



# Getting Started

Welcome to the Nutanix AOS on AHV Bootcamp! This workbook accompanies an instructor-led session that introduces Nutanix Core technologies and many everyday management tasks.

You will explore Prism Element (PE) and become familiar with its features and navigation. You will use PE to perform basic cluster administration tasks, including storage and networking. You will also walk through basic VM deployment and management tasks with Prism and AHV. The instructor explains the exercises and answers any additional questions that you may have.

At the end of the bootcamp, attendees should understand the core concepts and technologies that comprise the Nutanix Enterprise Cloud stack and be well prepared for a hosted or onsite proof-of-concept (POC) engagement.

## What's New

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*(Last updated 8-10-22)*

Labs are updated for the following software versions:

- AOS 6.5 LTS

## Agenda

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- Introductions
- Nutanix Presentation
- Technology Overview
- Storage Configuration
- Networking Configuration
- Deploying Workloads
- Managing Workloads

## Introductions

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- Name
- Familiarity with Nutanix

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[Technology Overview →](#)



# Technology Overview

## Overview

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In this section, we will introduce the Prism Element (PE) graphical user interface (GUI), familiarize you with its layout, and navigation.

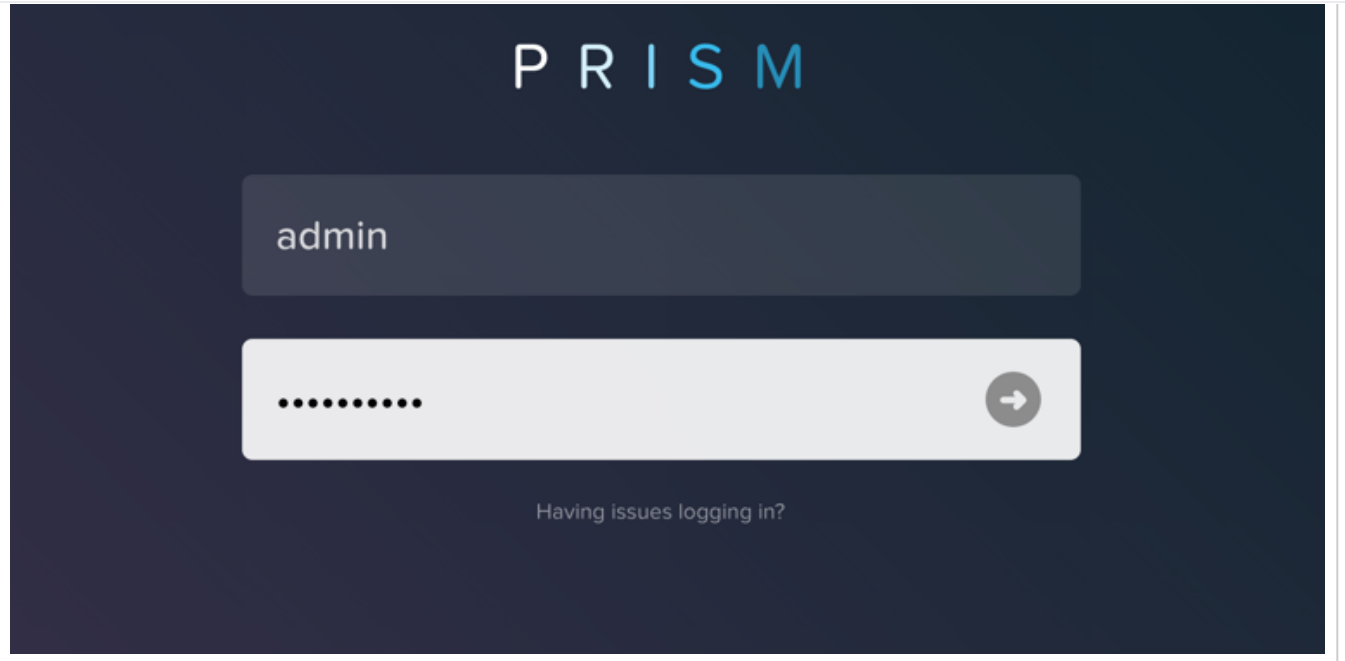
## Prism Element

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The Prism service provides the GUI for managing Nutanix clusters, and runs on every Controller VM (CVM), ensuring there isn't a single point of failure. This local Prism Element service can be accessed via the IP of any individual CVM, or via the virtual IP (VIP) for the cluster, which will redirect to the current Prism leader.

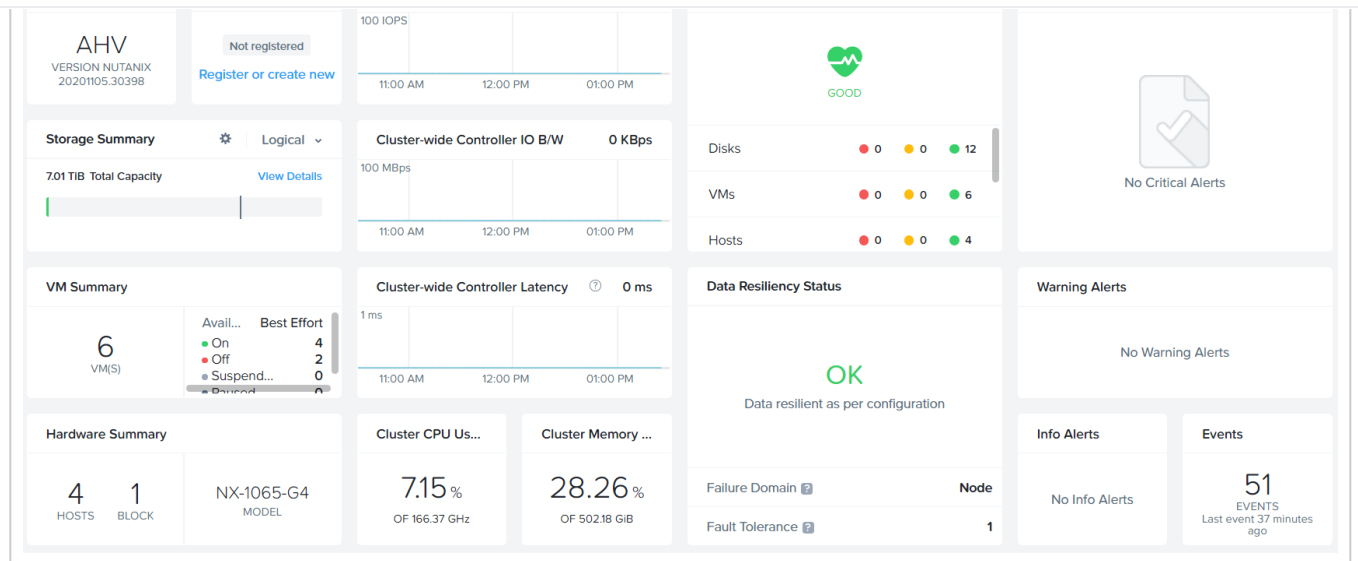
From the Firefox web browser (preferred), log into the Nutanix Prism GUI using the Cluster IP.

1. Enter `NUTANIX-CLUSTER-IP` into a new browser tab.
2. Log in using the following credentials:
  - **Username** - admin
  - **Password** - HPOC-PASSWORD

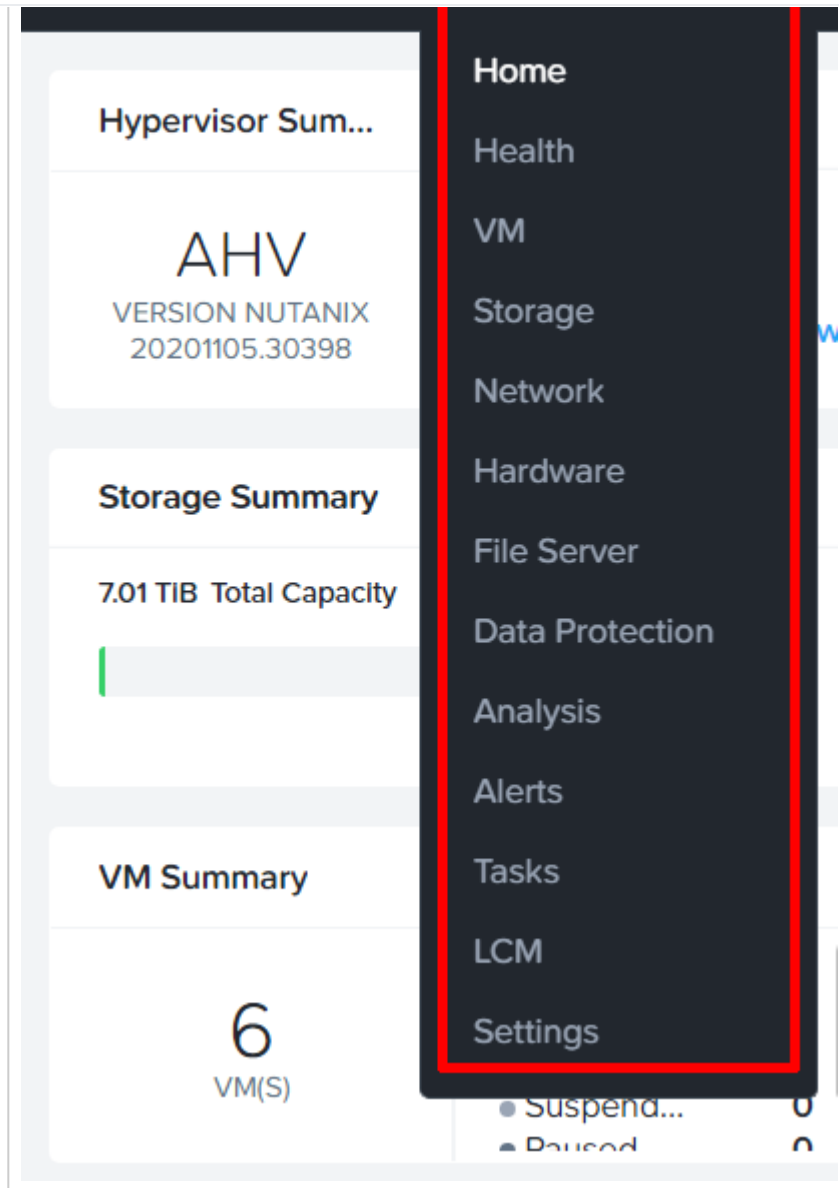


3. After you log in to PE, familiarize yourself with the GUI. Explore the information on the Home screen, as well as the other screens.
4. Review the Home screen, and identify the following items:
  - Hypervisor
  - Version
  - Hardware Model
  - Health
  - VM Summary
  - Warning Alerts
  - Data Resiliency Status

# NUTANIX BOOTCAMPS



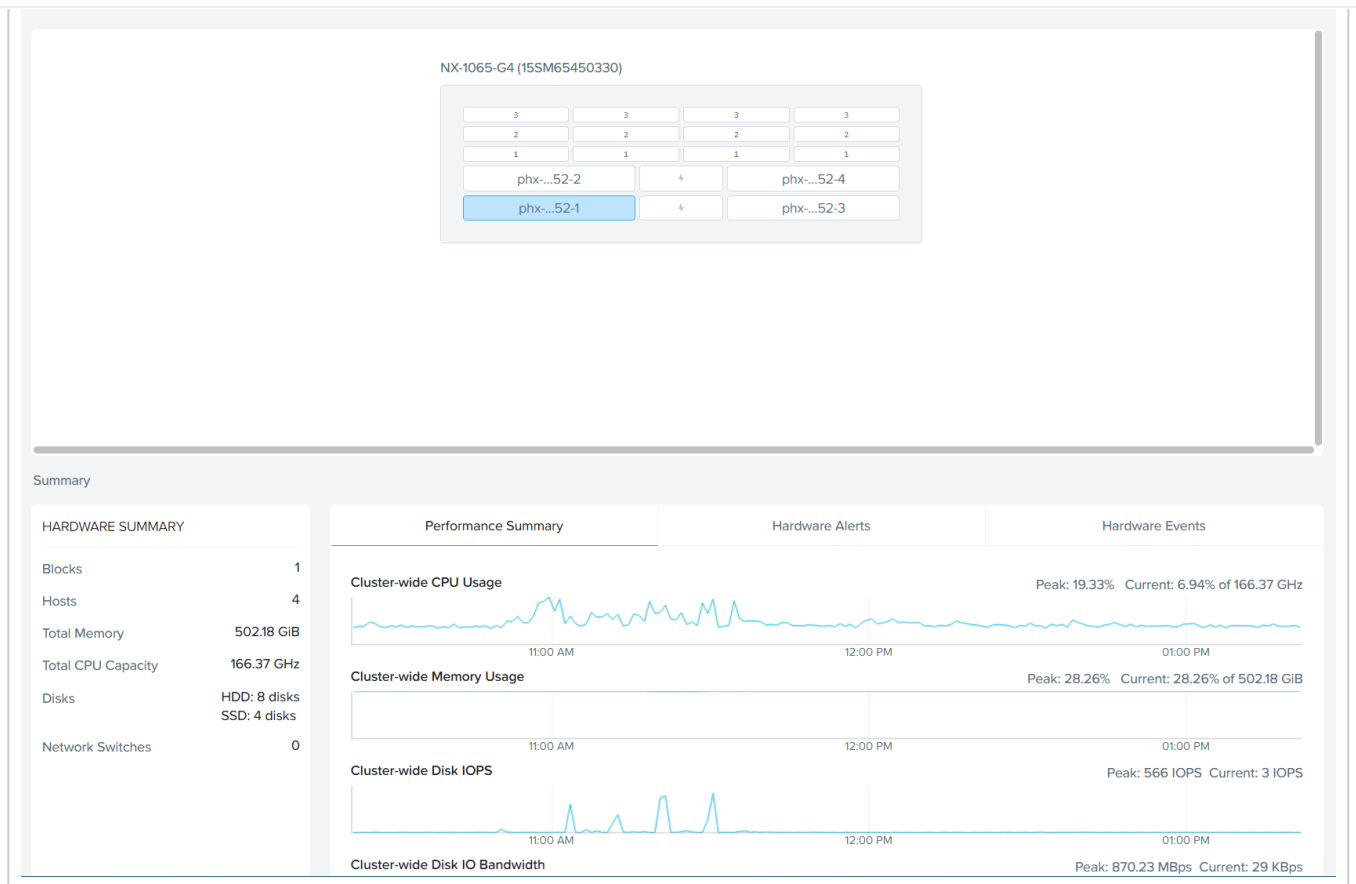
5. Review the GUI navigation options under the main drop-down menu. The label of this menu changes based on the dashboard that is currently being displayed. For example, from the Home dashboard it will be labeled *Home*, from the Health dashboard it will be labeled *Health*, etc.



6. Examine the cluster hardware. From the main drop-down, click **Hardware**, and then **Diagram**.

7. Review the hardware summary information:







- Blocks
- Hosts
- Memory
- CPU
- Disks



8. Review the other selections from the main drop-down, and do a quick walk through:

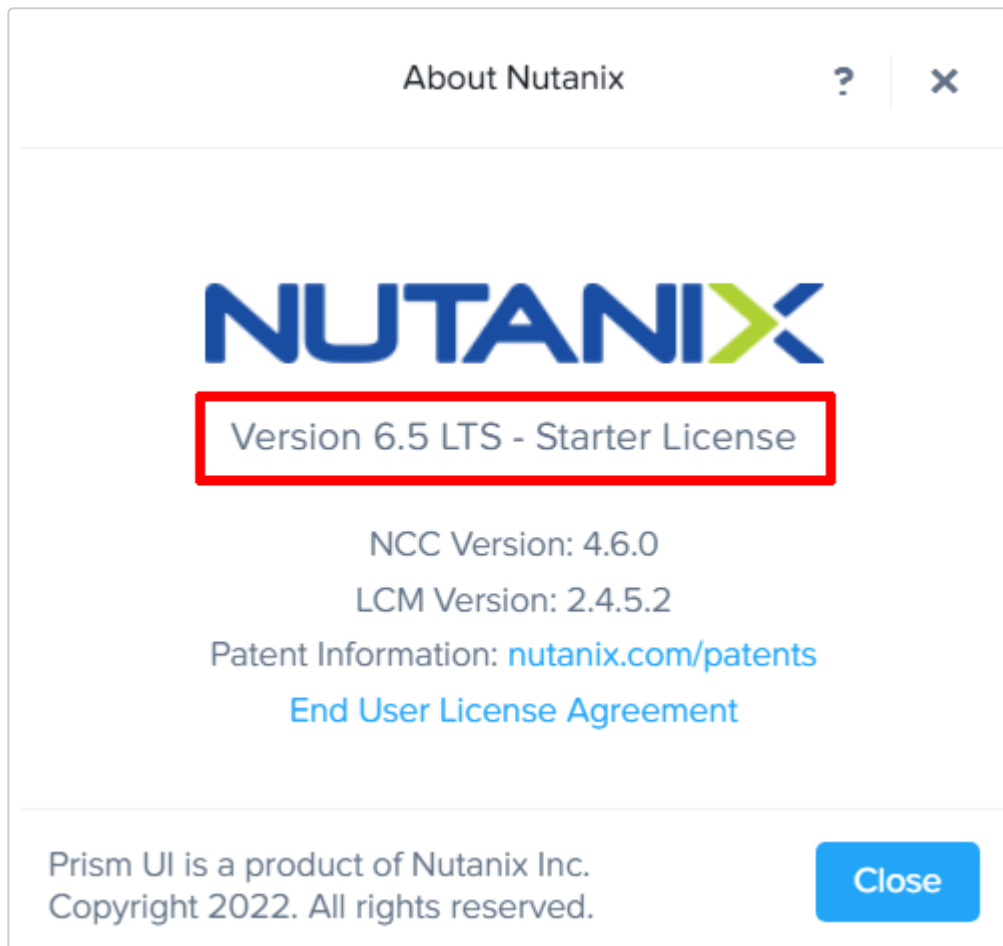
- VM
- Health
- Network
- Data Protection
- Storage
- Alerts

9. Review other selections on the top navigation bar:

- Health 
- Alarms 
- Tasks 
- Search 
- Help 
- Configuration 
- User - Displays currently logged in user (ex. admin)

## Prism Element GUI Review

Q: Where would you locate the version of AOS you are running?



A: You can do this by clicking on the *User* drop-down, and then clicking **About Nutanix**.

Q: How would you view a summary of the number of hosts (nodes), the resource capacity, and current utilization?



# NUTANIX BOOTCAMP

4 Hosts												
search in table												
Host	Disk	Switch										
Host Name	Host IP	CVM IP	Hypervisor	CPU Usage	CPU Capacity	Memory Usage	Memory Capacity	Total Disk Usage	Disk Usage	Disk IOPS	Disk IO B/W	Disk IO Latency
phx-poc052-1	10.42.52.25	10.42.52.29	AHV	8.94%	41.6 GHz	26.82%	125.5 5 GiB	41.19 GiB of 3.55 TiB	1.13%	0	1 KBps	43.24 ms
phx-poc052-2	10.42.52.26	10.42.52.30	AHV	7.83%	41.58 GHz	26.82%	125.5 5 GiB	35.08 GiB of 3.49 TiB	0.98%	0	6 KBps	22.19 ms
phx-poc052-3	10.42.52.27	10.42.52.31	AHV	9.04%	41.6 GHz	26.82%	125.5 5 GiB	17.88 GiB of 3.49 TiB	0.5%	0	2 KBps	11.5 ms
phx-poc052-4	10.42.52.28	10.42.52.32	AHV	8.23%	41.58 GHz	26.81%	125.5 5 GiB	15.03 GiB of 3.49 TiB	0.42%	0	0 KBps	20.62 ms

A: From the main drop-down, click **Hardware** > **Table** > **Host**.

Q: How would you see the health of your cluster?

☰ All Checks	760
BY CHECK STATUS	
✓ Passed	757
✗ Failed	0
! Warning	0
⚠ Error	1
⏻ Off	2
BY CHECK TYPE	
🕒 Scheduled	288
🕒 Not Scheduled	49
🕒 Event Triggered	423

A: From the main drop-down, click **Health**, which will default to *Summary* on the right-hand pane.

Q: What page would show you the latest activity, including being able to monitor the progress of any task, and keep track of what has been done in the past using time stamps? Can you figure out two different ways to get there?

Filters

Type text to filter by ☆

Viewing all 16 Tasks Export 1 - 16 of 16

Task	Entity Affected	Progress	Status	Created On	Duration
Cluster upgrade task	Cluster   <a href="#">Details</a>	<div></div> 100%	Succeeded	Aug 9, 2022, 10:5...	39 minutes 8 sec...
Preupgrade Steps	Cluster	<div></div> 100%	Succeeded	Aug 9, 2022, 10:5...	6 minutes 5 seco...
LCM operations completed su...	<a href="#">Details</a>	<div></div> 100%	Succeeded	Aug 8, 2022, 04:1...	20 hours 57 minu...
VM create with customize	<a href="#">WinServerGold   Details</a>	<div></div> 100%	Succeeded	Aug 8, 2022, 02:3...	1 second
VM create	<a href="#">CentOSGold</a>	<div></div> 100%	Succeeded	Aug 8, 2022, 02:3...	Under 1 second

A: From the main drop-down, click **Tasks**. Alternatively, click the circle .

## Takeaways

- Prism Element is thoughtfully laid-out GUI.
- Critical information is displayed front and center.

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[Storage Configuration →](#)

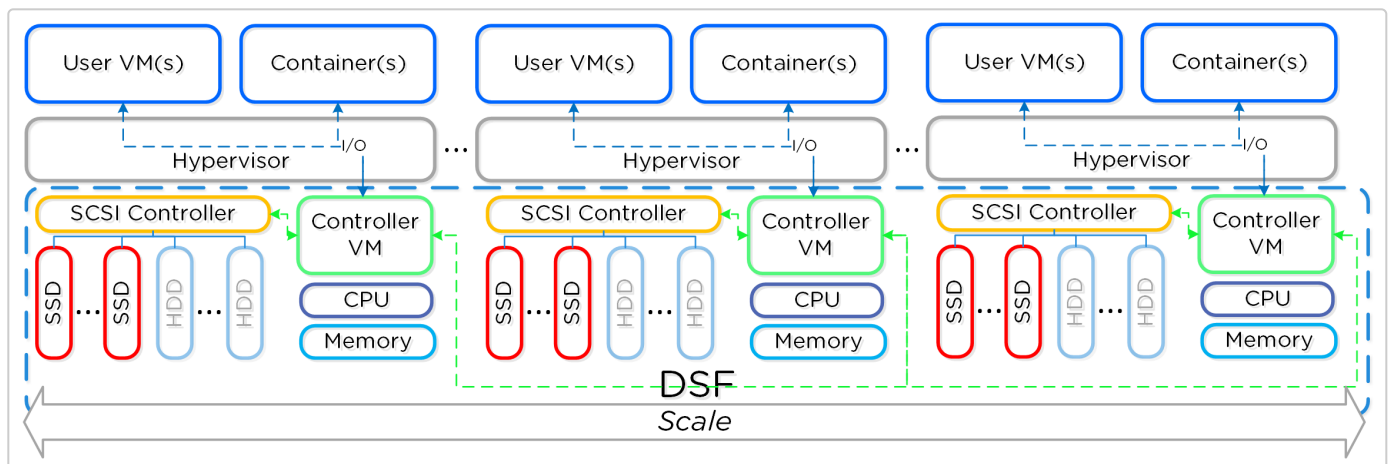
# Storage Configuration

## Overview

In this section, we will use Prism to perform a basic container setup.

## Distributed Storage Fabric (DSF)

The Nutanix Distributed Storage Fabric (DSF) presents storage to the hypervisor in a way that looks identical as if it were presented from any centralized storage array. However, Nutanix uses Controller VMs (CVMs) combined with the local storage within each node to provide shared storage for the cluster that is both redundant and resilient. The combination of computing and distributed local storage resources is now commonly referred to as Hyper-converged Infrastructure (HCI).



As a pioneer in the HCI space, Nutanix DSF is a mature solution capable of delivering the performance and resiliency needed to support **many different workloads** [↗](#), including enterprise databases, virtual desktops, Remote Office - Branch Office (ROBO), Big Data, and more.

The two main storage constructs within the DSF are the *Storage Pool* and *Storage Containers*.

environment) are not required. As new nodes are added to a cluster, disks are automatically added to the pool, and the cluster will begin [re-distributing data to the new disks](#) as a background task.

The *Storage Containers* are software-defined, logical constructs that allow you to configure storage policy for groups of VMs or vDisks. In the next exercise, you will walk through the process for creating and configuring Nutanix storage within Prism.

## Note

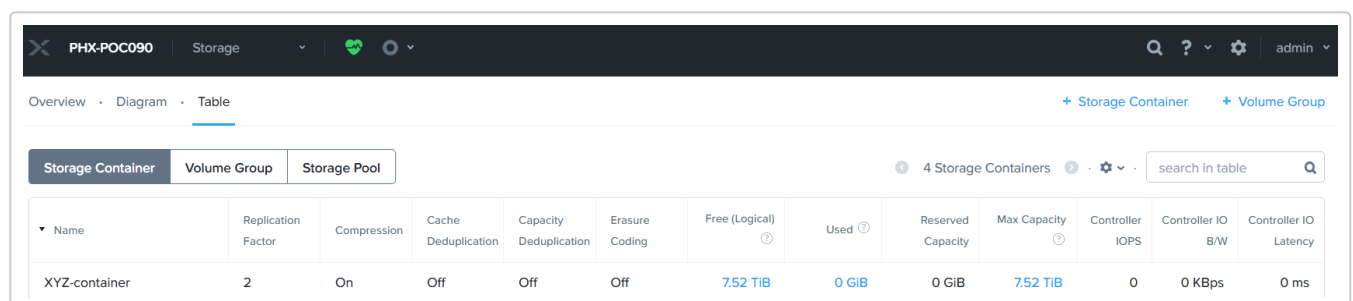
To learn more about additional DSF constructs such as vDisks, extents, and extent groups, refer to [this section](#) of the Nutanix Bible.

## Prism Element Storage Configuration Items

### Configure Storage Containers

Let's use PE to perform a basic container setup.

1. From the main drop-down, choose **Storage**. Select **Table > + Storage Container**.
2. Use the following specifications, and then click **Save**.
  - o **Name** - Initials -Container
  - o Select **Advanced Settings**
  - o **Advertised Capacity** - 500 GiB
  - o Select **Compression**
  - o **Delay (In Minutes)** - 0



The screenshot shows the Nutanix Prism Element interface for configuring storage containers. The top navigation bar includes the cluster name 'PHX-POC090', the 'Storage' section, and user controls. Below the navigation bar, there are tabs for 'Overview', 'Diagram', and 'Table'. The 'Table' tab is active, showing a list of storage containers. The table has columns for Name, Replication Factor, Compression, Cache Deduplication, Capacity Deduplication, Erasure Coding, Free (Logical), Used, Reserved Capacity, Max Capacity, Controller IOPS, Controller IO B/W, and Controller IO Latency. A single container named 'XYZ-container' is listed with a replication factor of 2, compression on, and various capacity and performance metrics.

Name	Replication Factor	Compression	Cache Deduplication	Capacity Deduplication	Erasure Coding	Free (Logical)	Used	Reserved Capacity	Max Capacity	Controller IOPS	Controller IO B/W	Controller IO Latency
XYZ-container	2	On	Off	Off	Off	7.52 TiB	0 GiB	0 GiB	7.52 TiB	0	0 KBps	0 ms

# NUTANIX BOOTCAMPS

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You can create multiple containers with different policies, all sharing capacity from the

**Storage Pool**. For example, you may want to enable **deduplication** [↗](#) for a storage container used for full clone persistent virtual desktops. However, deduplication wouldn't make sense for workloads such as databases. Similarly, you may want to create a storage container with **erasure coding** [↗](#) enabled for archival data, such as backups or security footage.

3. Explore the configuration basics further by updating your Container configuration. How would you ensure capacity availability for critical VMs on a cluster running mixed workloads?
4. Try selecting different storage containers on the cluster and reviewing the *Storage Container Details* below.

Name	XYZ-Container
Replication Factor	2
Free Space (Logical)	500 GiB
Used	0 GiB
Max Capacity	500 GiB
Reserved	0 GiB
Data Reduction Ratio	-
Data Reduction Savings	-
Effective Free	-
Overall Efficiency	-
Compression	On
Capacity Deduplication	Off
Cache Deduplication	Off
Erasure Coding	Off
Filesystem Whitelists	None

This view provides a breakdown of the savings from each available data reduction option and the *Effective Usable Capacity* of the container. Hover your mouse over any link for further details. The *Data Reduction Ratio* is the data efficiency when accounting for compression, deduplication, and erasure coding. The *Overall Efficiency* number tracks data reduction and native data avoidance, specific savings from thin provisioning and cloning.

## Replication Factor (RF)

number of data copies to maintain (2 or 3). A replication factor of 3 adds an extra layer of data protection at the cost of storage an additional data copy.

Interested in learning about how RF writes and reads work? Check out the video below.

## Tech TopX: Data Protection



RF policies are applied on a per-container basis.

Nutanix clusters can also enforce [availability domain policies](#) at the Block or Rack level.

Block Awareness ensures that secondary copies of data are not written to a node within the same physical enclosure as the primary copy. Block Awareness allows for the loss of a multi-node block without experiencing data unavailability. The same concept can be applied using a Nutanix cluster spanning multiple racks.

The basic requirement for rack/block fault tolerance is to have a minimum of 3 blocks in the cluster (for RF2) as we need to store three copies of metadata. Rack and block awareness can be supported with erasure coding enabled.


1. Within the *Home* screen, click **OK** within the *Data Resiliency Status* box.



Node		
Component	Failures Tolerable	Message
Extent Group	1	
Oplog	1	
Cassandra Ring	1	
Zookeeper	1	
Free Space	1	
Static Configuration	1	
Erasure Coding	1	
Stargate Health	1	

Close

Data Resiliency Status indicates how many failures can be tolerated without impacting the cluster. Each service listed has a specific function in the cluster. For example, Zookeeper nodes maintain configuration data (service states, IPs, host information, etc.) for the cluster.

- The RF of a cluster in PE can be configured by clicking **Redundancy State** in the  menu. An RF2 cluster can be upgraded to support RF3 (which requires a minimum of 5 nodes), or downgraded to RF1 with the following caveat:

Enabling RF1 does not guarantee data availability. Nutanix recommends enabling RF1 when your primary cluster use case is running applications that do not require storage resiliency.

## Takeaways

- The Distributed Storage Fabric provides RF2 or RF3 shared storage to the cluster.
- Storage Containers allow you to define storage policy for VMs, including RF level, compression, deduplication, and erasure coding.

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[Network Configuration →](#)

# Network Configuration

## Overview

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In this section, you will learn how to set up a network. The networks you create in the steps below provide VMs with connectivity by assigning the appropriate networks to the VM's respective virtual network interface cards (NICs).

## AHV Networking Background

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Nutanix's Acropolis Hypervisor (AHV) leverages Open vSwitch (OVS) for all VM networking. OVS is an open-source software switch designed to work in a multi-server virtualization environment. Each AHV server maintains an OVS instance, and all OVS instances combine to form a single logical switch.

Each node is typically uplinked to a physical switch to multiple virtual LANs (VLANs), exposed as virtual networks.

VM networking is configured through Prism (or optionally CLI/REST), making network management in AHV very simple.

With AHV, you can also set up a DHCP server to automatically provide IP addresses for VMs on that network using the IP address management (IPAM) service. IPAM can potentially make network management more straightforward, as you wouldn't have to set up a separate DHCP server for the network.

Additional details about AHV networking can be found [here](#).

## Virtual Networks

- Similar to a VMware distributed port group.

- Each virtual network is a common point of configuration for a group of VMs.
- Physical switch port must be configured to trunk VLAN.

Create Network

?

×

Network Name

XYZ-Network

Virtual Switch

vs0

▼

VLAN ID ?

1337

☐ Enable IP address management
 

This gives AHV control of IP address assignments within the network.

Cancel

Save

Network Configuration

?

×

Networks

Internal Interfaces



Virtual Switch

+ Create Network

Network Name	Virtual Switch	VLAN ID	Used IP Addresses	Free IPs in Subnets	Free IPs in Pool	Actions
Primary	vs0	0	3	125	81	Edit · Delete
Secondary	vs0	411	N/A	N/A	N/A	Edit · Delete

## Virtual NICs of VMs

- Each vNIC belongs to exactly one virtual network.
- For IPAM-enabled networks, vNICs get life-long static IP assignments.
- User may configure pools to allocate IPs, either automatically or by specifying the IP manually.

VLAN ID / VPC	VIRTUAL SWITCH	PRIVATE IP	MAC	
1337				
XYZ-network	vs0	-	... b7:c2:e3	 

## IP Address Management (IPAM)

- Integrated DHCP Server.
- AHV intercepts DHCP requests from guests on IPAM networks, and injects responses.
- Virtualization admin manages a range of IP addresses.
- Supports DHCP options, with UI support for DNS and TFTP configuration.

Create Network?×

Network Name

XYZ-Network\_IPAM

Virtual Switch

vs0

VLAN ID ?

1337

☒ Enable IP address management

This gives AHV control of IP address assignments within the network.

Network IP Address / Prefix Length

10.0.0.0/24

Gateway IP Address

10.0.0.1

Cancel

Save

## Configure Network

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In the following exercise, you will create networks using invalid VLANs, meaning no VM traffic will be transmitted outside an individual host. This behavior is expected for demonstration/education purposes only.

### Create Subnet without IPAM

Connect to Prism Element and create a network for user VM interfaces. Use any VLAN other than 0, and do not enable IP address management.

1. From the main drop-down, choose **VM**.
2. Select **Network Config**, and then click **+ Create Subnet**.
3. Fill out the following fields and click **Save**:

- **Subnet Name** - `Initials -Network`
- **VLAN ID** - A value (< 4096) other than your *Primary* or *Secondary* network VLANs
- Do not select *Enable IP Address Management*

The configured virtual network will now be available across all nodes within the cluster, conveying the benefit of not having to configure the same settings on each host within the cluster. When creating VMs in IPAM managed networks, the IP can optionally be manually specified during vNIC creation.

### Create Subnet with IPAM

Let's create another network, but this time we will enable IPAM.

1. Fill out the following fields and click **Save**:

- **Subnet Name** - `Initials -Network_IPAM`
- **VLAN ID** - A value (< 4096) other than your *Primary\** or *Secondary* network VLANs
- Select **Enable IP Address Management**
- **Network IP Address / Prefix Length** - `10.0.0.0/24`

- **Create Pool** - 10.0.0.100-10.0.0.150
- Do not select *Override DHCP Server*

Create Network?×

Network Name

XYZ-Network\_IPAM

Virtual Switch

vs0

VLAN ID ?

1337

☒ Enable IP address management

This gives AHV control of IP address assignments within the network.

Network IP Address / Prefix Length

10.0.0.0/24

Gateway IP Address

10.0.0.1

Cancel

Save

## Note

It is possible to create multiple pool ranges for a network.

The configured virtual network will now be available across all nodes within the cluster. VMs with vNICs on this network will receive a DHCP address from the range specified. This IP assignment lasts for the life of the VM, avoiding the need to depend on DHCP reservations or static IPs for many workloads.

## Takeaways

- It's effortless to set up a network in the cluster to establish VM connectivity.

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[← Storage Configuration](#)

[Deploying Workloads →](#)



# Deploying Workloads

## Overview

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In addition to storage, VM creation, management, and monitoring can all be performed for Nutanix AHV directly through Prism. Prism also offers native support for VM CRUD (create, read, update, delete) operations for Nutanix clusters running ESXi.

In the following exercise, we'll create VMs from source media and existing disk images.


## Creating a Windows VM

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You will now create a Windows Server VM from a Windows installation ISO image.

AHV provides an Image Service feature to build a store of imported ISO or disk image files. The Image Service supports raw, vhd, vhdx, vmdk, vdi, iso, and qcow2 disk formats.

### Note

You can explore the available images and upload additional images under  > **Image Configuration** in Prism Element.

To provide high-performance IO to VMs, AHV requires installing paravirtualized drivers into the guest (similar to VMware Tools). For Windows guests specifically, these drivers must be loaded during installation for the VM's disk to be accessible by the Windows installer.

Nutanix validates and distributes these drivers via the [Nutanix Portal](#). The ISO image containing the drivers has already been uploaded to the Image Service.

1. From the main drop-down, choose **VM**. Select **Table** > **+ Create VM**.
2. Fill out the following fields and click **Save**:

# NUTANIX BOOTCAMPS

◦ **Name** - `Initials` - `Windows`

- **vCPU(s)** - 2
- **Memory** - 4 GiB

Within the *Disks* section, select  next to CD-ROM.

- **Operation** - Clone from Image Service
- **Image** - Windows2019.ISO
- Select **Update**

This will mount the Windows Server ISO from the Image Service for boot/installation.

Select **+ Add New Disk**

- **Type** - DISK
- **Operation** - Allocate on Storage Container
- **Storage Container** - `Initials` -Container
- **Size (GiB)** - 30 GiB
- Select **Add**

This will create a 30GiB vDisk on the selected Storage Container.

Select **+ Add New Disk**

- **Type** - CD-ROM
- **Operation** - Clone from Image Service
- **Image** - Nutanix-VirtIO-1.1.6.iso
- Select **Add**

Select **+ Add New NIC**

- **VLAN Name** - `Initials` -Network
- Select **Add**

This will add a single virtual NIC to the VM on the selected Virtual Network.

3. Click **Save** to create the VM.

4. Right-click on your VM and then select **Power On**.

Manage Guest Tools

Launch Console

Power on

Take Snapshot

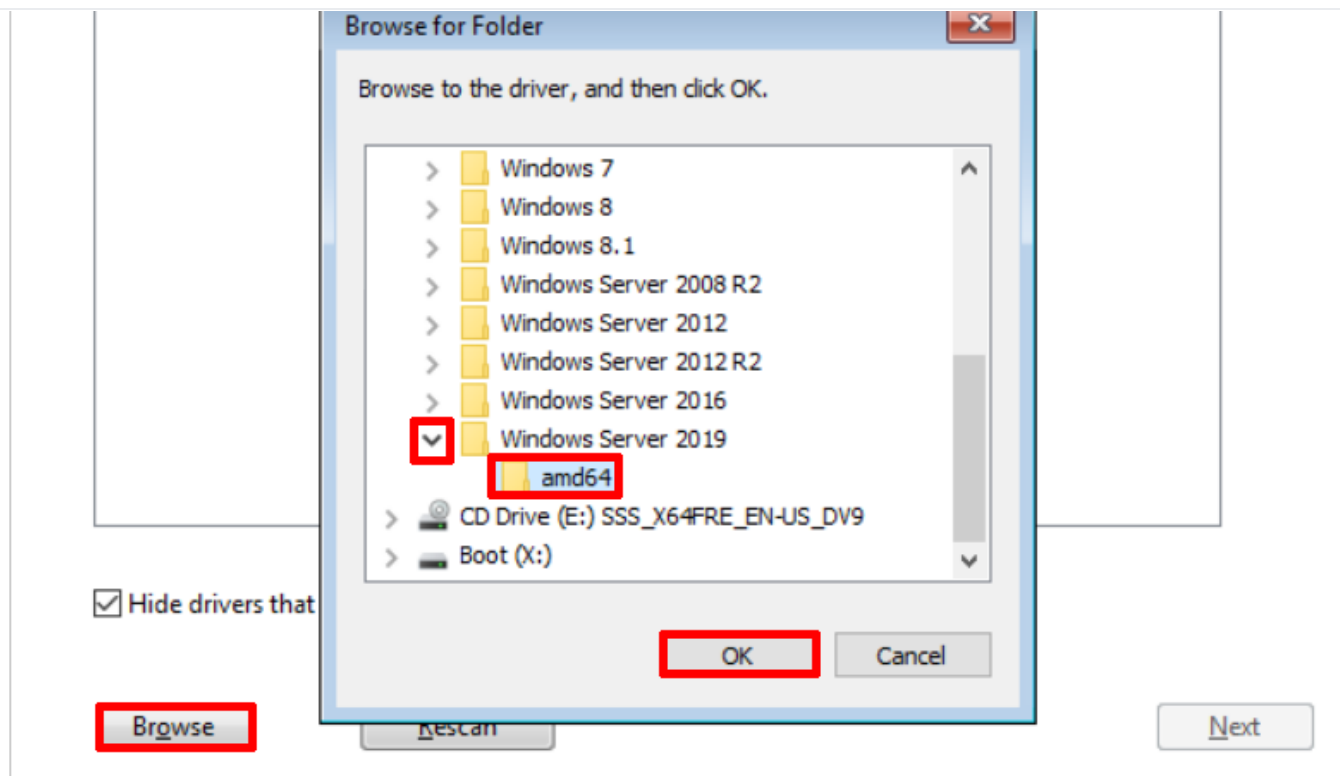
Migrate

Clone

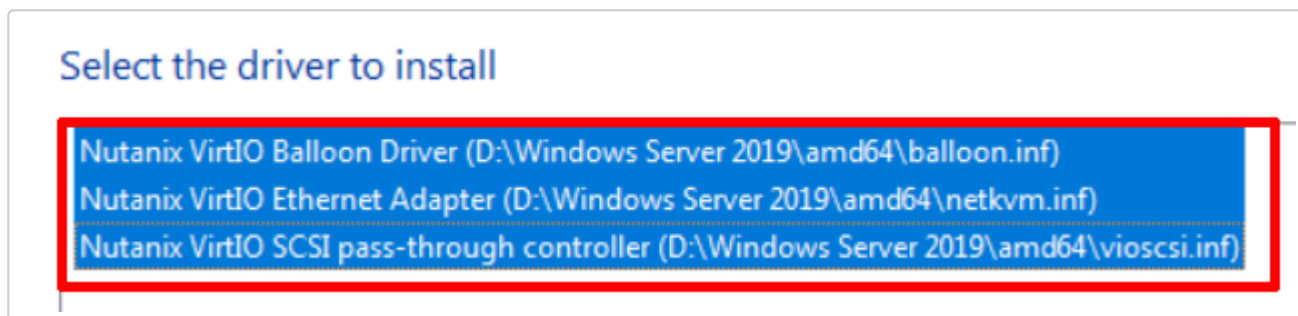
Update

Delete

5. After a few moments, right-click on your VM and select **Launch Console** from the list of actions to access the HTML5 console, allowing you to interact with the VM.
6. Progress through the standard install questions until you reach the Windows install location.
7. Choose **I don't have a license key, Windows Server 2019 Datacenter (Desktop Experience)**, and **Custom** installation when presented with the choice.
8. Click **Load Driver**, and navigate to the CD where the Nutanix VirtIO ISO is mounted.
9. Select the directory that corresponds to the Windows 2019.



10. Select the three Nutanix drivers displayed. Press and hold the **Ctrl** key to select all three drivers: Balloon, Ethernet adapter, and SCSI passthrough controller.



11. Click **Next**.

After the drivers are loaded, the disk created in step 2 appears as an installation target.

12. Select that disk, and continue with the normal install process.
13. Following Windows installation, install the Nutanix Guest Tools (NGT) by right-clicking and choosing **Manage Guest Tools > Enable Nutanix Guest Tools > Mount Nutanix Guest Tools > Submit**. Select the link to unmount one of the CD-ROM drives when prompted.

*Consistent (VSS) snapshots.*

Manage VM Guest Tools?×

Please select the guest tool

☒ Enable Nutanix Guest Tools

☒ Mount Nutanix Guest Tools

ENABLE APPLICATIONS

☒ Self Service Restore (SSR) ?

☒ Volume Snapshot Service / Application Consistent Snapshots (VSS) ?

Cancel

Submit

## Creating a Linux VM

You will now create a CentOS VM from an existing, pre-installed disk image in the Image Service. It is common in many environments to have template-style images of pre-installed operating systems. Similar to the previous exercise, the disk image has already been uploaded to the Image Service.

1. From the main drop-down, choose **VM > Table**, and then click **+ Create VM**.

2. Fill out the following fields and click **Save**:

- **Name** - `Initials -Linux`
- **vCPU(s)** - `1`
- **Memory** - `2` GiB Select **+ Add New Disk**
- **Type** - DISK

- Select **Add** Select **Add New NIC**
- **VLAN Name** - `Initials` -Network
- Select **Add** This will add a single virtual NIC to the VM on the selected Virtual Network.

3. Click **Save** to create the VM.

4. (Optional) Complete the installation within the VM console.

## Takeaways

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- In this lab, you saw how simple it is to deploy either a Windows and Linux VM.
- The Image Configuration tool allows you to catalog available images used in VM deployments as needed and cover broad format support that includes raw, vhd, vhdx, vmdk, vdi, iso, and qcow2.

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[Managing Workloads →](#)

# Managing Workloads

## Overview

Now that you have a couple of VMs deployed, let's have some fun and explore some of the VM management tasks with AHV: power actions, searching, cloning, and migrating.

## Workload Management

### Power Actions and Console Access

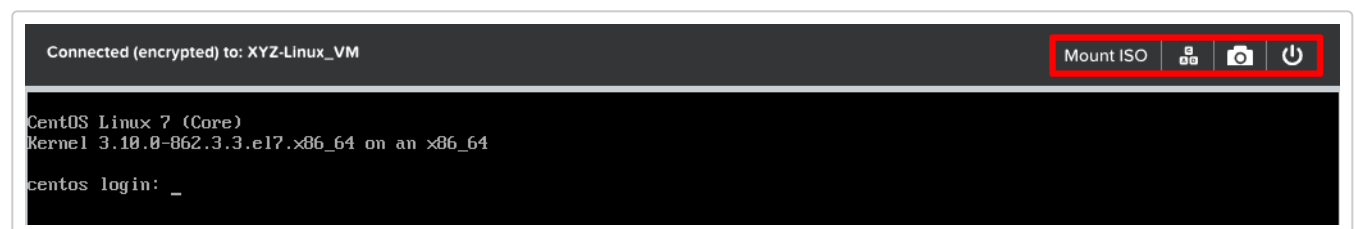
Explore VM power actions and console access.

1. Choose **VM** > **Table** from the main drop-down and use the search bar to locate the Linux VM you created in the previous exercise. (ex. `Initials -Linux`)

Note that the Power State column for that VM shows a red dot, indicating that the VM is powered off.

2. Right-click on the VM and choose **Power On**. Wait a few moments, and then right-click on the VM and select **Launch Console**.

The console window provides 4 actions: Mount ISO, Send CTRLALTDEL, Take screenshot, and Power.



## Cloning VMs

2. Fill out the following fields, and then click **Save**.

Leave other settings at their default values.

- **Number of Clones** - 2
- **Prefix Name** - `Initials -Linux-Clone`
- **Starting Index Number** - 1



## General Configuration

Number Of Clones

Prefix Name

Starting Index Number

Example: XYZ-Linux-Clone1, XYZ-Linux-Clone2, XYZ-Linux-Clone3,...

## Compute Details

vCPU(s)

Number Of Cores Per vCPU

Memory ?

Cancel

Save

Both Nutanix snapshots and clones use a [redirect-on-write](#) algorithm to quickly and efficiently create copies of VMs as a metadata operation.

## Migrating a VM Between Hosts

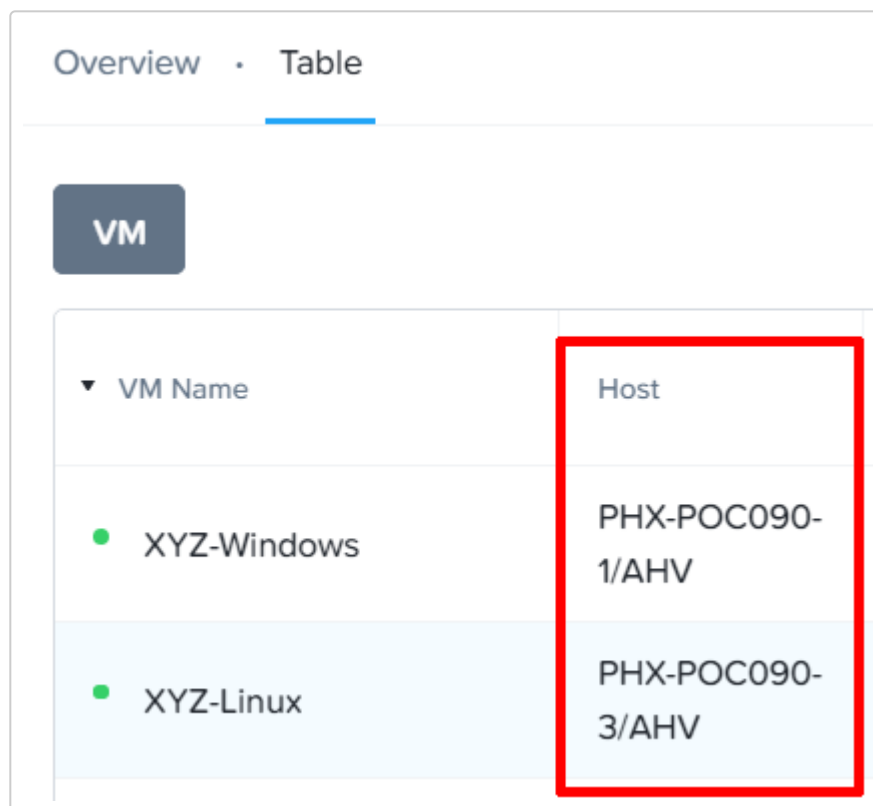
VM live migration is a critical feature for any virtualized environment, allowing VMs to move seamlessly across hosts within a cluster to enable infrastructure maintenance or performance

1. Right-click on your `Initials`-Linux-vm, and choose **Migrate**.

You can either choose one of the other hosts in the cluster as a migration target for the VM or accept the default and let AHV automatically select a location.

2. Click **Migrate** to finalize the action.

When the task completes, verify that your VM host location has changed from the host recorded above to the new location you selected.



The screenshot shows the 'Table' view of the VM management interface. A table lists VMs and their current hosts. The 'XYZ-Linux' VM is highlighted in blue, and its host, 'PHX-POC090-3/AHV', is highlighted with a red box.

VM Name	Host
XYZ-Windows	PHX-POC090-1/AHV
XYZ-Linux	PHX-POC090-3/AHV

## Configuring Affinity Policies

VM-to-Host affinity rules are commonly used to configure VMs to only run on specific hosts. Affinity is typically done either for performance or licensing reasons. AHV can also create VM-to-VM anti-affinity rules, commonly used for highly available applications, or when you need to ensure multiple instances of an application do not run on the same node.

1. Select one of your `Initials`-Linux clones from the previous exercises, right-click and choose **Update + Set Affinity**.

Set VM Host Affinity

?

×

Select Hosts

Select more than one host to ensure that the VM can be run even if there is a node failure.

PHX-POC090-1

PHX-POC090-2

✓

PHX-POC090-3

✓

PHX-POC090-4

Close

Save

## Note

We select more than one host, so the VM has a place to migrate to in the event of a node failure.

3. Power on the VM and verify it is running on one of the specified affinity hosts you selected within the affinity policy.
4. Right-click on the VM, and then click **Migrate**.

This VM has host affinity with 2 out of the 4 available hosts. It can only be migrated to those hosts.

Host

System will automatically select a host.

## 5. Click **Migrate**.

You should see that the VM has moved to the other host you selected within the affinity policy.

Overview • **Table**

VM

▼ VM Name

Host

● XYZ-Windows

PHX-POC090-1/AHV

● XYZ-Linux

PHX-POC090-4/AHV

## High Availability & Dynamic Scheduling

High availability is enabled by default for AHV and will restart VMs in a best-effort manner in the event of a host failure. Additional configuration can set resource reservations to ensure

# NUTANIX BOOTCAMPS

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With the Acropolis Dynamic Scheduler (ADS) service, AHV performs both intelligent initial placement of VMs, and also dynamically migrates VMs to other hosts within the cluster to optimize workload performance. ADS runs by default, and without additional configuration.

A benefit of a Nutanix AHV solution is making VM placement decisions not based solely on CPU/memory congestion avoidance but also on storage performance.

See [here](#) for additional details about the *Acropolis Dynamic Scheduler*.

## Takeaways

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In this lab, you experienced how AHV provides a complete set of tools and actions that can be performed to manage VMs in the cluster.

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[← Deploying Workloads](#)

[Data Protection →](#)

# Data Protection

## Overview

Nutanix provides the ability to perform VM/vDisk-level storage snapshots. Protection Domains (PDs) are the construct for grouping VMs and applying snapshot and replication policies.

In this section, you will use Prism to create and restore from VM snapshots and create a Protection Domain for your VMs.

## Data Protection

### VM Snapshots

1. Right-click on `Initials -Linux-Clone1`, and choose **Take Snapshot**.
2. Within the *Name* field, enter `Initials -Snapshot`, and then click **Submit**.
3. Select the **VM Snapshots** tab below the table to view the available snapshots for the selected VM.

The screenshot shows the Nutanix Prism interface for a VM named 'XYZ-Linux'. The 'VM Snapshots' tab is selected, displaying a table of snapshots. A red box highlights the 'XYZ-Linux' VM in the top table. Another red box highlights the 'VM Snapshots' tab in the left sidebar. A third red box highlights the snapshot table, which contains one entry: 'XYZ-snapshot' taken on 06/28/21 at 04:19:00 PM. The 'Actions' column for this snapshot includes links for 'Details', 'Clone', 'Restore', and 'Delete'.

VM	PHX-POC090-4/AHV	2	2 GiB	- / 0 GiB	0.46%	-	0	0	0 KBps	0 ms	Yes	No
XYZ-Windows	PHX-POC090-1/AHV	169.25...	4 GiB	13.2 GiB / 34.99 GiB	0.36%	25.18 %	0	1	10 KBps	1.63 ms	Yes	No

Summary > XYZ-Linux

Manage Guest Tools Launch Console Power Off Actions Take Snapshot Migrate Clone Update Delete

VM DETAILS

Name XYZ-Linux

Description

ID 6d47d24d-5291-4f66-81a0-bc7860959...

Host PHX-POC090-4

Host IP 10.42.90.28

VM Performance Virtual Disks VM NICs VM Snapshots VM Tasks I/O Metrics Console

Snapshots taken in Prism Element

1 Snapshot

search in table

Create Time	Name	Actions
06/28/21, 04:19:00 PM	XYZ-snapshot	Details Clone Restore Delete

4. Under the *Actions* column, click **Details** to see all of the VM's properties at the time of the snapshot. You can see the snapshot contains the VM's state, in addition to just its data.

5. Right-click your VM, and choose **Update**. Remove the disk by clicking the  icon, and then click **Save**.

6. Attempt to power on the VM, and launch its console window.


The VM no longer has any disks from which to boot, so the 2048 game is displayed.

7. Right-click your VM, and choose **Power Off Actions > Power off > Submit**.

8. Select your snapshot under **VM Snapshots** and click **Restore > Yes** to revert the VM to a functioning state.

Alternatively, you can click **Clone** instead of **Restore** to create a new VM from the snapshot.

9. Verify that the VM boots successfully.

As previously mentioned, Nutanix snapshots in AHV use a [redirect-on-write](#)  approach that does not suffer from the performance degradation of chained snapshots found in other hypervisors.

## Protection Domains

1. From the main drop-down, choose **Data Protection > Table**, and then click **+ Protection Domain > Async DR**.

2. Within the *Name* field, enter `Initials -PD`, and then click **Create**.

3. Filter or scroll to select the VMs you've created during this bootcamp.

4. Click **Protect Selected Entities**, and verify the VMs appear under *Protected Entities* (right column).

# NUTANIX BOOTCAMPS

NameEntitiesSchedule

Successfully protected 2 entities

Unprotected Entities (5) ?

Search by Entity Name

<input type="checkbox"/>	▲ Name	Type
<input type="checkbox"/>	AutoAD	Virtual Machine
<input type="checkbox"/>	calm-a75fd0f8	Volume Group
<input type="checkbox"/>	Prism Central pc.2021.3.0.1	Virtual Machine

Pick a Consistency Group ?

☐ Use an existing CG

☐ Create a new CG

Snapshots

☐ Use application consistent snapshots ?

☒ Auto protect related entities. ?

Protect Selected Entities

Protected Entities (2)

Search by Entity Name

Search by CG Name

<input type="checkbox"/>	▲ Entity Name	CG
<input type="checkbox"/>	XYZ-Linux	XYZ-Linux
<input type="checkbox"/>	XYZ-Windows	XYZ-Windows
<input type="checkbox"/>		
<input type="checkbox"/>		
<input type="checkbox"/>		
<input type="checkbox"/>		
<input type="checkbox"/>		
<input type="checkbox"/>		

<

Unprotect Selected Entities

Consistency groups allow you to group multiple VMs to have their snapshots simultaneously (ex. multiple VMs belonging to the same application).

## Note

Nutanix snapshots can perform application consistent snapshots for supported operating systems with NGT installed. Each VM using application consistent snapshots will be part of its consistency group.

5. Click **Next**.
6. Click **New Schedule** to define Recovery Point Objective (RPO) and retention.
7. Select **Repeat every 1 hour(s)**.



# NUTANIX BOOTCAMPS

AHV supports NearSync snapshots, with RPOs as low as 1 minute. Multiple schedules can be applied to the same PD, allowing you to take and retain X number of hourly, daily, monthly snapshots.

8. Within the *Retention policy* section, enter 5 (i.e., keep the last five snapshots).

## Note

For environments with remote cluster(s) configured, setting up replication is as easy as defining how many snapshots to keep at each remote site.

Protection Domain

Name

Entities

Schedule

Configure your local schedule

☐ Repeat every  minute(s) ?

☒ Repeat every  hour(s) ?

☐ Repeat every  day(s) ?

☐ Repeat weekly

☐ S ☐ M ☐ T ☐ W ☐ T ☐ F ☐ S

☐ Repeat monthly

Day of month:  ?

Start on  at

☐ End on  at

☐ Create application consistent snapshots

Retention policy

☒ Local

keep the last  snapshots

Up to 5 snapshots will be retained for this schedule and retention policy (5 snapshots for each interval).

Remote sites have not been defined for this cluster.

Cancel

Create Schedule

9. Set the *Start on* time to 11:00 PM.

11. Click Close to exit.

Additional information can be found [here](#) .

That's it! You've successfully configured native data protection.

## Takeaways

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- Nutanix offers data protection solutions for virtual datacenters via different strategies, including one-to-one or one-to-many replication.
- Nutanix provides data protection functions at the VM, file, and volume group level, so VMs and data remain safe.
- VM-level snapshot and replication policies can be managed through Prism for any supported hypervisor.

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[← Managing Workloads](#)



# Image Configuration

Nutanix's Image Service is where you can store ISOs, as well as other disk images.

While we already staged some disk images ahead of this bootcamp it's now time for you to upload an ISO.

1. From the drop-down menu, choose **Settings**, and then **Image Configuration** from the left-hand menu.
2. Click **+ Upload Image**.
3. Fill out the following fields and click **Save**:

- **Name** - `Initials -LinuxISO`
- **Image Type** - ISO
- **Storage Container** - `Initials -container`
- **Image Source** - Select **From URL**, and then enter `http://10.42.194.11/hol/os/CentOS-7-x86_64-Minimal-2009.iso` in the field.

Name

XYZ-LinuxISO

Annotation

Image Type

ISO

Storage Container

XYZ-container

Image Source

☒ From URL

http://10.42.194.11/images/CentOS/CentOS-7-x86\_64-Minimal-2009.iso

☐ Upload a file ?

Choose File

No file chosen

Back

Cancel

Save

## Takeaways

- Image management in Prism Central allows you to upload images that can deploy workloads in any of the clusters registered to that Prism Central instance.
- An image can also be uploaded directly from a cluster's Prism Element.
- This tool can also convert VM disk images to formats that AHV can understand.
- The image service supports raw, vhd, vhdx, vmdk, vdi, iso, and qcow2 disk formats.

# Glossary

## Nutanix Core

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### AOS

AOS stands for Acropolis Operating System, and it is the OS running on the Controller VMs (CVMs).

### Pulse

Pulse provides diagnostic system data to Nutanix customer support teams so that they can deliver proactive, context-aware support for Nutanix solutions.

### Prism Element

Prism Element is the native management plane for Nutanix. Because its design is based on consumer product interfaces, it is more intuitive and easier to use than many enterprise application interfaces.

### Prism Central

Prism Central is the multi-cloud control and management interface for Nutanix. Prism Central can manage multiple Nutanix clusters and serves as an aggregation point for monitoring and analytics.

### Node

An industry-standard x86 server with server-attached SSD and optional HDD (All-Flash & Hybrid Options).

## Block

2U rackmount chassis contains 1, 2, or 4 nodes with shared power and fans and no shared backplane.

## Storage Pool

A storage pool is a group of physical storage devices, including PCIe SSD, SSD, and HDD devices for the cluster.

## Storage Container

A container is a subset of available storage used to implement storage policies.

## Anatomy of a Read I/O

Performance and Availability

- Data is read locally
- Remote access only if data is not locally present

## Anatomy of a Write I/O

Performance and Availability

- Data is written locally
- Replicated on other nodes for high availability
- Replicas are spread across the cluster for high performance

## Nutanix Flow

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### Application Security Policy

## Isolation Environment Policy

Use an isolation environment policy when you want to block all traffic, regardless of direction, between two groups of VMs identified by their category. VMs within a group can communicate with each other.

## Quarantine Policy

Use a quarantine policy when you want to isolate a compromised or infected VM and optionally wish to subject it to forensics. You cannot modify this policy, and the two modes to quarantine a VM are Strict or Forensic.

**Strict:** Use this value when you want to block all inbound and outbound traffic.

**Forensic:** Use this value when you want to block all inbound and outbound traffic except the traffic to and from categories that contain forensic tools.

## AppTier

Add values for the tiers in your application (ex. web, application\_logic, and database) to this category and use the values to divide the application into tiers when configuring a security policy.

## AppType

Associate the VMs in your application with the appropriate built-in application type such as Exchange and Apache\_Spark. You can also update the category to add values for applications not listed in this category.

## Environment

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[Environment Details →](#)



## Environment Details

Nutanix Bootcamps are intended to be run within the Nutanix Hosted POC environment. Your cluster will be provisioned with all necessary images, networks, and VMs required to complete the exercises.

## Credentials

### Note

The `HPOC-PASSWORD` is unique to each cluster and will be provided by the leader of the Bootcamp.

Credential	Username	Password
Prism Element	admin	HPOC-PASSWORD
Prism Central	admin	HPOC-PASSWORD
Controller VM	nutanix	HPOC-PASSWORD
Prism Central VM	nutanix	HPOC-PASSWORD

Each cluster has a dedicated domain controller VM (AutoAD), responsible for providing AD services for the `NTNXLAB.LOCAL` domain. The domain is populated with the following users and groups:

Group	Username(s)	Password
Administrators	Administrator	nutanix/4u
SSP Admins	adminuser01-adminuser25	nutanix/4u

# NUTANIX BOOTCAMPS

SSP Developers	devuser01-devuser25	nutanix/4u
SSP Consumers	consumer01-consumer25	nutanix/4u
SSP Operators	operator01-operator25	nutanix/4u
SSP Custom	custom01-custom25	nutanix/4u
Bootcamp Users	user01-user25	nutanix/4u

## Access Instructions

The Nutanix Hosted POC environment can be accessed in several ways.

### Lab Access User Credentials

PHX Based Clusters:

**Username:** PHX-POCxxx-User01 through PHX-POCxxx-User20 **Password:** HPOC-PASSWORD

### Frame VDI

[Log in here](#)

**Nutanix Employees** - Use your **NUTANIXDC** credentials **Non-Employees** - Use **Lab Access User** credentials



### Parallels VDI

- [PHX Based Clusters](#)
- [BLR Based Clusters](#)

**Nutanix Employees** - Use your **NUTANIXDC** credentials **Non-Employees** - Use **Lab Access User** credentials

### Employee Pulse Secure VPN

## Download the client

- [PHX Based Clusters](#) 
- [BLR Based Clusters](#) 

Nutanix Employees - Use your NUTANIXDC credentials Non-Employees - Use Lab Access User credentials

## Install the client

In Pulse Secure Client, **Add** a connection:

PHX:

- **Type** - Policy Secure (UAC) or Connection Server
- **Name** - X-Labs - PHX
- **Server URL** - xlv-uswest1.nutanix.com

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# Network Configuration

The following tables detail the network IP Address assignments for multi-node and single-node environments.

## Multi-Node Reservations

IP Range	Service	Comments
10.x.x.7	Hyper-V Failover IP	
10.x.x.8 - 10.x.x.14	Files	
10.x.x.15	File Analytics	
10.x.x.16 - 10.x.x.21	Objects	
10.x.x.22		
10.x.x.23	Beam	
10.x.x.25 - 10.x.x.28	Hosts	
10.x.x.29 - 10.x.x.32	CVMs	
10.x.x.33 - 10.x.x.36	IPMI	
10.x.x.37	Cluster IP	
10.x.x.38	Data Services IP	
10.x.x.39	Prism Central	
10.x.x.40	VCSA	vCenter
10.x.x.41	AutoAD	Windows Domain Controller

10.x.x.42	PrismOpsLabUtilityServer	Used for Prism Ops Labs
10.x.x.44	Era	
10.x.x.45	Citrix DDC	
10.x.x.50 - 10.x.x.125	Primary Network IPAM	VLAN 0
10.x.x.126 - 10.x.x.254	Secondary Network IPAM	Secondary VLAN

## Single Node Reservations

Partition 1	Partition 2	Partition 3	Partition 4	Service	Comments
10.38.x.1	10.38.x.65	10.38.x.129	10.38.x.193	Gateway	
10.38.x.5	10.38.x.69	10.38.x.133	10.38.x.197	AHV Host	
10.38.x.6	10.38.x.70	10.38.x.134	10.38.x.198	CVM	
10.38.x.7	10.38.x.71	10.38.x.135	10.38.x.199	Cluster IP	
10.38.x.8	10.38.x.72	10.38.x.136	10.38.x.200	Data Services	
10.38.x.9	10.38.x.73	10.38.x.137	10.38.x.201	Prism Central	
10.38.x.11	10.38.x.75	10.38.x.139	10.38.x.203	AUTOAD	Windows Domain Controller
10.38.x.12	10.38.x.76	10.38.x.140	10.38.x.204	Utility Server	Prism Ops Lab
10.38.x.14	10.38.x.78	10.38.x.142	10.38.x.206	Era	
10.38.x.15	10.38.x.79	10.38.x.143	10.38.x.207	Citrix DDC	

# NUTANIX BOOTCAMPS

10.38.x.32 - 10.38.x.37	10.38.x.96 - 10.38.x.101	10.38.x.160 - 10.38.x.165	10.38.x.224 - 10.38.x.229	Objects	
10.38.x.38 - 10.38.x.58	10.38.x.102 - 10.38.x.122	10.38.x.166 - 10.38.x.186	10.38.x.230 - 10.38.x.250	Primary Network IPAM	6 IPs free for static assignment

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[← Environment Details](#)

[Active Directory User and Groups →](#)

# Active Directory User and Groups

Each cluster has a dedicated domain controller VM - AUTOAD - responsible for providing Active Directory services for the *ntnslab.local* domain. The domain is pre-populated with the following users and groups:

Group	Username(s)	Password
Administrators	Administrator	nutanix/4u
SSP Admins	adminuser01 -adminuser25	nutanix/4u
SSP Developers	devuser01 - devuser25	nutanix/4u
SSP Consumers	consumer01 - consumer-25	nutanix/4u
SSP Operators	operator01 - operator-25	nutanix/4u
SSP Custom	custom01 - custom25	nutanix/4u
Bootcamp Users	user01 - user25	nutanix/4u

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# Getting Help

## The Cluster

The cluster (ex. RX, password not working, Foundation failed, cluster in a degraded state, etc.).

[#rx-and-hpoc](#) 

## The Lab Content

The lab content (ex. instructions incorrect or unclear, typos, feedback, etc.) or staging (ex. images or blueprints are missing).

[#technology-bootcamps](#):

## Products, VDIs and Pulse Access

Frame, Parallels VDI, or Pulse VPN access.

[#x-labs](#)

## Feedback

Feedback and suggestions can also be submitted to [bootcamps@nutanix.com](mailto:bootcamps@nutanix.com).



