabled
Provisioning	Disabled
Fault Tolerance logging	Disabled
Management	Disabled
vSphere Replication	Disabled
vSphere Replication NFC	Disabled
vSAN	Disabled
vSAN Witness	Disabled
vSphere Backup NFC	Disabled
NVMe over TCP	Enabled
NVMe over RDMA	Disabled

### ▼ IPv4 settings

IPv4 address	172.21.118.191 (static)
Subnet mask	255.255.255.0

CANCEL

BACK

FINISH

Packages

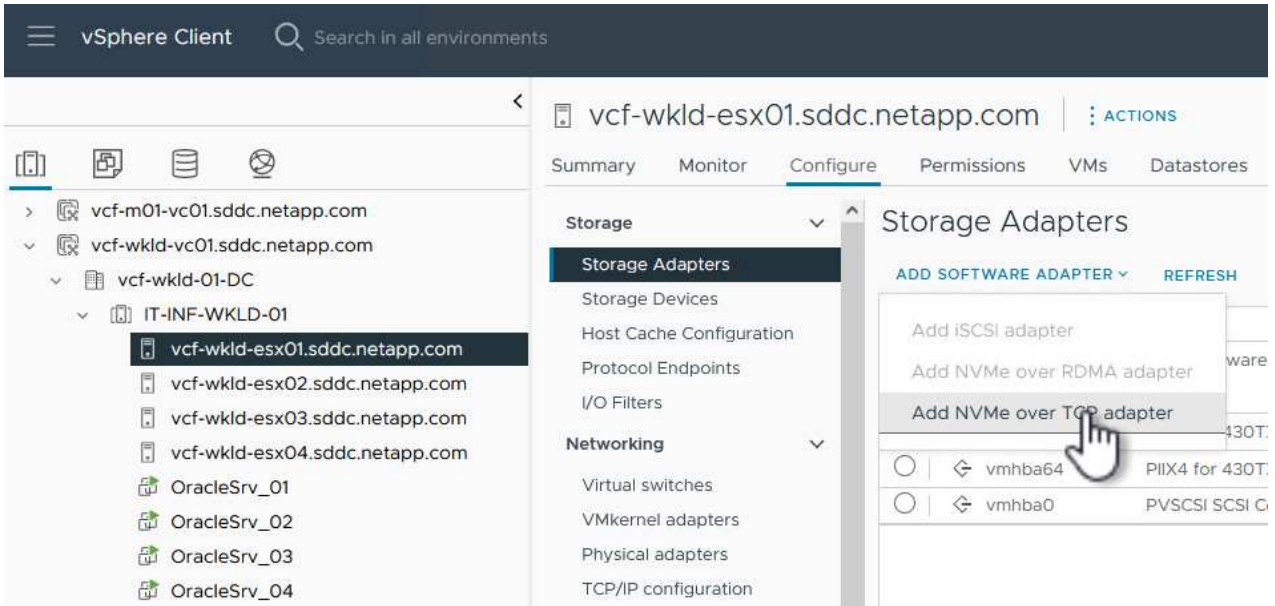
7. Repeat this process to create a VMkernel adapter for the second iSCSI network.

## Add NVMe over TCP adapter

Each ESXi host in the workload domain cluster must have an NVMe over TCP software adapter installed for every established NVMe/TCP network dedicated to storage traffic.

To install NVMe over TCP adapters and discover the NVMe controllers, complete the following steps:

1. In the vSphere client navigate to one of the ESXi hosts in the workload domain cluster. From the **Configure** tab click on **Storage Adapters** in the menu and then, from the **Add Software Adapter** drop-down menu, select **Add NVMe over TCP adapter**.



2. In the **Add Software NVMe over TCP adapter** window, access the **Physical Network Adapter** drop-down menu and select the correct physical network adapter on which to enable the NVMe adapter.

### Add Software NVMe over TCP adapter

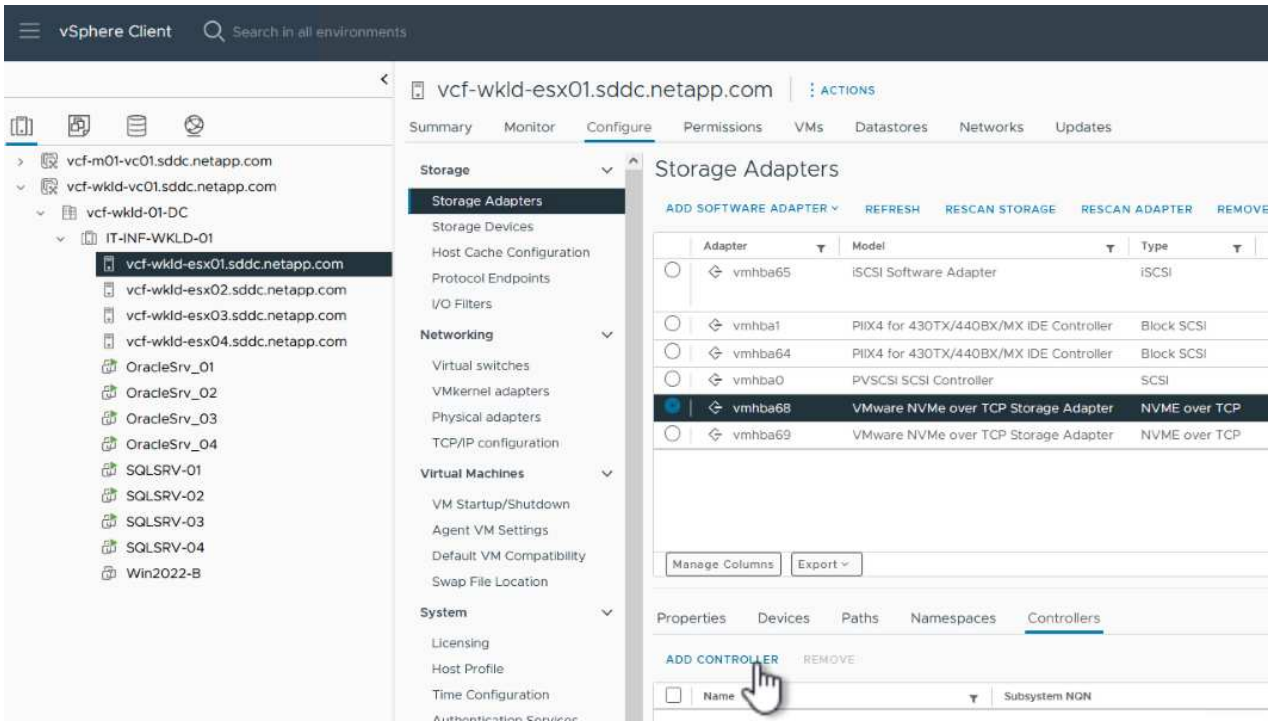
vcf-wkld-esx01.sddc.netapp.com

Enable software NVMe adapter on the selected physical network adapter.

#### Physical Network Adapter



- Repeat this process for the second network assigned to NVMe over TCP traffic, assigning the correct physical adapter.
- Select one of the newly installed NVMe over TCP adapters and, on the **Controllers** tab, select **Add Controller**.



- In the **Add controller** window, select the **Automatically** tab and complete the following steps.
  - Fill in an IP addresses for one of the SVM logical interfaces on the same network as the physical adapter assigned to this NVMe over TCP adapter.
  - Click on the **Discover Controllers** button.
  - From the list of discovered controllers, click the check box for the two controllers with network addresses aligned with this NVMe over TCP adapter.
  - Click on the **OK** button to add the selected controllers.

## Add controller | vmhba68



Automatically Manually

Host NQN

nqn.2014-08.com.netapp.sddc:nvme:vcf-wkld-...



IP

172.21.118.189

Enter IPv4 / IPv6 address

Central discovery controller

Port Number

Range more from 0

Digest parameter

Header digest

Data digest

DISCOVER CONTROLLERS

2

Select which controller to connect

<input type="checkbox"/>	Id	Subsystem NQN	Transport Type	IP	Port Number
<input checked="" type="checkbox"/>	65535	nqn.1992-08.com.netapp:sn.64df3069fb6411eea55100a098b46a21:subsystem.VCF_WKLD_04_NVMe_VCF_WKLD_04_NVMe	nvme	172.21.118.189	4420
<input checked="" type="checkbox"/>	65535	nqn.1992-08.com.netapp:sn.64df3069fb6411eea55100a098b46a21:subsystem.VCF	nvme	172.21.118.190	4420

4 items

3

4

OK

6. After a few seconds you should see the NVMe namespace appear on the Devices tab.

### Storage Adapters

ADD SOFTWARE ADAPTER ▾ REFRESH RESCAN STORAGE RESCAN ADAPTER REMOVE

Adapter	Model	Type	Status	Identifier	Targets	Devices	Paths
vmhba65	iSCSI Software Adapter	iSCSI	Online	iscsi_vmk(iqn.1998-01.com.vmware:vcf-wkld-esx01.sddc.netapp.com:794177624:65)	4	2	8
vmhba1	PIIX4 for 430TX/440BX/MX IDE Controller	Block SCSI	Unknown	--	1	1	1
vmhba64	PIIX4 for 430TX/440BX/MX IDE Controller	Block SCSI	Unknown	--	0	0	0
vmhba0	PVSCSI SCSI Controller	SCSI	Unknown	--	3	3	3
<b>vmhba68</b>	<b>VMware NVMe over TCP Storage Adapter</b>	<b>NVMe over TCP</b>	<b>Online</b>	--	<b>1</b>	<b>1</b>	<b>1</b>
vmhba69	VMware NVMe over TCP Storage Adapter	NVMe over TCP	Online	--	0	0	0

6 items

Properties Devices Paths Namespaces Controllers

REFRESH ATTACH DETACH RENAME

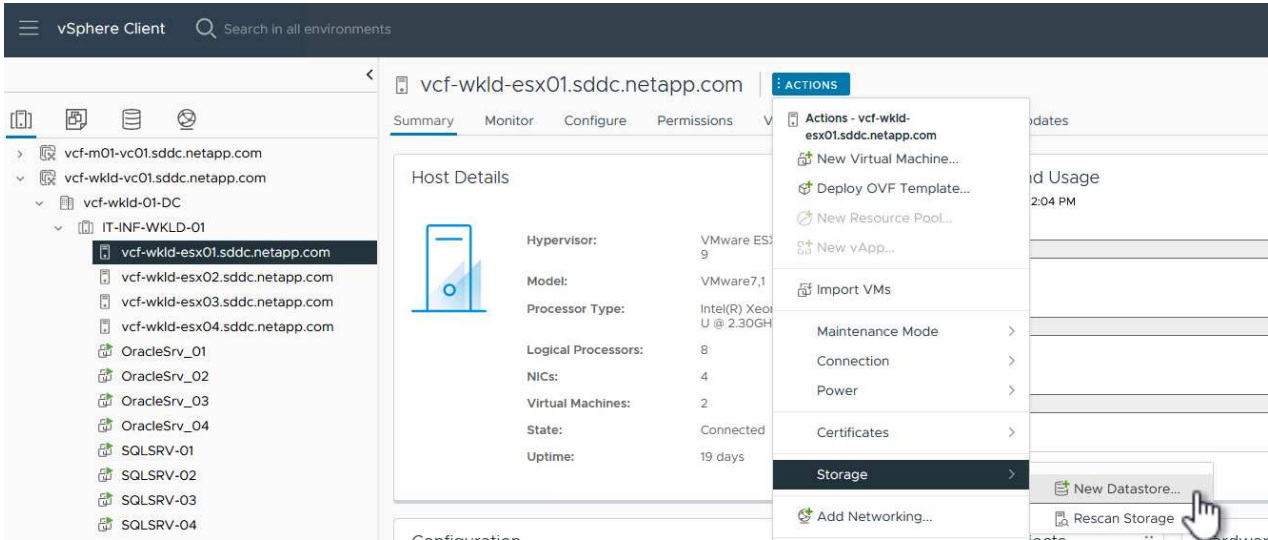
Name	LUN	Type	Capacity	Datastore	Operational State	Hardware Acceleration	Drive Type	Transport
NVMe TCP Disk (uuid.929a6a90457647849146e09d6e55b076)	0	disk	3.00 TB	Not Consumed	Attached	Supported	Flash	TCPRAN:RT

7. Repeat this procedure to create an NVMe over TCP adapter for the second network established for NVMe/TCP traffic.

## Deploy NVMe over TCP datastore

To create a VMFS datastore on the NVMe namespace, complete the following steps:

1. In the vSphere client navigate to one of the ESXi hosts in the workload domain cluster. From the **Actions** menu select **Storage > New Datastore....**



2. In the **New Datastore** wizard, select **VMFS** as the type. Click on **Next** to continue.
3. On the **Name and device selection** page, provide a name for the datastore and select the NVMe namespace from the list of available devices.

## New Datastore

1 Type

2 Name and device selection

3 VMFS version

4 Partition configuration

5 Ready to complete

## Name and device selection

Specify datastore name and a disk/LUN for provisioning the datastore.

Name

	Name	LUN	Capacity	Hardware Acceleration	Drive Type	Sector Format	Cl V S
<input checked="" type="radio"/>	NVMe TCP Disk (uuid:929a6a90457647849146e09d6e55b076)	0	3.00 TB	Supported	Flash	512e	N
<input type="radio"/>	Local VMware Disk (naa:6000c29f83dcf1e42d230340deb66036)	0	4.00 GB	Not supported	Flash	512n	N
<input type="radio"/>	Local VMware Disk (naa:6000c291464644a835bc23d384813ac0)	0	75.00 GB	Not supported	Flash	512n	N

Manage Columns Export 3 items

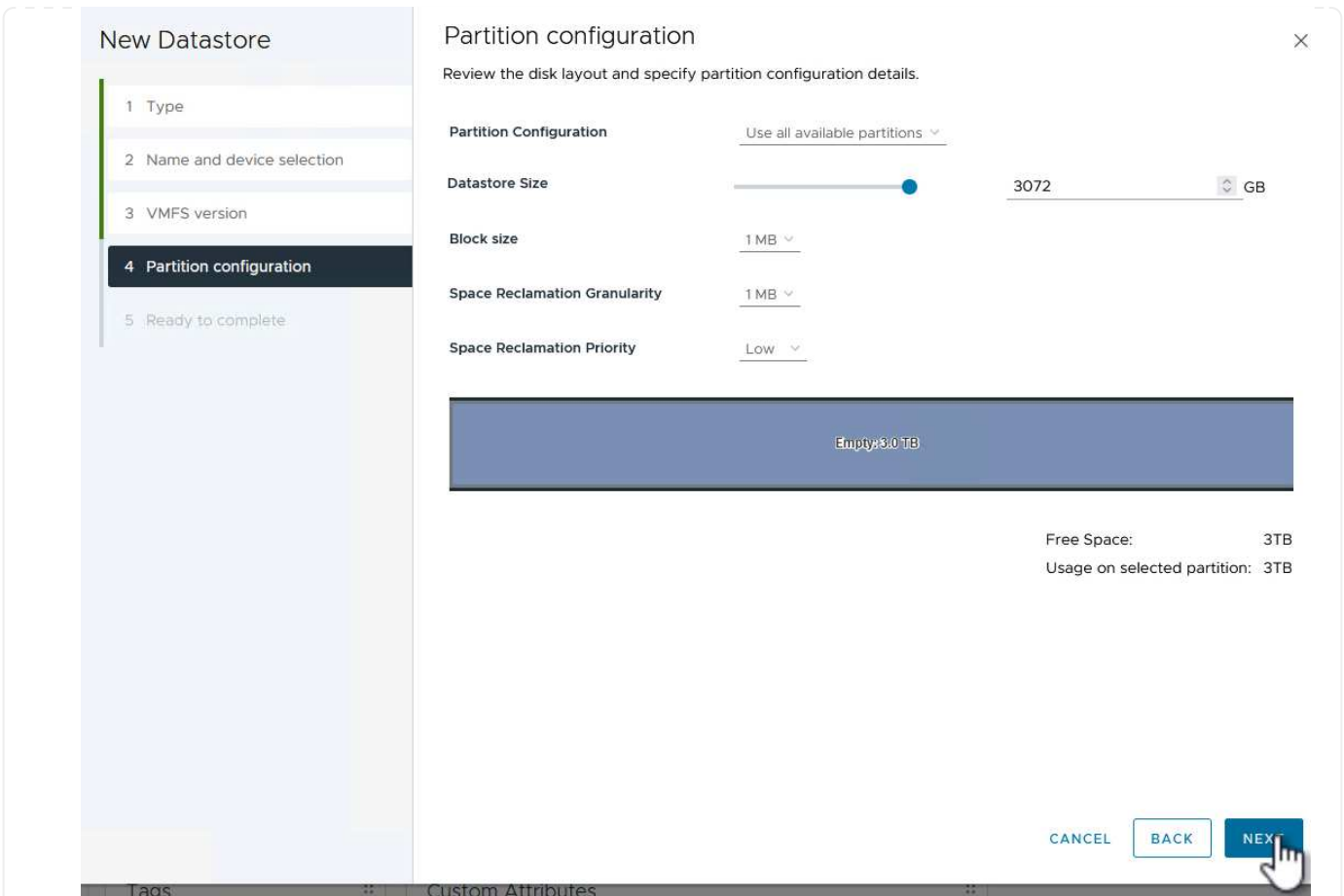
CANCEL

BACK

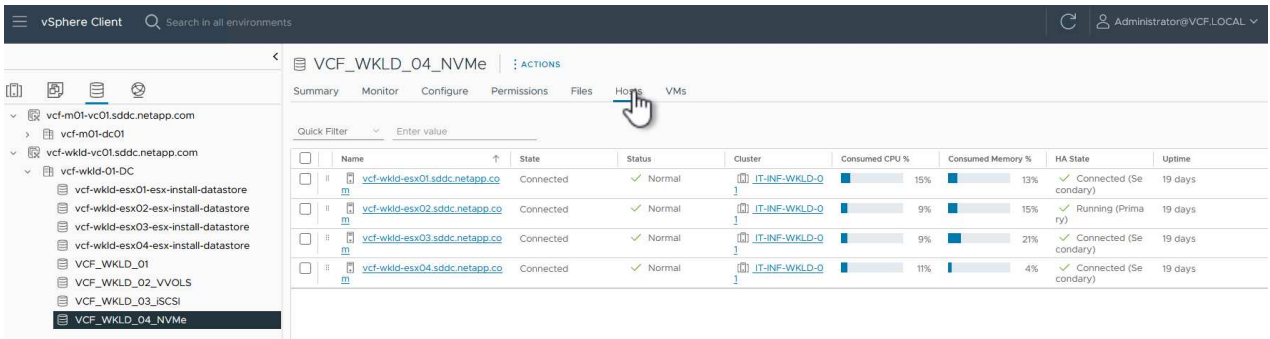
NEXT

4. On the **VMFS version** page select the version of VMFS for the datastore.
5. On the **Partition configuration** page, make any desired changes to the default partition scheme. Click on **Next** to continue.





6. On the **Ready to complete** page, review the summary and click on **Finish** to create the datastore.
7. Navigate to the new datastore in inventory and click on the **Hosts** tab. If configured correctly, all ESXi hosts in the cluster should be listed and have access to the new datastore.



### Additional information

For information on configuring ONTAP storage systems refer to the [ONTAP 9 Documentation](#) center.

For information on configuring VCF refer to [VMware Cloud Foundation Documentation](#).

In this scenario we will demonstrate how to deploy and use the SnapCenter Plug-in for VMware vSphere (SCV) to backup and restore VM's and datastores on a VCF workload domain. SCV uses ONTAP snapshot technology to take fast and efficient backup copies of the ONTAP storage volumes hosting vSphere datastores. SnapMirror and SnapVault technology are used to create secondary backups on a separate storage system and with retention policies that mimic the original volume or can be independent of the original volume for longer term retention.

iSCSI is used as the storage protocol for the VMFS datastore in this solution.

Author: Josh Powell

## Use SnapCenter Plug-in for VMware vSphere to protect VMs on VCF Workload Domains

### Scenario Overview

This scenario covers the following high level steps:

- Deploy the SnapCenter Plug-in for VMware vSphere (SCV) on the VI workload domain.
- Add storage systems to SCV.
- Create backup policies in SCV.
- Create Resource Groups in SCV.
- Use SCV to backup datastores or specific VMs.
- Use SCV to restores VMs to an alternate location in the cluster.
- Use SCV to restores files to a windows file system.

### Prerequisites

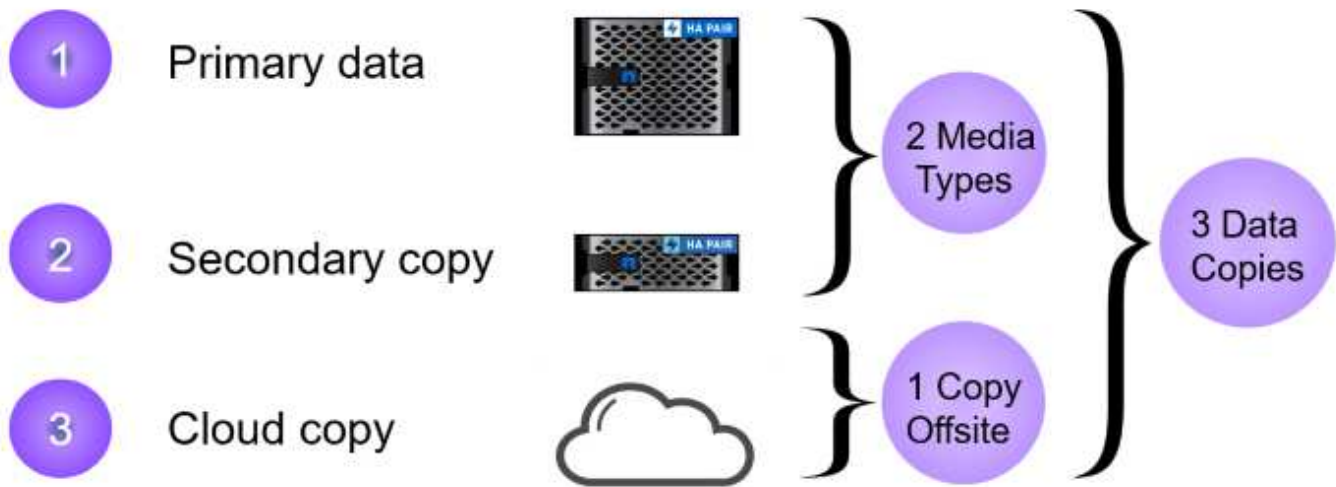
This scenario requires the following components and configurations:

- An ONTAP ASA storage system with iSCSI VMFS datastores allocated to the workload domain cluster.
- A secondary ONTAP storage system configured to received secondary backups using SnapMirror.
- VCF management domain deployment is complete and the vSphere client is accessible.
- A VI workload domain has been previously deployed.
- Virtual machines are present on the cluster SCV is designated to protect.

For information on configuring iSCSI VMFS datastores as supplemental storage refer to [iSCSI as supplemental storage for Management Domains](#) in this documentation. The process for using OTV to deploy datastores is identical for management and workload domains.



In addition to replicating backups taken with SCV to secondary storage, offsite copies of data can be made to object storage on one of the three (3) leading cloud providers using NetApp BlueXP backup and recovery for VMs. For more information refer to the solution [3-2-1 Data Protection for VMware with SnapCenter Plug-in and BlueXP backup and recovery for VMs](#).



### Deployment Steps

To deploy the SnapCenter Plug-in and use it to create backups, and restore VMs and datastores, complete the following steps:

#### Deploy and use SCV to protect data in a VI workload domain

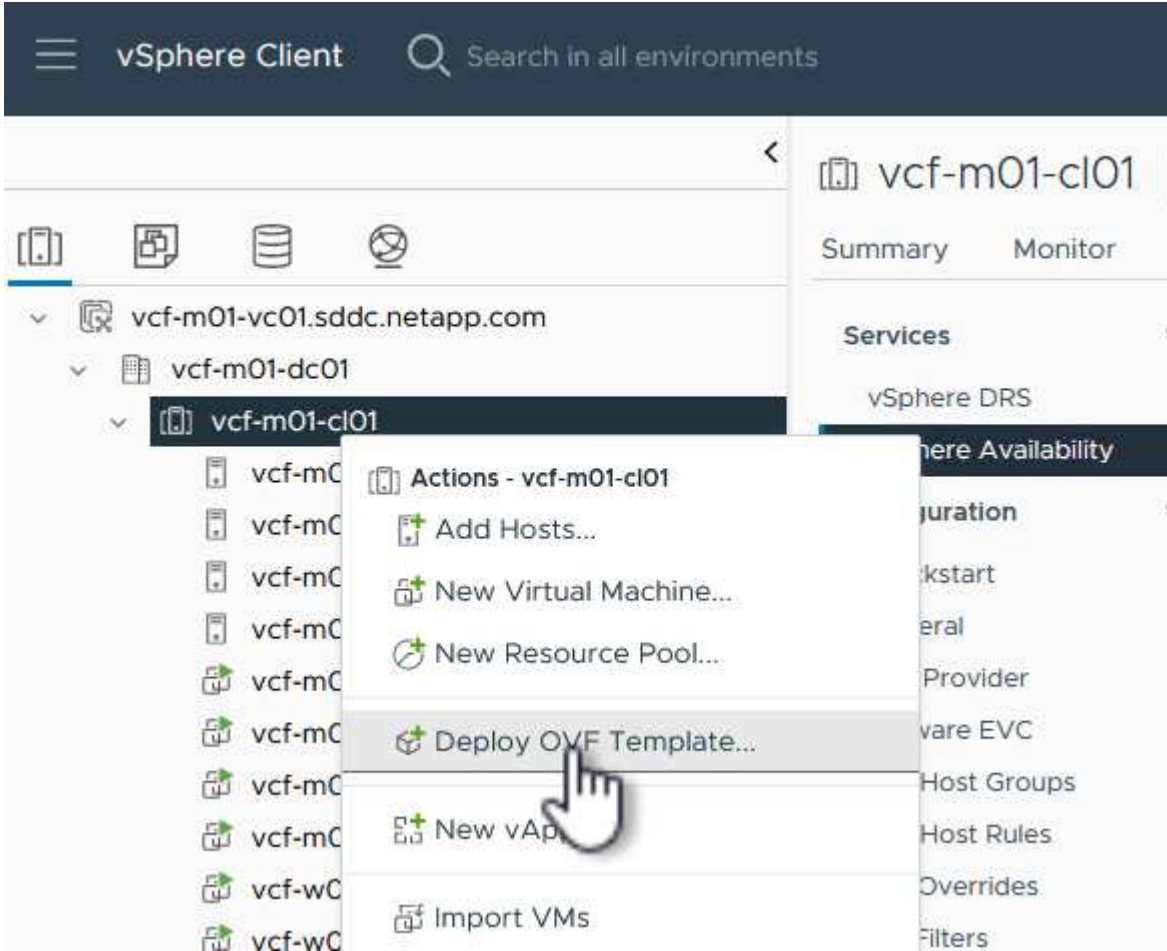
Complete the following steps to deploy, configure, and use SCV to protect data in a VI workload domain:

## Deploy the SnapCenter Plug-in for VMware vSphere

The SnapCenter Plug-in is hosted on the VCF management domain but registered to the vCenter for the VI workload domain. One SCV instance is required for each vCenter instance and, keep in mind that, a Workload domain can include multiple clusters managed by a single vCenter instance.

Complete the following steps from the vCenter client to deploy SCV to the VI workload domain:

1. Download the OVA file for the SCV deployment from the download area of the NetApp support site [HERE](#).
2. From the management domain vCenter Client, select to **Deploy OVF Template...**



3. In the **Deploy OVF Template** wizard, click on the **Local file** radio button and then select to upload the previously downloaded OVF template. Click on **Next** to continue.

## Deploy OVF Template

### 1 Select an OVF template

2 Select a name and folder

3 Select a compute resource

4 Review details

5 Select storage

6 Ready to complete

## Select an OVF template

Select an OVF template from remote URL or local file system

Enter a URL to download and install the OVF package from the Internet, or browse to a location accessible from your computer, such as a local hard drive, a network share, or a CD/DVD drive.

URL

http | https://remoteserver-address/filetoinstall.ovf | .ova

Local file

UPLOAD FILES scv-5.OP2-240310\_1514.ova

- On the **Select name and folder** page, provide a name for the SCV data broker VM and a folder on the management domain. Click on **Next** to continue.
- On the **Select a compute resource** page, select the management domain cluster or specific ESXi host within the cluster to install the VM to.
- Review information pertaining to the OVF template on the **Review details** page and agree to the licensing terms on the **Licensing agreements** page.
- On the **Select storage** page choose the datastore which the VM will be installed to and select the **virtual disk format** and **VM Storage Policy**. In this solution, the VM will be installed on an iSCSI VMFS datastore located on an ONTAP storage system, as previously deployed in a separate section of this documentation. Click on **Next** to continue.

## Deploy OVF Template

1 Select an OVF template

2 Select a name and folder

3 Select a compute resource

4 Review details

5 License agreements

6 Select storage

7 Select networks

8 Customize template

9 Ready to complete

## Select storage

Select the storage for the configuration and disk files

Encrypt this virtual machine ⓘ

Select virtual disk format Thin Provision ▾

VM Storage Policy Datastore Default ▾

Disable Storage DRS for this virtual machine

Name	Storage Compatibility	Capacity	Provisioned	Free	
<input checked="" type="radio"/> mgmt_01_iscsi	--	3 TB	3.71 TB	2.5 TB	▼
<input type="radio"/> vcf-m01-cl01-ds-vsant01	--	999.97 GB	49.16 GB	957.54 GB	▼
<input type="radio"/> vcf-m01-esx01-esx-install-datastore	--	25.75 GB	4.56 GB	21.19 GB	▼
<input type="radio"/> vcf-m01-esx02-esx-install-datastore	--	25.75 GB	4.56 GB	21.19 GB	▼
<input type="radio"/> vcf-m01-esx03-esx-install-datastore	--	25.75 GB	4.56 GB	21.19 GB	▼
<input type="radio"/> vcf-m01-esx04-esx-install-datastore	--	25.75 GB	4.56 GB	21.19 GB	▼

Manage Columns Items per page 10 6 items

### Compatibility

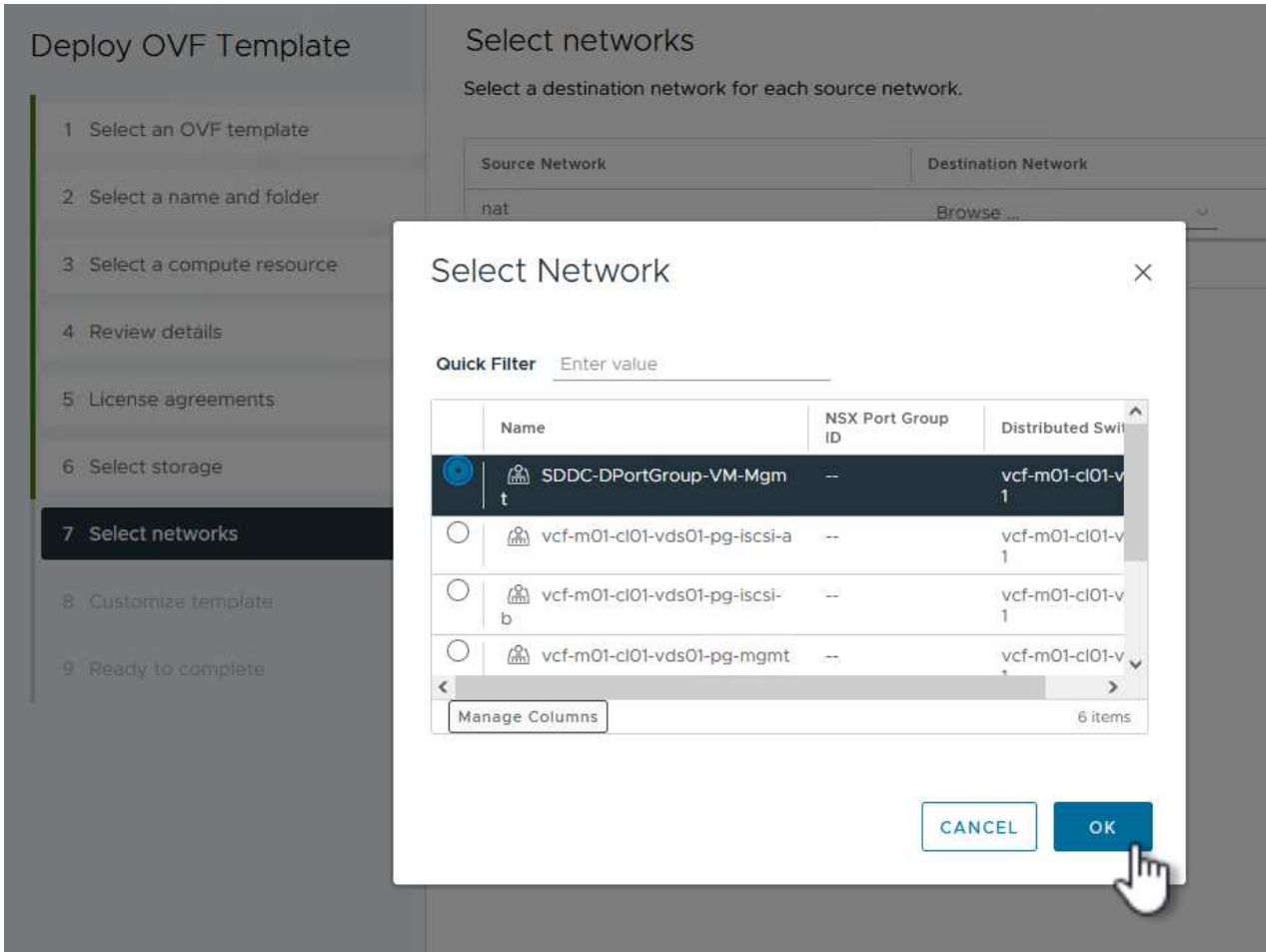
✓ Compatibility checks succeeded.

CANCEL

BACK

NEXT

8. On the **Select network** page, select the management network that is able to communicate with the workload domain vCenter appliance and both the primary and secondary ONTAP storage systems.



9. On the **Customize template** page fill out all information required for the deployment:

- FQDN or IP, and credentials for the workload domain vCenter appliance.
- Credentials for the SCV administrative account.
- Credentials for the SCV maintenance account.
- IPv4 Network Properties details (IPv6 can also be used).
- Date and Time settings.

Click on **Next** to continue.

## Deploy OVF Template

- 1 Select an OVF template
- 2 Select a name and folder
- 3 Select a compute resource
- 4 Review details
- 5 License agreements
- 6 Select storage
- 7 Select networks
- 8 Customize template**
- 9 Ready to complete

## Customize template

Customize the deployment properties of this software solution.

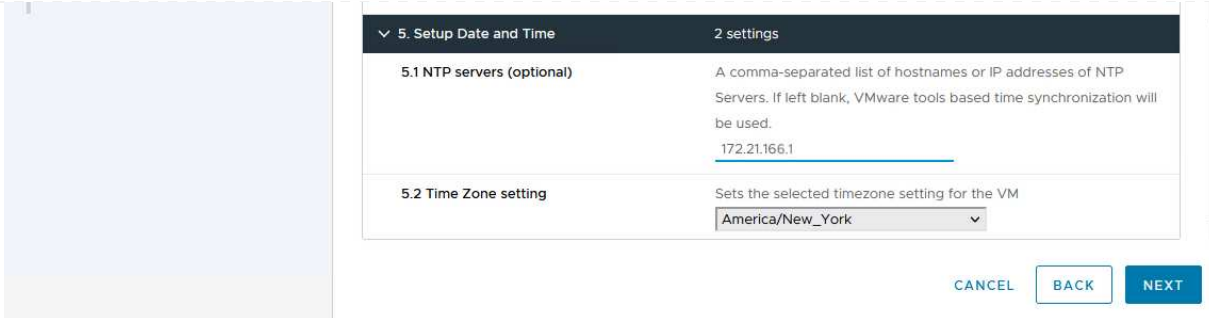
<b>1. Register to existing vCenter</b>		4 settings
1.1 vCenter Name(FQDN) or IP Address	<input type="text" value="cf-wkld-vc01.sddc.netapp.com"/>	
1.2 vCenter username	<input type="text" value="administrator@vcf.local"/>	
1.3 vCenter password	Password	<input type="password" value="....."/>
	Confirm Password	<input type="password" value="....."/>
1.4 vCenter port	<input type="text" value="443"/>	
<b>2. Create SCV Credentials</b>		2 settings
2.1 Username	<input type="text" value="admin"/>	
2.2 Password	Password	<input type="password" value="....."/>
	Confirm Password	<input type="password" value="....."/>
<b>3. System Configuration</b>		1 settings

## Deploy OVF Template

- 1 Select an OVF template
- 2 Select a name and folder
- 3 Select a compute resource
- 4 Review details
- 5 License agreements
- 6 Select storage
- 7 Select networks
- 8 Customize template**
- 9 Ready to complete

## Customize template

<b>4.2 Setup IPv4 Network Properties</b>		6 settings
4.2.1 IPv4 Address	IP address for the appliance. (Leave blank if DHCP is desired) <input type="text" value="172.21.166.148"/>	
4.2.2 IPv4 Netmask	Subnet to use on the deployed network. (Leave blank if DHCP is desired) <input type="text" value="255.255.255.0"/>	
4.2.3 IPv4 Gateway	Gateway on the deployed network. (Leave blank if DHCP is desired) <input type="text" value="172.21.166.1"/>	
4.2.4 IPv4 Primary DNS	Primary DNS server's IP address. (Leave blank if DHCP is desired) <input type="text" value="10.61.185.231"/>	
4.2.5 IPv4 Secondary DNS	Secondary DNS server's IP address. (optional - Leave blank if DHCP is desired) <input type="text" value="10.61.186.231"/>	
4.2.6 IPv4 Search Domains (optional)	Comma separated list of search domain names to use when resolving host names. (Leave blank if DHCP is desired) <input type="text" value="netapp.com,sddc.netapp.com"/>	
<b>3.3 Setup IPv6 Network Properties</b>		6 settings
4.3.1 IPv6 Address	IP address for the appliance. (Leave blank if DHCP is desired) <input type="text"/>	
4.3.2 IPv6 PrefixLen	Prefix length to use on the deployed network. (Leave blank if DHCP is desired) <input type="text"/>	



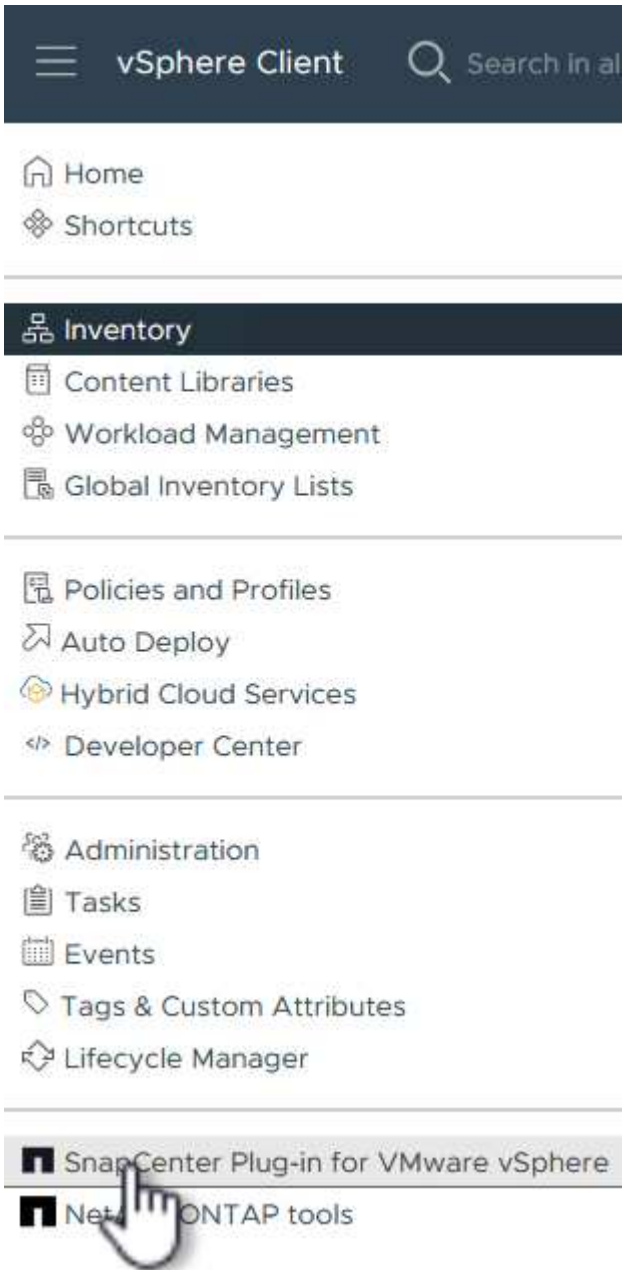
10. Finally, on the **Ready to complete page**, review all settings and click on Finish to start the deployment.



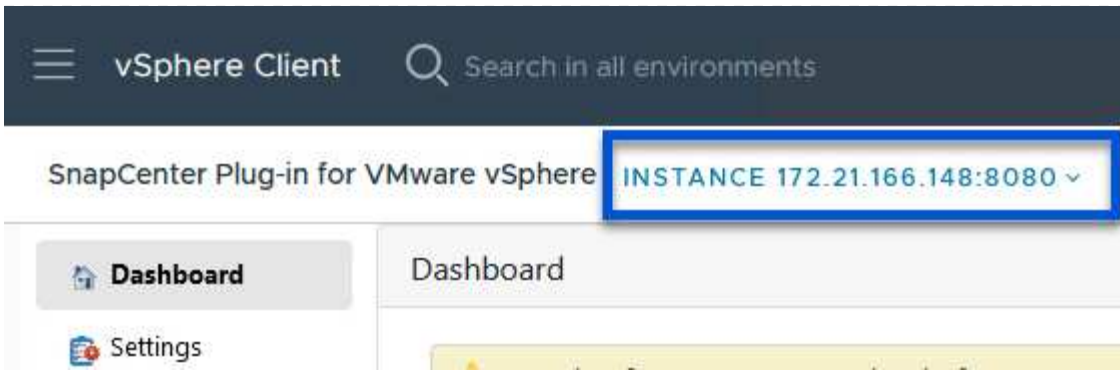
## Add Storage Systems to SCV

Once the SnapCenter Plug-in is installed complete the following steps to add storage systems to SCV:

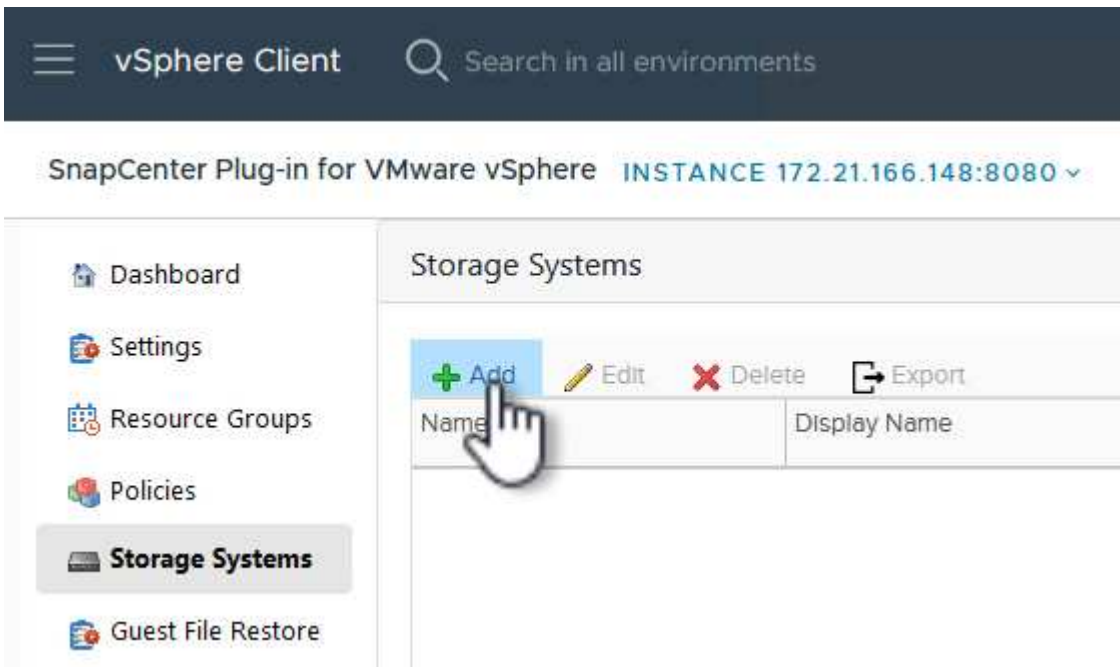
1. SCV can be accessed from the main menu in the vSphere Client.



2. At the top of the SCV UI interface, select the correct SCV instance that matches the vSphere cluster to be protected.



3. Navigate to **Storage Systems** in the left-hand menu and click on **Add** to get started.



4. On the **Add Storage System** form, fill in the IP address and credentials of the ONTAP storage system to be added, and click on **Add** to complete the action.

## Add Storage System



Storage System	<input type="text" value="172.16.9.25"/>
Authentication Method	<input checked="" type="radio"/> Credentials <input type="radio"/> Certificate
Username	<input type="text" value="admin"/>
Password	<input type="password" value="••••••••"/>
Protocol	<input type="text" value="HTTPS"/>
Port	<input type="text" value="443"/>
Timeout	<input type="text" value="60"/> Seconds
<input type="checkbox"/> Preferred IP	<input type="text" value="Preferred IP"/>

### Event Management System(EMS) & AutoSupport Setting

- Log Snapcenter server events to syslog
- Send AutoSupport Notification for failed operation to storage system



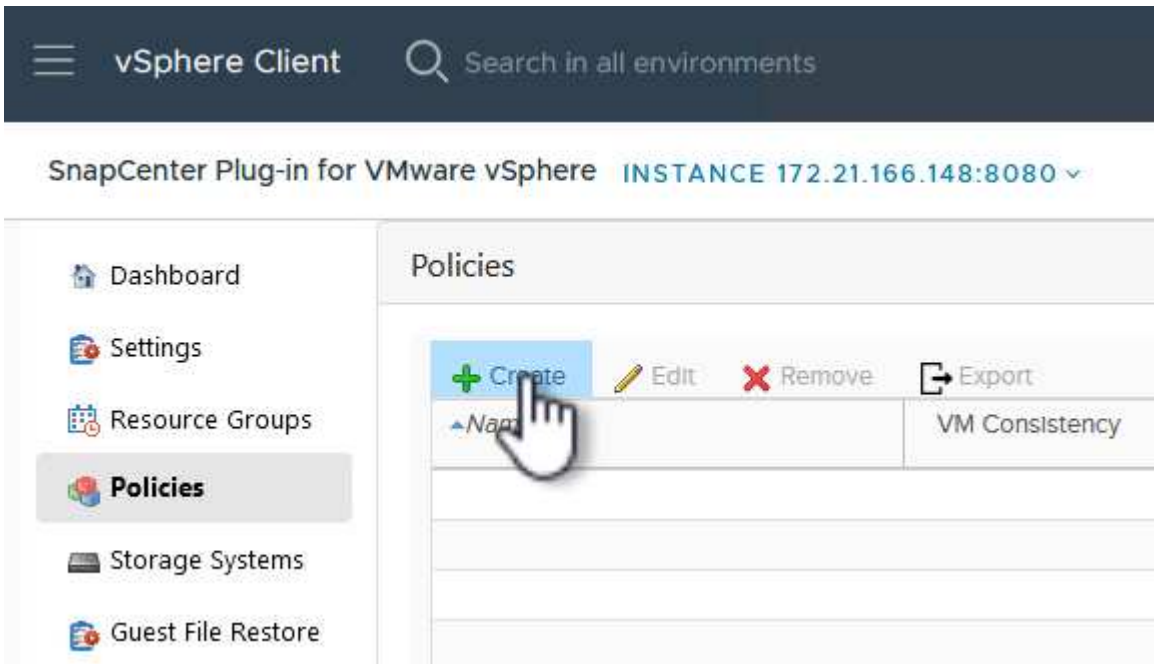
- Repeat this procedure for any additional storage systems to be managed, including any systems to be used as secondary backup targets.

## Configure backup policies in SCV

For more information on creating SCV backup policies refer to [Create backup policies for VMs and datastores](#).

Complete the following steps to create a new backup policy:

1. From the left-hand menu select **Policies** and click on **Create** to begin.



2. On the **New Backup Policy** form, provide a **Name** and **Description** for the policy, the **Frequency** at which the backups will take place, and the **Retention** period which specifies how long the backup is retained.

**Locking Period** enables the ONTAP SnapLock feature to create tamper proof snapshots and allows configuration of the locking period.

For **Replication** Select to update the underlying SnapMirror or SnapVault relationships for the ONTAP storage volume.



SnapMirror and SnapVault replication are similar in that they both utilize ONTAP SnapMirror technology to asynchronously replicate storage volumes to a secondary storage system for increased protection and security. For SnapMirror relationships, the retention schedule specified in the SCV backup policy will govern retention for both the primary and secondary volume. With SnapVault relationships, a separate retention schedule can be established on the secondary storage system for longer term or differing retention schedules. In this case the snapshot label is specified in the SCV backup policy and in the policy associated with the secondary volume, to identify which volumes to apply the independent retention schedule to.

Choose any additional advanced options and click on **Add** to create the policy.

## New Backup Policy



**Name**

**Description**

**Frequency**

**Locking Period**  Enable Snapshot Locking ⓘ

**Retention**   ⓘ

**Replication**  Update SnapMirror after backup ⓘ  
 Update SnapVault after backup ⓘ

Snapshot label

**Advanced** ▾  VM consistency ⓘ  
 Include datastores with independent disks

**Scripts** ⓘ

CANCEL

ADD

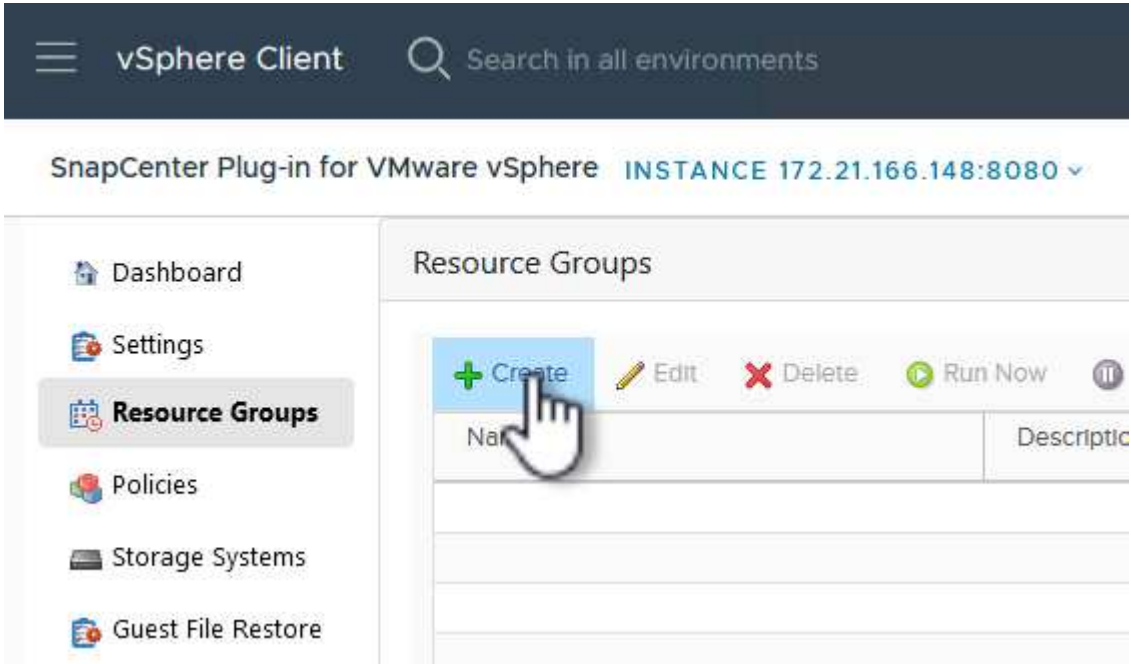


## Create resource groups in SCV

For more information on creating SCV Resource Groups refer to [Create resource groups](#).

Complete the following steps to create a new resource group:

1. From the left-hand menu select **Resource Groups** and click on **Create** to begin.



2. On the **General info & notification** page, provide a name for the resource group, notification settings, and any additional options for the naming of the snapshots.
3. On the **Resource** page select the datastores and VM's to be protected in the resource group. Click on **Next** to continue.



Even when only specific VMs are selected, the entire datastore is always backed up. This is because ONTAP takes snapshots of the volume hosting the datastore. However, note that selecting only specific VMs for backup limits the ability to restore to only those VMs.

## Create Resource Group

1. General info & notification

2. Resource

3. Spanning disks

4. Policies

5. Schedules

6. Summary

Scope: Virtual Machines

Parent entity: VCF\_WKLD\_03\_iSCSI

Enter available entity name

Available entities

OracleSrv\_01  
OracleSrv\_02  
OracleSrv\_03  
OracleSrv\_04

Selected entities

SQLSRV-01  
SQLSRV-02  
SQLSRV-03  
SQLSRV-04

BACK

NEXT

FINISH

CANCEL

4. On the **Spanning disks** page select the option for how to handle VMs with VMDK's that span multiple datstores. Click on **Next** to continue.

## Create Resource Group

✓ 1. General info & notification

✓ 2. Resource

3. Spanning disks

4. Policies

5. Schedules

6. Summary

Always exclude all spanning datastores

This means that only the datastores directly added to the resource group and the primary datastore of VMs directly added to the resource group will be backed up

Always include all spanning datastores

All datastores spanned by all included VMs are included in this backup

Manually select the spanning datastores to be included ⓘ

You will need to modify the list every time new VMs are added

There are no spanned entities in the selected virtual entities list.

BACK

NEXT

FINISH

CANCEL

5. On the **Policies** page select a previously created policy or multiple policies that will be used with this resource group. Click on **Next** to continue.



# Create Resource Group

✓ 1. General info & notification

✓ 2. Resource

✓ 3. Spanning disks

**4. Policies**

5. Schedules

6. Summary

+ Create

<input type="checkbox"/>	Name	VM Consistent	Include independent di...	Schedule
<input checked="" type="checkbox"/>	Daily_Snapmirror	No	No	Daily
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				

BACK NEXT FINISH CANCEL



6. On the **Schedules** page establish for when the backup will run by configuring the recurrence and time of day. Click on **Next** to continue.

## Create Resource Group

✓ 1. General info & notification

✓ 2. Resource

✓ 3. Spanning disks

✓ 4. Policies

**5. Schedules**

6. Summary

Daily\_Snapmi... ▼

Type

Daily

Every

1 Day(s)

Starting

04/04/2024 

At

04 45 PM   

BACK

**NEXT**

FINISH

CANCEL

7. Finally review the **Summary** and click on **Finish** to create the resource group.

## Create Resource Group

- 1. General info & notification
- 2. Resource
- 3. Spanning disks
- 4. Policies
- 5. Schedules
- 6. Summary**

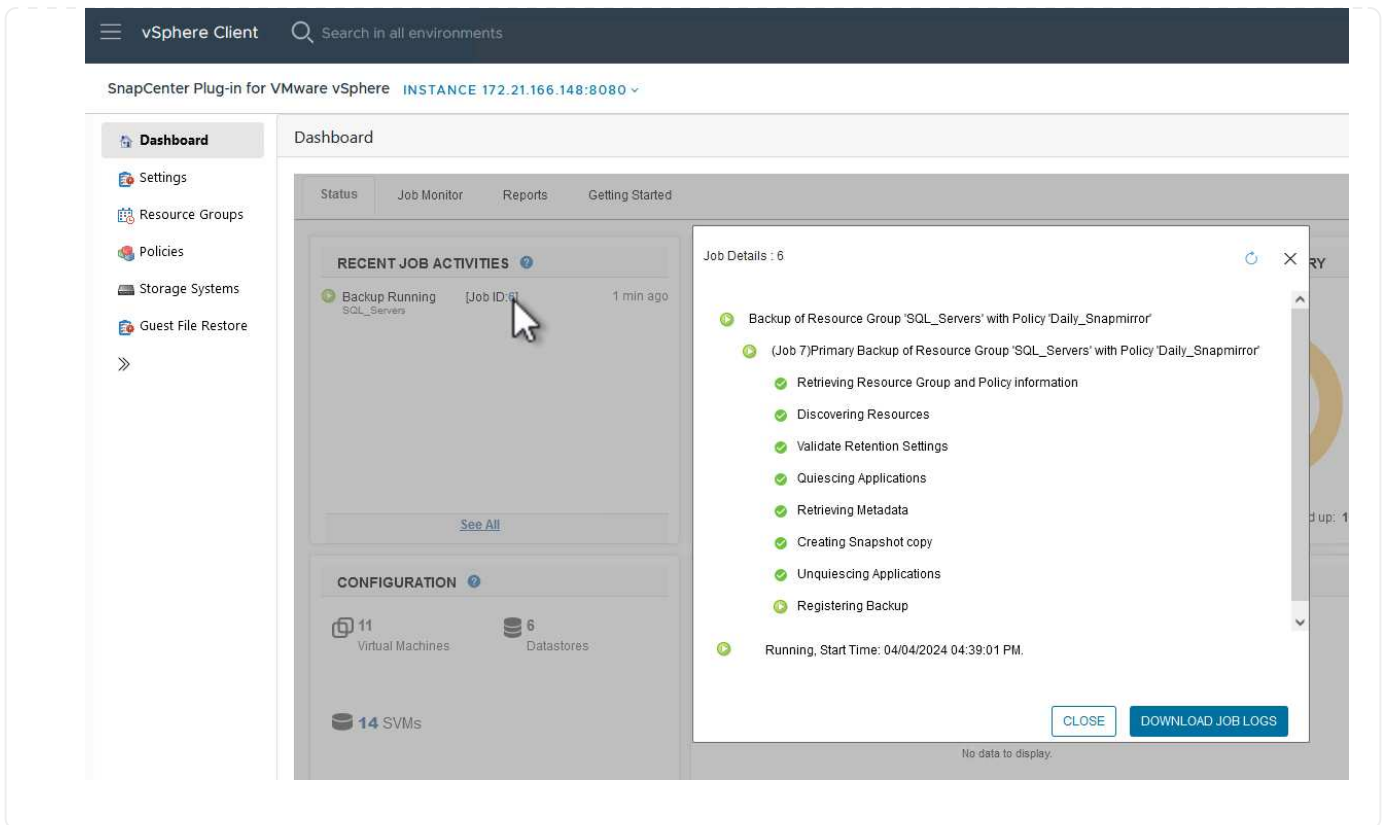
Name	SQL_Servers						
Description							
Send email	Never						
Latest Snapshot name	None ⓘ						
Custom snapshot format	None ⓘ						
Entities	SQLSRV-01, SQLSRV-02, SQLSRV-03, SQLSRV-04						
Spanning	False						
Policies	<table><thead><tr><th>Name</th><th>Frequency</th><th>Snapshot Locking Period</th></tr></thead><tbody><tr><td>Daily_Snapmir...</td><td>Daily</td><td>-</td></tr></tbody></table>	Name	Frequency	Snapshot Locking Period	Daily_Snapmir...	Daily	-
Name	Frequency	Snapshot Locking Period					
Daily_Snapmir...	Daily	-					

BACK NEXT **FINISH** CANCEL

8. With the resource group created click on the **Run Now** button to run the first backup.

The screenshot shows the vSphere Client interface. At the top, there is a search bar and the text "vSphere Client". Below that, it says "SnapCenter Plug-in for VMware vSphere" and "INSTANCE 172.21.166.148:8080". On the left, there is a navigation menu with "Resource Groups" selected. The main area shows a table of Resource Groups with columns for Name, Description, and Policy. The "Run Now" button is highlighted with a hand cursor.

9. Navigate to the **Dashboard** and, under **Recent Job Activities** click on the number next to **Job ID** to open the job monitor and view the progress of the running job.



## Use SCV to restore VMs, VMDKs and files

The SnapCenter Plug-in allows restores of VMs, VMDKs, files, and folders from primary or secondary backups.

VMs can be restored to the original host, or to an alternate host in the same vCenter Server, or to an alternate ESXi host managed by the same vCenter or any vCenter in linked mode.

vVol VMs can be restored to the original host.

VMDKs in traditional VMs can be restored to either the original or to an alternate datastore.

VMDKs in vVol VMs can be restored to the original datastore.

Individual files and folders in a guest file restore session can be restored, which attaches a backup copy of a virtual disk and then restores the selected files or folders.

Complete the following steps to restore VMs, VMDKs or individual folders.

## Restore VMs using SnapCenter Plug-in

Complete the following steps to restore a VM with SCV:

1. Navigate to the VM to be restored in the vSphere client, right click and navigate to **SnapCenter Plug-in for VMware vSphere**. Select **Restore** from the sub-menu.

OracleSrv\_04 | Summary Monitor Configure Permissions

Guest OS Virtual Mac

**Actions - OracleSrv\_04**

- Power
- Guest OS
- Snapshots
- Open Remote Console
- Migrate...
- Clone
- Fault Tolerance
- VM Policies
- Template
- Compatibility
- Export System Logs...
- Edit Settings...
- Move to folder...
- Rename...
- Edit Notes...
- Tags & Custom Attributes
- Add Permission...
- Alarms
- Remove from Inventory
- Delete from Disk
- vSAN
- NetApp ONTAP tools
- SnapCenter Plug-in for VMware vSphere
  - Create Resource Group
  - Add to Resource Group
  - Attach Virtual Disk(s)
  - Detach Virtual Disk(s)
  - Restore
  - File Restore

4 CPU(s), 22 MHz used  
32 GB, 0 GB memory active  
100 GB | Thin Provision  
VCF\_WKLD\_03\_ISCSI  
(of 2) vcf-wkld-01-IT-INF-WKLD-01-vc (connected) | 00:50:56:83:02:f  
Disconnected  
ESXI 7.0 U2 and later (VM vers

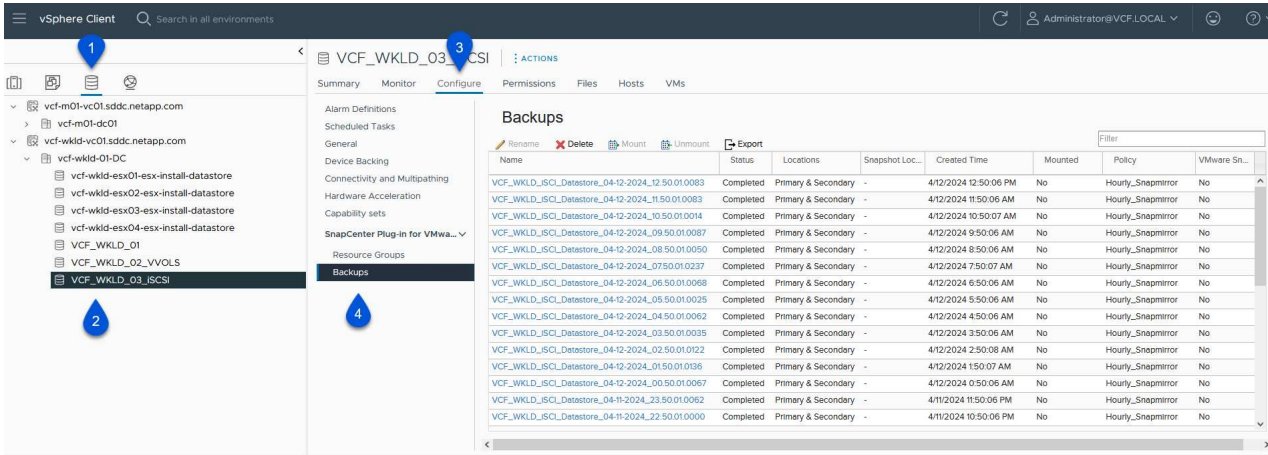
Recent Tasks

Task Name

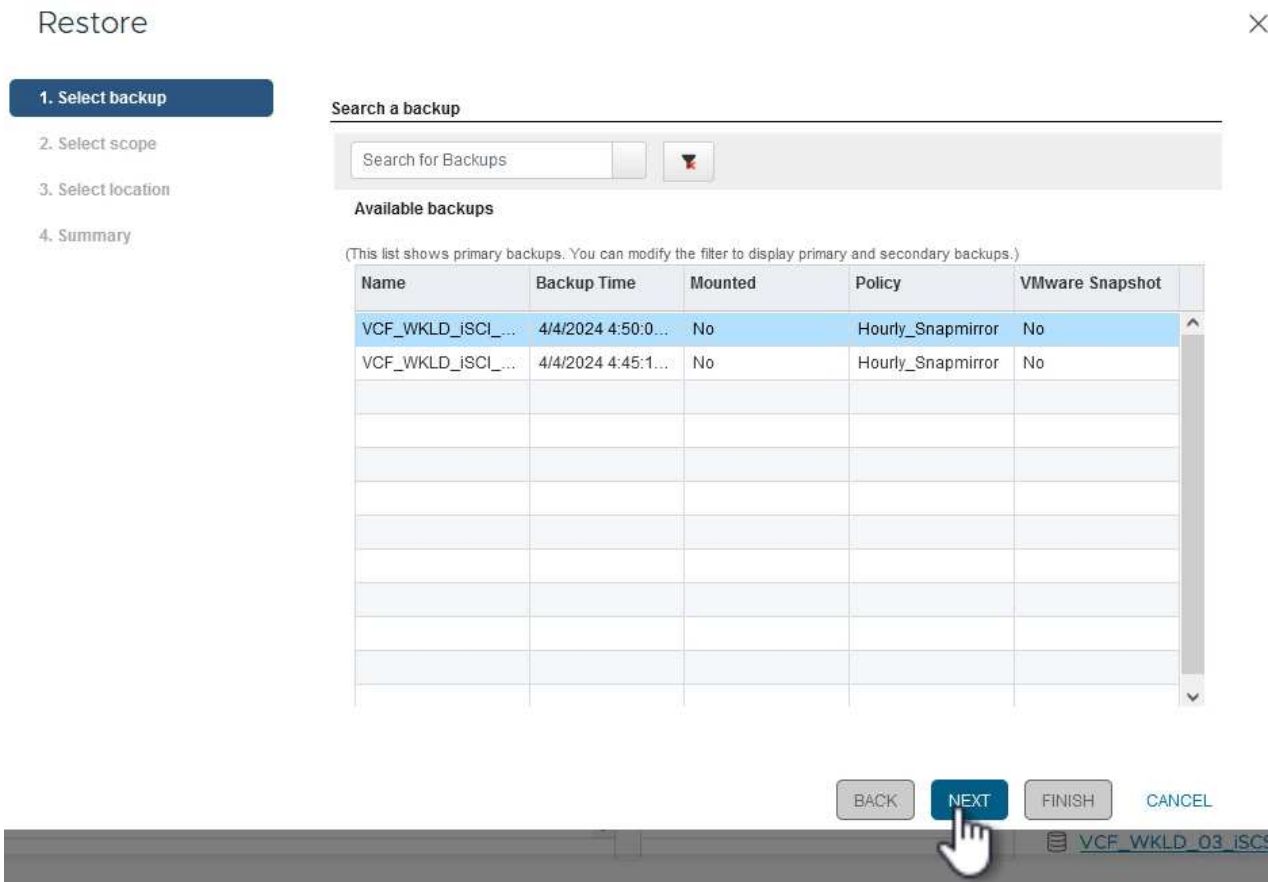
Manage Columns Run



An alternative is to navigate to the datastore in inventory and then under the **Configure** tab go to **SnapCenter Plug-in for VMware vSphere > Backups**. From the chosen backup, select the VMs to be restored.



2. In the **Restore** wizard select the backup to be used. Click on **Next** to continue.



3. On the **Select scope** page fill out all required fields:

- **Restore scope** - Select to restore the entire virtual machine.
- **Restart VM** - Choose whether to start the VM after the restore.
- **Restore Location** - Choose to restore to the original location or to an alternate location. When choosing alternate location select the options from each of the fields:
  - **Destination vCenter Server** - local vCenter or alternate vCenter in linked mode
  - **Destination ESXi host**
  - **Network**
  - **VM name after restore**
  - **Select datastore:**

Restore ×

1. Select backup  
 **2. Select scope**  
 3. Select location  
 4. Summary

**Restore scope**: Entire virtual machine (dropdown)  
**Restart VM**:   
**Restore Location**:
 

- Original Location  
(This will restore the entire VM to the original Hypervisor with the original settings. Existing VM will be unregistered and replaced with this VM.)
- Alternate Location**  
(This will create a new VM on selected vCenter and Hypervisor with the customized settings.)

**Destination vCenter Server**: 172.21.166.143 (dropdown)  
**Destination ESXi host**: vcf-wkld-esx04.sddc.netapp.com (dropdown)  
**Network**: vcf-wkld-01-HT-INF-WKLD-01-vds-01-pg- (dropdown)  
**VM name after restore**: OracleSrv\_04\_restored (text field)  
**Select Datastore**: VCF\_WKLD\_03\_ISCSI (dropdown)

VCF\_WKLD\_03\_ISCSI

Click on **Next** to continue.

4. On the **Select location** page, choose to restore the VM from the primary or secondary ONTAP storage system. Click on **Next** to continue.



## Restore

- ✓ 1. Select backup
- ✓ 2. Select scope
- 3. Select location**
- 4. Summary

Destination datastore	Locations
VCF_WKLD_03_iSCSI	(Primary) VCF_iSCSI:VCF_WKLD_03_iSCSI
	(Primary) VCF_iSCSI:VCF_WKLD_03_iSCSI
	(Secondary) svm_iscsi:VCF_WKLD_03_iSCSI_dest
	< >

5. Finally, review the **Summary** and click on **Finish** to start the restore job.

## Restore

- ✓ 1. Select backup
- ✓ 2. Select scope
- ✓ 3. Select location
- 4. Summary**

<b>Virtual machine to be restored</b>	OracleSrv_04
<b>Backup name</b>	VCF_WKLD_iSCSI_Datastore_04-04-2024_16.50.00.0940
<b>Restart virtual machine</b>	No
<b>Restore Location</b>	Alternate Location
<b>Destination vCenter Server</b>	172.21.166.143
<b>ESXi host to be used to mount the backup</b>	vcf-wkld-esx04.sddc.netapp.com
<b>VM Network</b>	vcf-wkld-01-IT-INF-WKLD-01-vds-01-pg-mgmt
<b>Destination datastore</b>	VCF_WKLD_03_iSCSI
<b>VM name after restore</b>	OracleSrv_04_restored



Change IP address of the newly created VM after restore operation to avoid IP conflict.

BACK

NEXT

**FINISH**

CANCEL

6. The restore job progress can be monitored from the **Recent Tasks** pane in the vSphere Client and from the job monitor in SCV.

Dashboard

- Settings
- Resource Groups
- Policies
- Storage Systems
- Guest File Restore

Dashboard

Status Job Monitor Reports Getting Started

RECENT JOB ACTIVITIES

- Restore Running [Job ID:18] 1 min ago  
VCF\_WKLD\_ISCI\_Datastore\_04-04-20...
- Backup Successful [Job ID:15] 8 min ago  
VCF\_WKLD\_ISCI\_Datastore
- Backup Successful [Job ID:12] 13 min ago  
VCF\_WKLD\_ISCI\_Datastore
- Backup Successful [Job ID:9] 13 min ago  
SQL\_Servers
- Backup Successful [Job ID:6] 19 min ago  
SQL\_Servers

[See All](#)

CONFIGURATION

11 Virtual Machines    6 Datastores

14 SVMs

2 Resource Groups    2 Backup Policies

Job Details : 18

- Restoring backup with name: VCF\_WKLD\_ISCI\_Datastore\_04-04-2024\_16:50:00.0940
- Preparing for Restore: Retrieving Backup metadata from Repository.
- Pre Restore
- Restore

Running, Start Time: 04/04/2024 04:58:24 PM.

[CLOSE](#) [DOWNLOAD JOB LOGS](#)

No data to display.

Recent Tasks Alarms

Task Name	Target	Status	Details	Initiator	Queued For	Start Time
NetApp Mount Datastore	<a href="#">vcf-wkld-esx04.sdd</a> <a href="#">c.netapp.com</a>	35%	Mount operation completed successfully.	VCF.LOCAL\Administrator	6 ms	04/04/2024, 4:58:27 P M
NetApp Restore	<a href="#">vcf-wkld-esx04.sdd</a> <a href="#">c.netapp.com</a>	2%	Restore operation started.	VCF.LOCAL\Administrator	10 ms	04/04/2024, 4:58:27 P M

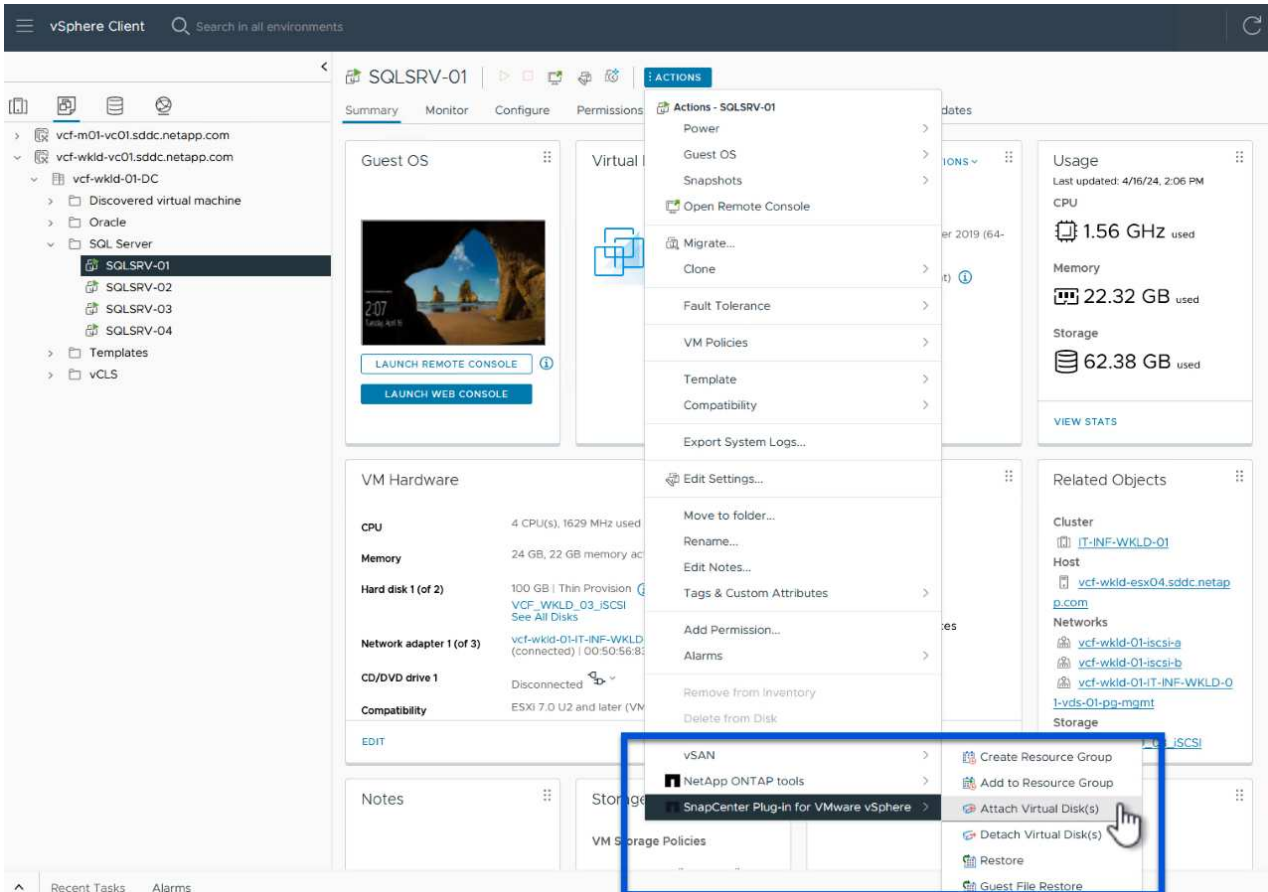
Manage Columns Running More Tasks

## Restore VMDKs using SnapCenter Plug-in

ONTAP Tools allows full restore of VMDK's to their original location or the ability to attach a VMDK as a new disk to a host system. In this scenario a VMDK will be attached to a Windows host in order to access the file system.

To attach a VMDK from a backup, complete the following steps:

1. In the vSphere Client navigate to a VM and, from the **Actions** menu, select **SnapCenter Plug-in for VMware vSphere > Attach Virtual Disk(s)**.



2. In the **Attach Virtual Disk(s)** wizard, select the backup instance to be used and the particular VMDK to be attached.

# Attach Virtual Disk(s)



Click here to attach to alternate VM

## Backup

(This list shows primary backups. **1** modify the filter to display primary and secondary backups.)

Name	Backup Time	Mounted	Policy	VMware Snapshot
VCF_WKLD_iSCSI_Datastore_04-17-2024_09.50.01.0218	4/17/2024 9:50:01 AM	No	Hourly_Snapmirror	No
VCF_WKLD_iSCSI_Datastore_04-17-2024_08.50.01.0223	4/17/2024 8:50:01 AM	No	Hourly_Snapmirror	No
VCF_WKLD_iSCSI_Datastore_04-17-2024_07.50.01.0204	4/17/2024 7:50:00 AM	No	Hourly_Snapmirror	No
VCF_WKLD_iSCSI_Datastore_04-17-2024_06.50.01.0194	4/17/2024 6:50:00 AM	No	Hourly_Snapmirror	No
VCF_WKLD_iSCSI_Datastore_04-17-2024_05.50.01.0245	4/17/2024 5:50:01 AM	No	Hourly_Snapmirror	No
VCF_WKLD_iSCSI_Datastore_04-17-2024_04.50.01.0231	4/17/2024 4:50:01 AM	No	Hourly_Snapmirror	No

## Select disks

Virtual disk	Location
<input type="checkbox"/> [VCF_WKLD_03_iSCSI] SQLSRV-01/SQLSRV-01.vmdk	Primary:VCF_iSCSI:VCF_WKLD_03_iSCSI:VCF_WKLD_iSCSI_Datastore_04-17-2024_09.50.01.0...
<input checked="" type="checkbox"/> [VCF_WKLD_03_iSCSI] SQLSRV-01/SQLSRV-01_1.v...	Primary:VCF_iSCSI:VCF_WKLD_03_iSCSI:VCF_WKLD_iSCSI_Datastore_04-17-2024_09.50.01.0...



CANCEL ATTACH



Filter options can be used to locate backups and to display backups from both primary and secondary storage systems.

# Attach Virtual Disk(s)



Attach Virtual Disk(s)
Click here to attach to alternate VM

(This list shows primary backups.)

Name	Backup Time	Mounted	Policy	VMware Snapshot
VCF_WKLD_iSCSI_Datastore_04-17-2024_09.50.01.0218	4/17/2024 9:50:01 AM	No	Hourly_Snapmirror	No
VCF_WKLD_iSCSI_Datastore_04-17-2024_08.50.01.0223	4/17/2024 8:50:01 AM	No	Hourly_Snapmirror	No
VCF_WKLD_iSCSI_Datastore_04-17-2024_07.50.01.0204	4/17/2024 7:50:00 AM	No	Hourly_Snapmirror	No
VCF_WKLD_iSCSI_Datastore_04-17-2024_06.50.01.0194	4/17/2024 6:50:00 AM	No	Hourly_Snapmirror	No
VCF_WKLD_iSCSI_Datastore_04-17-2024_05.50.01.0245	4/17/2024 5:50:01 AM	No	Hourly_Snapmirror	No
VCF_WKLD_iSCSI_Datastore_04-17-2024_04.50.01.0231	4/17/2024 4:50:01 AM	No	Hourly_Snapmirror	No

Select disks

Virtual disk	Location
<input type="checkbox"/> [VCF_WKLD_03_iSCSI] SQLSRV-01/SQLSRV-01.vmdk	Primary:VCF_iSCSI:VCF_WKLD_03_iSCSI:VCF_WKLD_iSCSI_Datastore_04-17-2024_09.50.01.0...
<input checked="" type="checkbox"/> [VCF_WKLD_03_iSCSI] SQLSRV-01/SQLSRV-01_1.v...	Primary:VCF_iSCSI:VCF_WKLD_03_iSCSI:VCF_WKLD_iSCSI_Datastore_04-17-2024_09.50.01.0...

CANCEL ATTACH

Time range
From

12 Hour 00 Minute 00 Second AM

To

12 Hour 00 Minute 00 Second AM

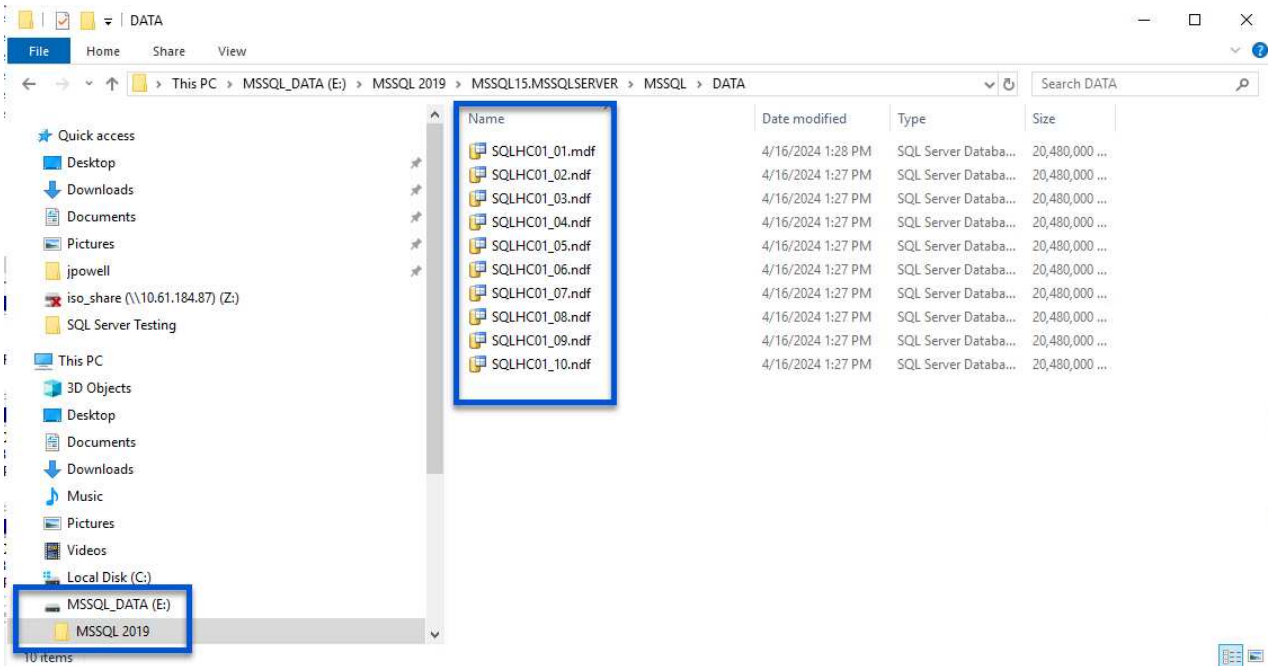
VMware snapshot

Mounted

Location

CLEAR OK

3. After selecting all options, click on the **Attach** button to begin the restore process and attached the VMDK to the host.
4. Once the attach procedure is complete the disk can be accessed from the OS of the host system. In this case SCV attached the disk with its NTFS file system to the E: drive of our Windows SQL Server and the SQL database files on the file system are accessible through File Explorer.



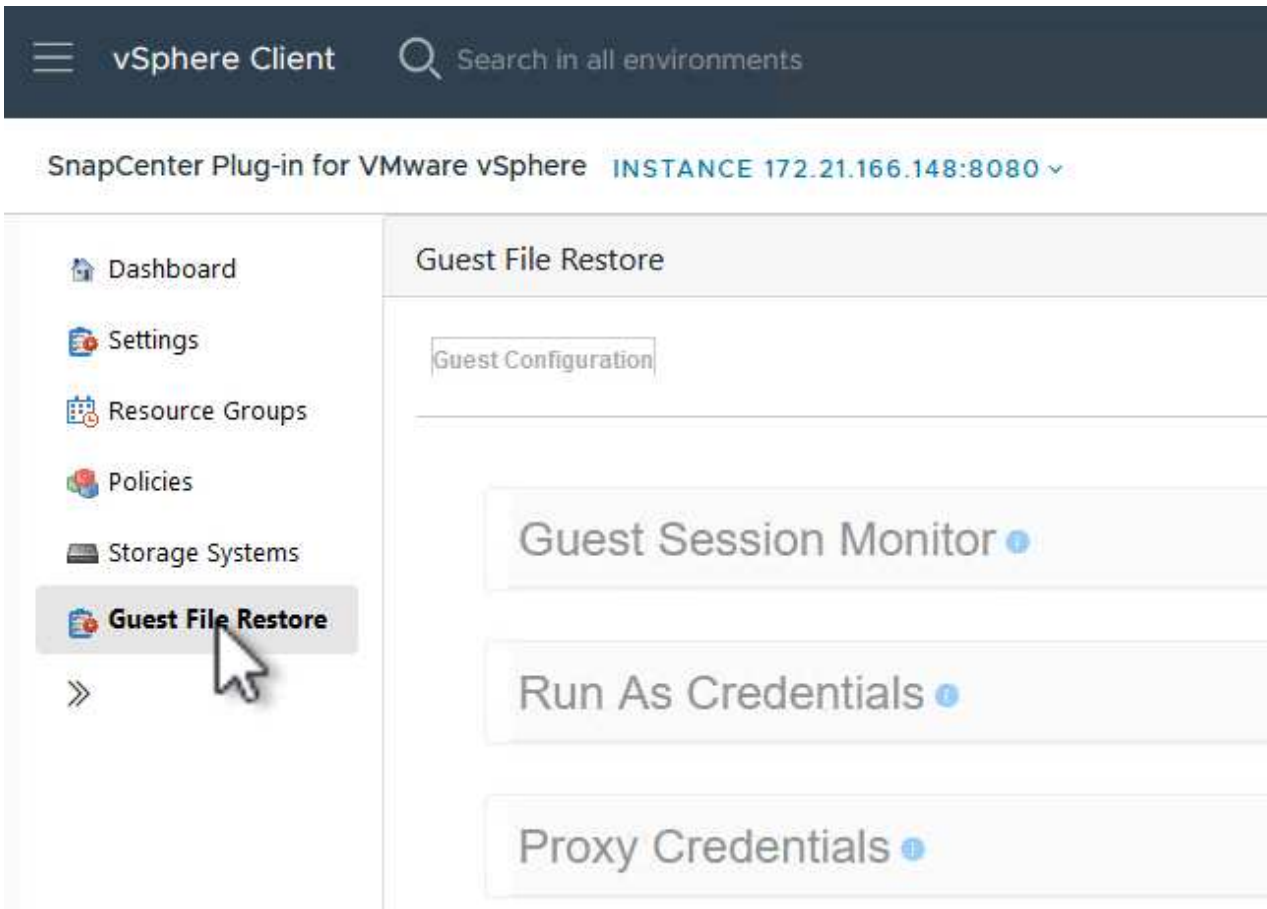
## Guest File System Restore using SnapCenter Plug-in

ONTAP Tools features guest file system restores from a VMDK on Windows Server OSes. This is performed centrally from the SnapCenter Plug-in interface.

For detailed information refer to [Restore guest files and folders](#) at the SCV documentation site.

To perform a guest file system restore for a Windows system, complete the following steps:

1. The first step is to create Run As credentials to provide access to the Windows host system. In the vSphere Client navigate to the CSV plug-in interface and click on **Guest File Restore** in the main menu.



2. Under **Run As Credentials** click on the + icon to open the **Run As Credentials** window.
3. Fill in a name for the credentials record, an administrator username and password for the Windows system, and then click on the **Select VM** button to select an optional Proxy VM to be used for the restore.

## Run As Credentials



Run As Name	<input type="text" value="Administrator"/>	
Username	<input type="text" value="administrator"/>	
Password	<input type="password" value="••••••••"/>	
Authentication Mode	<input type="text" value="Windows"/>	
VM Name	<input type="text"/>	



<input type="button" value="CANCEL"/>	<input type="button" value="SAVE"/>
---------------------------------------	-------------------------------------

4. On the Proxy VM page provide a name for the VM and locate it by searching by ESXi host or by name. Once selected, click on **Save**.

## Proxy VM



VM Name

SQLSRV-01

Search by ESXi Host

ESXi Host

vcf-wkld-esx04.sddc.netapp.com

Virtual Machine

SQLSRV-01

Search by Virtual Machine name

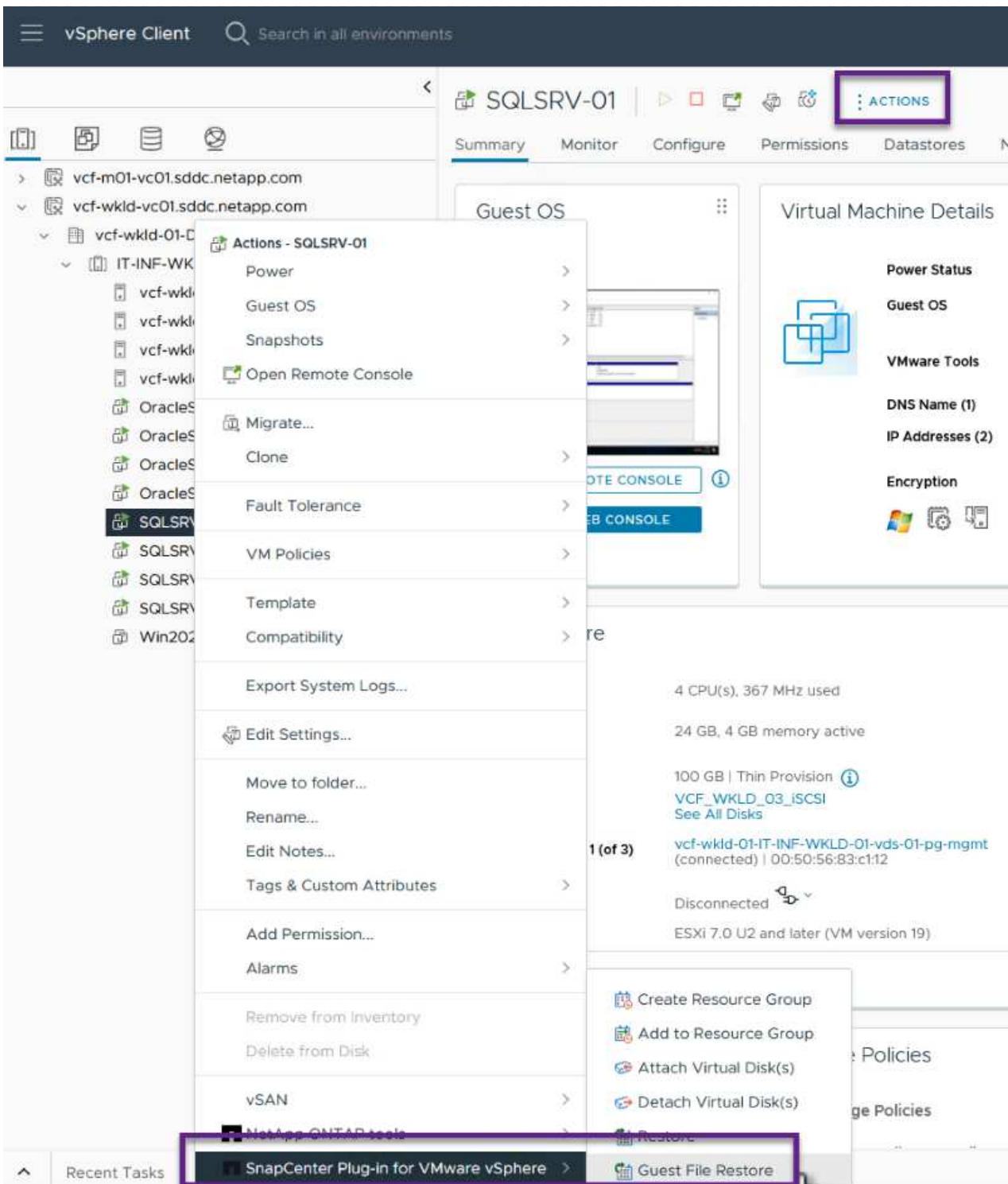
CANCEL

SAVE



5. Click on **Save** again in the **Run As Credentials** window to complete saving the record.
6. Next, navigate to a VM in the inventory. From the **Actions** menu, or by right-clicking on the VM, select **SnapCenter Plug-in for VMware vSphere > Guest File Restore**.





7. On the **Restore Scope** page of the **Guest File Restore** wizard, select the backup to restore from, the particular VMDK, and the location (primary or secondary) to restore the VMDK from. Click on **Next** to continue.

## Guest File Restore



### 1. Restore Scope

2. Guest Details

3. Summary

Backup Name	Start Time	End Time
SQL_Servers_04-16-2024_13.52.3...	4/16/2024 1:52:34 PM	4/16/2024 1:52:40 PM
VCF_WKLD_iscsi_Datastore_04-1...	4/16/2024 1:50:01 PM	4/16/2024 1:50:08 PM

VMDK
[VCF_WKLD_03_iscsi] SQLSRV-01/SQLSRV-01.vmdk
[VCF_WKLD_03_iscsi] SQLSRV-01/SQLSRV-01_1.vmdk

Locations
Primary:VCF_iscsi:VCF_WKLD_03_iscsi:SQL_Servers_04-16-2024_13.52.34.0329
Secondary:svm_iscsi:VCF_WKLD_03_iscsi_dest:SQL_Servers_04-16-2024_13.52.34.0329

BACK NEXT FINISH CANCEL



8. On the **Guest Details** page, select to use **Guest VM** or **Use Gues File Restore proxy VM** for the restore. Also, fill out email notification settings here if desired. Click on **Next** to continue.

## Guest File Restore



### 1. Restore Scope

### 2. Guest Details

### 3. Summary

#### Use Guest VM

Guest File Restore operation will attach disk to guest VM

Run As Name	Username	Authentication Mode
Administrator	administrator	WINDOWS

#### Use Guest File Restore proxy VM

#### Send email notification

Email send from:

Email send to:

Email subject:

BACK

NEXT

FINISH

CANCEL

- Finally, review the **Summary** page and click on **Finish** to begin the Guest File System Restore session.
- Back in the SnapCenter Plug-in interface, navigate to **Guest File Restore** again and view the running session under **Guest Session Monitor**. Click on the icon under **Browse Files** to continue.

The screenshot shows the vSphere Client interface with the SnapCenter Plug-in for VMware vSphere. The main content area displays the 'Guest File Restore' configuration page, which includes a 'Guest Configuration' section and a 'Guest Session Monitor' table. The table has the following columns: Backup Name, Source VM, Disk Path, Guest Mount Path, Time To Expire, and Browse Files. A hand cursor is pointing at the 'Browse Files' column header. Below the table, there are sections for 'Run As Credentials' and 'Proxy Credentials', both with dropdown menus.

Backup Name	Source VM	Disk Path	Guest Mount Path	Time To Expire	Browse Files
SQL_Servers_04-16-2024_13:52:34.0329	SQLSRV-01	[VCF_WKLD_03]SCSI(c-202404161419...	E1	23h:58m	

- In the **Guest File Browse** wizard select the folder or files to restore and the file system location to restore them to. Finally, click on **Restore** to start the **Restore** process.

## Guest File Browse



### Select File(s)/Folder(s) to Restore



E:\MSSQL 2019

	Name	Size	
<input type="checkbox"/>	MSSQL15.MSSQLSERVER		^
			v

Selected 0 Files / 1 Directory

Name	Path	Size	Delete	
MSSQL 2019	E:\MSSQL 2019			^
				v

### Select Restore Location



Select address family for UNC path:

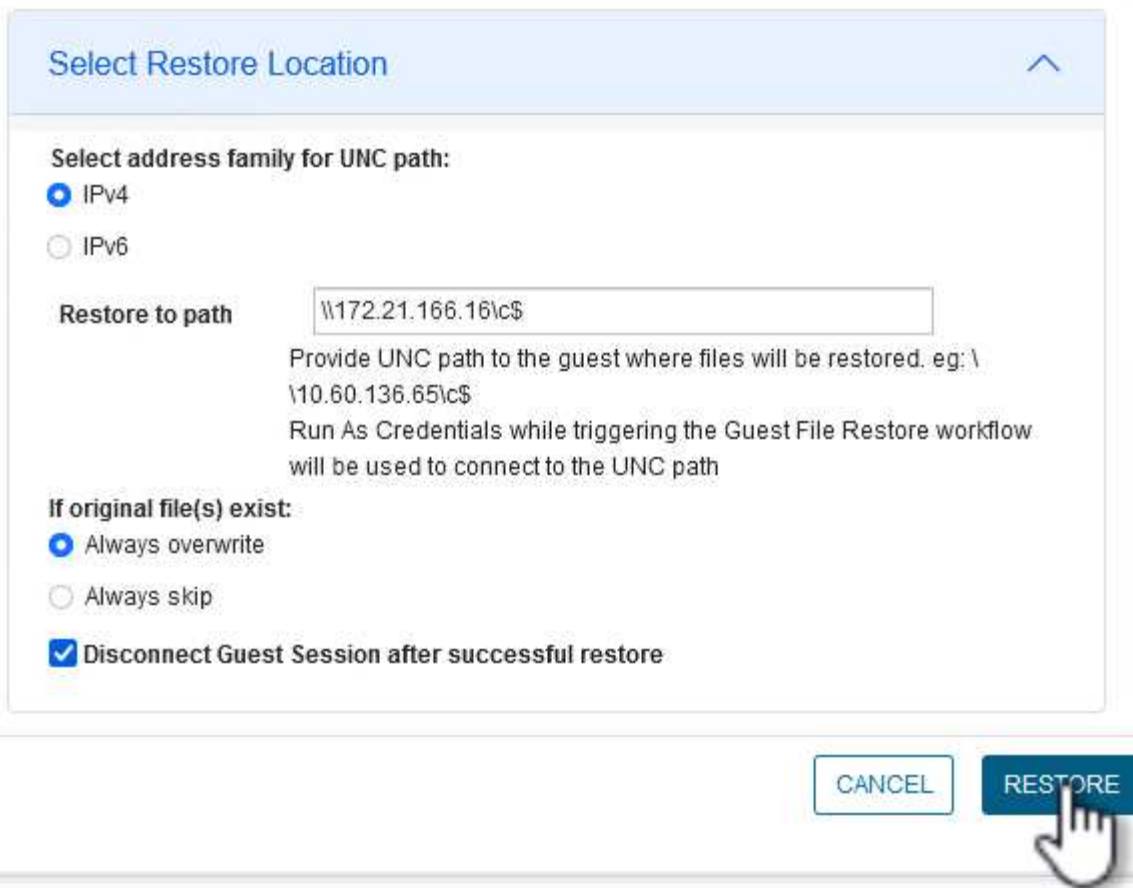
IPv4

IPv6

**Either Files to Restore or Restore Location is not selected!**

CANCEL

RESTORE



12. The restore job can be monitored from the vSphere Client task pane.

#### Additional information

For information on configuring VCF refer to [VMware Cloud Foundation Documentation](#).

For information on configuring ONTAP storage systems refer to the [ONTAP 9 Documentation](#) center.

For information on using the SnapCenter Plug-in for VMware vSphere refer to the [SnapCenter Plug-in for VMware vSphere documentation](#).

VMware Cloud Foundation (VCF) is an integrated software defined data center (SDDC) platform that provides a complete stack of software-defined infrastructure for running enterprise applications in a hybrid cloud environment. It combines compute, storage, networking, and management capabilities into a unified platform, offering a consistent operational experience across private and public clouds.

Author: Josh Powell, Ravi BCB

## VMware Cloud Foundation with NetApp AFF Arrays

This document provides information on storage options available for VMware Cloud Foundation using the NetApp All-Flash AFF storage system. Supported storage options are covered with specific instruction for

creating workload domains with NFS and vVol datastores as principal storage as well as a range of supplemental storage options.

## Use Cases

Use cases covered in this documentation:

- Storage options for customers seeking uniform environments across both private and public clouds.
- Automated solution for deploying virtual infrastructure for workload domains.
- Scalable storage solution tailored to meet evolving needs, even when not aligned directly with compute resource requirements.
- Deploy VCF VI Workload Domains using ONTAP as principal storage.
- Deploy supplemental storage to VI Workload Domains using ONTAP Tools for VMware vSphere.

## Audience

This solution is intended for the following people:

- Solution architects looking for more flexible storage options for VMware environments that are designed to maximize TCO.
- Solution architects looking for VCF storage options that provide data protection and disaster recovery options with the major cloud providers.
- Storage administrators wanting to understand how to configure VCF with principal and supplemental storage.

## Technology Overview

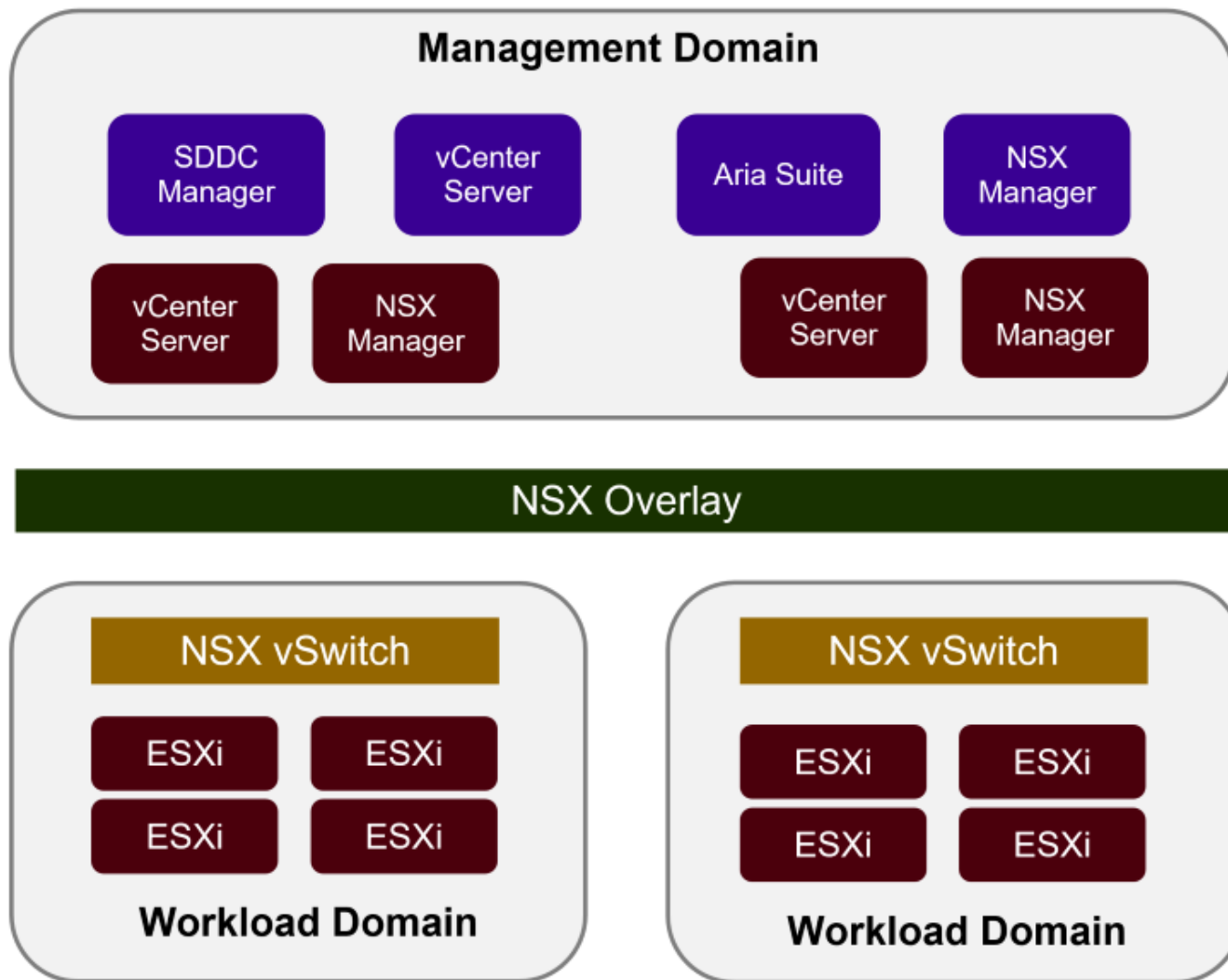
The VCF with NetApp AFF solution is comprised of the following major components:

### VMware Cloud Foundation

VMware Cloud Foundation extends VMware's vSphere hypervisor offerings by combining key components such as SDDC Manager, vSphere, vSAN, NSX, and VMware Aria Suite to create a virtualized datacenter.

The VCF solution supports both native Kubernetes and virtual machine-based workloads. Key services such as VMware vSphere, VMware vSAN, VMware NSX-T Data Center, and VMware vRealize Cloud Management are integral components of the VCF package. When combined, these services establish a software-defined infrastructure capable of efficiently managing compute, storage, networking, security, and cloud management.

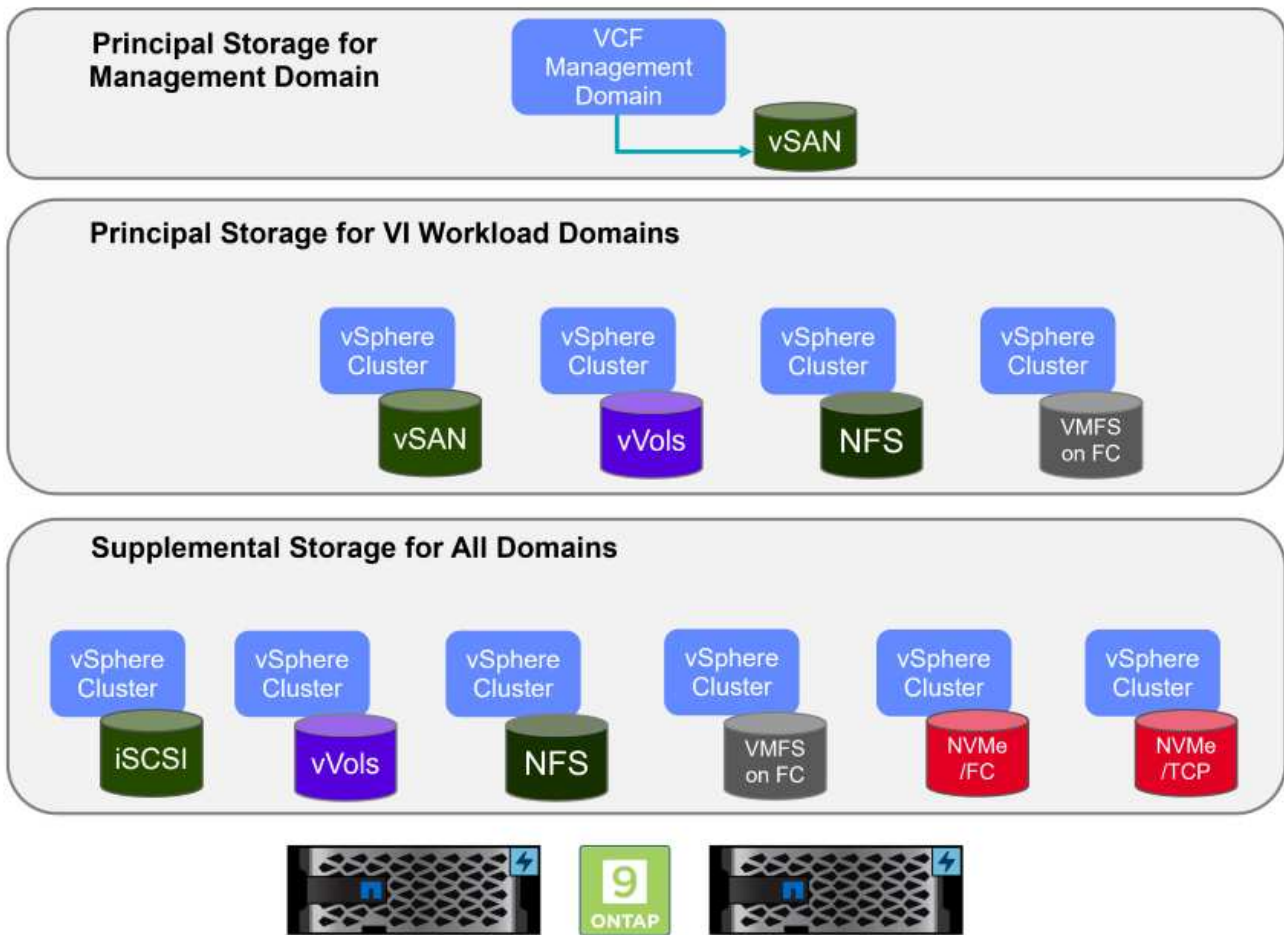
VCF is comprised of a single management domain and up to 24 VI Workload Domains that each represent a unit of application-ready infrastructure. A workload domain is comprised of one or more vSphere clusters managed by a single vCenter instance.



For more information on VCF architecture and planning, refer to [Architecture Models and Workload Domain Types in VMware Cloud Foundation](#).

#### VCF Storage Options

VMware divides storage options for VCF into **principal** and **supplemental** storage. The VCF Management Domain must use vSAN as its principal storage. However, there are many supplemental storage options for the Management Domain and both principal and supplemental storage options available for VI Workload Domains.



### Principal Storage for Workload Domains

Principal Storage refers to any type of storage that can be directly connected to a VI Workload Domain during the setup process within SDDC Manager. Principal storage is the first datastore configured for a Workload Domain and includes vSAN, vVols (VMFS), NFS and VMFS on Fibre Channel.

### Supplemental Storage for Management and Workload Domains

Supplemental storage is the storage type that can be added to the management or workload domains at any time after the cluster has been created. Supplemental storage represents the widest range of supported storage options, all of which are supported on NetApp AFF arrays.

Additional documentation resources for VMware Cloud Foundation:

- \* [VMware Cloud Foundation Documentation](#)
- \* [Supported Storage Types for VMware Cloud Foundation](#)
- \* [Managing Storage in VMware Cloud Foundation](#)

### NetApp All-Flash Storage Arrays

NetApp AFF (All Flash FAS) arrays are high-performance storage solutions designed to leverage the speed and efficiency of flash technology. AFF arrays incorporate integrated data management features such as snapshot-based backups, replication, thin provisioning, and data protection capabilities.

NetApp AFF arrays utilize the ONTAP storage operating system, offering comprehensive storage protocol support for all storage options compatible with VCF, all within a unified architecture.



NetApp AFF storage arrays are available in the highest performing A-Series and a QLC flash-based C-Series. Both series use NVMe flash drives.

For more information on NetApp AFF A-Series storage arrays see the [NetApp AFF A-Series](#) landing page.

For more information on NetApp C-Series storage arrays see the [NetApp AFF C-Series](#) landing page.

## NetApp ONTAP Tools for VMware vSphere

ONTAP Tools for VMware vSphere (OTV) allows administrators to manage NetApp storage directly from within the vSphere Client. ONTAP Tools allows you to deploy and manage datastores, as well as provision vVol datastores.

ONTAP Tools allows mapping of datastores to storage capability profiles which determine a set of storage system attributes. This allows the creation of datastores with specific attributes such as storage performance and QoS.

ONTAP Tools also includes a **VMware vSphere APIs for Storage Awareness (VASA) Provider** for ONTAP storage systems which enables the provisioning of VMware Virtual Volumes (vVols) datastores, creation and use of storage capability profiles, compliance verification, and performance monitoring.

For more information on NetApp ONTAP tools see the [ONTAP tools for VMware vSphere Documentation](#) page.

## Solution Overview

In the scenarios presented in this documentation we will demonstrate how to use ONTAP storage systems as principal storage for VCF VI Workload Domain deployments. In addition, we will install and use ONTAP Tools for VMware vSphere to configure supplemental datastores for VI Workload Domains.

Scenarios covered in this documentation:

- **Configure and use an NFS datastore as principal storage during VI Workload Domain deployment.** Click [here](#) for deployment steps.
- **Install and demonstrate the use of ONTAP Tools to configure and mount NFS datastores as supplemental storage in VI Workload Domains.** Click [here](#) for deployment steps.

In this scenario we will demonstrate how to configure an NFS datastore as principal storage for the deployment of a VI Workload Domain in VCF. Where appropriate we will refer to external documentation for the steps that must be performed in VCF's SDDC Manager, and cover those steps that are specific to the storage configuration portion.

Author: Josh Powell, Ravi BCB

## NFS as principal storage for VI Workload Domains

### Scenario Overview

This scenario covers the following high level steps:

- Verify networking for the ONTAP storage virtual machine (SVM) and that a logical interface (LIF) is present

to carry NFS traffic.

- Create an export policy to allow the ESXi hosts access to the NFS volume.
- Create an NFS volume on the ONTAP storage system.
- Create a Network Pool for NFS and vMotion traffic in SDDC Manager.
- Commission hosts in VCF for use in a VI Workload Domain.
- Deploy a VI Workload Domain in VCF using an NFS datastore as principal storage.
- Install NetApp NFS Plug-in for VMware VAAI

### Prerequisites

This scenario requires the following components and configurations:

- NetApp AFF storage system with a storage virtual machine (SVM) configured to allow NFS traffic.
- Logical interface (LIF) has been created on the IP network that is to carry NFS traffic and is associated with the SVM.
- VCF management domain deployment is complete and the SDDC Manager interface is accessible.
- 4 x ESXi hosts configured for communication on the VCF management network.
- IP addresses reserved for vMotion and NFS storage traffic on the VLAN or network segment established for this purpose.



When deploying a VI Workload Domain, VCF validates connectivity to the NFS Server. This is done using the management adapter on the ESXi hosts before any additional vmkernel adapter is added with the NFS IP address. Therefore, it is necessary to ensure that either 1) the management network is routable to the NFS Server, or 2) a LIF for the management network has been added to the SVM hosting the NFS datastore volume, to ensure that the validation can proceed.

For information on configuring ONTAP storage systems refer to the [ONTAP 9 Documentation](#) center.

For information on configuring VCF refer to [VMware Cloud Foundation Documentation](#).

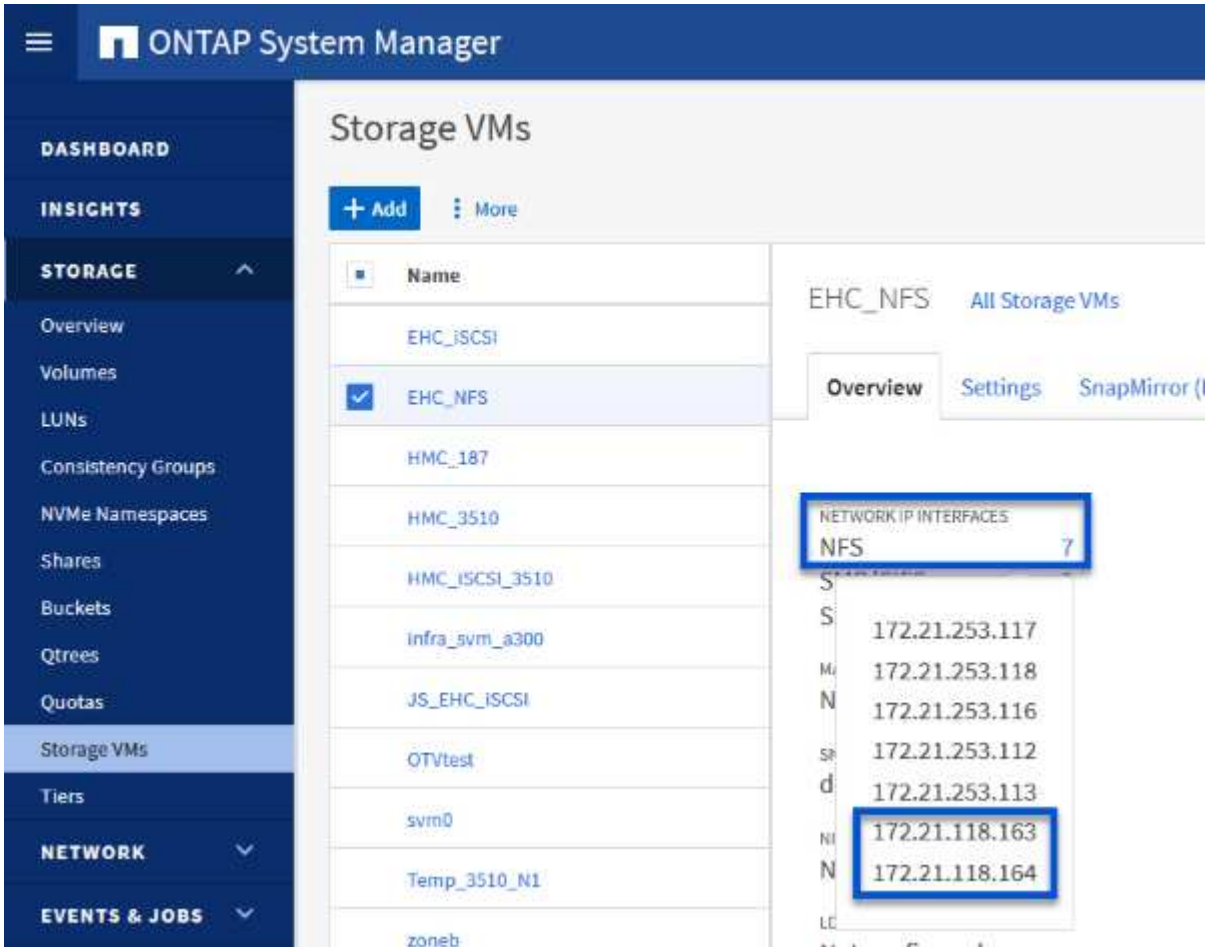
### Deployment Steps

To deploy a VI Workload Domain with an NFS datastore as principal storage, complete the following steps:

## Verify networking for ONTAP SVM

Verify that the required logical interfaces have been established for the network that will carry NFS traffic between the ONTAP storage cluster and VI Workload Domain.

1. From ONTAP System Manager navigate to **Storage VMs** in the left-hand menu and click on the SVM to be used for NFS traffic. On the **Overview** tab, under **NETWORK IP INTERFACES**, click on the numeric to the right of **NFS**. In the list verify that the required LIF IP addresses are listed.



The screenshot shows the ONTAP System Manager interface. The left-hand menu is expanded to 'Storage VMs'. The main content area displays a list of Storage VMs. The 'EHC\_NFS' SVM is selected. The 'Overview' tab is active, and the 'NETWORK IP INTERFACES' section is expanded to show a list of interfaces. The 'NFS' interface is highlighted, and a list of IP addresses is displayed. The IP addresses 172.21.118.163 and 172.21.118.164 are highlighted with blue boxes.

Name	IP Address
EHC_NFS	172.21.253.117
EHC_NFS	172.21.253.118
EHC_NFS	172.21.253.116
EHC_NFS	172.21.253.112
EHC_NFS	172.21.253.113
EHC_NFS	172.21.118.163
EHC_NFS	172.21.118.164

Alternately, verify the LIFs associated with an SVM from the ONTAP CLI with the following command:

```
network interface show -vserver <SVM_NAME>
```

1. Verify that the ESXi hosts can communicate to the ONTAP NFS Server. Log into the ESXi host via SSH and ping the SVM LIF:

```
vmkping <IP Address>
```

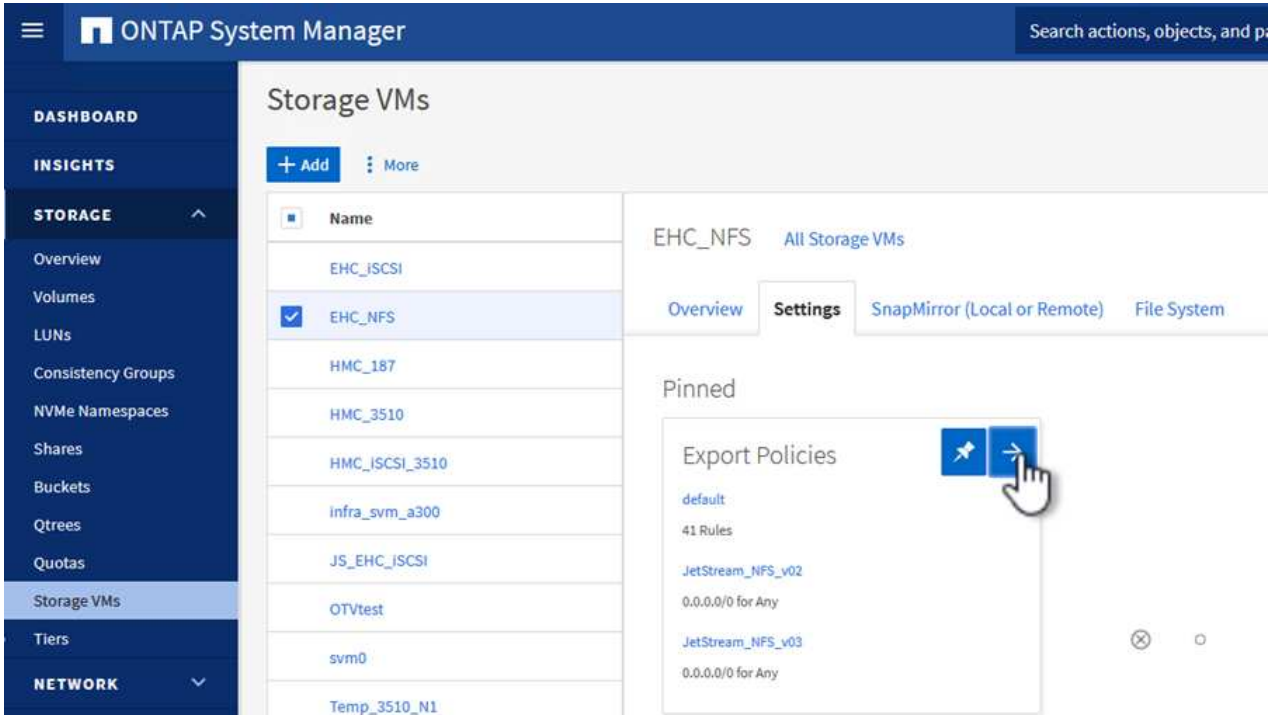


When deploying a VI Workload Domain, VCF validates connectivity to the NFS Server. This is done using the management adapter on the ESXi hosts before any additional vmkernel adapter is added with the NFS IP address. Therefore, it is necessary to ensure that either 1) the management network is routable to the NFS Server, or 2) a LIF for the management network has been added to the SVM hosting the NFS datastore volume, to ensure that the validation can proceed.

## Create Export Policy for sharing NFS volume

Create an export policy in ONTAP System Manager to define access control for NFS volumes.

1. In ONTAP System Manager click on **Storage VMs** in the left-hand menu and select an SVM from the list.
2. On the **Settings** tab locate **Export Policies** and click on the arrow to access.



The screenshot displays the ONTAP System Manager interface. The left-hand navigation menu is expanded to show 'Storage VMs'. The main content area is titled 'Storage VMs' and shows a list of Storage VMs. The 'EHC\_NFS' SVM is selected. The 'Settings' tab is active, and the 'Export Policies' section is visible. A hand cursor is pointing to the right arrow icon next to the 'Export Policies' title, indicating the next step in the process.

Name
EHC_ISCSI
<input checked="" type="checkbox"/> EHC_NFS
HMC_187
HMC_3510
HMC_ISCSI_3510
infra_svm_a300
JS_EHC_ISCSI
OTVtest
svm0
Temp_3510_N1

Export Policies

- default
- 41 Rules
- JetStream\_NFS\_v02
- 0.0.0.0 for Any
- JetStream\_NFS\_v03
- 0.0.0.0 for Any

3. In the **New export policy** window add a name for the policy, click on the **Add new rules** button and then on the **+Add** button to begin adding a new rule.

## New export policy

NAME

WKLD\_DM01

Copy rules from existing policy

STORAGE VM

svm0

EXPORT POLICY

default

RULES

No data

+ Add



Add New Rules

Save

Cancel

4. Fill in the IP Addresses, IP address range, or network that you wish to include in the rule. Uncheck the **SMB/Cifs** and **FlexCache** boxes and make selections for the access details below. Selecting the UNIX boxes is sufficient for ESXi host access.

## New Rule




### CLIENT SPECIFICATION

### ACCESS PROTOCOLS

 SMB/CIFS FlexCache NFS  NFSv3  NFSv4

### ACCESS DETAILS

Type	Read-only Access	Read/Write Access	Superuser Access
All	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
All (As anonymous user) 	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
UNIX	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Kerberos 5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kerberos 5i	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Kerberos 5p	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
NTLM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Cancel

Save 



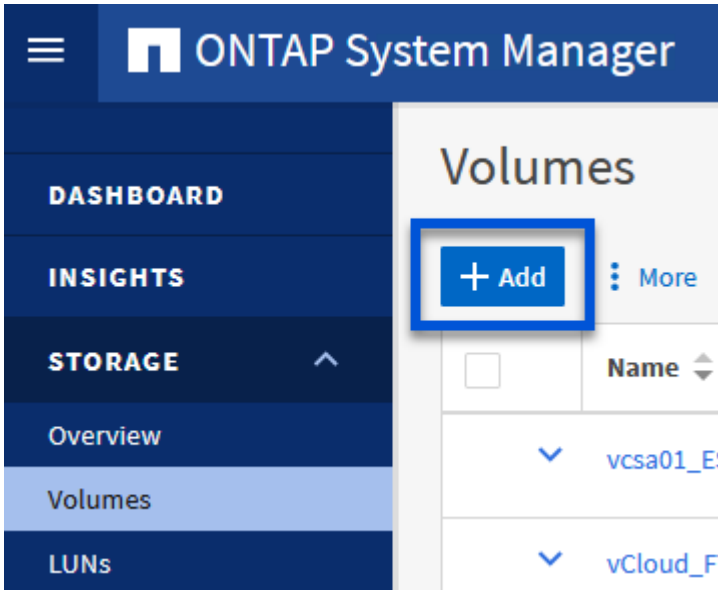
When deploying a VI Workload Domain, VCF validates connectivity to the NFS Server. This is done using the management adapter on the ESXi hosts before any additional vmkernel adapter is added with the NFS IP address. Therefore, it is necessary to ensure that the export policy includes the VCF management network in order to allow the validation to proceed.

- Once all rules have been entered click on the **Save** button to save the new Export Policy.
- Alternately, you can create export policies and rules in the ONTAP CLI. Refer to the steps for creating an export policy and adding rules in the ONTAP documentation.
  - Use the ONTAP CLI to [Create an export policy](#).
  - Use the ONTAP CLI to [Add a rule to an export policy](#).

## Create NFS volume

Create an NFS volume on the ONTAP storage system to be used as a datastore in the Workload Domain deployment.

1. From ONTAP System Manager navigate to **Storage > Volumes** in the left-hand menu and click on **+Add** to create a new volume.



2. Add a name for the volume, fill out the desired capacity and selection the storage VM that will host the volume. Click on **More Options** to continue.



## Add Volume



NAME

VCF\_WKLD\_01

CAPACITY

5



TiB



STORAGE VM

EHC\_NFS



Export via NFS

[More Options](#)

Cancel


Save

- Under Access Permissions, select the Export Policy which includes the VCF management network or IP address and NFS network IP addresses that will be used for both validation of the NFS Server and NFS traffic.

## Access Permissions

Export via NFS

GRANT ACCESS TO HOST

default 

- JetStream\_NFS\_v04  
Clients : 0.0.0.0/0 | Access protocols : Any
- NFSmountTest01  
3 rules
- NFSmountTestReno01  
Clients : 0.0.0.0/0 | Access protocols : Any
- PerfTestVols  
Clients : 172.21.253.0/24 | Access protocols : NFSv3, NFSv4, NFS
- TestEnv\_VPN  
Clients : 172.21.254.0/24 | Access protocols : Any
- VCF\_WKLD  
2 rules
- WKLD\_DM01  
2 rules
- Wkld01\_NFS  
Clients : 172.21.252.205, 172.21.252.206, 172.21.252.207, 172.21.252.208

+



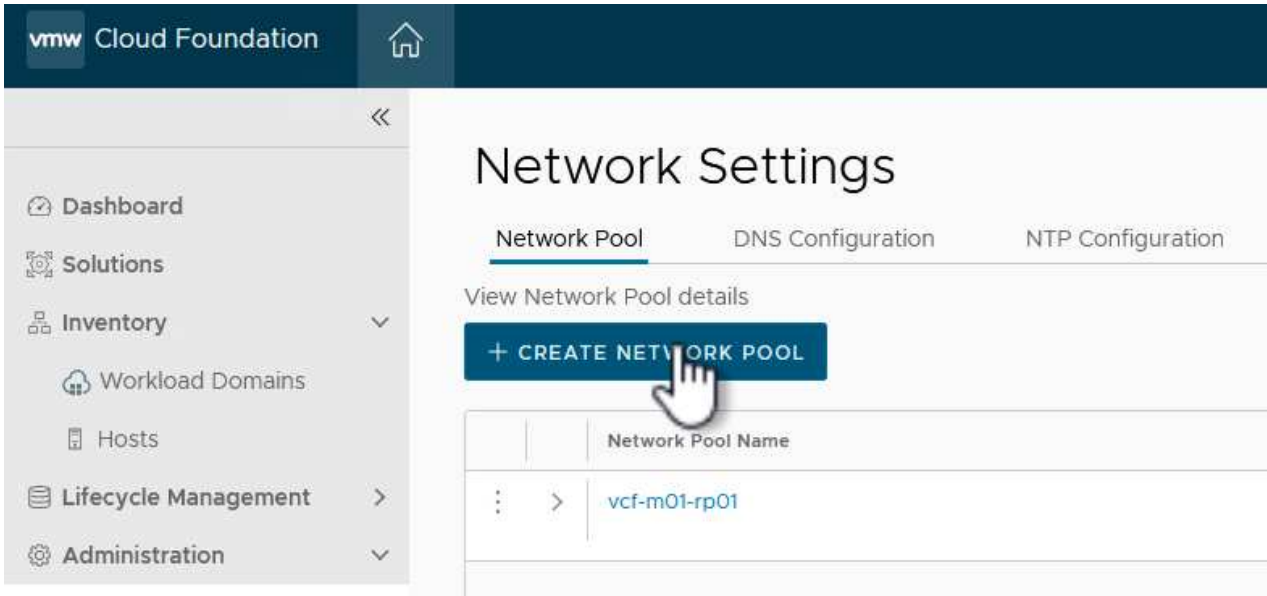
When deploying a VI Workload Domain, VCF validates connectivity to the NFS Server. This is done using the management adapter on the ESXi hosts before any additional vmkernel adapter is added with the NFS IP address. Therefore, it is necessary to ensure that either 1) the management network is routable to the NFS Server, or 2) a LIF for the management network has been added to the SVM hosting the NFS datastore volume, to ensure that the validation can proceed.

4. Alternately, ONTAP Volumes can be created in the ONTAP CLI. For more information refer to the [lun create](#) command in the ONTAP commands documentation.

## Create Network Pool in SDDC Manager

A Network Pool must be created in SDDC Manager before commissioning the ESXi hosts, as preparation for deploying them in a VI Workload Domain. The Network Pool must include the network information and IP address range(s) for VMkernel adapters to be used for communication with the NFS server.

1. From the SDDC Manager web interface navigate to **Network Settings** in the left-hand menu and click on the **+ Create Network Pool** button.



2. Fill out a name for the Network Pool, select the check box for NFS and fill out all networking details. Repeat this for the vMotion network information.

The screenshot shows the VMware Cloud Foundation interface for creating a Network Pool. The page is titled "Network Settings" and "Create Network Pool". The "Network Pool Name" is "NFS\_NPOOL". The "Network Type" is "NFS".

**NFS Network Information**

VLAN ID	3374
MTU	9000
Network	172.21.118.0
Subnet Mask	255.255.255.0
Default Gateway	172.21.118.1

**Included IP Address Ranges**

Once a network pool has been created, you are not able to edit or remove IP ranges from that pool.

172.21.118.145	To	172.21.118.148	REMOVE
xxx.xxx.xxx.xxx	To	xxx.xxx.xxx.xxx	ADD

**vMotion Network Information**

VLAN ID	3423
MTU	9000
Network	172.21.167.0
Subnet Mask	255.255.255.0
Default Gateway	172.21.167.1

**Included IP Address Ranges**

Once a network pool has been created, you are not able to edit or remove IP ranges from that pool.

172.21.167.121	To	172.21.167.124	REMOVE
xxx.xxx.xxx.xxx	To	xxx.xxx.xxx.xxx	ADD

At the bottom, there are "CANCEL" and "SAVE" buttons.

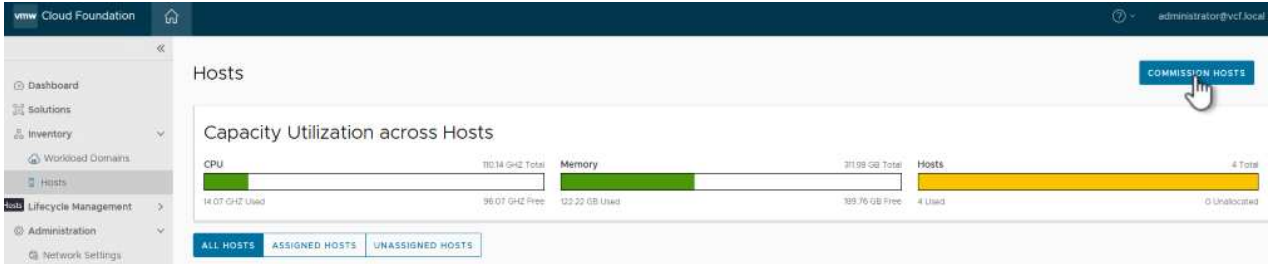
3. Click the **Save** button to complete creating the Network Pool.

## Commission Hosts

Before ESXi hosts can be deployed as a workload domain they must be added to the SDDC Manager inventory. This involves providing the required information, passing validation and starting the commissioning process.

For more information see [Commission Hosts](#) in the VCF Administration Guide.

1. From the SDDC Manager interface navigate to **Hosts** in the left-hand menu and click on the **Commission Hosts** button.



2. The first page is a prerequisite checklist. Double-check all prerequisites and select all checkboxes to proceed.

## Checklist

Commissioning a host adds it to the VMware Cloud Foundation inventory. The host you want to commission must meet the checklist criterion below.

- Select All**
- Host for vSAN/vSAN ESA workload domain should be vSAN/vSAN ESA compliant and certified per the VMware Hardware Compatibility Guide. BIOS, HBA, SSD, HDD, etc. must match the VMware Hardware Compatibility Guide.
- Host has a standard switch with two NIC ports with a minimum 10 Gbps speed.
- Host has the drivers and firmware versions specified in the VMware Compatibility Guide.
- Host has ESXi installed on it. The host must be preinstalled with supported versions (8.0.2-22380479)
- Host is configured with DNS server for forward and reverse lookup and FQDN.
- Hostname should be same as the FQDN.
- Management IP is configured to first NIC port.
- Ensure that the host has a standard switch and the default uplinks with 10Gb speed are configured starting with traditional numbering (e.g., vmnic0) and increasing sequentially.
- Host hardware health status is healthy without any errors.
- All disk partitions on HDD / SSD are deleted.
- Ensure required network pool is created and available before host commissioning.
- Ensure hosts to be used for VSAN workload domain are associated with VSAN enabled network pool.
- Ensure hosts to be used for NFS workload domain are associated with NFS enabled network pool.
- Ensure hosts to be used for VMFS on FC workload domain are associated with NFS or VMOTION only enabled network pool.
- Ensure hosts to be used for vVol FC workload domain are associated with NFS or VMOTION only enabled network pool.
- Ensure hosts to be used for vVol NFS workload domain are associated with NFS and VMOTION only enabled network pool.
- Ensure hosts to be used for vVol iSCSI workload domain are associated with iSCSI and VMOTION only enabled network pool.
- For hosts with a DPU device, enable SR-IOV in the BIOS and in the vSphere Client (if required by your DPU vendor).

CANCEL

PROCEED

3. In the **Host Addition and Validation** window fill out the **Host FQDN**, **Storage Type**, The **Network Pool** name that includes the vMotion and NFS storage IP addresses to be used for the workload domain, and the credentials to access the ESXi host. Click on **Add** to add the host to the group of hosts to be validated.

## 1 Host Addition and Validation

2 Review

## Add Hosts

You can either choose to add host one at a time or download [JSON](#) template and perform bulk commission.

Add new  Import

Host FQDN

Storage Type  vSAN  NFS  VMFS on FC  vVol

Network Pool Name

User Name

Password

ADD

## Hosts Added

Hosts added successfully. Add more or confirm fingerprint and validate host

REMOVE

Confirm all Finger Prints

VALIDATE ALL

<input checked="" type="checkbox"/>	FQDN	Network Pool	IP Address	Confirm FingerPrint	Validation Status
<input checked="" type="checkbox"/>	vcf-wkld-esx01.sddc.netapp.com	NFS_NP01	172.21.166.135	<input checked="" type="checkbox"/> SHA256:CKbsinf EOG+Hz/ lpFUoFDI2tLuY FZ47WicVdp6v EGM	<input type="checkbox"/> Not Validated

1 hosts

CANCEL

NEXT

- Once all hosts to be validated have been added, click on the **Validate All** button to continue.
- Assuming all hosts are validated, click on **Next** to continue.

## Hosts Added

✔ Host Validated Successfully. ✕

REMOVE  Confirm all Finger Prints (i) VALIDATE ALL

<input checked="" type="checkbox"/>	FGDN	Network Pool	IP Address	Confirm FingerPrint	Validation Status
<input checked="" type="checkbox"/>	vcf-wkld-esx04.sddc.netapp.com	NFS_NP01 <span style="font-size: 0.8em;">(i)</span>	172.21.166.138	<span style="color: green; font-weight: bold;">✔</span> SHA256:9Kg+9nQaE4SQkOMsQPON/k5gZB9zyKN+6CBPmXsvLBc	<span style="color: green; font-weight: bold;">✔</span> Valid
<input checked="" type="checkbox"/>	vcf-wkld-esx03.sddc.netapp.com	NFS_NP01 <span style="font-size: 0.8em;">(i)</span>	172.21.166.137	<span style="color: green; font-weight: bold;">✔</span> SHA256:nPX4/mei/2zmLJHfmPwbk6zhapoUxV2IOWZDPFH+z0	<span style="color: green; font-weight: bold;">✔</span> Valid
<input checked="" type="checkbox"/>	vcf-wkld-esx02.sddc.netapp.com	NFS_NP01 <span style="font-size: 0.8em;">(i)</span>	172.21.166.136	<span style="color: green; font-weight: bold;">✔</span> SHA256:AMhyR60OpTQ1YYq0DJhqVbj/M/GvrQaqUy7Ce+M4IWY	<span style="color: green; font-weight: bold;">✔</span> Valid
<input checked="" type="checkbox"/>	vcf-wkld-esx01.sddc.netapp.com	NFS_NP01 <span style="font-size: 0.8em;">(i)</span>	172.21.166.135	<span style="color: green; font-weight: bold;">✔</span> SHA256:CKbsinfEOG+ +z/lpFUoFDI2tLuYFZ47WicVDp6vEQM	<span style="color: green; font-weight: bold;">✔</span> Valid

CANCEL NEXT

- Review the list of hosts to be commissioned and click on the **Commission** button to start the process. Monitor the commissioning process from the Task pane in SDDC manager.



## Commission Hosts

1 Host Addition and Validation

2 **Review**

## Review

Skip failed hosts during commissioning   On

Validated Host(s)	
vcf-wkld-esx04.sddc.netapp.com	Network Pool Name: NFS_NP01 IP Address: 172.21.166.138 Storage Type: NFS
vcf-wkld-esx03.sddc.netapp.com	Network Pool Name: NFS_NP01 IP Address: 172.21.166.137 Storage Type: NFS
vcf-wkld-esx02.sddc.netapp.com	Network Pool Name: NFS_NP01 IP Address: 172.21.166.136 Storage Type: NFS
vcf-wkld-esx01.sddc.netapp.com	Network Pool Name: NFS_NP01 IP Address: 172.21.166.135 Storage Type: NFS

CANCEL

BACK

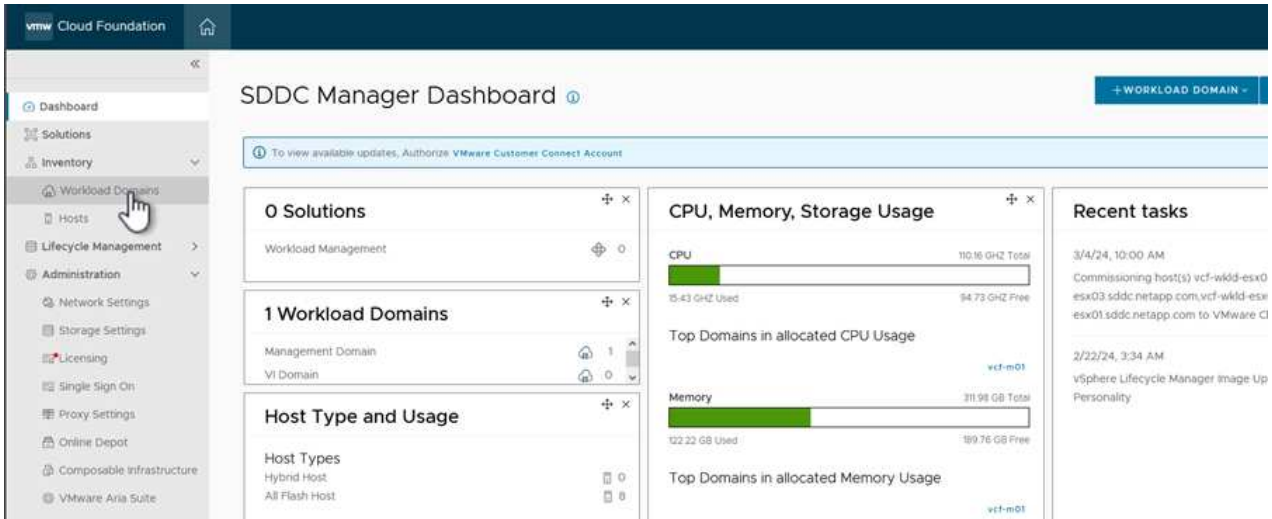
COMMISSION

## Deploy VI Workload Domain

Deploying VI workload domains is accomplished using the VCF Cloud Manager interface. Only the steps related to the storage configuration will be presented here.

For step-by-step instructions on deploying a VI workload domain refer to [Deploy a VI Workload Domain Using the SDDC Manager UI](#).

1. From the SDDC Manager Dashboard click on **+ Workload Domain** in the upper right hand corner to create a new Workload Domain.



2. In the VI Configuration wizard fill out the sections for **General Info, Cluster, Compute, Networking, and Host Selection** as required.

For information on filling out the information required in the VI Configuration wizard refer to [Deploy a VI Workload Domain Using the SDDC Manager UI](#).

+

# VI Configuration

## 1 General Info

2 Cluster

3 Compute

4 Networking

5 Host Selection

6 NFS Storage

7 Switch Configuration

8 License

9 Review

1. In the NFS Storage section fill out the Datastore Name, the folder mount point of the NFS volume and the IP address of the ONTAP NFS storage VM LIF.

VI Configuration

- 1 General Info
- 2 Cluster
- 3 Compute
- 4 Networking
- 5 Host Selection
- 6 NFS Storage

### NFS Storage

**NFS Share Details**

Datastore Name ⓘ	VCF_WKLD_01
Folder ⓘ	/VCF_WKLD_01
NFS Server IP Address ⓘ	172.21.118.163

2. In the VI Configuration wizard complete the Switch Configuration and License steps, and then click on **Finish** to start the Workload Domain creation process.

### VI Configuration

- 1 General Info
- 2 Cluster
- 3 Compute
- 4 Networking
- 5 Host Selection
- 6 NFS Storage
- 7 Switch Configuration
- 8 License
- 9 Review

### Review

General	
Virtual Infrastructure Name	vcf-wkld-01
Organization Name	it-inf
SSO Domain Option	Joining Management SSO Domain
Cluster	
Cluster Name	IT-INF-WKLD-01
Compute	
vCenter IP Address	172.21.166.143
vCenter DNS Name	vcf-wkld-vc01.sddc.netapp.com
vCenter Subnet Mask	255.255.255.0
vCenter Default Gateway	172.21.166.1
Networking	
NSX Manager Instance Option	Creating new NSX instance
NSX Manager Cluster IP	172.21.166.147
NSX Manager Cluster FQDN	vcf-w01-nsxc101.sddc.netapp.com
NSX Manager IP Addresses	172.21.166.144, 172.21.166.145, 172.21.166.146

CANCEL
BACK
FINISH

3. Monitor the process and resolve any validation issues that arise during the process.

### Install NetApp NFS Plug-in for VMware VAAI

The NetApp NFS Plug-in for VMware VAAI integrates the VMware Virtual Disk Libraries installed on the ESXi host and provides higher performance cloning operations that finish faster. This is a recommended procedure when using ONTAP storage systems with VMware vSphere.

For step-by-step instructions on deploying the NetApp NFS Plug-in for VMware VAAI following the instructions at [Install NetApp NFS Plug-in for VMware VAAI](#).

#### Video demo for this solution

[NFS Datastores as Principal Storage for VCF Workload Domains](#)

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