

TECH NOTE

Prism

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1. Executive Summary

The Nutanix cloud platform natively converges compute, storage, virtualization, systems management, and operations management into a turnkey platform that can be deployed in minutes to run any application out of the box.

Nutanix also offers powerful virtualization capabilities, including core virtual machine (VM) operations, live migration, VM high availability, and virtual network management, as fully integrated features of the infrastructure stack rather than as standalone products that require separate deployment and management. The Nutanix solution has two primary product families—Nutanix AOS and Nutanix Prism. AOS is the distributed data plane that provides storage, virtualization, backup, and disaster recovery services, and Prism is the centralized management solution for Nutanix environments.

2. Introduction

Audience

We wrote this document for IT administrators, architects, and business leaders who want to understand the operation management experience the Nutanix solution provides.

Purpose

This tech note describes how to use Prism to manage, monitor, and scale Nutanix clusters. It explains and highlights simplified cluster administration methods and operational insights.

Document Version History

Version Number	Published	Notes
1.0	March 2016	Original publication.
1.1	June 2016	Added a section on localization for AOS 4.7.
1.2	December 2016	Updated for AOS 5.0.
1.3	January 2018	Updated for AOS 5.5.
2.0	February 2019	Updated for AOS 5.10.
2.1	February 2020	Annual update.
2.2	January 2022	Updated LCM One-Click Upgrades section.
2.3	October 2022	Updated product naming in Prism Central Architecture section.

3. What Is Prism?

Nutanix Prism provides central access for administrators to configure, monitor, and manage virtual environments in a simple and elegant way. Prism uses machine learning to mine large volumes of system data easily and quickly, generating actionable insights for optimizing all aspects of virtual infrastructure management. Prism is a part of every Nutanix deployment and has two core components:

Prism Element

Prism Element is a service built into the platform for every Nutanix cluster deployed. Prism Element enables you to fully configure, manage, and monitor Nutanix clusters running any hypervisor.

Prism Central

Because Prism Element only manages the cluster it's part of, each Nutanix cluster in a deployment has a unique Prism Element instance for management. Prism Central allows you to manage different clusters across separate physical locations on one screen and offers an organizational view into a distributed Nutanix environment.

Prism Element Distributed Architecture

Prism is a distributed service in every Nutanix cluster and provides users access to the distributed system. Prism runs on every node in the cluster and, like other components, it elects a leader. The system forwards all requests from followers to the leader. This configuration allows administrators to access Prism using the cluster IP address or any Controller VM (CVM) IP address. If the Prism leader fails, the system elects a new leader.

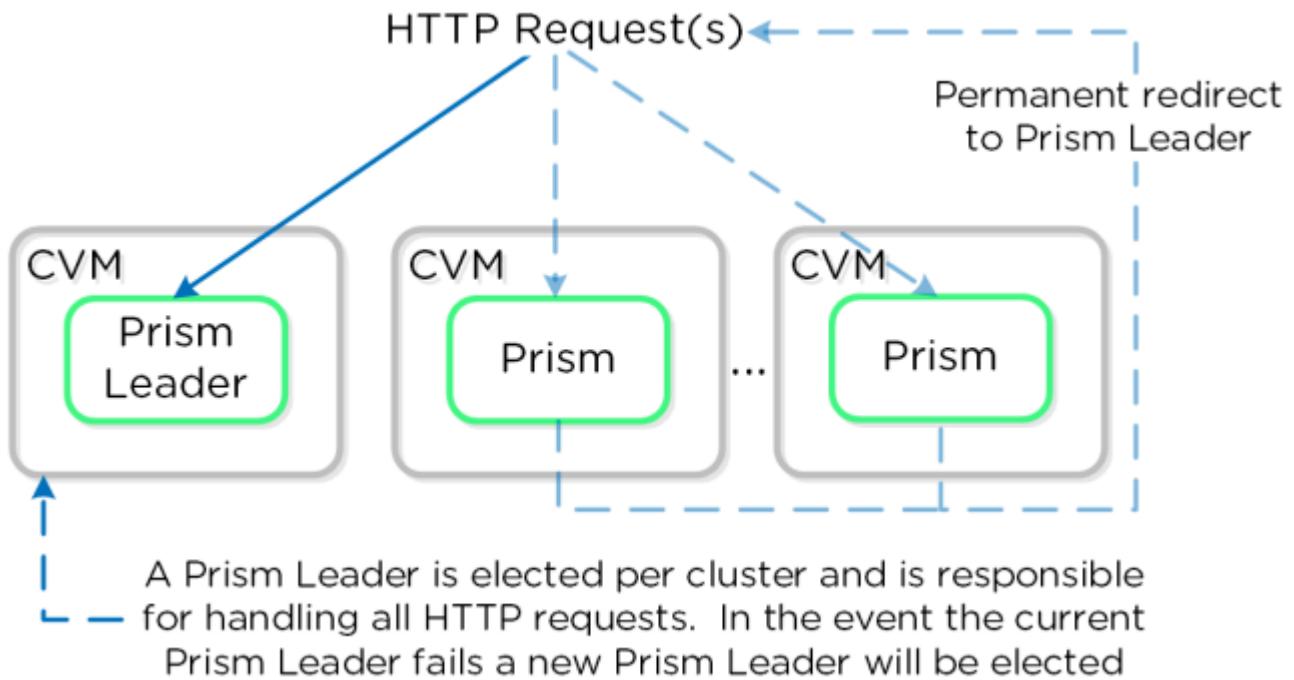


Figure 1: Conceptual View of Prism Services and HTTP Request Handling

Prism Central Architecture

You can deploy Prism Central in a VM (Prism Central VM) or in a scale-out cluster of VMs (Prism Central instance), either manually, by importing a VM template, or from Prism Element. You can run a Prism Central VM in a VM of any size; the only difference is the amount of CPU and memory available to the Prism Central VM for VM management. You can deploy a Prism Central instance initially as a scale-out cluster or, if you're running it as a single VM, scale it out from Prism Element. The design decisions involved in using this architecture are dramatically simpler than legacy solutions. You only need to answer two questions before deploying:

1. How many VMs do you need to manage?
2. Do you want high availability?

Prism allows users to scale an instance up and out to address changing conditions. The following diagram shows the two different architectures with the number of VMs each can manage.

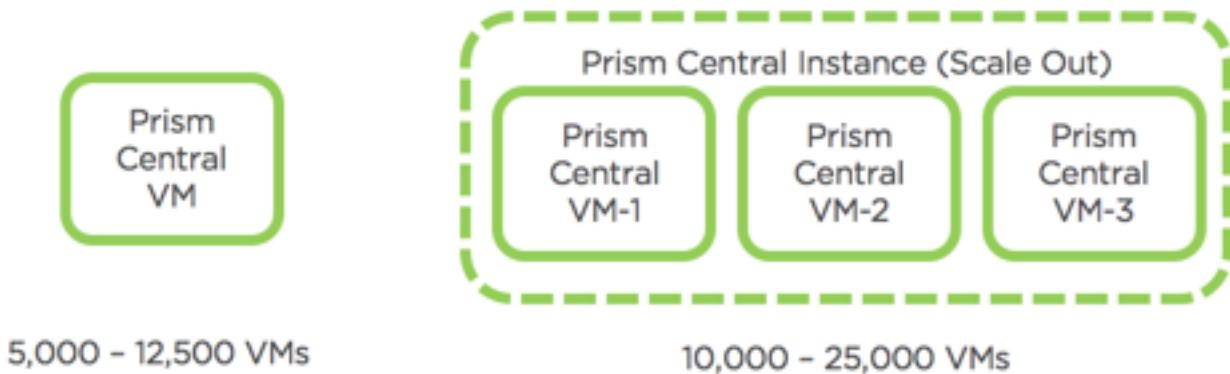


Figure 2: Prism Central Architectures

This extensible architecture allows you to enable value-added features and products, such as Nutanix Cloud Manager and Flow Virtual Networking in the Prism Central application, as shown in the following diagram. These additional features operate in a single Prism Central VM or clustered Prism Central instance and don't require you to design or deploy separate products. This streamlined strategy enables a simplified experience throughout the phases of a project and includes one-click upgrades that allow users to benefit from regular innovations.

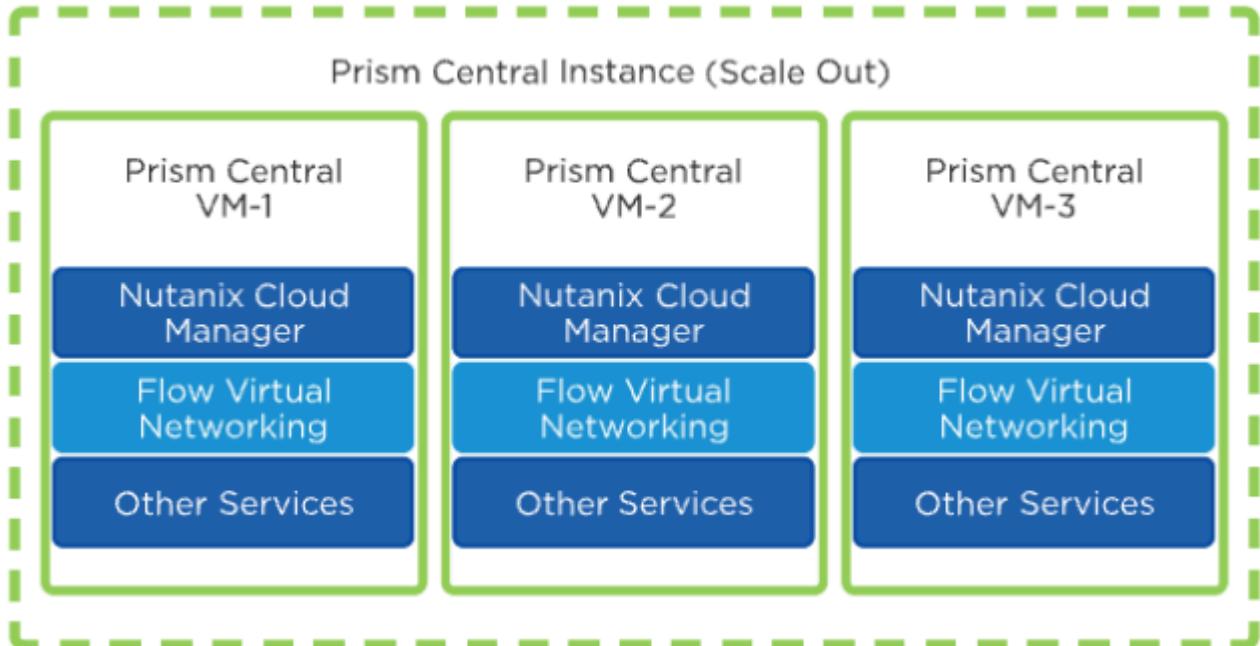


Figure 3: Prism Central Value-Added Features

How Prism Interacts with Other Services

Prism is the user interface for the Nutanix solution, and it must communicate with and collect data from each of the underlying services. Prism interacts with a distributed configuration management database for cluster configuration data and with a distributed NoSQL key-value store for statistics to present to the user. It also liaises with the hypervisor hosts for VM status, configuration, performance data, and related information.

4. Infrastructure Management

Historically, managing a datacenter's infrastructure components has consumed the majority of engineers' time. Through software, Nutanix has removed the majority of these time-consuming tasks and simplified the rest to a few mouse clicks.

Prism provides detailed data in an accessible and intuitive layout. In Prism, you first see a home screen that summarizes your cluster hardware and software, performance reports, and whether there are any events or alerts that you should investigate further.

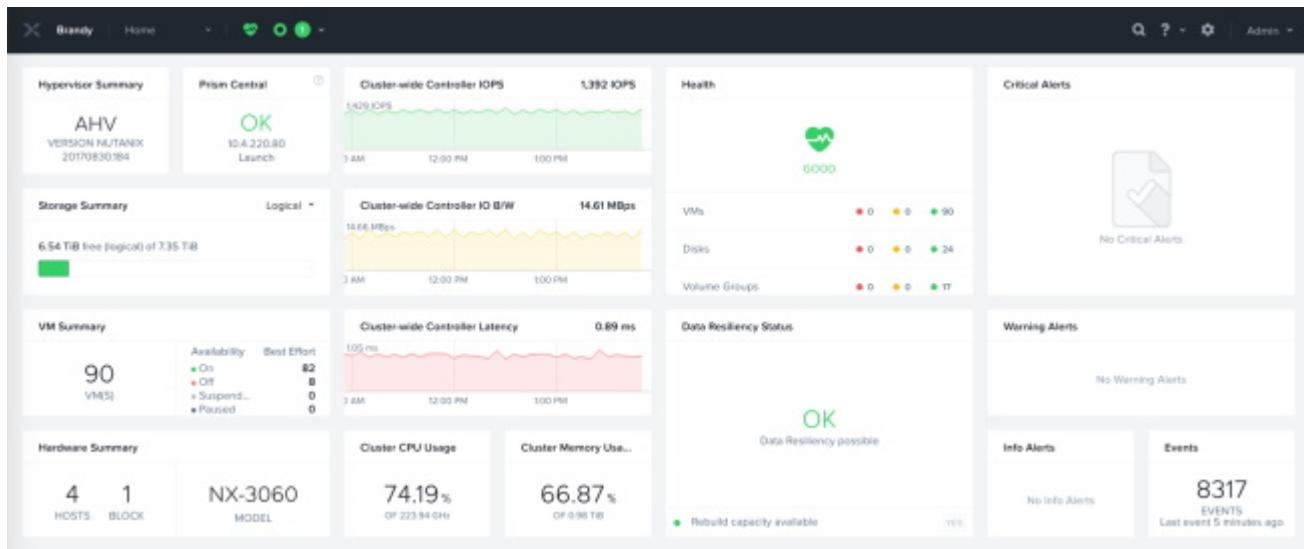


Figure 4: Prism Home Screen

The home screen provides a simple overview of your environment's health and performance. When you need to investigate further or make changes, you can dive deeper with focused views.

You can access a focused view easily from the Prism menu for each major infrastructure component. Each focused view provides the same look into its specific area that the home screen offers for the entire environment.

Cluster Management

Prism gives you a single control plane for the typical management and maintenance tasks a cluster requires. These tasks include configuration, expansion, performance, and cluster updates. The first thing you see is a cluster summary, without needing to click through numerous screens and reports. You receive a count of blocks and hosts and their model numbers, along with how many hosts are part of the cluster and a count of newly discovered hosts. The cluster's total available compute capacity is presented in terms of the amount of CPU in GHz and the total usable memory. Prism presents multiple lists to inform administrators of the top-performing hosts for I/O, bandwidth, memory usage, and CPU usage.

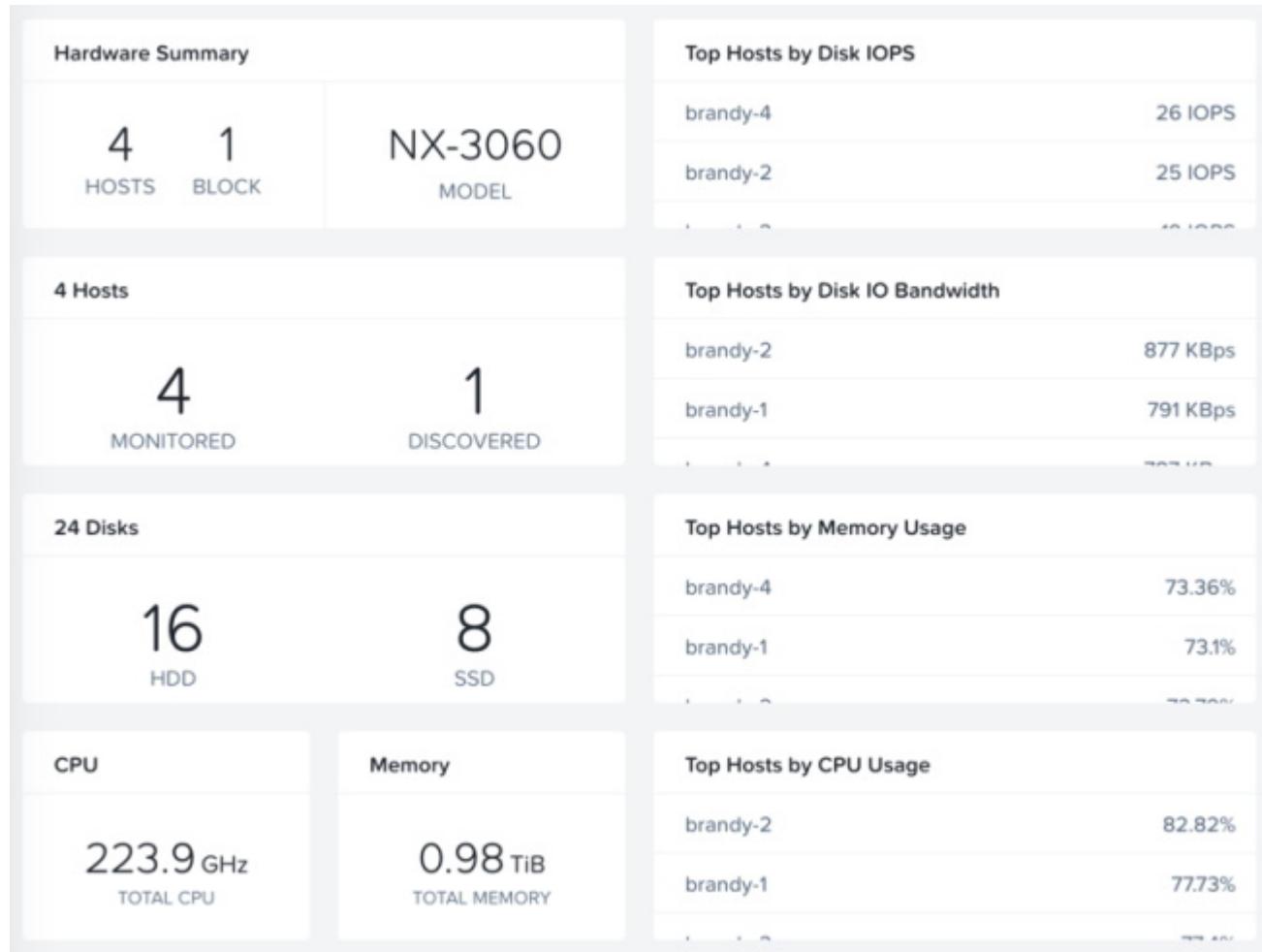


Figure 5: Prism Cluster Management View

If you want deeper insights into the hosts in the cluster, you can choose the table-based view, which offers a detailed look into hardware, host configuration, and resource consumption. This perspective helps you understand the current state of a cluster and provides an excellent place to start when you're looking for the root cause of an issue. The same table offers comparable data for all the disks in the cluster, so you can see usage and performance statistics for each drive.

HOST NAME	HOST IP	CVM IP	HYPERVISOR	CPU USAGE	CPU CAPACITY	MEMORY USAGE	MEMORY CAPACITY	TOTAL DISK USAGE	DISK IOPS	DISK IOPS AVG	DISK IOPS LATENCY
Host-1	10.4.96.78	10.4.96.82	AHV	2.3%	63.86 GHz	36.87%	281.98 GB	102.79 GB of 37.78	0	0.4Kops	2 ms
Host-2	10.4.96.79	10.4.96.83	AHV	2.62%	63.86 GHz	32.09%	281.95 GB	103.46 GB of 37.78	0	1.4Kops	0.13 ms
Host-3	10.4.96.80	10.4.96.84	AHV	16.78%	63.74 GHz	100%	281.98 GB	104.28 GB of 37.78	3708	167.61 Mops	0.37 ms
Host-4	10.4.96.81	10.4.96.85	AHV	0.22%	63.88 GHz	23.34%	281.95 GB	104.36 GB of 37.78	0	7 Kops	0.17 ms

Figure 6: Prism Cluster Management Table View

The Nutanix platform is built on a scale-out architecture, and Prism lets you scale clusters with minimal effort by discovering new nodes that have been cabled and attached to the network. When the system discovers new nodes, they become available for you either to add to an existing cluster or use to create a new one.

In Prism, the Expand Cluster feature offers a simple process for adding these new nodes to a cluster. When you choose to expand the cluster, the interface presents any available new nodes and allows you to select which ones should be prepared and added to the existing cluster. If necessary, the system images new nodes with the correct hypervisor to match the other nodes in the cluster. This process allows you to add one node or multiple nodes without changing the workflow.

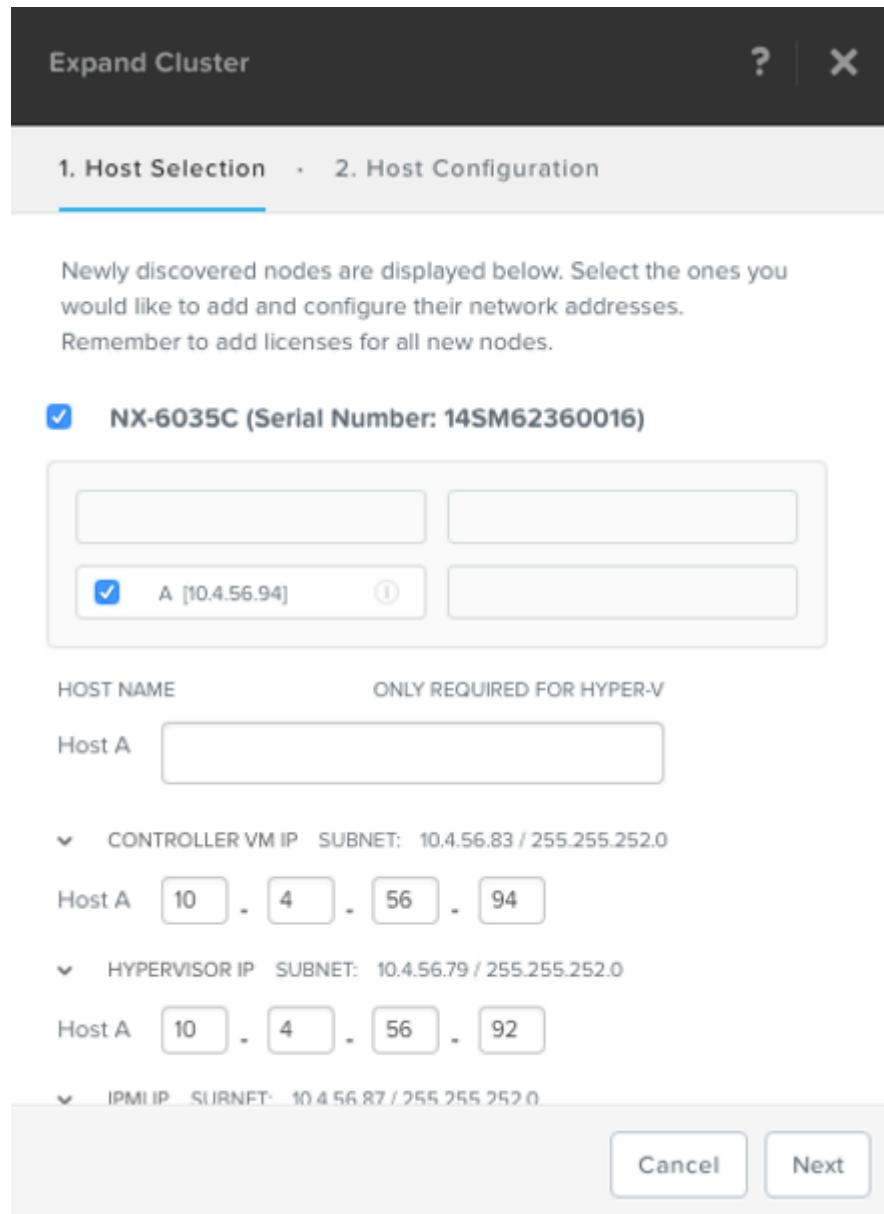


Figure 7: Expand Cluster Feature in Prism

Life-Cycle Manager One-Click Upgrades

Historically, updating your IT infrastructure has been a painful and time-consuming activity that was reserved only for correcting a serious bug or

maintaining compliance for support reasons. Prism solves update reluctance by offering one-click upgrades for each product in a cluster. The Life-Cycle Manager (LCM) one-click upgrade process downloads the next version or allows you to upload manually as needed.

Each upgrade process is a nondisruptive workflow that follows a rolling upgrade flow through the clusters on a node-by-node basis. Before beginning the upgrade, the system performs a series of preupgrade and health checks on the cluster that it must pass before proceeding. Once the upgrade has completed for every node in the cluster, a final health check runs before finalizing the process.

LCM upgrades are available for AOS, which includes Prism and the distributed storage fabric. There are also updates for hypervisor version, host firmware, Foundation, Nutanix Files, and Nutanix Cluster Check (NCC). You can find all these upgrades in the Prism interface and start each with a mouse click.

Component	Available Version	Current Version	Last Updated	Release Notes
AHv hypervisor	e7nutanix.20201105.300007 2 version updates	e7nutanix.20201105.22229 4 entities		View Release Notes
AOS	5.20.2 LTS Release Date: November 26, 2021 2 version updates	5.20.2 LTS		View Release Notes
Cluster Maintenance Utilities	2.0.3 1 version update	1.0.0 4 entities		View Release Notes
FSM	2.11 4 version updates	1.5.1		
Foundation	5.11 1 version update	5.0.4 4 entities		View Release Notes
NCC	4.3.0 1 version update	4.2.01		View Release Notes

Figure 8: LCM Upgrades in Prism

Storage Management

Nutanix clusters offer a LUN-free experience that focuses on providing storage services without legacy headaches. Storage management views in Prism have

a look and feel similar to the cluster management views already discussed. The storage-focused view shows you the storage environment, giving you important performance charts, data reduction metrics, capacity summaries, and important alerts and warnings.

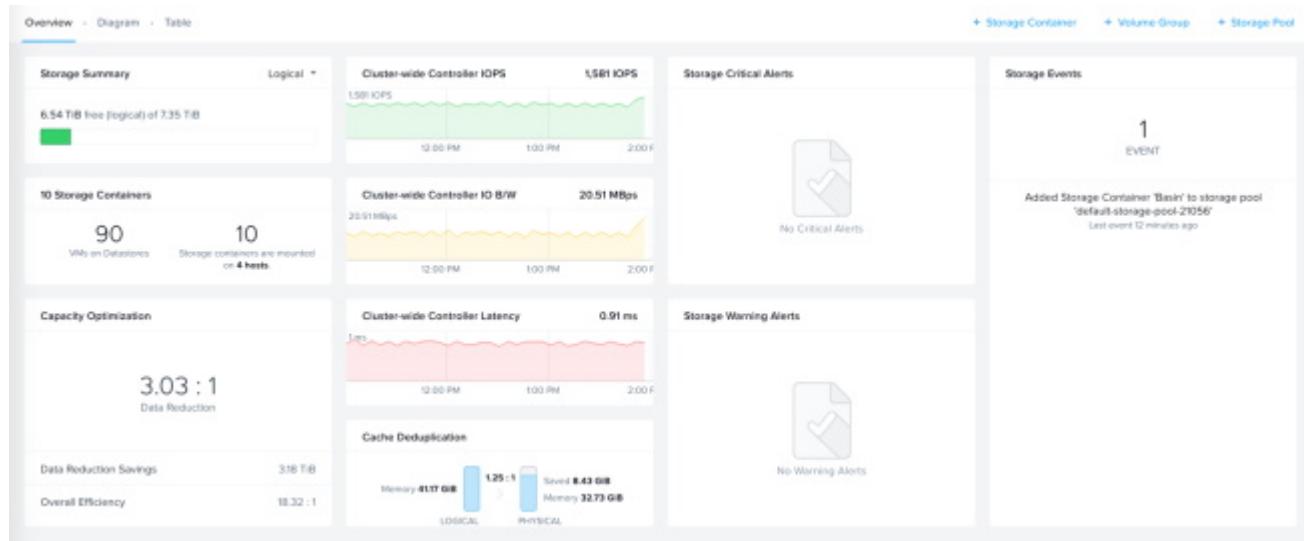


Figure 9: Prism Storage Management View

When you require further details about storage services, you can use the detailed table view. This screen provides three primary views of the storage constructs in a cluster: volume groups, containers, and storage pools. The table view elegantly displays the configuration settings for each container, capacity metrics, and several performance charts.

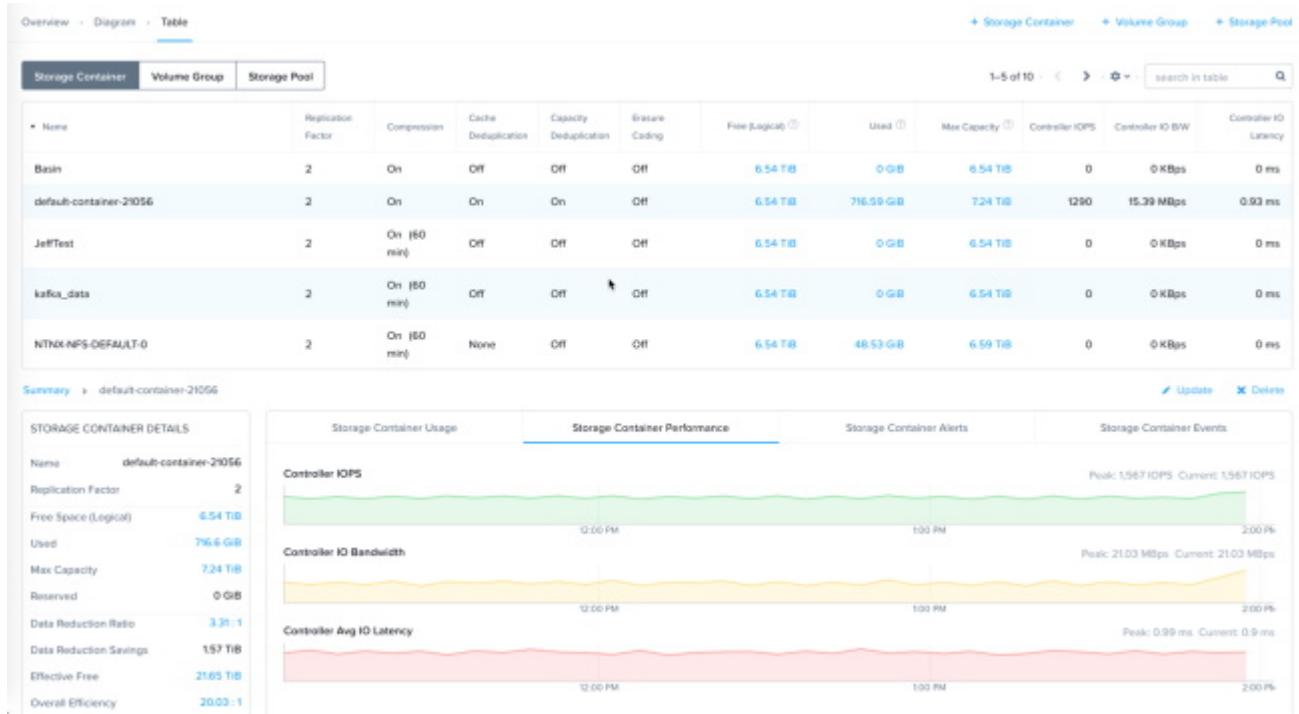


Figure 10: Prism Storage Management Table View

Creating a new datastore container for a hypervisor and VMs to consume is a simple process. In each specific storage management view in Prism, there are green buttons in the upper right of the screen for items that you can create or add in that view. The option to create objects in Prism is also in the settings menu. You only need to provide a name for the container and check any data reduction settings you want to enable, and the container is created immediately.

Create Container

Enter a name for your container and select a storage pool for it. You can provision the container for all hosts, or select individual hosts.

NAME
Type_name_here

STORAGE POOL
default-storage-pool-21056

MAX CAPACITY
11.94 TiB (Physical) Based on storage pool free unreserved capacity

ADVANCED SETTINGS

REPLICATION FACTOR ⓘ
2

ERASURE CODING ⓘ
Erasure coding enables capacity savings across solid-state drives and hard disk drives.

RESERVED CAPACITY (GiB)
0

ADVERTISED CAPACITY (GiB)
Total GiB

PERF TIER (RAM/SSD) DEDUPLICATION (FINGERPRINT ON WRITE) ⓘ
This enables performance improvements by intelligently deduplicating data in the premium (RAM/SSD) tiers.

CAPACITY TIER (HDD) DEDUPLICATION (ON-DISK) ⓘ
On-Disk Deduplication works in conjunction with "Fingerprint on Write" and enables capacity savings across all tiers - RAM, SSD, & Hard Disk - in addition to performance improvements.

COMPRESSION
Inline compression is enabled if the delay is set to 0 minutes.
Offline compression is enabled if there's a delay.

Advanced Settings

Figure 11: Container Creation in Prism

VM Management

To give you more visibility into your VMs, Prism delivers a VM-focused management view. The VM view provides the same kind of overview summary that the cluster and storage management views offer. The VM summary delivers VM counts as well as VM power status. Highlighted CPU and memory usage statistics focus on provisioned amounts versus reserved amounts. You can also see the top consumers for IOPS, latency, memory usage, and CPU usage, enabling you to identify which VMs are using the most resources and detect any outliers.

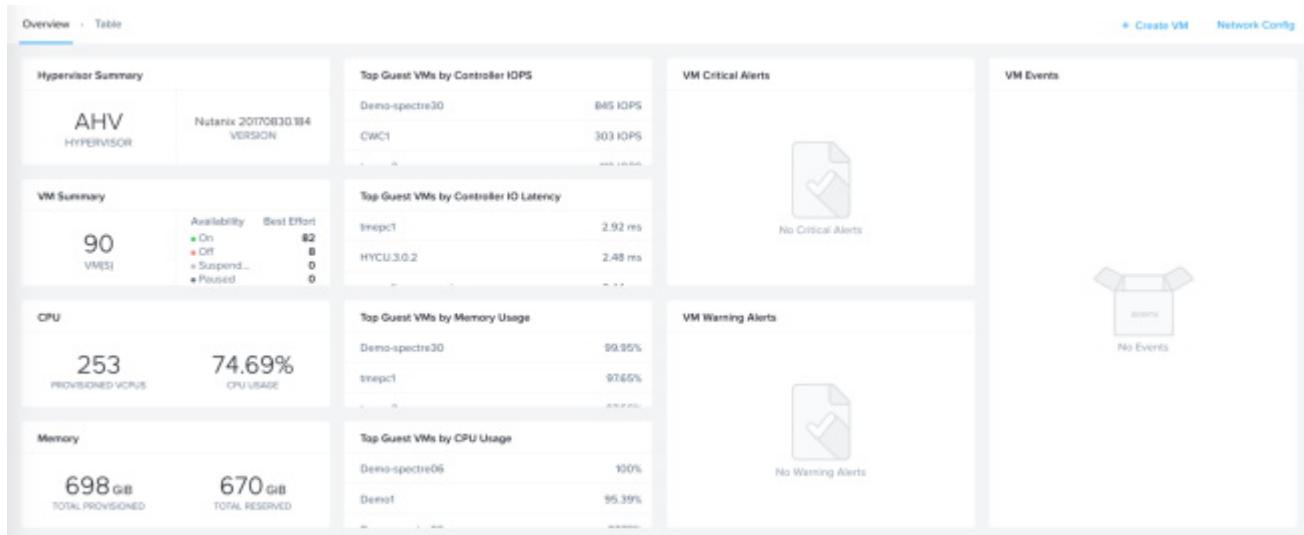


Figure 12: Prism VM Management View

Following the user experience in the other sections, the VM-focused view in Prism also offers a table-based layout for VM management. Similar to the detailed host data in the cluster view, the VM-based view provides a greater number of VM-focused data points.

This VM-focused view allows organizations to easily compare the CPU and memory settings configured versus the actual amounts of CPU and memory used. You can also access storage metrics for read versus write IOPS, combined IOPS, storage bandwidth, and latency. Prism tracks each of these data points on a per-VM basis to give a quick overview and locate potential issues faster.

VM Name	Host	IP Addresses	Cores	Memory Capacity	Storage	CPU Usage	Memory Usage	Controller Read IOPS	Controller Write IOPS	Controller IO Bandwidth	Controller Avg IO Latency	Becks.	Flash Mode
Demo-spectre10	brandy-3/AHV	10.4.2...	2	4 GiB	59.03 GiB / 60 GiB	78.37%	13.66%	0	0	3 Kbps	1.07 ms	Yes	No
Demo-spectre11	brandy-3/AHV	10.4.2...	2	4 GiB	59.06 GiB / 60 GiB	78.19%	13.83%	0	0	0 Kbps	0 ms	Yes	No
Demo-spectre12	brandy-1/AHV	10.4.2...	2	4 GiB	59.01 GiB / 60 GiB	71.6%	14.03%	0	0	0 Kbps	0 ms	Yes	No
Demo-spectre13	brandy-2/AHV	10.4.2...	2	4 GiB	59.05 GiB / 60 GiB	81.88%	13.75%	0	0	2 Kbps	0.82 ms	Yes	No
Demo-spectre14	brandy-3/AHV	10.4.2...	2	4 GiB	59.05 GiB / 60 GiB	77.92%	13.93%	0	0	3 Kbps	1.03 ms	Yes	No
Demo-spectre15	brandy-3/AHV	10.4.2...	2	4 GiB	59.04 GiB / 60 GiB	78.82%	13.95%	0	0	0 Kbps	0 ms	Yes	No
Demo-spectre16	brandy-1/AHV	10.4.2...	2	4 GiB	59.04 GiB / 60 GiB	85.75%	13.75%	0	0	2 Kbps	0.73 ms	Yes	No
Demo-spectre17	brandy-2/AHV	10.4.2...	2	4 GiB	58.92 GiB / 60 GiB	69.56%	13.82%	0	0	2 Kbps	0.76 ms	Yes	No
Demo-spectre18	brandy-4/AHV	10.4.2...	2	4 GiB	59.04 GiB / 60 GiB	80.5%	13.81%	0	0	0 Kbps	0 ms	Yes	No
Demo-spectre19	brandy-3/AHV	10.4.2...	2	4 GiB	59.05 GiB / 60 GiB	79.32%	13.95%	0	0	0 Kbps	0 ms	Yes	No

Figure 13: Prism VM Management Table View

When your system combines Prism with ESXi or AHV, you can also manage all VMs using Prism. This single interface allows you to cover CRUD (create, read, update, and delete) operations in a VM's life cycle.

Along with VM life-cycle management, Prism delivers simple processes for taking snapshots, adding additional resources to VMs, providing console access, vNIC and vDisk operations, and power control operations. These standard VM-based operations are all available through the VM table view in Prism when you select a VM.

Enable NGT Launch Console Power Off Actions Take Snapshot Migrate Pause Clone Update Delete

Figure 14: Standard VM Operations in Prism

Entity Explorer

Prism Central serves as a single management point for multicloud and multisite Nutanix environments. In multicloud environments, you need easy

access to information in a simple summary. The entity explorer, accessed via the explore view in Prism Central, provides this overview.

Prism's analysis features can report on and allow you to view a number of entities in a Nutanix cluster. The entity explorer focuses on a subset of entities that provide administrators with access to configuration and inventory data:

- Virtual machines
- Nutanix clusters
- Hosts
- Disks
- Containers

When you select an entity to view, Prism immediately returns a list of all the items in the selected entity. If you select VMs, for example, you see a list of every VM on each of the clusters a Prism Central instance is managing. You can view the entity list in one of three formats: a list view, tile view, or circle view. Each view provides a unique look into the data provided.

When viewing a set of entities, such as VMs, there are two options for the type of data Prism presents. The first option delivers a general data set, which in this example includes common VM-related details such as the host and cluster the VM is running on, IP address, and hypervisor version. Alternatively, there is a performance-based view; in this example, this view reports VM memory usage along with several other vital storage performance metrics. You can set the table that contains the selected data points to display 10–60 rows in increments of 10.

<input type="checkbox"/>	Name	Host	Project	Owner	Hypervisor	Memory Capacity	IP Addresses	Power State	NFT Status	Cluster
<input type="checkbox"/>	2008R2_Template	brandy-3	default	admin	AHV	8 GiB	10.4.222.50	● On	Upgrade ...	Brandy
<input type="checkbox"/>	2008R2_Template	10.4.220.35	-	-	ESXi	8 GiB	-	● Off	Not Install...	Files
<input type="checkbox"/>	2008R2Mig	■ brandy-1	default	admin	AHV	8 GiB	10.4.222.26 , 1...	● On	Not Install...	Brandy
<input type="checkbox"/>	2008R2Mig-s1	brandy-2	default	admin	AHV	8 GiB	10.4.222.32 , 1...	● On	Not Install...	Brandy
<input type="checkbox"/>	2012r2	-	default	admin	AHV	4 GiB	-	● Off	Not Install...	Brandy
<input type="checkbox"/>	2012R2VM1	NTNX-BLOCK-1-A.tm...	-	-	Hyper-V	4 GiB	-	● Off	Not Install...	savannah.TME...
<input type="checkbox"/>	2016_Template	10.4.220.35	-	-	ESXi	4 GiB	-	● Off	Not Install...	Files
<input type="checkbox"/>	2016_Template	10.4.220.49	-	-	ESXi	4 GiB	-	● Off	Not Install...	Biomed
<input type="checkbox"/>	2016VM	-	default	admin	AHV	4 GiB	-	● Off	Not Install...	Brandy
<input type="checkbox"/>	2016VM1	NTNX-BLOCK-1-B.tm...	-	-	Hyper-V	4 GiB	-	● Off	Not Install...	savannah.TME...
<input type="checkbox"/>	2016VM2	NTNX-BLOCK-1-A.tm...	-	-	Hyper-V	4 GiB	-	● Off	Not Install...	savannah.TME...
<input type="checkbox"/>	2016VM3	NTNX-BLOCK-1-D.tm...	-	-	Hyper-V	4 GiB	10.4.58.10 , fe...	● On	Not Install...	savannah.TME...
<input type="checkbox"/>	2016VM4	NTNX-BLOCK-1-D.tm...	-	-	Hyper-V	4 GiB	10.4.58.16 , fe...	● On	Not Install...	savannah.TME...

Figure 15: Entity Explorer in Prism

In the explore view, there are several ways to group and filter entity data points to make the information easier to consume. When viewing VMs, you can apply a color to each entity to show the vCPU count, VM health, or power state. The group function displays VMs that you can group by cluster, hypervisor, power state, health, or vCPU count. Once you have filtered the data in the desired manner, you can choose multiple items by selecting the checkbox for each item that you want or by holding down the Shift key and clicking the first and last items to select a contiguous range.

In addition to the general and performance-focused views available in the entity browser, you can create custom views. To create new custom views, select the Custom option from the Focus dropdown menu. This option prompts you to name the new custom view and select from a list of columns that provide a variety of data points. The following figure provides an example of creating a custom view for VM data. Administrators can create multiple custom views, including custom views for any of the five entities available in the entity browser, with each providing a unique set of data points relevant to the selected entity.

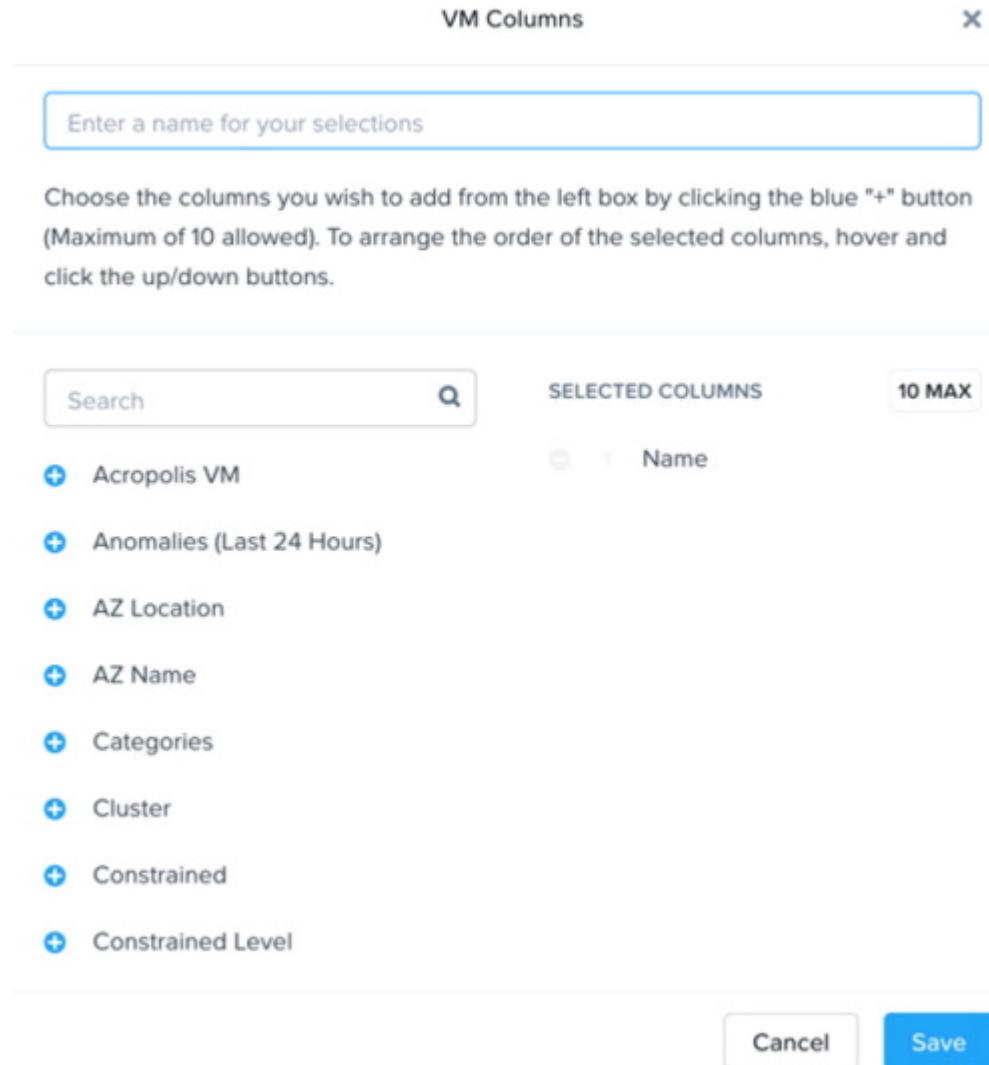


Figure 16: Custom Views in Prism

When you select VMs running on AHV in the entity explorer, you can run VM actions on a single VM or a group of selected VMs. This capability allows you to implement traditional VM management for distributed environments from a centralized point. The available actions are:

- Power actions
- Clone VM

- Launch console
- Pause VM
- Resume
- Snapshot
- Migrate VM
- Update VM configuration
- Delete VM

You can quickly find a specific entity, a subset of entities, or a range of entities by applying a filter to the results provided in the explore list. You can apply multiple filters to a single view to further reduce the total number of results and drill down to a focused set. Each of the filters provides a count of the number of entities that it applies to.

Filters Hide

HOST NAME

Contains

CLUSTER

Contains

HYPervisor

ESXi 4
 AHV 4

HEALTH

Critical 0
 Warning 0
 Good 8

MEMORY CAPACITY

251.95 GiB to 253.26 GiB 4
 253.26 GiB to 254.58 GiB 0
 254.58 GiB and above 4
 From to GiB

CPU USAGE

0% to 10% 6
 10% to 20% 1
 20% and above 0
 From to %

Figure 17: Filters in the Entity Explorer

The filters for each type of entity are different; you can apply the following the filters:

- Filter based on host name
- Filter based on cluster name
- Hypervisor type
- Health
- Memory capacity
- CPU usage

- Memory usage
- Read IOPS
- Write IOPS
- I/O bandwidth
- I/O latency

Entity Tagging

The entity explorer allows you to tag VMs with one or more labels. When the entity explorer displays results, it represents your labels with a symbol; it also offers labels as an additional method to filter results by.

Labels can have a number of uses, including tagging VMs that belong to a single application, business owner, or customer.

The screenshot shows the Entity Explorer interface. At the top, there is a header with 'Filters' and a 'Hide' button. Below the header, there is a section titled 'LABELS' with a 'Manage' button. The 'LABELS' section lists three categories: 'Desktops' (1 item), 'FileServer' (4 items), and 'Linux' (1 item). In the main list area, there are four entries: 'CHVVMMo' (unchecked), 'DT1' (checked), and 'DT2' (unchecked). A tooltip is displayed over the 'DT1' entry, showing the labels 'Desktops' and 'Linux'. The 'DT1' entry is highlighted with a black box and a callout pointing to the labels.

Figure 18: Entity Tagging

Search

Prism Central lets you quickly search for data points and reduces the clicks required to find information through the search function. You can enter common tasks and entities into the search bar to perform searches. The interface displays the returned results in a formatted entity explorer layout, typically with counts for each of the different result types.

Beyond searching for entities, search allows you to find data such as versioning or a configuration setting from a group of entities quickly. The updated search feature also allows you to jump directly to a given page in Prism, such as the software upgrade or name server configuration pages.

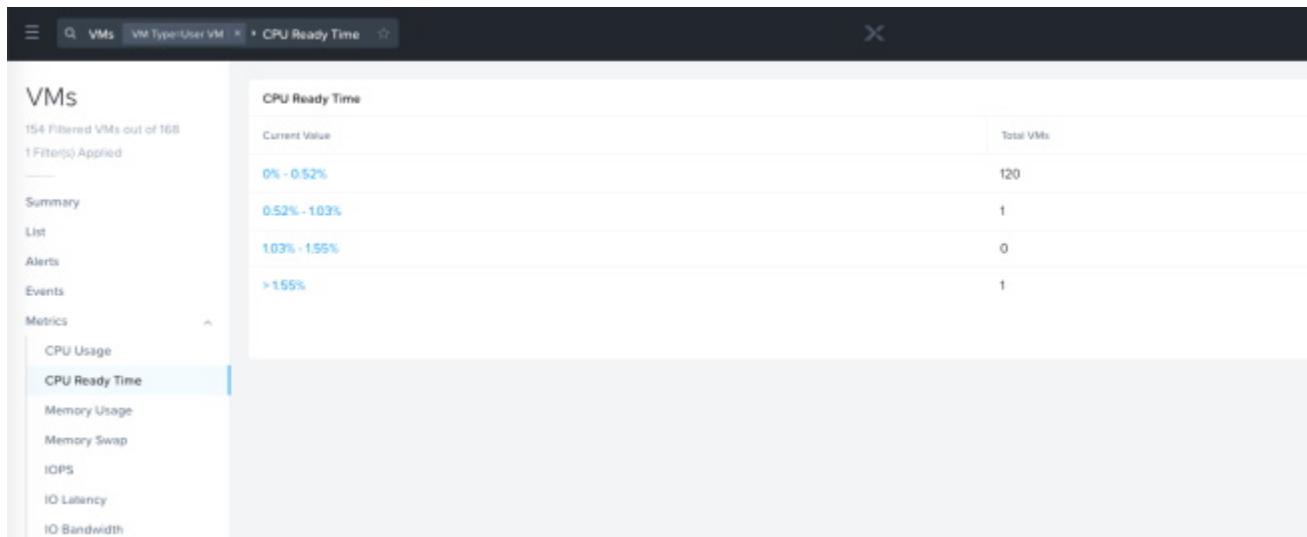


Figure 19: Search Function in Prism Central

The search function offers autocomplete to help administrators identify or complete their target search string.

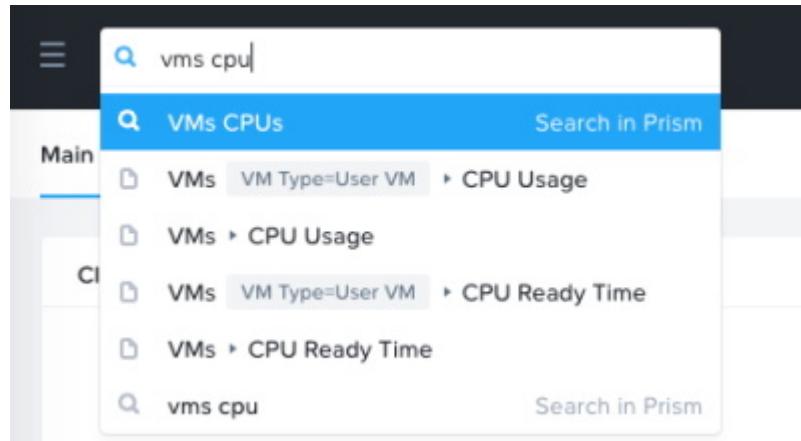


Figure 20: Search Bar Autocomplete

Networking

Prism network management features convey networking configuration and metrics for analysis. Prism collects network data for VMs from the configured hypervisor and from configured physical network switches via SNMP.

VM Performance			Virtual Disks		VM Alerts		VM Events			VM NICs			
VIRTUAL NIC	ADAPTER TYPE	MAC ADDRESS	IPV4 ADDRESSES	IPV6 ADDRESSES	RECEIVED PACKETS	TRANSMITTED PACKETS	DROPPED RX PACKETS	DROPPED TX PACKETS	NETWORK USAGE RATE				
4000	00:0c:29:47:3b:65	10.3.148.6/22			59	7	0	0	0 Kbps				
<hr/>													
Virtual NICs Stats				Host NICs Stats				Physical Switch Interface Stats					
PHYSICAL SWITCH INTERFACE	SWITCH ID	INDEX	MTU (IN BYTES)	MAC ADDRESS	UNICAST RX PKTS	UNICAST TX PKTS	ERROR RX PKTS	ERROR TX PKTS	DISCARD RX PKTS	DISCARD TX PKTS			
Ethernet48	568b689c-2ccc-40c8-9cfb-bfc311e41e3ec	48	9214	0:1c:73:26:fb:b0	22121728	23091344	0	0	0	0			
<hr/>													

Figure 21: Prism Network View

When Prism is managing a cluster running AHV, it also lets you create new VM networks. Prism provides a simple pop-up form to fill in with the network name

and corresponding VLAN ID. Once you create a network, you can assign it to both existing and newly created VMs.

The screenshot shows the 'Create Network' dialog box. At the top right are a help icon (?) and a close button (X). The main area has two input fields: 'Name' containing 'desktop118' and 'VLAN ID' containing '118'. Below these is a checkbox labeled 'Enable IP address management' with a descriptive note: 'This gives AHV control of IP address assignments within the network.' At the bottom are 'Cancel' and 'Save' buttons.

Figure 22: Network Creation in Prism

When creating each VM network, Prism can also provide DHCP address management. This functionality allows you to configure address pools for each network that can be automatically assigned to VMs requesting DHCP addresses.

Data Protection

The data protection view in Prism offers insight into Nutanix backup and replication capabilities following the same user experience as the other management views. The summary layout provides a single point of management for synchronous and asynchronous replication.

The data protection overview summarizes the number of remote sites and protection domains, giving you a quick look into the cluster's data protection. Charts report replication data transfer bandwidth, as well as a list of the top remote sites by bandwidth consumption. This report lets an organization easily

understand the bandwidth that replication is consuming, whether something is operating abnormally, and which sites use the most resources.

Administrators also gain awareness of ongoing replication, pending replication, and successful replication tasks, so they can recognize if any tasks are being held up or simply verify that replication is completing successfully.

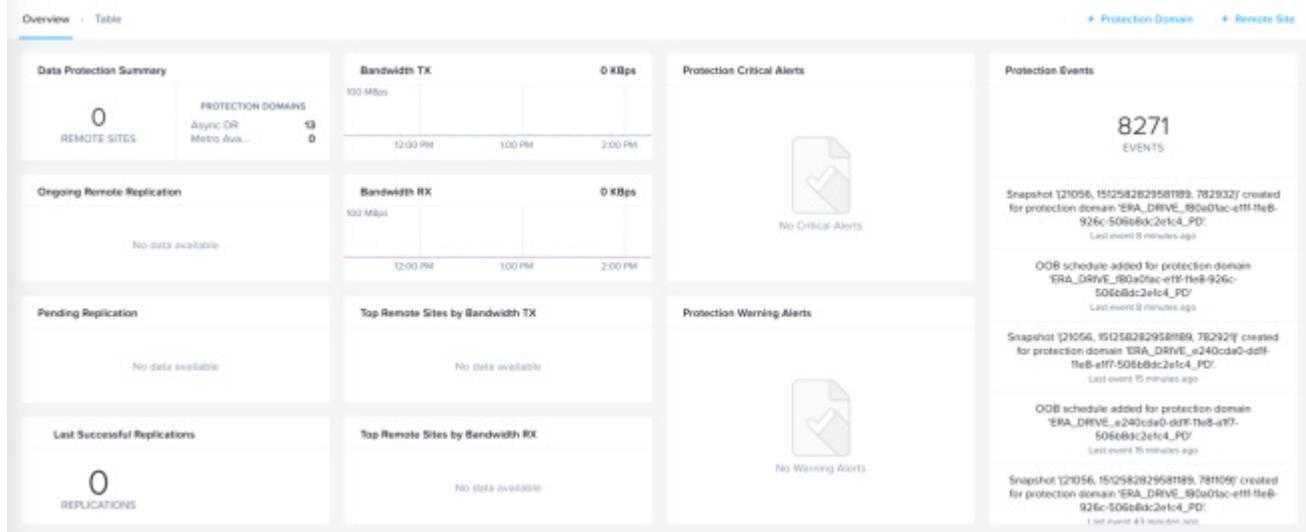


Figure 23: Prism Data Protection View

A protection domain is a set of policies that govern the local backup and remote replication functions for one or more VMs. A schedule attached to each protection domain controls the rate at which snapshots are taken and how long they are retained. This architecture allows you to create protection domains that can protect either a single VM or groups of VMs. The flexibility to use multiple protection domains in a cluster means that you can create different policies for protecting diverse applications and groups of VMs and for controlling replication to different sites and clusters.

The data protection table view summarizes the configuration, performance, and status of the protection domains that provide backup and disaster protection in your cluster. From this view you can see how many resources each protection domain consumes, what is contained in a protection domain, when the last snapshot was successfully taken, and whether there are any pending jobs.

When you select a specific protection domain or remote site, a greater amount of data becomes available through additional charts and tables. These entity-specific data points provide extensive details on the contents, schedules, alerts, and metrics for each item.

The screenshot shows the Prism Data Protection Table View. At the top, there are tabs for 'Overview' and 'Table'. Below the tabs, there are two sub-tabs: 'Async DR' and 'Remote Site', with 'Remote Site' being the active tab. A search bar at the top right contains the placeholder 'Search in table'.

The main table displays 1-6 of 13 protection domains. The columns are: Name, Remote Sites, Entity Count, Next Snapshot Time, Snapshot Exclusive Usage, B/W Used (Tx), B/W Used (Rx), Ongoing, and Pending. The rows show various protection domains like '2008R2Template', 'CorpBackupPDG', and several ERA_ DRIVE entries.

Below the table, a summary for the selected 'ERA_DRIVE_4751561c-decc-11e8-926b-506b8dc2efc4_PD' protection domain is shown. The summary includes:

- PROTECTION DOMAIN DETAILS:**
 - Name: ERA_DRIVE_4751561c-decc-11e8-926b-506b8dc2efc4_PD
 - Mode: Active
 - Next Snapshot Time: No Schedule
 - VM Count: 0
 - Volume Group Count: 1
 - File Count: 0
 - Remote Site(s):
- Replications:** Shows 'Total Ongoing (0)' and 'Total Pending (0)' sections with columns for Direction, Protection Domain, Remote Site, Snapshot, Start Time, and Data Completed.
- Entities:** Shows 'Schedules', 'Local Snapshots', 'Remote Snapshots', 'Metrics', 'Alerts', and 'Events'.

Figure 24: Prism Data Protection Table View

The protection domains that Nutanix uses to safeguard VMs can contain either a single VM or groups of VMs. The process of selecting the VMs to include in a protection domain is simple and follows the earlier upgrade and configuration examples. When you create or edit an existing protection domain, you can select from the list of all VMs running on the cluster.

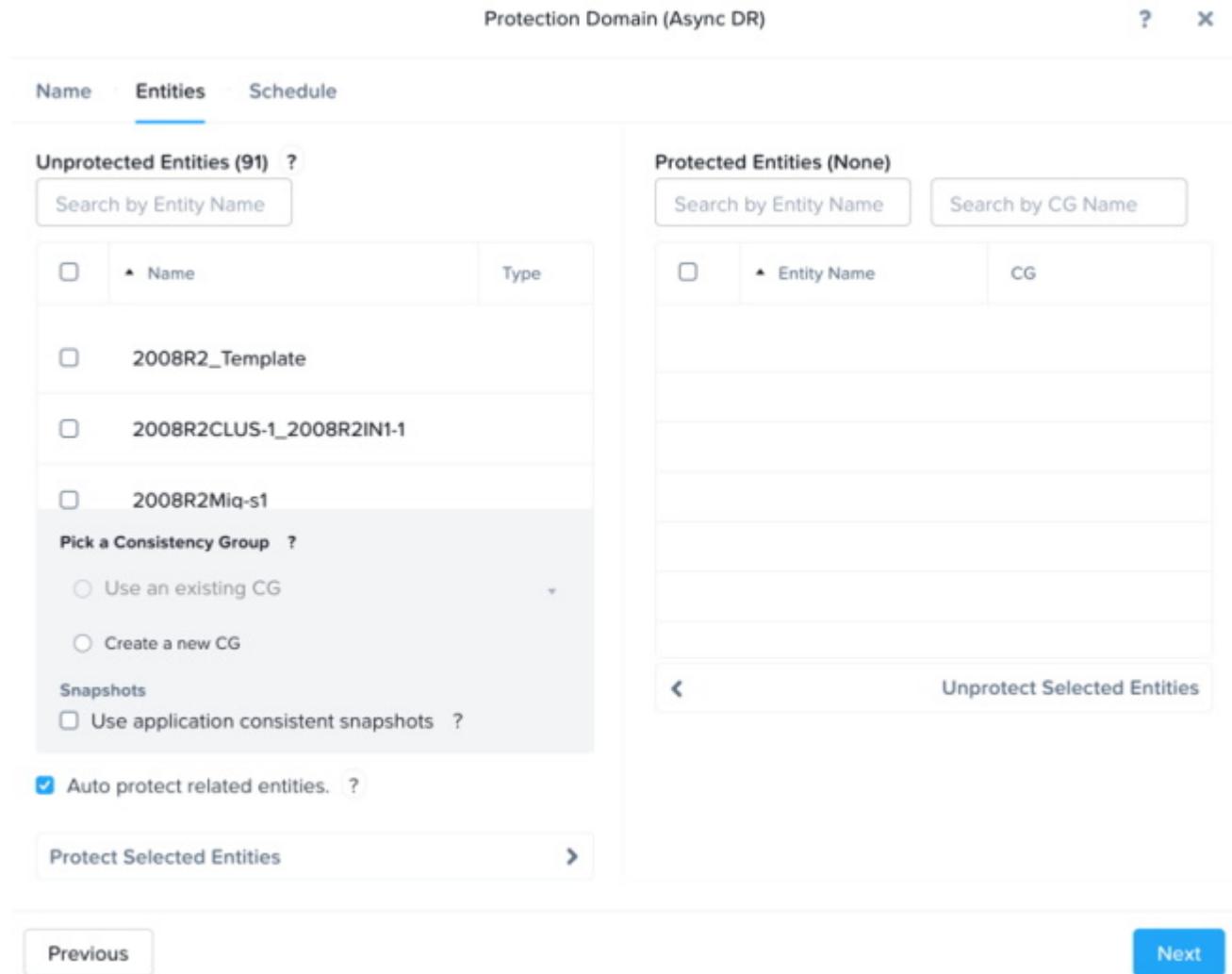


Figure 25: Updating a Protection Domain in Prism

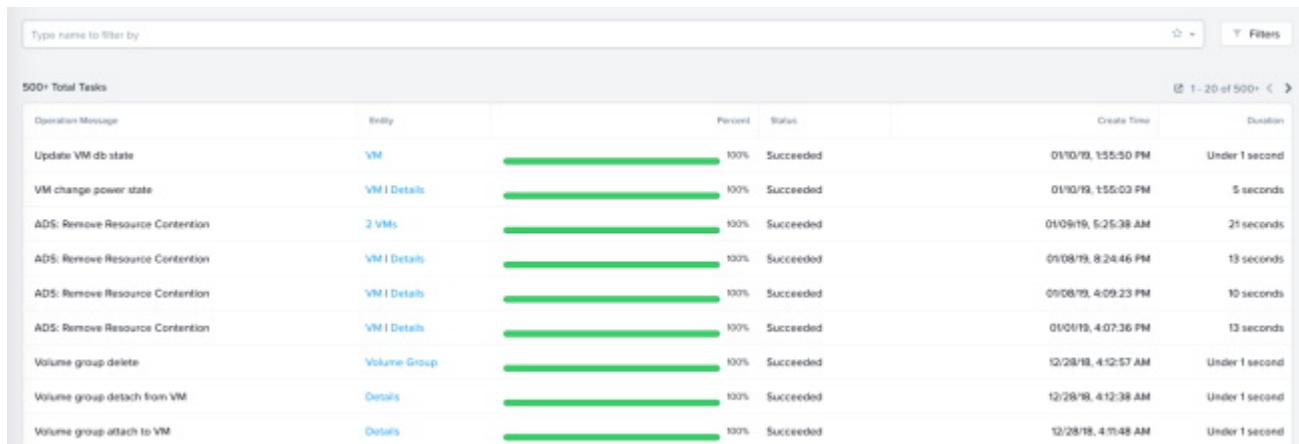
User Management and Authentication

Prism offers two types of user accounts for authentication. You can create and manage the first type, local accounts, in the given Prism instance. The second type of account is authentication based on Identity Provider (IDP). Configuring Prism to use IDP supports Microsoft Active Directory, OpenLDAP, or SAML as an authentication source, which in turn allows organizations to use existing user accounts and groups to control access to Prism.

Tasks

Monitoring and understanding the actions performed over time is helpful in any environment. Prism records these actions and presents them as tasks in the tasks view. A table format displays all tasks and lists what actions were performed, the entity each action was performed on, and the cluster, status, running time, and duration of each action.

From the task view, organizations can easily see recent actions and get a comprehensive sense of the current status. The task view is also a helpful resource when looking back to a specific time period to research an issue's root cause or find the source of configuration changes.



The screenshot shows a table titled "500+ Total Tasks" with the following columns: Operation Message, Entity, Percent, Status, Create Time, and Duration. The tasks listed are:

Operation Message	Entity	Percent	Status	Create Time	Duration
Update VM db state	VM	100%	Succeeded	01/10/19, 1:55:50 PM	Under 1 second
VM change power state	VM Details	100%	Succeeded	01/10/19, 1:55:03 PM	5 seconds
ADS: Remove Resource Contention	2 VMs	100%	Succeeded	01/09/19, 5:25:38 AM	21 seconds
ADS: Remove Resource Contention	VM Details	100%	Succeeded	01/08/19, 8:24:46 PM	13 seconds
ADS: Remove Resource Contention	VM Details	100%	Succeeded	01/08/19, 4:09:23 PM	10 seconds
ADS: Remove Resource Contention	VM Details	100%	Succeeded	01/08/19, 4:07:36 PM	13 seconds
Volume group delete	Volume Group	100%	Succeeded	12/28/18, 4:12:57 AM	Under 1 second
Volume group detach from VM	Details	100%	Succeeded	12/28/18, 4:12:38 AM	Under 1 second
Volume group attach to VM	Details	100%	Succeeded	12/28/18, 4:11:48 AM	Under 1 second

Figure 26: Prism Task View

In environments running AHV, you can see a list of tasks performed against a single VM via the VM view in Prism.

Localization

Prism offers Unicode (UFT-8 encoded) support for characters not contained in ASCII. Unicode support allows administrators to use supported characters in names of entities such as containers, VMs, and clusters. Because Unicode support is native through every layer, service, and access point in the Nutanix platform, everything from command line access to system services can use this expanded character set.

When users change their preferred language in Prism, the date, time, and number formats update to display correctly for the language selected. Prism also supports Simplified Chinese and Japanese.

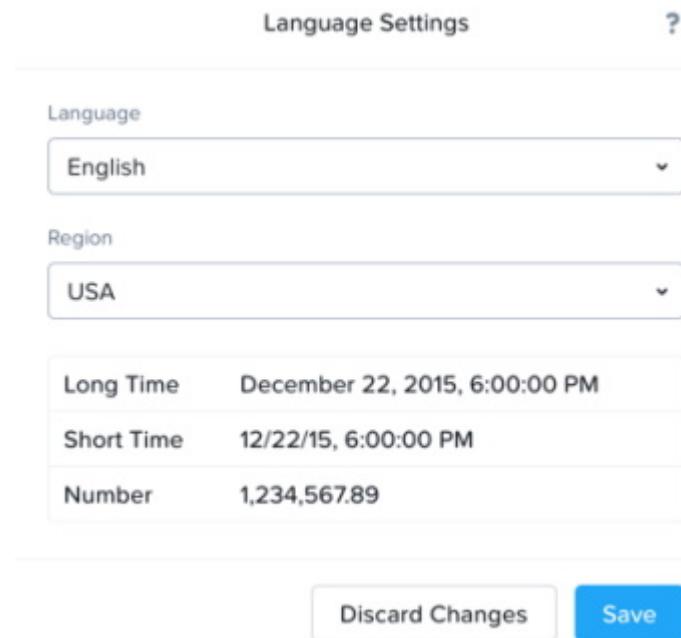


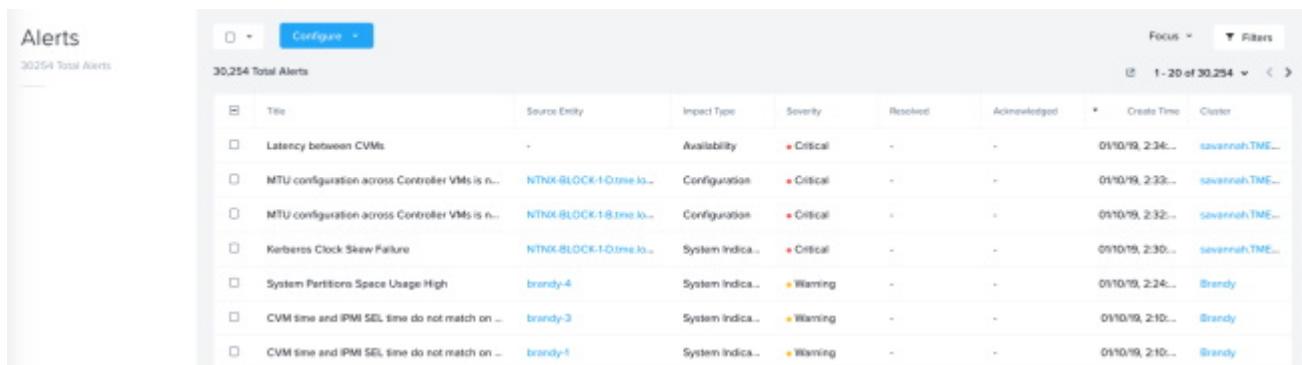
Figure 27: Prism Language Settings

5. Operational Insights

Prism also helps organizations manage their Nutanix clusters by providing operational insights. Operational insights focus on providing administrators with alerts, metrics, and the ability to analyze data.

Alerts

The Prism alerts view presents all notifications and events in an easy-to-consume table format. The table presents each alert with the color-coded severity level, a description of the alert, the timestamp, and which entities the alert involves, along with cause and resolution guidance.



The screenshot shows the Prism Alert View interface. At the top, there's a header with 'Alerts' and a 'Configure' button. Below the header, it says '30,254 Total Alerts'. The main area is a table with the following columns: Title, Source Entity, Impact Type, Severity, Resolved, Acknowledged, Create Time, and Cluster. There are 8 rows of data in the table:

Title	Source Entity	Impact Type	Severity	Resolved	Acknowledged	Create Time	Cluster
Latency between CVMs	-	Availability	Critical	-	-	01/10/19, 2:34...	savannah.TME...
MTU configuration across Controller VMs is n...	NUTANIX-BLOCK-1-Dtime.lo...	Configuration	Critical	-	-	01/10/19, 2:33...	savannah.TME...
MTU configuration across Controller VMs is n...	NUTANIX-BLOCK-1-Dtime.lo...	Configuration	Critical	-	-	01/10/19, 2:32...	savannah.TME...
Kerberos Clock Skew Failure	NUTANIX-BLOCK-1-Dtime.lo...	System Indica...	Critical	-	-	01/10/19, 2:30...	savannah.TME...
System Partition Space Usage High	brandy-4	System Indica...	Warning	-	-	01/10/19, 2:24...	Brandy
CVM time and IPMI SEL time do not match on ...	brandy-3	System Indica...	Warning	-	-	01/10/19, 2:10...	Brandy
CVM time and IPMI SEL time do not match on ...	brandy-5	System Indica...	Warning	-	-	01/10/19, 2:10...	Brandy

Figure 28: Prism Alert View

To help administrators remediate alerts, Prism offers a summary of the probable root cause for each alert in the documentation column. Prism also provides the most likely resolution, helping administrators correct issues faster.

	ENTITIES	DOCUMENTATION
	Host	Cause Resolution
	Host	Cause Resolution
	Host	Cause Resolution
	Cluster	Cause Resolution
	Host	Cause Resolution
	Nutanix internal time configuration is out of sync.	
		Cause Resolution

Figure 29: Prism Alert Summary Detail

There can be a significant amount of variance between organizations, and if alert policies are too rigid to accommodate these differences, they become a hindrance. Prism lets you update and customize alert policies with different values to suit your particular organization's conditions. The Prism Central instance applies such policy changes to all clusters under management.

When a different value should be applied to different clusters in the environment, you can configure each alert policy with exceptions.

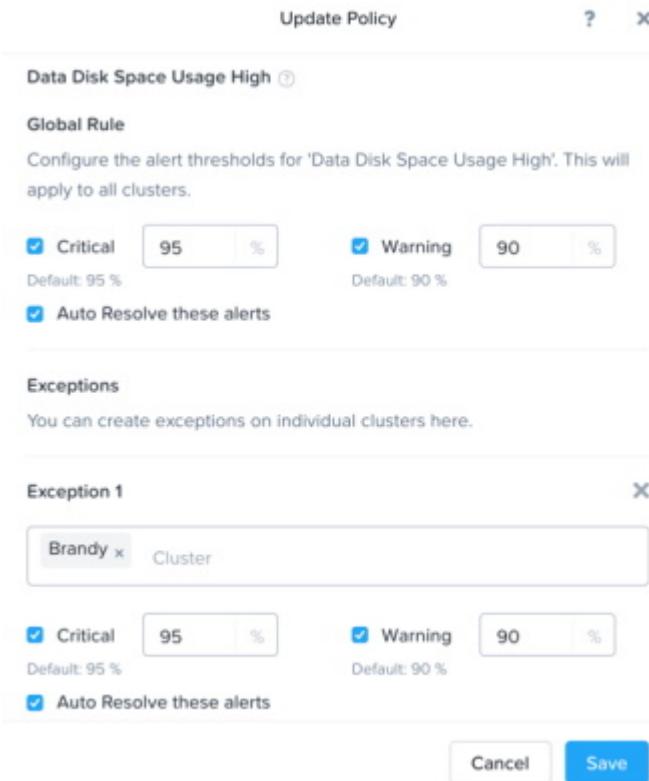


Figure 30: Alert Policy Update in Prism

With centralized control for alert policies and SMTP email alerts, organizations can set their alerting policies from Prism Central, and the policies for all managed clusters automatically update to match. This feature saves time in configuring and updating policies and ensures that each cluster is compliant.

User-Created Alerts

Along with customizable platform-level alerts, administrators can create alert policies to satisfy more specific monitoring requirements for an entity (VM, cluster, host, container) or group of entities. Each policy focuses on a selected metric, and you can configure it with a warning and alert value. To prevent false notifications, you can configure the policy such that the value doesn't trigger an alert until that value has been sustained for a certain amount of time.

Create Alert Policy

Entity Type
Cluster

Entity
One Cluster
Brandy

Metric
Controller IOPS

Impact Type
Performance

Policy Name
Brandy - Cluster Controller IO

Description *Optional

Auto resolve alerts ①

Enable Policy

Controller IOPS 1 Anomaly
Last week

3000 IOPS
2000 IOPS
1000 IOPS

01/04 01/05 01/06 01/07 01/08 01/09 01/10

Behavioral Anomaly ①

Every time there is an anomaly, alert Warning

Ignore all anomalies between IOPS and IOPS

Static Threshold ①

Alert Critical if <= IOPS or >= IOPS

Alert Warning if <= IOPS or >= IOPS

Trigger alert if conditions persist for 10 Minutes

Cancel Save

Figure 31: Create Alert Policy

Alert-Driven Root Cause Analysis

As we mentioned in the previous section, Prism offers a summary of probable causes and the most likely resolution for each alert generated. Each possible root cause Prism suggests includes recommended steps for correcting the issue along with items to review, logs to examine, and any other applicable actions.

Some root cause corrective measures also provide a performance metric chart for you to review. To help identify whether a performance issue caused the problem, a bell on the chart marks the time when the alert was created. This marker allows you to see if the suggested metric was in violation at the time of the event.

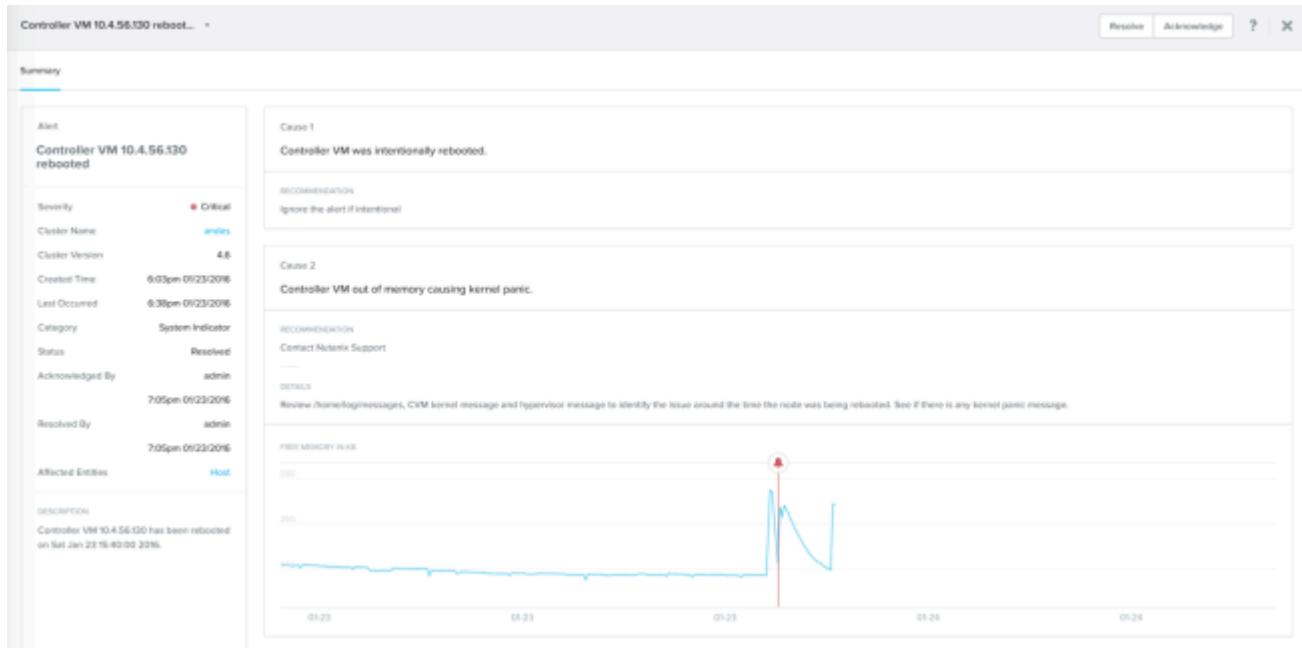


Figure 32: Root Cause Analysis

Analytics

Prism looks at analytics by using charts based on metrics that you select from the hundreds available. Each chart focuses on a single metric and can be configured to display data from one entity or from multiple entities. The entities available in analytical charts are:

- Hosts
- Clusters
- Disk
- Virtual Disk

- Storage Pool
- Container
- Virtual Machine
- Protection Domain
- Remote Site
- Replication Link

With granular entity selection and a large list of metrics, you can create charts as focused or as broad as you require.

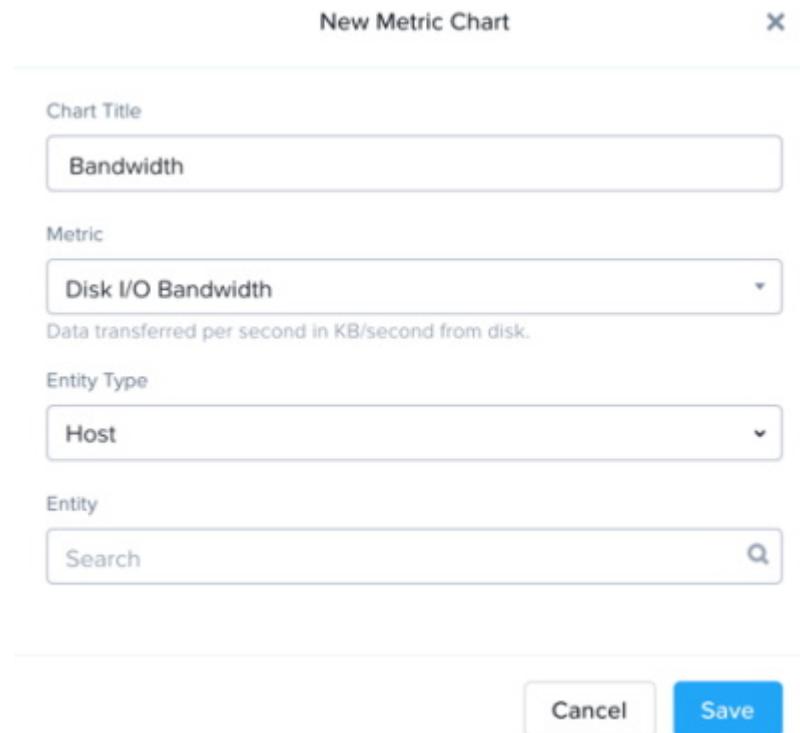


Figure 33: Analytic Chart Creation in Prism

Prism Element stores analytical data for 90 days; if you need to store data for a longer period, you can configure a Prism Central instance for additional data retention. You can also look at an analytical chart in different time increments:

- 3 hours
- 6 hours
- 1 day
- 1 week
- Week to date
- 1 month

The ability to change a chart's time increments allows you to select a specific day and focus on that date, a portion of the selected date, or the week surrounding the selected date. Variable date views can provide insight into events leading up to or following a specific point in time.

Analysis

Prism's analysis feature brings all relevant analytics into a single view. This unique analysis view stacks all the charts and lines them up in time sync. Above the stack of charts, Prism adds all alerts and events, represented with colors and counts.

This visual layout lets you click on a chart at any point in time, placing a vertical line stretched through all charts for easy correlation. By focusing on a specific point and syncing all metrics, you can reduce the effort it takes to identify possible root causes. The rightmost column of the screen provides a summary of any alerts and events, so you don't need to leave the analysis page.

Prism Central then brings all the relevant analytics for the entire environment or any single entity into one view.



Figure 34: Prism Analysis View

The analysis view allows you to fully customize the number and size of the analytical charts you see and to add charts to your screen or remove them as needed. You can export each chart to a .csv or .json file.

VM I/O Metrics

When you select a VM in the VM-focused view in Prism, the I/O Metrics tab can provide a deeper set of storage-related data points. These data points focus on I/O statistics and patterns for the selected VM. The ability to determine I/O behavior and patterns is incredibly helpful when sizing or scaling workloads or troubleshooting issues.

The following data points are available:

- Read performance distribution by I/O block size
- Write performance distribution by I/O block size

- Average I/O latency (read versus write)
- Read latency distribution by percentage
- Write latency distribution by percentage
- Read source (DRAM, SSD, or HDD tiers)
- Read I/O (sequential versus random) by percentage
- Write I/O (sequential versus random) by percentage



Figure 35: VM I/O Metrics View

Network Visualization

The network view in Prism provides a visual representation of networking connections and traffic flows, as shown in the following diagram. In this view, VMs are located on the left and you can either group them using different filters or show them as a list. The physical nodes appear in the middle of the screen, and the connected network switches are represented on the right. This

visualization allows you to see the entire environment, as you can filter each of the columns down to a group or single entity.

Network visualization gives you the power to click on a single VM and understand what networks it's connected to. You can see the host a given VM runs on, which physical network connection it's using, and what switch port that connection is using. This level of detail is vital when you need to report on environment configuration, make changes, or troubleshoot an issue.

In Prism, you can use network visualization for a single VM, for a group of VMs, or for hypervisor nodes. Networks are color-coded at the VM and network switch levels so you can easily understand whether the networks configured for a VM are available on the switch port they're using. Network visualization is currently only available for clusters running AHV as the hypervisor.

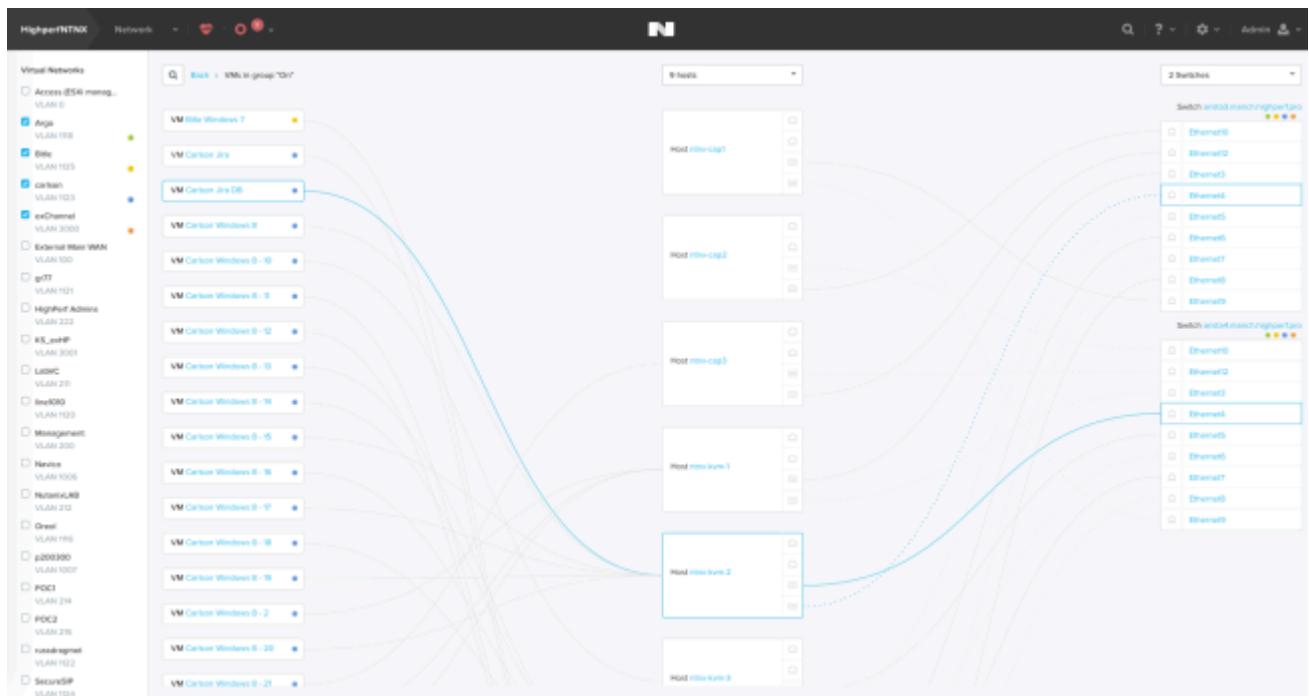


Figure 36: Network Visualization View

6. Prism API

Prism both offers and consumes the Nutanix API. Each function you can use in the Prism HTML5 interface is actually performed in the background using API calls. The REST API is also available to allow other systems to access data from Nutanix and to let organizations build their own automation by using API functions.

Prism provides a REST API explorer to simplify the experience of discovering available functions and testing their outputs before trying them in your custom code. The explorer-focused view delivers a list of all commands and groups them into categories that are based on the entity or function you want to connect with.

The screenshot shows the Prism REST API Explorer Live interface. At the top, there's a dark header bar with the title 'REST API Explorer Live!' and a small icon. Below the header, there's a list of API endpoints grouped into categories:

Category	Operations
/alerts	Show/Hide List Operations Expand Operations Raw
/authconfig	Show/Hide List Operations Expand Operations Raw
/cloud	Show/Hide List Operations Expand Operations Raw
/cluster	Show/Hide List Operations Expand Operations Raw

Figure 37: Prism REST API Explorer View

You can expand each group in the explorer to show the list of API commands in the group. These include Get, Put, Patch, and Delete commands, allowing for a specific function to be created, updated, and deleted.

/cluster

Show/Hide | List Operations | Expand Operations | Raw

GET /cluster/	Get Cluster details.
PATCH /cluster/	Modify Cluster params.
PUT /cluster/	Update Cluster params.
GET /cluster/name_servers	Get the list of Name Servers.
POST /cluster/name_servers	Add name server.

Figure 38: API Commands in Prism

7. Conclusion

Nutanix embodies a radically new approach to enterprise infrastructure—one that simplifies every step of the infrastructure life cycle, from buying and deploying to managing, scaling, and supporting. The Nutanix solution's web-scale technologies and architecture let you run any workload at any scale. With Nutanix AOS and Nutanix Prism, administrators get powerful virtualization capabilities that are fully integrated into the converged infrastructure stack and can be managed from a single pane of glass.

About Nutanix

Nutanix is a global leader in cloud software and a pioneer in hyperconverged infrastructure solutions, making clouds invisible and freeing customers to focus on their business outcomes. Organizations around the world use Nutanix software to leverage a single platform to manage any app at any location for their hybrid multicloud environments. Learn more at www.nutanix.com or follow us on Twitter [@nutanix](https://twitter.com/nutanix).

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