

TECH NOTE

NCM Intelligent Operations Tiers

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1. Executive Summary

The Nutanix Cloud Platform (NCP) is a secure, resilient, and self-healing platform for building a hybrid multicloud infrastructure. It supports all kinds of workloads and use cases across public and private clouds, multiple hypervisors, and containers—with varied compute, storage, and network requirements.

The two main pillars of NCP are:

- Nutanix Cloud Infrastructure (NCI): a distributed infrastructure platform for enterprise IT applications. NCI software combines compute, storage, and networking resources from a cluster of servers into a single logical pool with integrated resiliency, security, performance, and simplified administration.
- Nutanix Cloud Manager (NCM): a unified solution for providing intelligent operations, self-service and orchestration, security compliance and visibility, and control of cloud costs.

In this tech note, we focus on the NCM Intelligent Operations (formerly Prism Pro and Ultimate) set of features and functionality.

2. Introduction

Audience

This document is part of the Nutanix Solutions Library. We wrote it for IT administrators, architects, and business leaders who want to understand the operation management experience of the Nutanix solution.

Purpose

This tech note describes how to use NCM Intelligent Operations features to gain control and visibility of AHV and ESXi virtual environments across the organization by implementing infrastructure artificial intelligence for IT operations (AIOps). It explains how advanced analytics and machine learning help provide intelligent insights into managing a Nutanix environment.

Document Version History

Version Number	Published	Notes
1.0	March 2016	Original publication.
1.1	June 2016	Updated for AOS 4.7.
1.2	December 2016	Updated for AOS 5.0.
1.3	May 2017	Updated for AOS 5.1.
1.4	December 2017	Updated for AOS 5.5.
1.5	April 2018	Updated for AOS 5.6.
2.0	February 2019	Updated for AOS 5.10.
2.1	August 2019	Updated for AOS 5.11.
3.0	February 2021	Updated for AOS 5.18 and PC 2020.11.
3.1	March 2021	Refreshed content.

Version Number	Published	Notes
3.2	March 2022	Refreshed content.
4.0	October 2022	Updated product names and descriptions. Reorganization of content.

3. Customer Value

Nutanix Solution

In today's modern datacenter, customers are facing challenges. They often use many different monitoring tools, which can produce vast amounts of overwhelming data to sift through. NCM Starter and Pro come with Intelligent Operations features to help make IT operations more efficient and help customers focus on what's important.

4. Licensing

NCM licenses are available on a per-core basis through a yearly subscription. There are three licensing tiers: Starter (AIOps), Pro (advanced AIOps, Self-Service Marketplace, and Cost Governance), and Ultimate (Advanced Application Automation and Security Central). In this tech note, we focus on the Intelligent Operations features available in NCM Starter and Pro.

NCM Software Editions	Starter	Pro	Ultimate
Ideal for	Infrastructure AIOps: monitoring, planning, rightsizing and low code automation	IaaS across private and public clouds, plus cost governance	Enterprise deployments, supporting complex app automation, security features and governance workflows
Intelligent Operations			
Reporting	x	x	x
Capacity Forecast and Planning	x	x	x
Resource Inefficiency Detection and Right-sizing	x	x	x
Support for ESXi on non-NCI Environments	x	x	x
Low-code/No-code Operations Automation	x	x	x
SQL Server Monitoring for IT Ops		x	x
Application Discovery		x	x
Self-tuning with Machine Learning		x	x
Cost Governance			
Cost Metering for Private Cloud Resources		x	x
Multi-Cloud Visibility and Optimization		x	x
Budgeting and Chargeback		x	x
Self-Service			
Self-Service Marketplace		x	x
IaaS VM Blueprints		x	x
Advanced Orchestration Runbooks		x	x
App Blueprints			x
Governance (Approvals & Scheduler)			x
Security Compliance			
Security Monitoring & Remediation			x
Network Security Planning			x
Regulatory Compliance			x

Figure 1: NCM Software Editions

5. NCM Starter

The NCM Starter (formerly Prism Pro) tier provides advanced analytics and intelligent insights into managing a Nutanix environment. These features include performance anomaly detection, capacity planning, custom dashboards, reporting, and advanced automation capabilities. Prism Central comes with a 90-day trial of all of the Intelligent Operations features for NCM (currently shown as a Prism Ultimate trial).

Note: 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.

Reporting

NCM includes a set of customizable predefined reports, and you can create new reports using a built-in WYSIWYG editor. In the editor, select data points and arrange them in the desired layout to create your report. The ability to group within reports can help you get a global view of a given data point or allow you to look at entities by cluster.

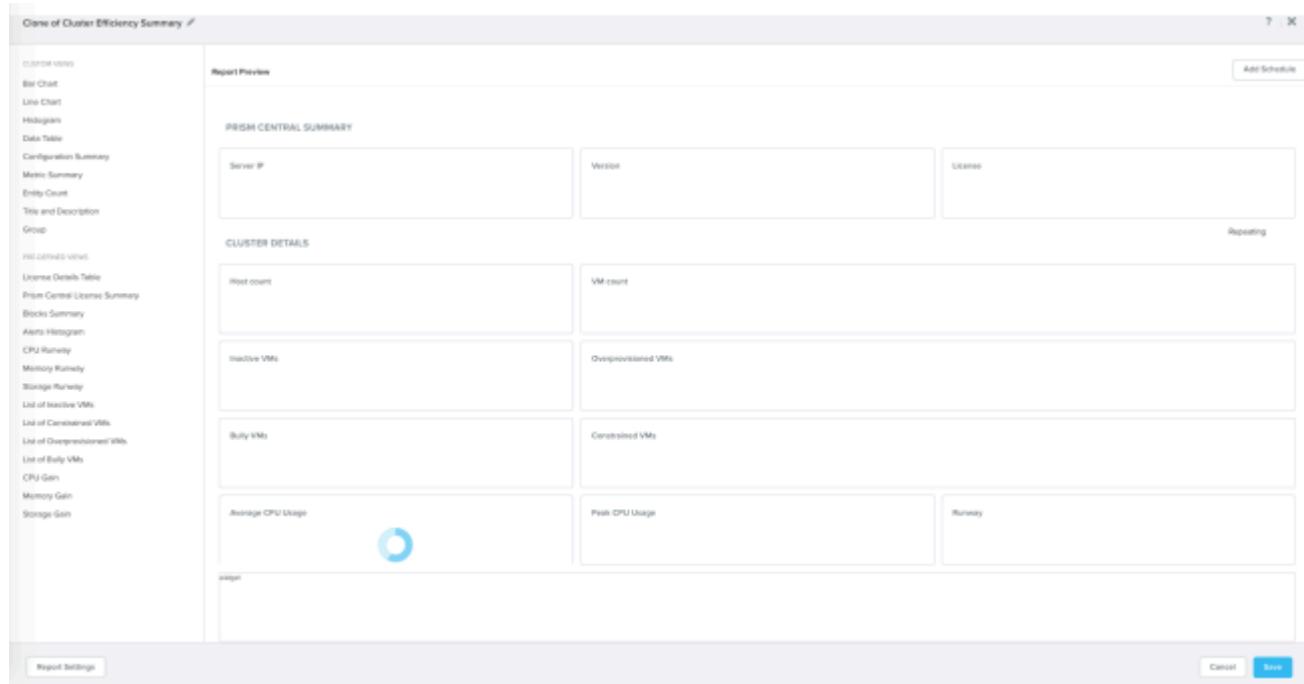


Figure 2: Report Builder

Once you have created them, you can run reports on an as-needed basis or on a schedule. Each report is configured to retain a certain number of copies before the system purges the oldest versions. To access reports, choose the report, then select the version you wish to view. You can view the report either in Prism or through email if you've configured the report to send copies to a recipient list.

Reports provide information that all levels of the organization, from operations to leadership, can use. A few common report types include the following:

- Environmental summary: Provides a summary of cluster inventory entities and resource utilization.
- Cluster efficiency: Details possible capacity savings at the VM or cluster level.
- Inventory: Produces a list of physical clusters, nodes, VMs, or other entities in an environment.

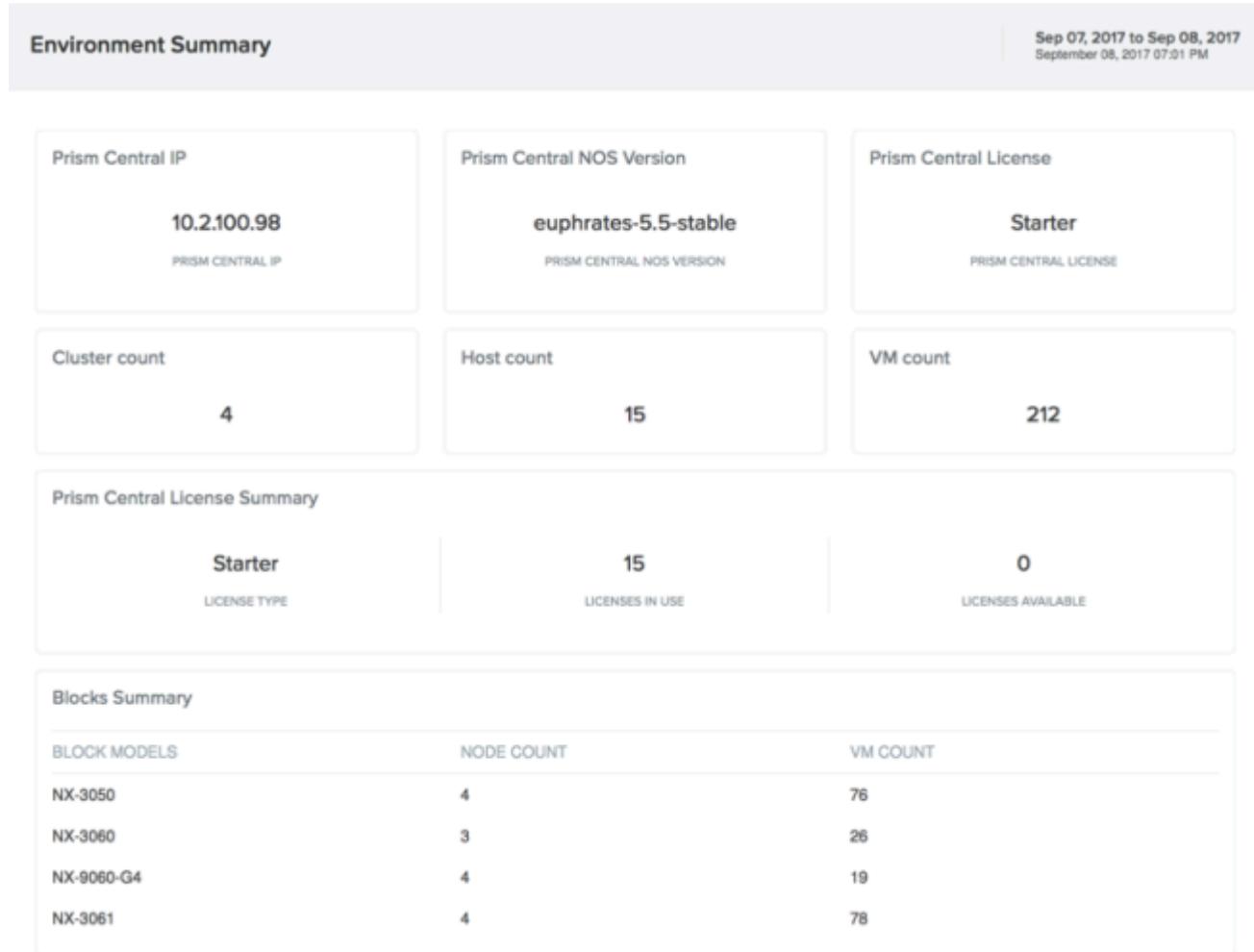


Figure 3: Report Sample

Capacity Forecast and Planning

Capacity forecast and planning focuses on consumption from three resource buckets: storage capacity, CPU, and memory. Capacity results are illustrated as a chart that shows the historical consumption for the capacity metric along with the estimated capacity runway. The capacity runway is the number of days remaining before the resource item is fully consumed. The Nutanix X-FIT algorithms perform capacity calculations based on historical data. NCM initially uses the 90 days of historical data from each Prism Element instance, then

continues to collect additional data to use in calculations. NCM retains capacity data points longer than Prism Element, allowing organizations to study a larger data sample.

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

Storage calculations factor the amount of live usage, system usage, reserved capacity, and snapshot capacity into runway calculations. Storage capacity runway is aware of containers, so it can calculate capacity when multiple containers growing at different rates consume a single storage pool. Container awareness allows X-FIT to create more accurate runway estimates.



Figure 4: Capacity Runway

When you can't reclaim enough resources or need to scale the overall environment, the capacity planning function can make node-based recommendations. For example, if the runway period is set to 180 days, NCM Starter calculates the number, type, and configuration of nodes recommended to provide the requested 180 days of capacity.

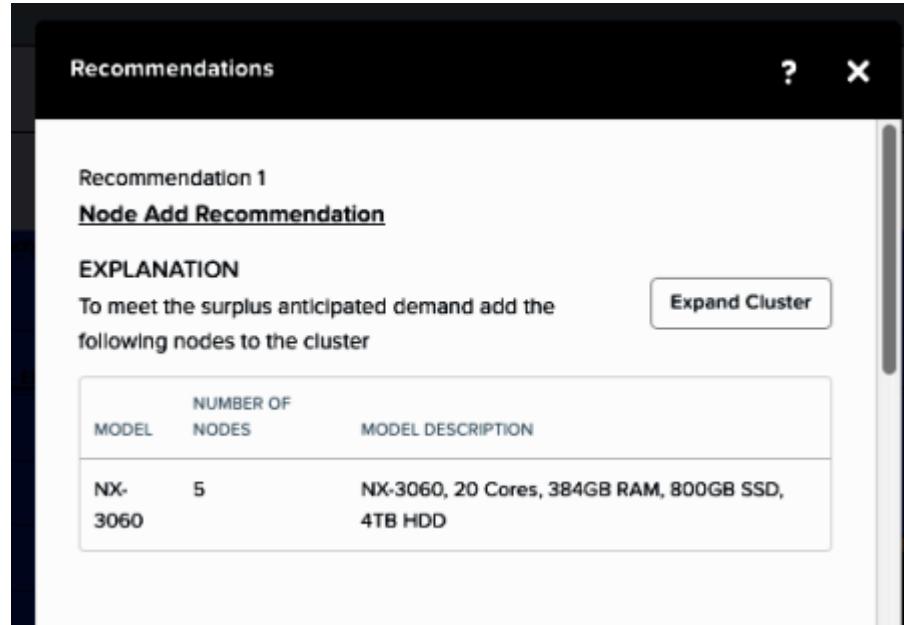


Figure 5: Node-Based Recommendations for Adding Capacity

You can model adding new workloads to a cluster to see how those workloads may affect your capacity. Scaling cluster capacity is an important operational function that ensures that existing and future applications run optimally. Historically, organizations made these scaling decisions in legacy environments based on imprecise math and guesswork.

NCM uses data from X-FIT and workload models that have been carefully curated over time through our Sizer application to inform capacity planning. The add workload function allows you to add various applications for capacity planning:

- SQL Server: Size based on different workloads and database types.
- VMs: Manually specify a generic VM size or select existing VMs on your cluster to model growth against.
 - Helpful when you plan to scale a specific application already running on the cluster.
- VDI: Select broker technology, provisioning method, user type, and number of users.

- Splunk: Size based on daily index size, hot and cold retention times, and number of search users.
- Citrix Virtual Apps and Desktops: Size server-based computing with data points for broker types, server OS, provisioning type, and concurrent user numbers.
- Percentage: Model an increase or decrease in capacity demand for the cluster.
 - › Example: Plan for 20 percent growth of cluster resources on a specified date.

To model a new cluster workload, select the cluster and click Add/Adjust Workload. Select New Workload, then pick a workload from the dropdown menu and provide the data points for it. Once you have provided the workload characteristics, enter the date you want it added to the cluster and click Add Workload. The following figure shows an example of part of the modeling process.

Add/Adjust Workload X

Workload Type

New Workload Disregard Existing Workloads

Workload ▼

SQL Server

Number Of DB VMs (1 DB Instance Per VM)

1

Profile Type

Small Medium Large

Database Type

OLAP OLTP

Business Critical

Yes No

Cancel Save

Figure 6: Adding Workload Modeling

Once you have added a workload to a cluster for modeling, the planning feature adjusts the cluster runway to reflect the addition. Depending on when you want to add the new workload, your runway time may immediately shorten. To adjust for your target runway, NCM recommends additional nodes for the scenario. We show an example cluster expansion recommendation in the following figure, with the new nodes in the red box.

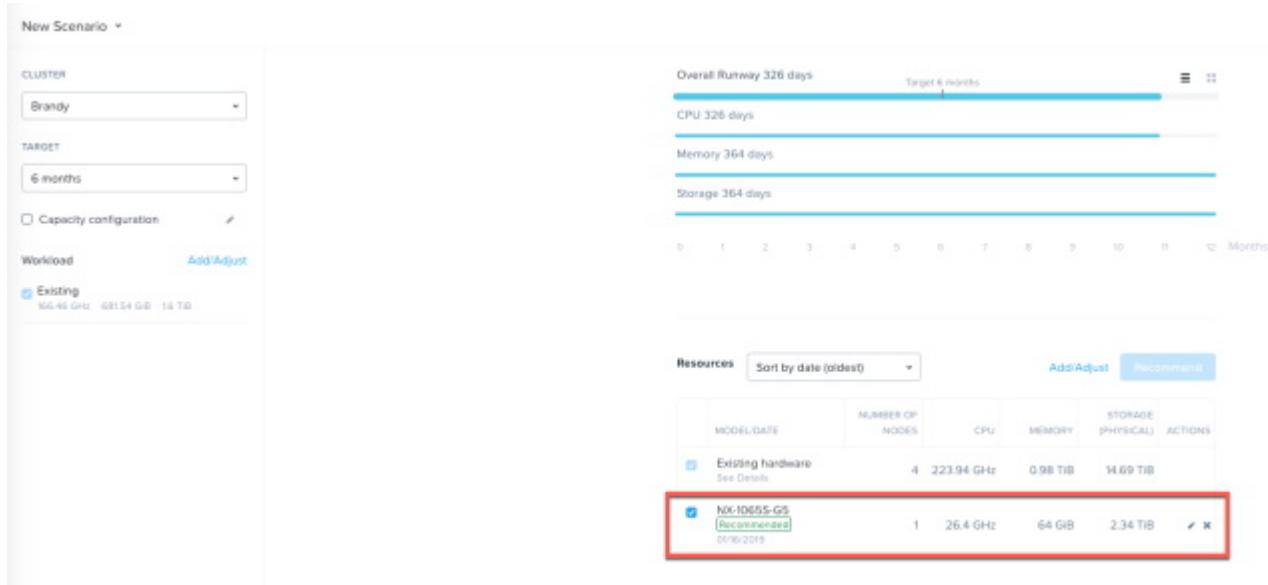


Figure 7: Cluster Expansion Recommendation

Environments with multiple clusters under NCM management can model a newly defined workload expansion against different clusters. Once you have created a scenario and defined at least one workload, you can switch between the different clusters to understand how adding this workload affects them. This capability also provides intelligent guidance for which cluster is the best location for the workload.

Resource Inefficiency Detection and Right-sizing

In a virtualized environment, resources can become constrained globally or on a per-VM basis. Administrators can address global capacity constraints by scaling out resources, either by adding capacity or by reclaiming existing resources. The VM efficiency features in NCM recommend VMs in the environment that are candidates for reclaiming unused resources that you can then return to the cluster.

NCM presents the VMs it has identified as candidates for VM efficiency in a widget, breaking the efficiency data into four different categories for easy identification: overprovisioned, inactive, constrained, and bully. The

overprovisioned and inactive categories provide a high-level summary of the amount of potential resources that could be reclaimed from each VM.

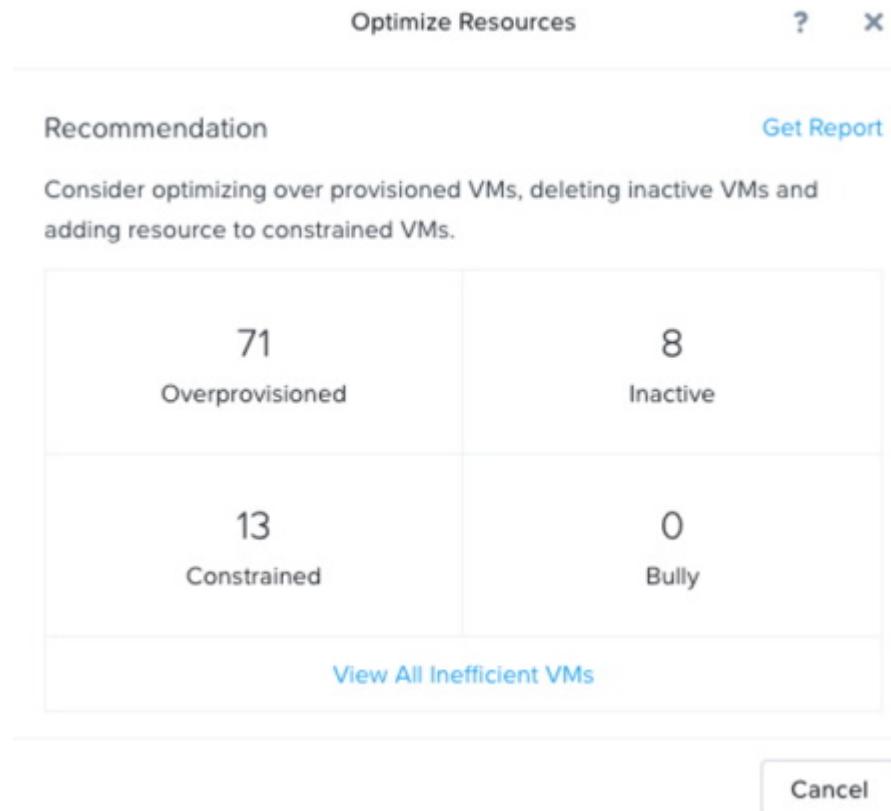


Figure 8: Recommendations for Reclaiming Resources

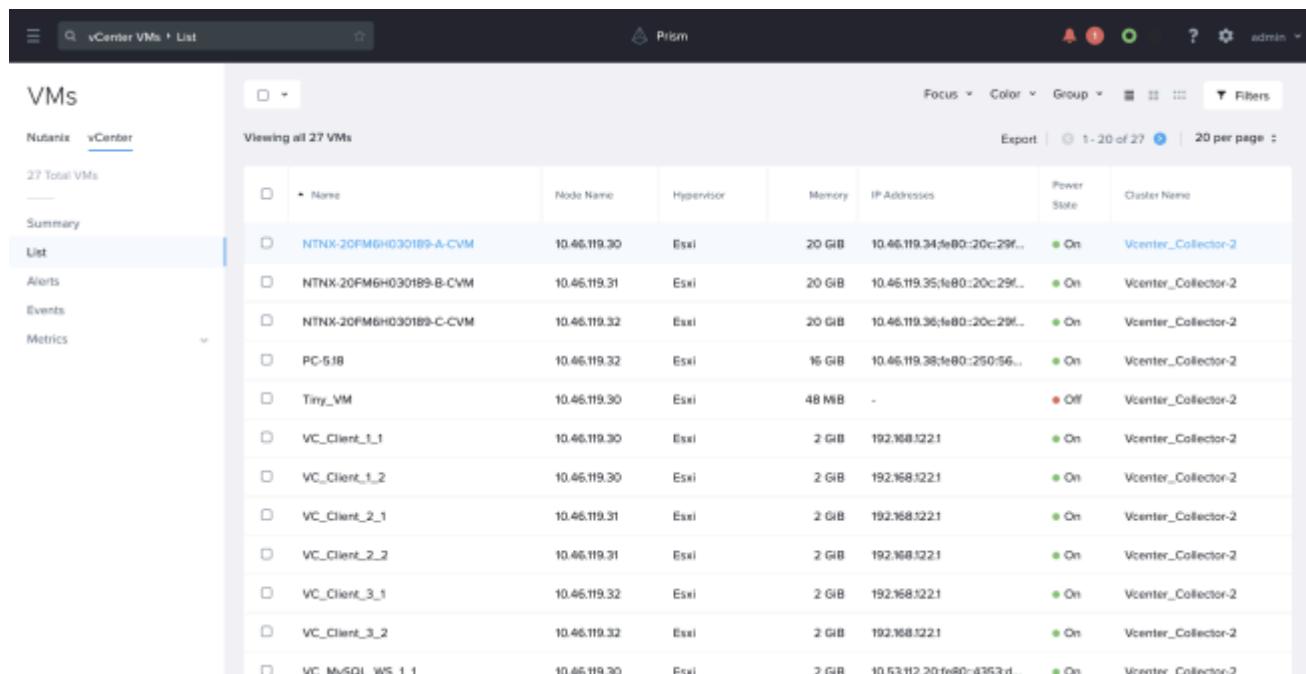
The list of candidates presents the total amount of CPU and memory configured versus the peak amounts of CPU and memory used for each VM.

- Overprovisioned: VMs identified as using minimal amounts of assigned resources.
- Inactive: VMs that have been powered off for a period of time or that are running VMs that do not consume any CPU, memory, or I/O resources.
- Constrained: VMs that could see improved performance with additional resources.

- Bully: VMs identified as using an abundance of resources and affecting other VMs.

Support for ESXi on Non-NCI Environments

NCM can monitor non-Nutanix virtual infrastructure by creating a connection to a VMware vCenter server, which allows NCM to collect data on the virtual infrastructure regardless of what infrastructure it's hosted on. Through these connections, you can extend all the NCM functionality including X-Play automation and advanced analytics, such as VM efficiency detection and capacity runway, to your VMware environments. All your virtual environments can benefit from a single operations workflow. You can also enable the NCM Pro features for application discovery, application monitoring, and X-Pilot for non-Nutanix environments.



The screenshot shows the Prism interface for monitoring vCenter VMs. The top navigation bar includes 'vCenter VMs > List', 'Prism', and user information. The left sidebar has tabs for 'Nutanix' and 'vCenter', with 'vCenter' selected. Under 'vCenter', there are sections for 'Summary', 'List', 'Alerts', 'Events', and 'Metrics'. The main content area displays a table titled 'Viewing all 27 VMs' with columns: Name, Node Name, Hypervisor, Memory, IP Addresses, Power State, and Cluster Name. The table lists 13 VM entries, each with a checkbox and a green 'On' status under 'Power State'. The 'Cluster Name' column for all listed VMs is 'Vcenter_Collector-2'.

	Name	Node Name	Hypervisor	Memory	IP Addresses	Power State	Cluster Name
<input type="checkbox"/>	NTNX-20FM6H0301B9-A-CVM	10.46.119.30	Esxi	20 GB	10.46.119.34;fe80::20c:29ff...	On	Vcenter_Collector-2
<input type="checkbox"/>	NTNX-20FM6H0301B9-B-CVM	10.46.119.31	Esxi	20 GB	10.46.119.35;fe80::20c:29ff...	On	Vcenter_Collector-2
<input type="checkbox"/>	NTNX-20FM6H0301B9-C-CVM	10.46.119.32	Esxi	20 GB	10.46.119.36;fe80::20c:29ff...	On	Vcenter_Collector-2
<input type="checkbox"/>	PC-51B	10.46.119.32	Esxi	16 GB	10.46.119.38;fe80::250:56ff...	On	Vcenter_Collector-2
<input type="checkbox"/>	Tiny_VM	10.46.119.30	Esxi	48 MB	-	Off	Vcenter_Collector-2
<input type="checkbox"/>	VC_Client_1_1	10.46.119.30	Esxi	2 GB	192.168.122.1	On	Vcenter_Collector-2
<input type="checkbox"/>	VC_Client_1_2	10.46.119.30	Esxi	2 GB	192.168.122.1	On	Vcenter_Collector-2
<input type="checkbox"/>	VC_Client_2_1	10.46.119.31	Esxi	2 GB	192.168.122.1	On	Vcenter_Collector-2
<input type="checkbox"/>	VC_Client_2_2	10.46.119.31	Esxi	2 GB	192.168.122.1	On	Vcenter_Collector-2
<input type="checkbox"/>	VC_Client_3_1	10.46.119.32	Esxi	2 GB	192.168.122.1	On	Vcenter_Collector-2
<input type="checkbox"/>	VC_Client_3_2	10.46.119.32	Esxi	2 GB	192.168.122.1	On	Vcenter_Collector-2
<input type="checkbox"/>	VC_MYSQL_WS_1_1	10.46.119.30	Esxi	2 GB	10.53.112.20;fe80::4352:1d...	On	Vcenter_Collector-2

Figure 9: vCenter Infrastructure Monitoring

Low-Code/No-Code Operations Automation (X-Play)

X-Play allows administrators to automate routine operational tasks, reducing the effort and time spent on tasks while increasing the quality of results. To provide this automation, X-Play lets you select actions and triggers from a provided catalog to construct a playbook.

A trigger is a condition that prompts the X-Play automated playbook to run defined actions. The most common type of trigger is alert-based, where a system- or user-defined alert causes an action to occur. An alert could be something as simple as crossing a certain CPU or memory limit. Other triggers can be manual, which means that the playbook doesn't take an action until an admin explicitly tells it to. With a manual trigger, the admin selects an entity such as a VM, then asks the specified playbook to run against it. Manual triggers allow the admin to control when and where the automation takes place.

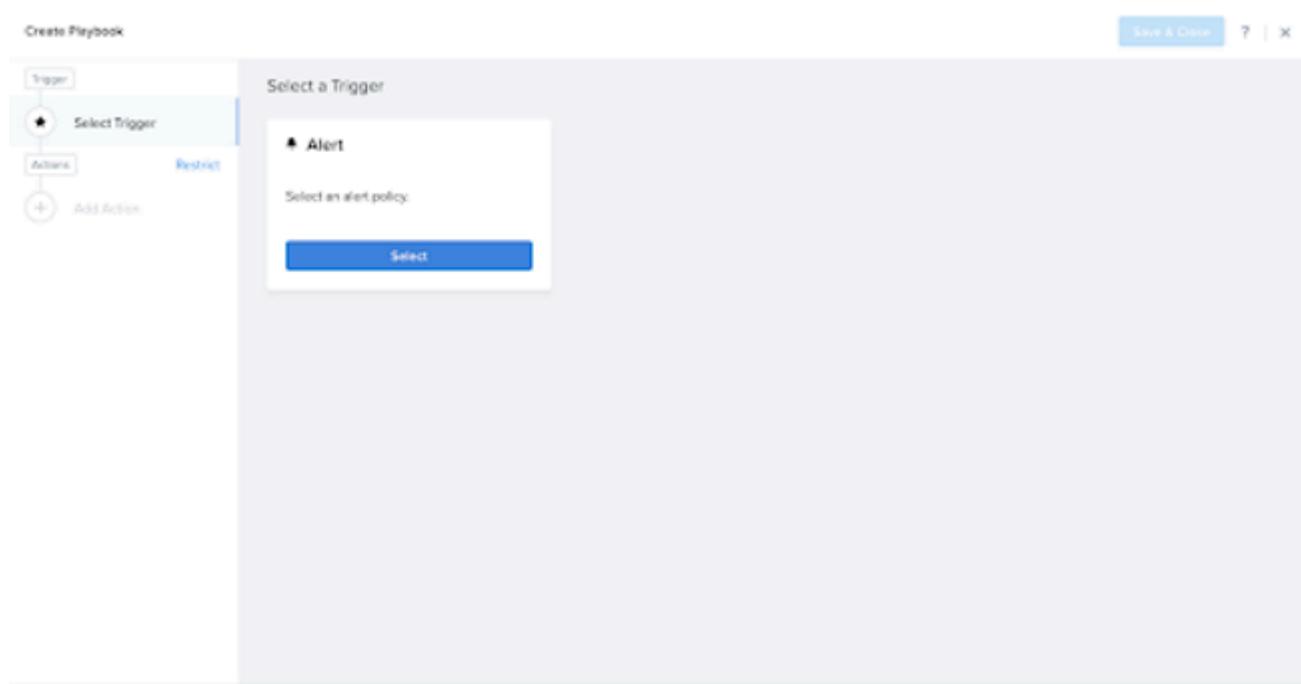


Figure 10: X-Play Playbook Triggers

An action is a step in your playbook automation. The action gallery presents several predefined actions and a few additional actions that you can customize

to perform more advanced procedures. The predefined actions provide a robust starting point that enables most admins to accomplish their automated action goals, while the more advanced actions allow for customization using different code methods to accomplish nearly anything. The following available actions are just a few samples from the full set:

- Power a VM on or off.
- Add or remove CPU or memory on a VM.
- Take a snapshot.
- Clear an alert.
- Send a notification.
- Run code (PowerShell, API, CLI).

The screenshot shows the 'Create Playbook' interface. On the left, there's a sidebar with 'Trigger' (Alert), 'Actions' (Restrict, New Action, Add Action), and a 'Save & Close' button at the top right. The main area displays a grid of actions categorized by type:

Action Type	Action Name	Description	Category Buttons	Select Button
Alert Action	Mark an Alert as Resolved	Make a call to a REST API endpoint.	Execution Action, System	Select
	VM Hot Add CPU	Hot add CPU for a VM.	VM Action, System	Select
Execution Action	VM Hot Add Memory	Hot add memory for a VM.	VM Action, System	Select
	VM Powershell	Remotely execute powershell script for a given VM.	Execution Action, System	Select
VM Action	VM Reduce CPU	Reduce CPU for a VM.	VM Action, System	Select
	VM Reduce Memory	Reduce memory for a VM.	VM Action, System	Select
System	VM Snapshot	Captures the state of a VM and saves it.	VM Action, System	Select

Figure 11: X-Play Playbook Actions

A playbook combines a trigger and at least one action; in practice, most playbooks contain several actions. The playbook organizes defined steps into

a fluid process that understands the specific subject VM. A common playbook might be configured with an alert trigger to act when a VM is above 90 percent CPU usage. Shortly after this CPU-based alert appears for the affected VM, the playbook reacts with the following actions. First, it snapshots the VM, then hot-adds a CPU to the VM (if the guest OS supports hot adding). After these steps are complete, the playbook sends the operations team a notice via email and finally acknowledges the CPU alert so that it's cleared. X-Play VM actions can act on Nutanix as well as non-Nutanix vCenter VMs.

6. NCM Pro

NCM Pro (formerly Prism Ultimate) provides advanced Intelligent Operations capabilities that build on all the features of NCM Starter. These features include SQL Server monitoring, application discovery, and self-tuning with machine learning.

SQL Server Monitoring for IT Ops

With NCM Pro, you can gather data from many sources, process it into a meaningful context, and gain insights to better understand your system with monitoring content packs. NCM Pro provides the ability to monitor your SQL databases using an agentless method that allows NCM to establish a connection to each SQL Server and collect data. The data provides insights into databases, queries, and metrics, which are fed into NCM's behavior learning and anomaly detection engine. You can create playbooks based on these signals for Microsoft SQL-specific automation workflows.

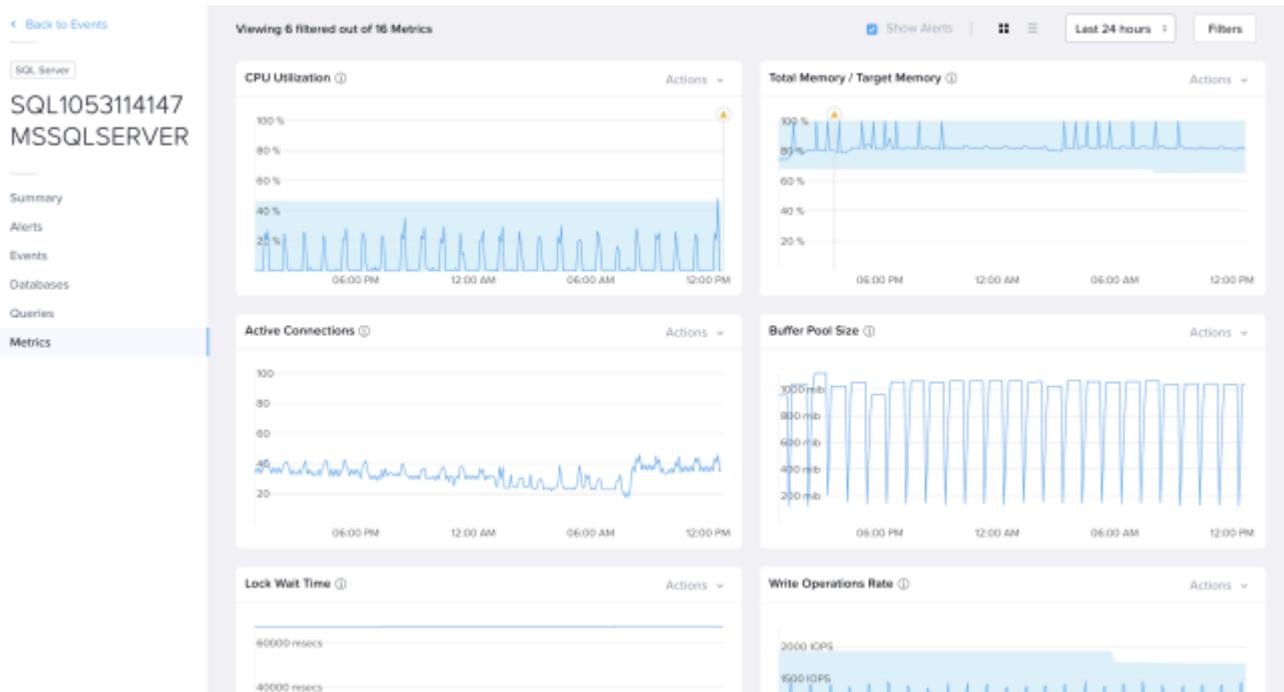


Figure 12: SQL Server Database

Application Discovery

Application Discovery uses an agentless approach to discover applications in a specified set of clusters. It uses IPFIX data to identify which VM each application runs in along with the port used for communication. The discovery service sends data about the VM network traffic stats to a software as a service (SaaS) like service in the cloud for analysis and publishes the results in Prism. In addition to the policies that come out of the box, you can configure custom discovery policies to identify apps by matching their TCP or UDP port signatures.

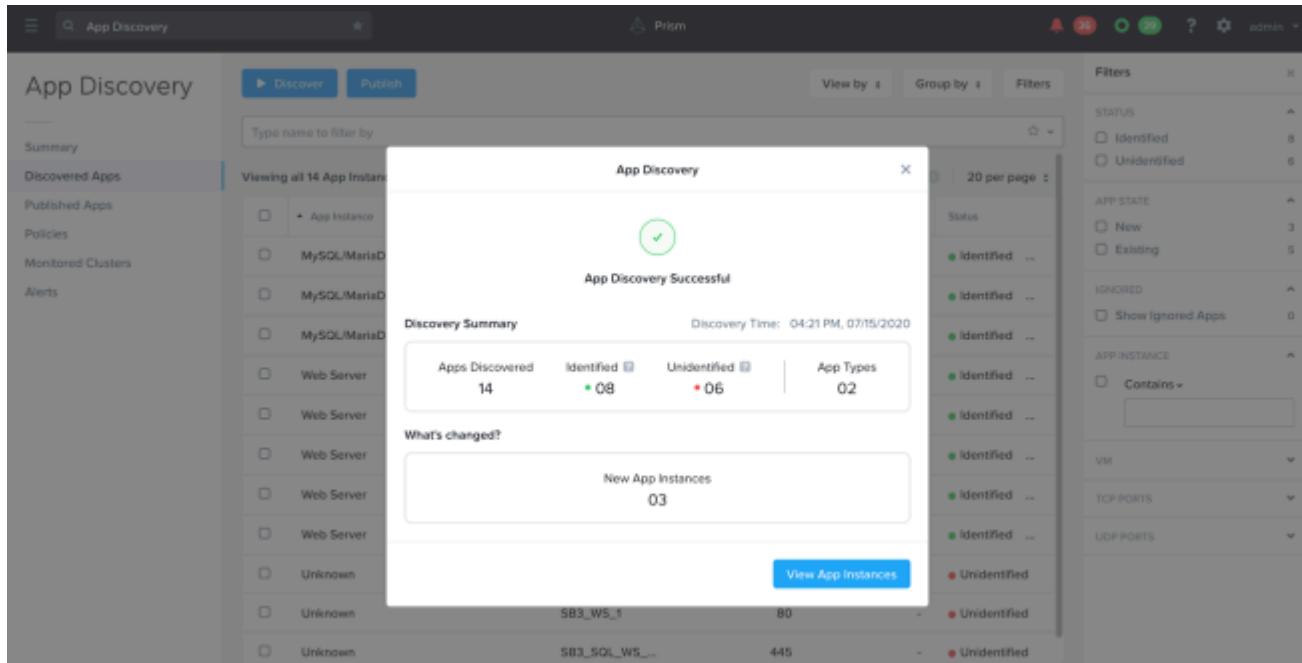


Figure 13: Application Discovery Summary

Self-Tuning with Machine Learning (X-Pilot)

You can now use X-Pilot to provide intelligent autonomy to playbooks and lower your team's overhead. Admins can choose an infrastructure metric and a range of optimal boundaries for that metric and define a period of time for the KPI to be monitored. The admin then defines a set of actions the system can take, ensuring that the system always behaves in a predictable manner, and the maximum number of allowed autonomous corrections before manual intervention is needed. Once these autopilot inputs are defined and enabled, X-Pilot intelligently tunes infrastructure parameters and takes action to ensure that the defined metrics stay within the predetermined boundaries.



Figure 14: Autopilot Enabled Playbook Results

7. Additional Included Features

The following features are available in every version of NCM.

Customizable Operations Dashboards

The custom dashboard feature allows you to build a dashboard based on a collection of widgets. You can arrange the widgets on the screen to create a view of the environment that works best for you. A dashboard's contents can range from a single widget to a screen full of widgets. Prism Central comes with a default dashboard that shows capacity, health, performance, and alerts that is ideal for most users and a good starting point for others.

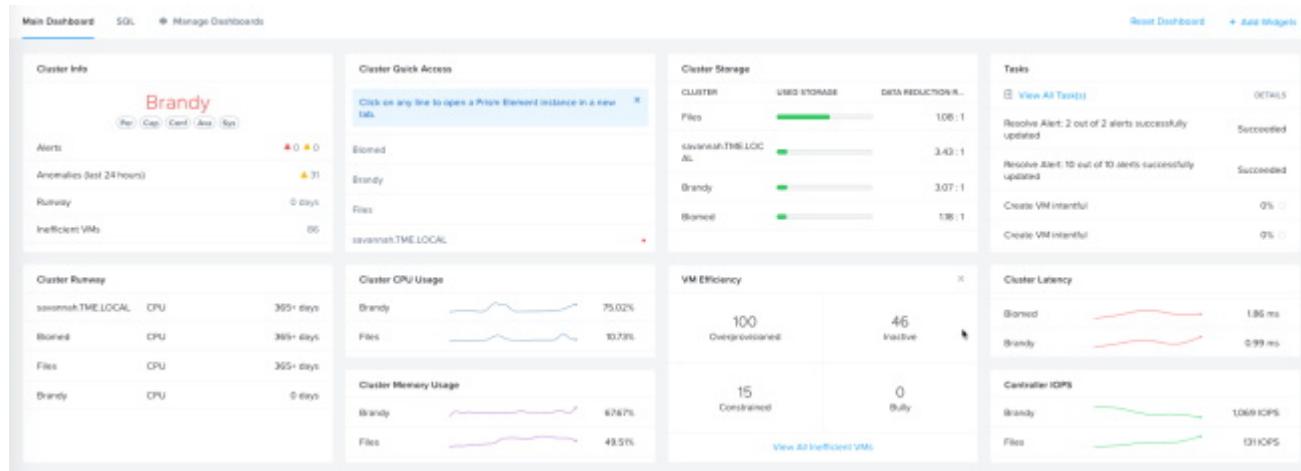


Figure 15: Customizable Operations Dashboards

With the custom dashboard feature, you can create multiple dashboards, including dashboards that focus on data. Organizations can create separate dashboards for different physical sites, business units, administrators, or any number of other functions.

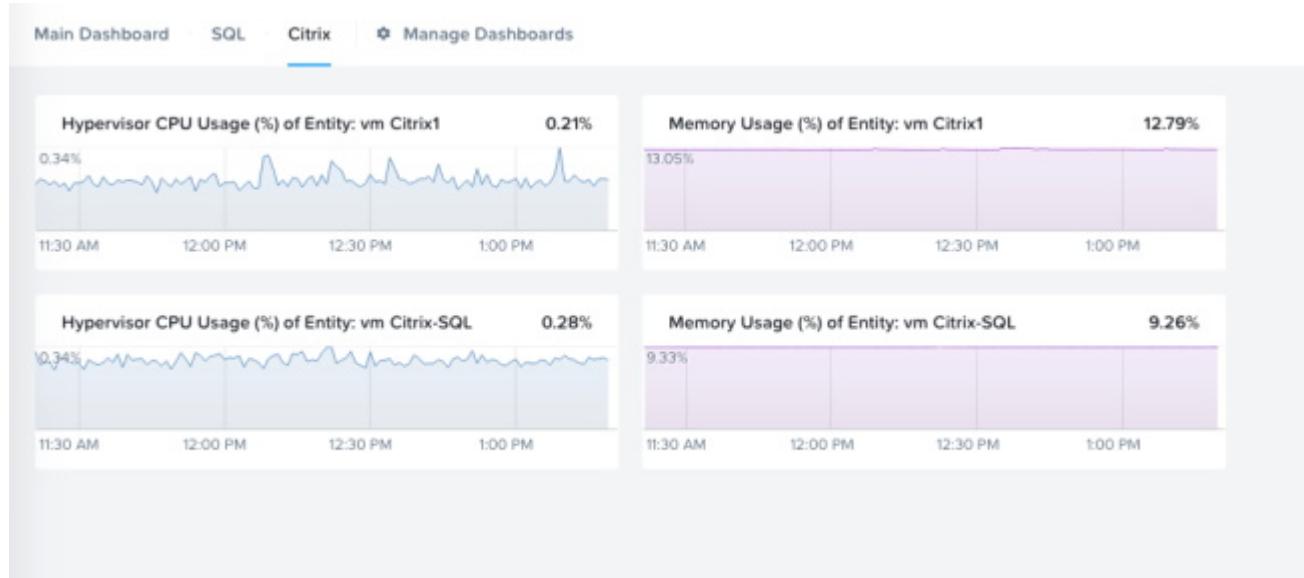


Figure 16: Multiple Dashboard Feature

Dynamic Monitoring

Dynamic monitoring uses VM behavioral learning powered by X-FIT technology to build on VM-level resource monitoring. The system learns the behavior of each VM and establishes a dynamic threshold as a performance baseline for each resource assigned to that VM. Each of the resource charts represents the baseline as a blue shaded range. If a given data point for a VM strays outside the baseline range (higher or lower), the system detects an anomaly and generates an alert. The anomaly is noted on the performance charts for easy reference and follow-up.

If the data point's anomalous results persist over time, the system learns the VM's new behavior and adjusts the baseline for that resource. With behavioral learning, performance reporting delivered through NCM helps organizations better understand their workloads and have early knowledge of issues that traditional static threshold monitoring doesn't discover.



Figure 17: Resource Chart Sample Baseline

Dynamic monitoring is available for both VMs and physical hosts and encompasses multiple data points in CPU, memory, storage, and networking.

8. 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 NCI and NCM, 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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