

Dell CloudIQ: A Detailed Review

A Proactive Monitoring and Analytics Application for the Dell Environment

Abstract

This white paper details CloudIQ, the cloud-based AIOps proactive monitoring and predictive analytics application for Dell systems. It describes how it uses machine learning and other algorithms, notifications, and recommendations to help you optimize compute, storage, data protection and network health, performance, and capacity. CloudIQ supports a broad range of Dell Technologies products, including servers (PowerEdge), storage (PowerStore, PowerMax, PowerScale, PowerVault, Unity, Unity XT, XtremIO, and SC Series), data protection (PowerProtect DD and PowerProtect Data Manager), converged and hyperconverged infrastructure (VxBlock, VxRail, and PowerFlex), and networking (PowerSwitch and Connectrix) - plus Dell Technologies APEX Data Storage Services.

January 2022

Revisions

Date	Description
December 2016	Initial release
August 2017	Updated with additional functionality
June 2019	Updated with support for PowerMax/VMAX, SC Series, XtremIO, Connectrix, and VMware
June 2020	Updated with support for PowerStore, PowerScale, Isilon, PowerVault, and Converged Systems
November 2020	Updated to reference support.dell.com and cloudiq.dell.com Updated with details on enabling Dell Trusted Advisors and Partners Updated with Lifecycle Management for Converged Systems
May 2021	Updated with support for PowerProtect DD and PowerProtect Data Manager Updated with support for VxRail Updated with support for custom labels and custom reports
July 2021	Updated with support for APEX Offerings Updated with Cybersecurity
January 2022	Updated with support for PowerFlex, PowerEdge, and PowerSwitch Updated with support for Webhooks

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Executive Summary

With our busy daily lives, it is important to find easier and faster ways to manage IT infrastructure. With CloudIQ, Dell Technologies seeks to simplify the user experience when it comes to proactively monitoring the Dell environment. With support for PowerEdge, PowerStore, PowerMax (including VMAX), PowerScale (including Isilon), PowerVault, Dell EMC Unity (including Dell EMC Unity XT), XtremIO, SC Series, PowerProtect DD, PowerProtect Data Manager, VxBlock, VxRail, PowerFlex, PowerSwitch, Connectrix, and APEX Data Storage Services, Dell is providing a single interface to simplify the user experience in every possible way.

CloudIQ is designed to deliver faster time to insights¹ for customers, such as:

- Up to 10x faster to predict capacity approaching or almost full¹
- Up to 16x faster to identify HA problems¹
- Up to 50% fewer steps to identify anomalies in system performance¹
- Up to 1.4x faster to identify a “noisy neighbor” LUN¹
- Up to 42x faster to find reclaimable storage¹

This white paper describes the CloudIQ features that are available in a consolidated user interface through any HTML5 browser. Users can also access CloudIQ on their iOS or Android mobile device.

As a Software-as-a-Service solution, CloudIQ delivers frequent, dynamic, nondisruptive content updates for the user. CloudIQ is built in a secure multitenant platform to ensure that each customer tenant is properly isolated and secure from other customers.

¹ *Based on an April 2020 Principled Technologies Report commissioned by Dell EMC, "Dell EMC CloudIQ streamlined the user experience in five cloud-based storage preventive management tasks", compared to HPE InfoSight with an HPE Primera array vs. CloudIQ with a Dell EMC Unity array. Actual results may vary. Full report: <http://facts.pt/m8a5u3v>

Audience

This white paper is intended for Dell customers, partners, and employees who are interested in understanding CloudIQ features and how to monitor the following Dell systems: PowerEdge, PowerStore, PowerMax (including VMAX), PowerScale (including Isilon), PowerVault, Dell EMC Unity (including Unity XT), XtremIO, SC Series, PowerProtect DD, PowerProtect Data Manager, VxBlock, VxRail, PowerFlex, PowerSwitch, Connectrix, and APEX Data Storage Services.

Terminology

CloudIQ Collector – A small virtual machine distributed as a vApp that enables collection of VMware and Connectrix data. The Collector retrieves information from the target objects (vCenter or switches) and sends the collected data back to CloudIQ using Secure Remote Services Gateway. For VMware, the Collector communicates to vCenter using the VMware API and requires a user with read-only privileges. For Connectrix, the Collector communicates to the individual switches using REST API and uses a nonprivileged user. A single collector can be used for both VMware and Connectrix.

Secure Remote Services – Provides the remote connectivity that enables Dell storage platforms, Dell Converged and Hyperconverged systems, and the CloudIQ Collector to connect to CloudIQ. Secure Remote Services allows Dell to securely transfer files, such as logs and dumps, from the systems. There are two types of Secure Remote Services: **Integrated** and **Centralized**.

Integrated Secure Remote Services – Embedded in Unisphere for Dell EMC Unity arrays. It is recommended for Unity customers who do not want to use a centralized gateway server. Secure Remote Services communication uses ports 443 and 8443 (HTTPS) and needs unrestricted access to the Global Access Servers (GAS).

Centralized Secure Remote Services – connects the system to a Secure Remote Services gateway server installed on a customer site. It allows for HA capabilities when multiple Secure Remote Services VE servers are installed. Secure Remote Services Centralized communication uses ports 443 and 9443 (HTTPS) and needs unrestricted access to the Global Access Servers (GAS).

SupportAssist – Provides the remote connectivity that enables SC Series, PowerStore, PowerVault, and PowerSwitch systems to connect to CloudIQ and send associated data packets for performance, capacity, and health monitoring. SupportAssist allows Dell to securely transfer files, such as alerts, performance stats, capacity, and configuration information from the systems.

Unisphere – The graphical management interface that is built into Dell storage systems for configuring, provisioning, and managing the systems' features. For Dell EMC Unity, and PowerMax/VMAX, systems, Unisphere connects to CloudIQ using Secure Remote Services; for SC Series, it connects using SupportAssist.

PowerVault Manager – The graphical management interface for PowerVault storage systems. Connectivity to CloudIQ is established in the Settings section of PowerVault Manager using SupportAssist.

PowerStore Manager – The graphical management interface for PowerStore storage systems. Connectivity to CloudIQ is established in the Settings section of PowerStore Manager using SupportAssist.

Web UI – The graphical management interface for XtremIO storage arrays. Web UI is part of XMS – XtremIO Management Server, which connects to CloudIQ using Secure Remote Services.

DD System Manager – The graphical management interface for PowerProtect DD systems. Connectivity to CloudIQ is established in the Maintenance section of DD System Manager using Secure Remote Services.

VxRail Manager – A plug-in for VMware vCenter that provides a software stack for software-defined data center building blocks including compute, network, storage, and management. Connectivity to Secure Remote Services and CloudIQ is established under the Support tab in VxRail Manager.

1 CloudIQ Overview

CloudIQ is a cloud-based application that provides for simple and proactive monitoring and troubleshooting of your Dell IT infrastructure including integration with VMware. It leverages machine learning to proactively monitor and measure the overall health of servers, storage, and switches through intelligent, comprehensive, and predictive analytics. CloudIQ is available at no additional charge for products with a valid ProSupport (or higher) contract. CloudIQ is hosted on Dell Technologies Private Cloud which is highly available, fault-tolerant, and guarantees a 4-hour Disaster Recovery SLA.

CloudIQ provides each customer an independent, secure portal and ensures that customers will only be able to see their own environment. Each user can only see those systems in CloudIQ which are part of that user's site access as defined in Dell Service Center. Customers register their systems with their Site ID. For SC Series and PowerVault systems, a new site ID is created, named after the system ID, for each system selected to be viewed in CloudIQ.

The discussion below elaborates on the various features and functionality in CloudIQ. Some details will vary by product type. For specific details per product type, consult **Online Help**, which is updated with each new feature added into CloudIQ.

1.1 Key Values of CloudIQ

Reduce Risk – CloudIQ makes daily IT administration tasks easier by helping you identify potential vulnerabilities before they impact your environment. Leveraging a suite of advanced analytics CloudIQ helps answer key questions IT Administrators deal with regularly, using features such as: Proactive Health Scores, Performance Impact Analysis and Anomaly Detection, and Workload Contention Identification. It also identifies security risks by comparing system configurations to a configurable test evaluation plan.

Plan Ahead – CloudIQ helps you stay ahead of business needs with short-term Capacity Full Prediction, Capacity Anomaly Detection, and longer-term Capacity Forecasting. It allows users to leverage subject-matter expertise to identify potential risks before they impact the environment and machine learning to pinpoint deviations for faster resolution.

Improve Productivity – CloudIQ helps users improve productivity of your IT resources, staffing, and equipment by:

- Providing a Single Pane-of-glass view of your environment that extends view into virtual infrastructure with our VMware integration
- Enabling Trusted Advisor access for added oversight
- Delivering immediate time-to-value with easy access

1.2 CloudIQ Requirements

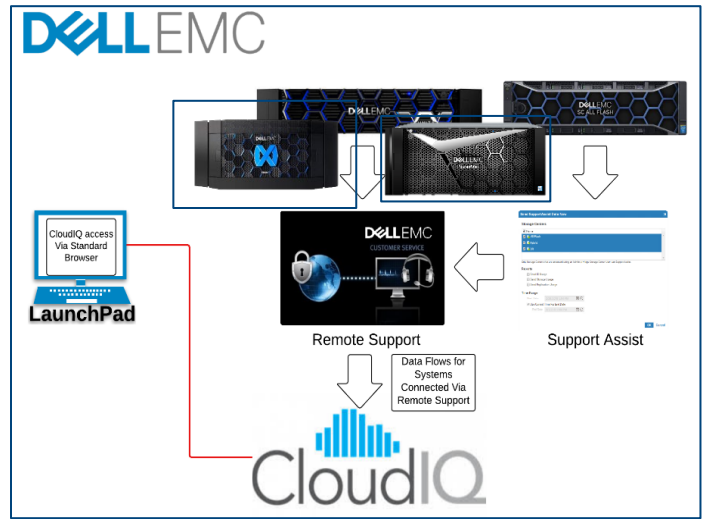
CloudIQ is available to all customers with the following Dell Technologies systems:

Type of Data	Product Models	Minimum Code Version
Connectrix B-Series	Connectrix Brocade	FOS 8.2.1a and later
Connectrix MDS Series	Connectrix Cisco	NX-OS 8.2(2) and later, except for NX-OS v8.3(1)
Converged Infrastructure	Vblock 340, 350, 540, 740 VxBlock 340, 350, 540, 740, 1000	VxBlock Central 2.5 and later VMware 6.5 and later
Dell EMC Unity	XT, All Flash, Hybrid, and UnityVSA – Professional Edition	Unity OE 4.1 and later
PowerEdge	C Series, FC Series, M, and MX Module SLEDs (chassis and network monitoring not supported), R series, T Series, XE Series, XR, and XR2 Series	OpenManage Enterprise 3.7 and later
PowerFlex	PowerFlex software and Ready-Nodes PowerFlex Rack and PowerFlex Appliance	V 3.6.x and later PowerFlex Manager 3.7 and later
PowerMax/VMAX	VMAX 10K, 20K, 40K, 100K, 200K, 400K, 250F, 450F, 850F, 950F PowerMax 2000, 8000	Unisphere 9.0.2.10 and later ²
PowerProtect Data Manager	-	PowerProtect Data Manager 19.0 and later
PowerProtect DD	DD9900, DD9400, DD6900, DD3300, DD9800, DD9500, DD9300, DD6800, DD6300, DD7200, DD4500, DD4200, Data Domain Virtual Edition (DDVE)	DDOS 7.4.0.5 and later
PowerScale/Isilon	Gen 5 and Gen 6	OneFS 8.2 and later
PowerStore	PowerStore X and PowerStore T	PowerStoreOS 1.0 and later ¹
PowerSwitch	S3048-ON, S4112F-ON, S4112T-ON, S4128F-ON, S4128T-ON, S4148F-ON, S4148T-ON, S5148F-ON, S5296F-ON, S5248F-ON, S5232F-ON, S5224F-ON, S5212F-ON, Z9264F-ON, Z9332F-ON, Z9432F-ON	OS10 v10.5.3 and later
PowerVault	PowerVault ME4	Firmware GT280R004 and later
SC Series	SC All Flash and SC Hybrid	7.3.1 and later
VMware	-	ESXi 5.5 and higher (some metrics available at 6.0+)
VxRail	-	4.5.215 and later 4.7.100 and later 7.0 and later
XtremIO	X1 and X2	XMS 6.2.0 and later

1. Cybersecurity Requirements: PowerStoreOS 2.0 or higher.
2. Cybersecurity Requirements: For host-based Unisphere, v9.2.1 or higher is required. For embedded Unisphere, v9.2.1 or higher and Operating System 5978.711.711 are required.

1.3 CloudIQ Data Collection

Details on configuring Dell infrastructure, Connectrix, and VMware for CloudIQ can be found in Appendix A of this document. After the Dell systems or Connectrix switches have established connection to CloudIQ, data will be collected and available to the user in the CloudIQ user interface. Dell systems are connected through Secure Remote Services or SupportAssist. CloudIQ receives Connectrix and VMware data by way of a local collector that sends the data through Secure Remote Services to CloudIQ.



The frequency with which data is updated in CloudIQ varies based on the type of information and the type of system. The following table shows the types of data and the frequency with which CloudIQ updates this information for Dell EMC Unity systems; collection for other systems is comparable:

Type of Data	Sample Update Frequency
Alerts	5 minutes
Performance	5 minutes
Capacity ¹	1 hour
Configuration ¹	1 hour
Data Collection ²	Daily

1. Connectrix and VMware collect at 5-minute intervals
2. Daily “all-in” collection

CloudIQ maintains up to 2 years of historical data for systems that are being monitored. The details of the data retention are as follows:

Alerts: 2 years

Configuration: 2 years at hourly intervals

Performance Data:

	5 Min Interval	Hourly Interval	Daily Interval
System level	100 days	2 years	2 years
Object level	22 days	90 days	2 years

1.4 CloudIQ Features

CloudIQ makes it faster and easier to analyze and identify issues accurately and intelligently, by delivering:

- Centralized monitoring of performance, capacity, system components, configuration, and data protection. CloudIQ also provides details about Storage Systems, Storage Pools, Block and File Storage Objects, Connectrix, PowerSwitch, Converged, Hyperconverged, PowerEdge, Data Protection, and VMware environments.
- Predictive Analytics that enable intelligent planning and optimization of capacity and performance utilization.
- Proactive Health Scores for monitored storage systems, servers, and switches. CloudIQ identifies potential issues in the infrastructure and offers practical recommendations based on best practices and risk management.
- Cybersecurity feature that monitors and implements security assessments for Dell systems by comparing configurations to a set of security-related evaluation criteria, notifying users when there are deviations from the configured plan.

1.4.1 Centralized Monitoring

CloudIQ allows you to improve your system health by providing instant insight into your Dell IT environment without the maintenance of installed software. The Overview Page summarizes key aspects of the environment so that users can quickly see what needs to be addressed and provides hyperlinks to easily open more detailed views. Some examples of these summaries include Proactive Health Scores, Capacity Predictions, Performance Anomaly and Impact Detection, and Reclaimable Storage. These features and others are discussed in detail below.

1.4.2 Predictive Analytics

CloudIQ's advanced predictive analytics differentiate it from other monitoring and reporting tools.

1.4.2.1 Performance Anomaly and Impact Detection

Using machine learning and analytics, CloudIQ identifies performance anomalies (supported across all storage platforms and Connectrix switches). It compares current performance metrics with historical values to determine when the current values deviate outside of normal ranges. This feature provides timely information about the risk level of the storage systems with insights into conditions and anomalies affecting performance.

In addition to performance anomalies, CloudIQ goes one step further and identifies performance impacts (supported for PowerMax, PowerStore, and Unity systems). CloudIQ analyzes increases in latency against other metrics such as IOPS and bandwidth to determine if an increase in latency is caused by a change in workload characteristics or competing resources. In the case where an impact is identified, CloudIQ also identifies the most likely storage objects causing the resource contention. By differentiating between changes in workloads characteristics and workload contention, CloudIQ enables users to narrow the focus of troubleshooting on when actual impacts to performance may have occurred.

1.4.2.2 Capacity Trending and Predictions

CloudIQ provides historical trending and both short- and longer-term future predictions to provide intelligent insight on how capacity is being used, and what future needs may arise.






- Short-term Capacity Full Prediction: CloudIQ uses a daily analysis of capacity usage to help users avoid short-term data unavailability events by starting to predict, within a quarter, when capacity is expected to reach full.

- **Capacity Anomaly Detection:** CloudIQ uses an hourly analysis of capacity usage to identify a sudden surge of capacity utilization that could result in data unavailability. This anomaly detection helps to avoid the 2:00am phone call resulting from a sudden capacity utilization spike due to a potentially runaway query or rogue actor in the environment.
- **Longer-term Capacity Forecasting:** CloudIQ helps users more intelligently project capacity utilization so that they can plan future capacity requirements and budget accordingly.

1.4.3 Proactive Health Score

The Proactive Health Score is another key differentiator for CloudIQ, relative to other monitoring and reporting tools. CloudIQ proactively monitors the critical areas of each system to quickly identify potential issues and provide recommended remediation solutions. The Health Score is a number ranging from 100 to 0, with 100 being a perfect Health Score.

The Health Score is based on the five categories shown in the table to the left. Some examples of how Proactive Health mitigates risk are:

Category		Sample Health Issues
	Components	Physical components with issues: for example, faulty cables and fans
	Configuration	Non-HA Hosts connections
	Capacity	Pools or Clusters that are oversubscribed and reaching full capacity
	Performance	Storage Groups not meeting their SLO
	Data Protection	Recovery Point Objectives not meeting native replication and snapshot policy

Note:

The Components and Data Protection categories do not apply for PowerMax/VMAX systems.

The Performance and Data Protection categories do not apply for PowerVault ME4 Series systems.

The Data Protection category does not apply to VxRail systems.

Only the Components category is currently used for Connectrix and PowerSwitch.

1.4.4 Cybersecurity

Cybersecurity is a new feature in CloudIQ that identifies potential security violations. System configurations are continuously monitored and compared to a user configurable evaluation plan at which point a risk level is assigned to each system. Users can quickly get a visual representation of system security risk by seeing the identified issues and can remediate security violations using the provided recommended remediations.

1.5 CloudIQ UI Layout

This section discusses the layout of the user interface.

1.5.1 Navigation Pane

The left navigation bar is designed to provide clear visibility into CloudIQ functionality to streamline access to information. The top-level menu selections are task-oriented, directing the user to the appropriate section of the user interface to access the necessary information. The navigation bar consists of the following selections:

Overview – Access the overview page that provides high-level summary information and some detailed information about the health of the environment, allowing users to quickly identify potential risks. This information includes the Proactive Health Score, predictions on when pools and clusters will reach full capacity and system performance impacts.

Health – View the multisystem System Health page for Storage, Networking, Hyperconverged, Server, and Data Protection showing the proactive health scores across the environment. View an aggregated list of all health issues, alerts, and available system updates.

Inventory – View the multisystem Inventory page for Storage, Networking, Converged, Hyperconverged, Server, and Data Protection showing the system code versions, location, site, and contract status for systems in CloudIQ. This menu also includes a link to the aggregated listing and detailed views for Hosts.

Capacity – View the multisystem Capacity page for Storage, Networking, Hyperconverged, and Data Protection showing system level capacity information. This view includes the overall efficiencies to support the Dell all flash guarantee. For SAN switches, capacity is displayed in terms of ports. Also access the aggregate and detailed Pools listing as well as the Reclaimable Storage listing.

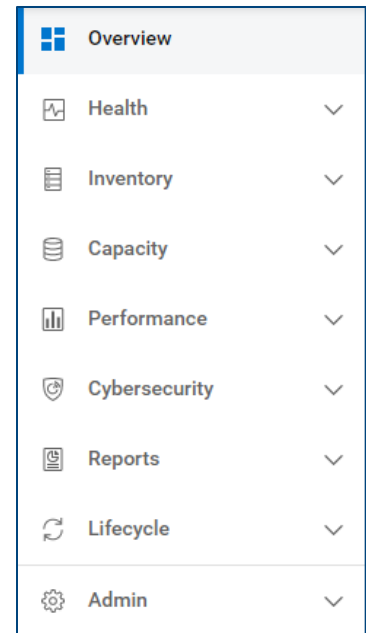
Performance – View the multisystem Performance page for Storage, Networking, Hyperconverged, and Server showing system level performance KPIs for all systems and switches. Also access the Metrics Browser for more detailed performance analysis.

Cybersecurity – View security risk levels, active and resolved security issues, and configure security evaluation policies for cybersecurity enabled systems. Currently supported for PowerMax and PowerStore.

Reports – Create and view custom reports. Reports can consist of both tables and line charts. They can be exported on demand or scheduled to be emailed to a specified list of recipients.

Lifecycle – View life-cycle milestones for the components in VxBlock Converged Systems. This view includes timelines that display the following milestone dates: General Availability, End of Life, End of Support, End of Renewal, End of Service Life.

Admin – Includes links to various administrative tasks. The Customization section allows users to temporarily pause connectivity health checks for hosts connected to Unity and SC Series systems and capacity health checks for Unity file systems. The Connectivity page shows the connectivity status of all CloudIQ capable systems and allows users to onboard SC Series, PowerVault, PowerSwitch, and VxBlock Converged systems. The Collectors section is where users can download the CloudIQ Collector for VMware and Connectrix and see the status of all installed Collectors. The Settings menu is used to configure access for



User Community and Customer Support and email notification settings. The Settings section also allows users to set filters on which systems they want to see in both the CloudIQ user interface and the mobile app. The Integrations section provides access to Webhooks and REST API settings. The User Access section allows CloudIQ administrators to set access controls for standard CloudIQ users.

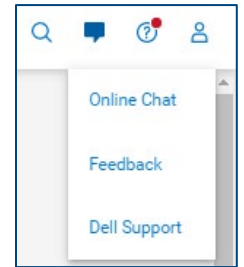
1.5.2 Global Search

The Global Search feature helps users quickly find Systems, Hosts, Pools, Storage Resource Pools, Storage Groups, LUNs/Volumes, File Systems, Virtual Machines, and MTrees/Storage Units. Users can specify a few keywords and get a summarized list of top matches. From there, users can click an item to access its details or go to an expanded view with all matches.



1.5.3 Online Chat, Feedback, and Dell Support

Selecting the comment icon allows the user to open a chat session with Dell Customer Support, submit feedback to the CloudIQ product team, or open the Dell Support website. When opening a live chat session, the user will need to provide the serial number of the system in question.

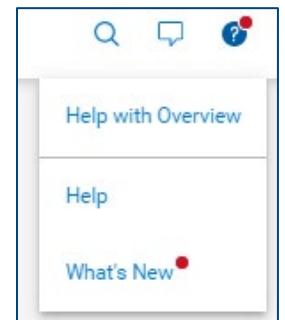


1.5.4 Help and What's New in CloudIQ

CloudIQ is updated frequently to deliver helpful new content to users. As such, please use the CloudIQ Simulator (<https://cloudiq.dell.com/simulator>) to view the latest features which may not be documented in this paper.

New features can be seen by clicking the icon on the top menu bar.

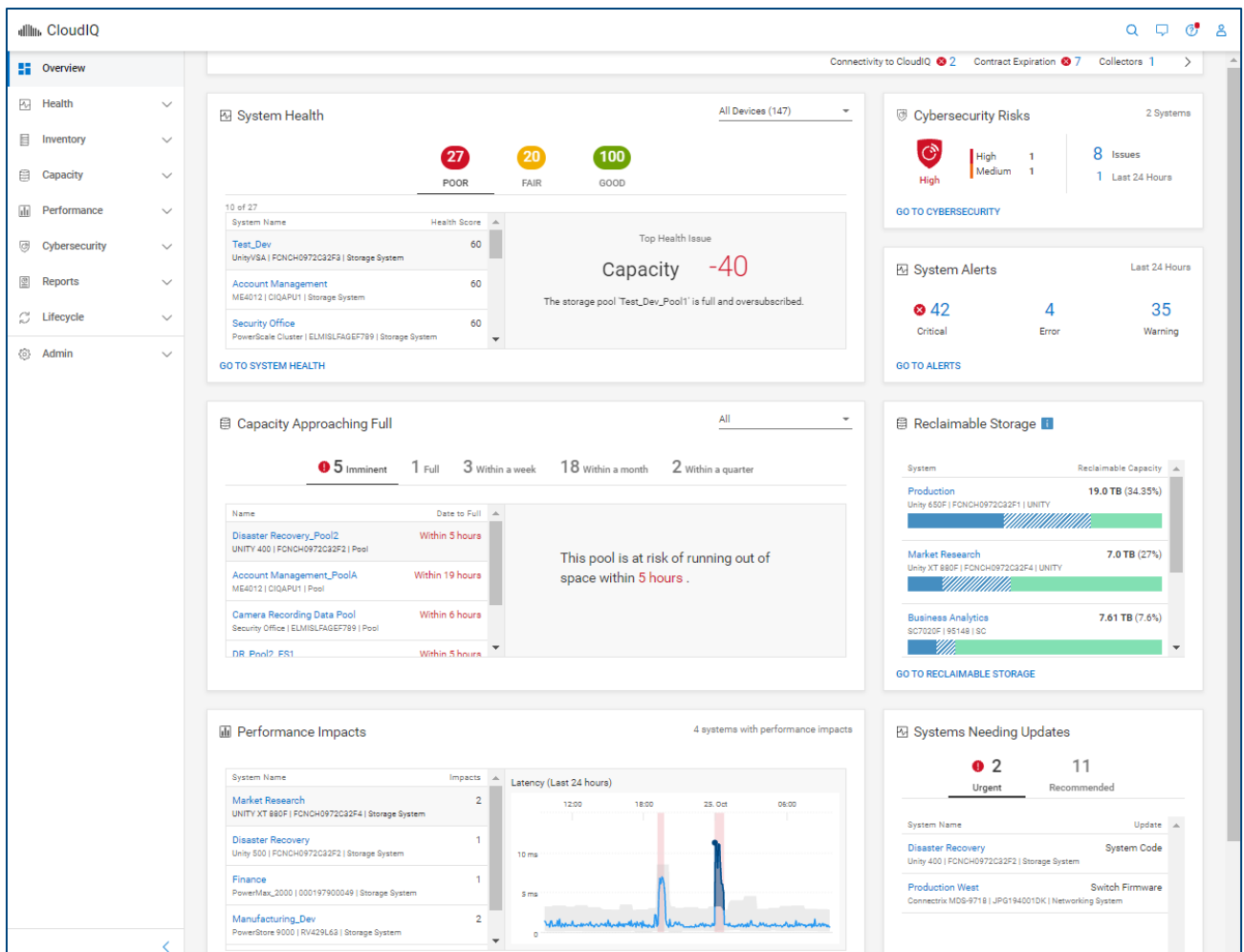
The “What’s New in CloudIQ” window will appear showing recent changes and enhancements. Clicking “**View All Enhancements**” displays a historical list of all the updates. The most recent information is presented first, and users can scroll down the list to see the monthly evolution of CloudIQ since its introduction. This display can be turned off by sliding the “**Don’t show again until the next update**” button.



Selecting the user icon allows the user to switch companies if they have access to multiple sites and sign out of the UI.

2 Overview Page

The **Overview** Page provides a consolidated view of the Dell environment. This page is the highest-level summary of the environment providing users with a roll-up of the key factors to understand the overall health and operation of the IT infrastructure.



There are three tiles along the top of the Overview page (minimized in the above image, but shown below).

Connectivity to CloudIQ – Shows the connectivity status for all systems registered in CloudIQ and the CloudIQ Collector. Systems are displayed in the following four categories:

- **Install Base Issues:** CloudIQ cannot display due to Install Base configuration issues.
- **Lost Connection:** Systems that have lost connection and are no longer sending data to CloudIQ.
- **Not Set Up:** Systems that are not set up to send data through Secure Remote Services to CloudIQ.
- **Connected:** Systems that are successfully sending data to CloudIQ.

Selecting each category redirects the user to the Connectivity Page and displays a filtered list of systems and collectors corresponding to that connectivity status.

Contract Expiration – Shows the number of systems with contracts that are:

- Expired

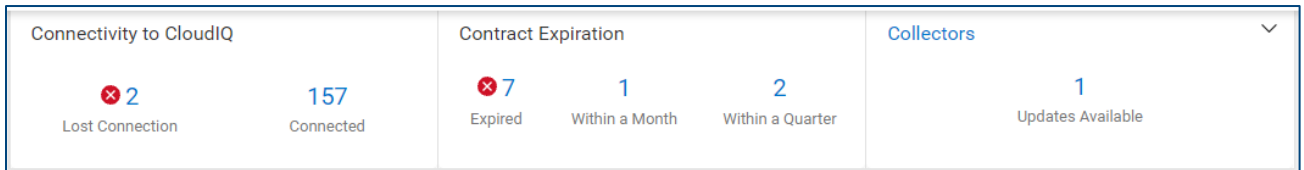
- Expire within a month
- Expire within a quarter

The user can select the number to open a window with the list of systems that meets the expiration criteria. Systems whose contracts have expired will be removed from other standard CloudIQ views.

Collectors – Displays number of CloudIQ Collectors that have

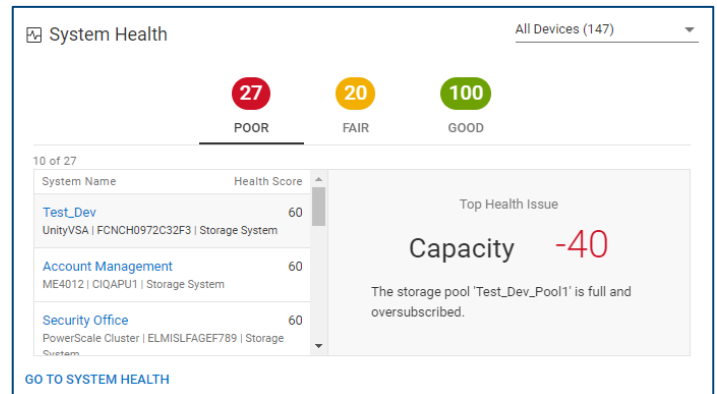
- Issues that need to be resolved
- Available Updates

The user can select the number in each category to view a filtered list of collectors from the Collectors view.



System Health – Categorizes all monitored products into three ranges of health scores:

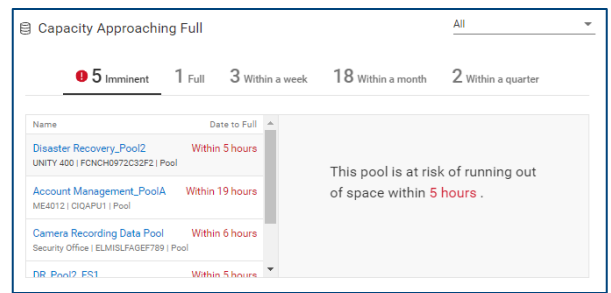
- **Poor:** 0-70
- **Fair:** 71-94
- **Good:** 95-100
- **Unknown:** List of systems whose health score cannot be calculated. This situation could indicate a connection issue.



Selecting a range's number along the top of the tile displays the system names and health scores for that range, sorted from low to high. The chart is interactive allowing the user to select a system in the list to display its Top Health Issue in the right pane. This window displays the most impactful issue affecting the health score. Selecting the system name hyperlink directs the user to the Health Score tab of the systems details page. There is also a filter that allows the user to filter this tile on the following product types:

- Storage Systems
- Networking Systems
- HCI Systems
- Data Protection Systems
- Servers

Capacity Approaching Full – Leverages predictive analytics to identify the storage pools, clusters, file systems, and subscriptions running out of space. The chart is interactive allowing the user to select each object to display a trend line of the historical capacities. For Unity and PowerVault storage pools, PowerMax storage resource pools, PowerStore, VxRail, PowerScale/Isilon, and XtremIO clusters, Unity File Systems, and APEX subscriptions, a forecast capacity chart is also shown.



The estimated time range until each pool, cluster, or file system will be full is shown as:

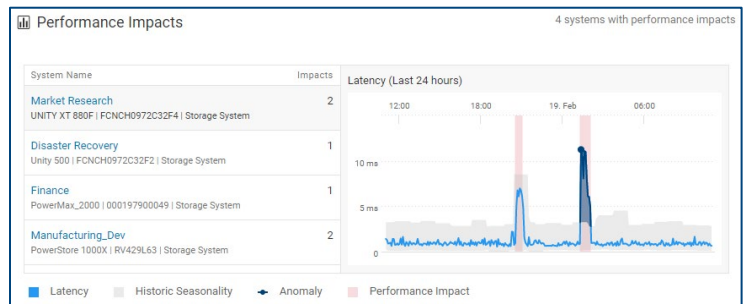
- Imminent (predicted to run out of space within 24 hrs.)
- Full
- Within a week
- Within a month
- Within a quarter

There is a pull-down menu that allows the user to filter the tile based on object type: File Systems, Pools, Clusters, or Subscriptions.

Note that the Imminent risk category is currently supported for Unity, PowerVault, PowerMax/VMAX, PowerScale, and VxRail systems. It will expand to include other platforms in the future.

Selecting the object name hyperlink directs the user to the Capacity tab on the object details page. This could be the pool details page, file system details page or the cluster details page, depending on the object type.

Performance Impacts – Currently supported for APEX Block Services, PowerMax, PowerStore, PowerFlex, and Unity systems. Utilizes CloudIQ analytics to identify when there are performance impacts on a system due to a possible workload contention. It will also identify the existence of performance anomalies where the current system workload is outside of expected boundaries based on historical workloads.

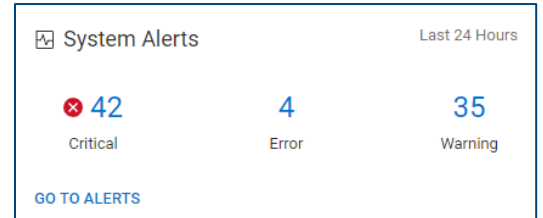


The chart is interactive allowing the user to select an impacted system and see the block latency of that system over the last 24 hours in the right pane. Both performance impacts and performance anomalies are highlighted in the chart. Selecting the system name hyperlink directs the user to the Performance tab of the system details page where the user can see more detailed performance information for the system.

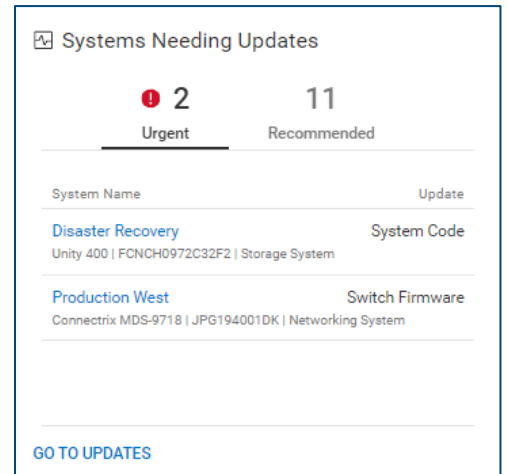
Cybersecurity Risks – Summarizes the active cybersecurity risks in the environment. The overall environment has an assigned risk level. A breakdown of the number of systems per risk level is provided as well as total issues and issues identified in the last 24 hours. Links to the System Risk page and the Cybersecurity Issues page are available.



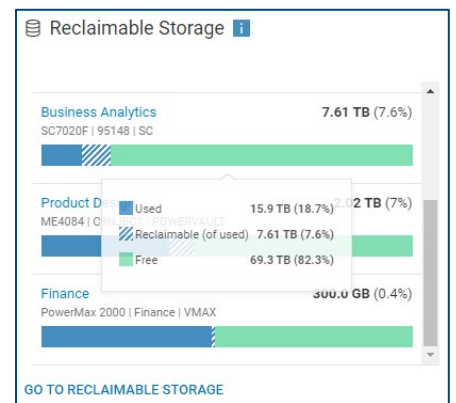
System Alerts – Summarizes the alerts collected by CloudIQ over the last 24 hours across the Critical, Error, and Warning severity levels. Clicking a number opens a list of alerts in the Alerts window filtered by the selected severity level. Selecting the “GO TO ALERTS” link navigates the user to a filtered list of alerts, across all severity levels, from the last 24 hours.



Systems Needing Updates – This tile identifies systems that have either Urgent or Recommended system code, firmware, or management software updates available. It shows the system and the type of update. Selecting the “GO TO UPDATES” link opens the System Updates page. This page shows all available code, firmware, and software updates across all systems and includes links to download the updates. Selecting the system name hyperlink directs the user to the Configuration tab on the system details page.



Reclaimable Storage – This tile summarizes PowerMax, Unity, SC Series, and PowerVault ME4 systems that have reclaimable storage. Each system with reclaimable storage shows the total amount of used, reclaimable (of used) and free storage. Selecting the system name hyperlink directs the user to the Capacity tab on the system details page.



3 Health

3.1 System Health

The System Health page displays the Proactive Health Score for all systems across all products in a consolidated view. There are up to five tabs: STORAGE, NETWORKING, HCI, SERVER, and DATA PROTECTION. These tabs organize the systems into individual views. Users can quickly identify the systems at highest risk along with the number of issues in each category that makes up the health score.

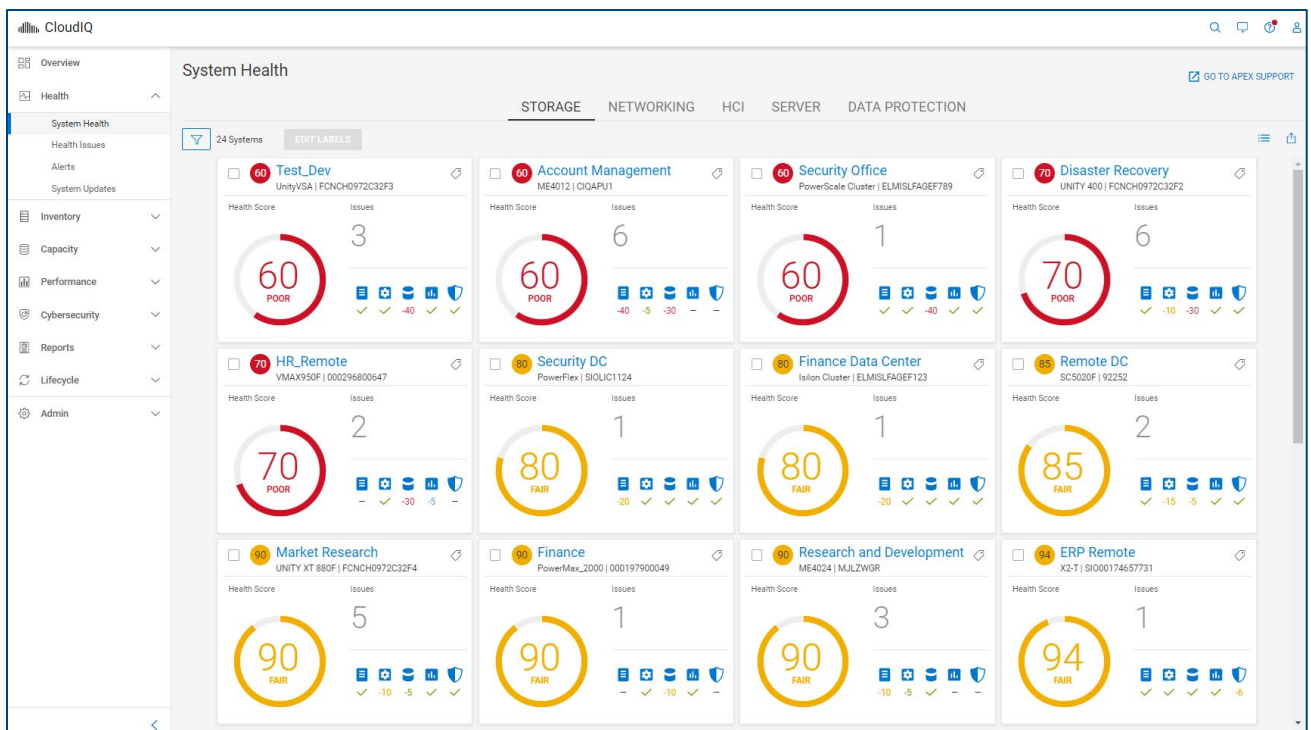
CloudIQ uses up to five categories to determine the Proactive Health Score presented on the System Health page: **Components** (☰), **Configuration** (⚙️), **Capacity** (📊), **Performance** (📈), and **Data Protection** (🛡️).

Note: PowerMax and VMAX systems do not include health issues in the Components or Data Protection categories. CloudIQ will display a dash (—) for these categories.

Note: PowerVault ME4 systems do not include the Performance or Data Protection categories. CloudIQ will display a dash (—) for these categories.

Note: VxRail systems do not include the Data Protection category.

Note: Connectrix, PowerSwitch, and PowerEdge currently use only the Components category.

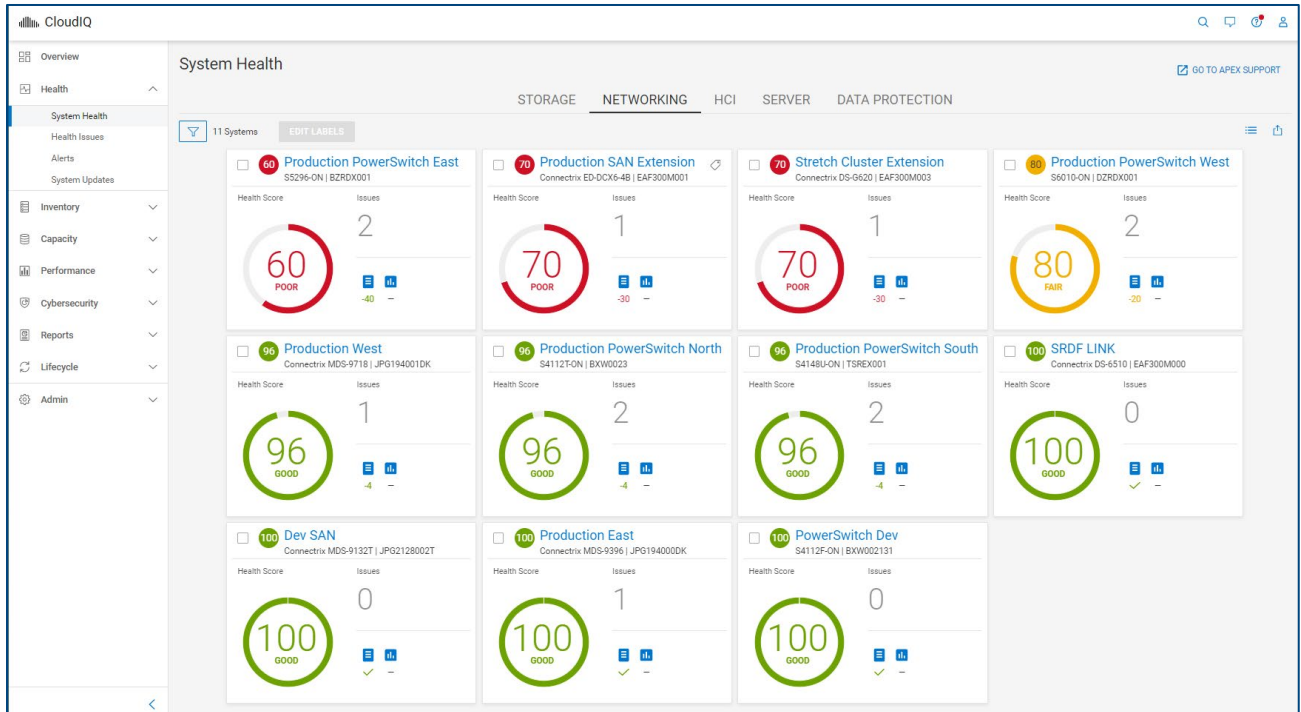


Each system has a health score displayed in the circle (ranging from 100 to 0) which is calculated as 100 minus the issue with the greatest impact. Each of the five categories has either a green check mark, a negative number, or a dash. The green check indicates no issues are present for that category. A negative number represents the deduction for the most impactful issue in the category. A dash indicates that the category is not supported for that system type. This approach is intended to help users focus on the most significant issue for the system, so that they can resolve the issue to improve the health score.

The Health Score range is as follows:

- **Good** = 95–100 (Green)
- **Fair** = 71–94 (Yellow)
- **Poor** = 0–70 (Red)

The System Health Score is displayed in the color that corresponds to the range. Blue coloring with a dash instead of a number indicates a system that has recently been added to CloudIQ and does not yet have a calculated health score. Gray coloring with a number indicates a connectivity issue which leads to an uncertain health score. In this case, the user should check the system connectivity.



The **Card** view, shown previously for both Storage and Networking, is the default view for this page. Users can alternatively choose the **List** view, by selecting the List View Icon (☰) in the upper right of the window. The list view is shown on the next page for Storage. This view may be more useful for larger environments because it allows for a more condensed view of the information and the ability to sort columns. Users can now view and edit custom labels from either the Card view or the List view. Custom labels are covered in detail in Chapter 17.

Users can also export the data from many of the views in CloudIQ to a CSV file by selecting the Export CSV icon (📄) in the upper right of the view. Exporting the data from any of the multisystem views exports the data from all the multisystem views including the information displayed in the Health, Inventory, Performance, and Capacity views. The exported information includes either the Storage, SAN, HCI, or Data Protection views depending on where the user initiates the export.

Users can filter the systems in both the Card View and List View by selecting the **Filter** icon (🔍) and entering in various criteria. The available criteria vary based on the view, but examples include System Name, Product Type, Health Score, Label, Site Name, and Location. The filter settings stay in effect until the user clears the filter or logs out of the UI.

Each view provides the following information:

- **Score** – CloudIQ Proactive Health Score for system

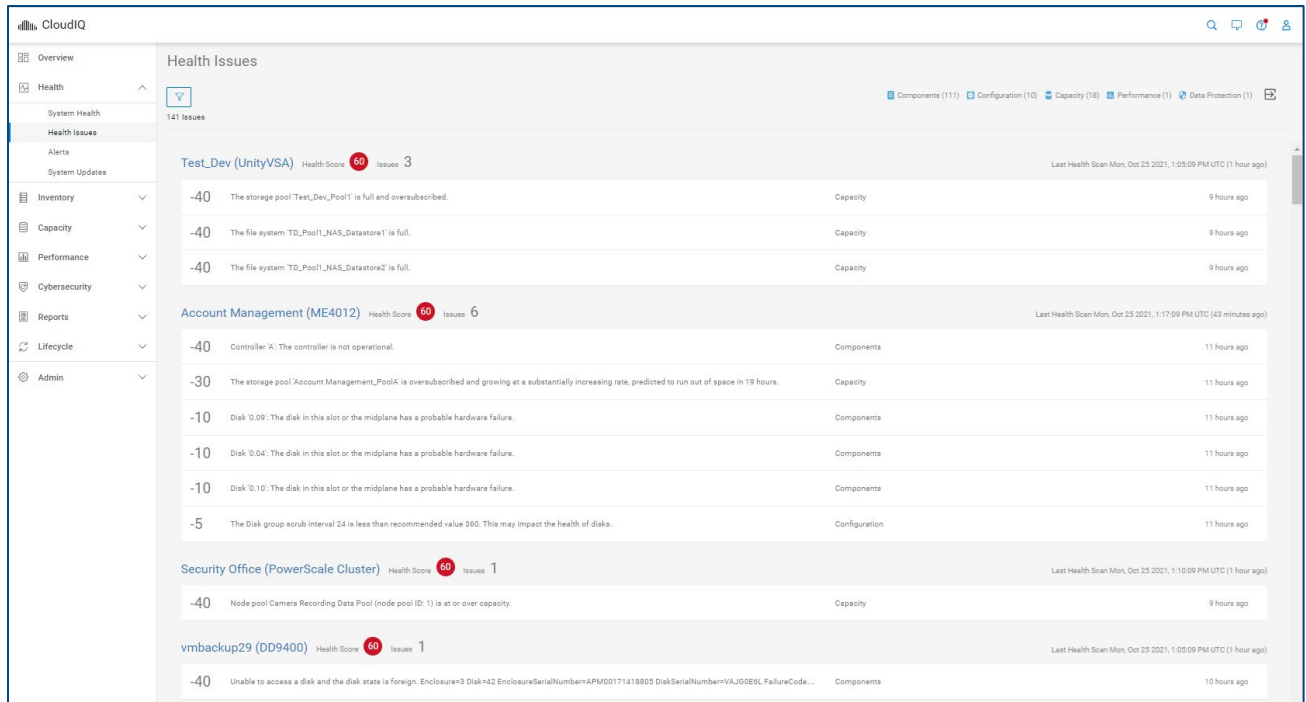
- **Name** – User-defined name of system
- **Model** – Specific model of system
- **Serial number** – Unique serial number or identifier for the system

Selecting an individual system from either the card view or list view navigates the user to the System Details page. These pages are discussed for each system type later in this paper.

Health Score	System	Identifier	Model	Components	Configuration	Capacity	Performance	Data Protection	Labels
60	Test_Dev	FCNCH0972C32...	UnityVSA	✓	✓	-40	✓	✓	DataCenter:MA-HOP-DC3 BusinessUnit:Services +2
60	Account Manag...	CIQAPU1	ME4012	-40	-5	-30	✓	✓	DataCenter:TX-RR-DC1 BusinessUnit:Sales +2
60	Security Office	ELMISLFAGEF789	PowerScale Clu...	✓	✓	-40	✓	✓	DataCenter:MA-HOP-DC3 BusinessUnit:IT +2
70	Disaster Recovery	FCNCH0972C32...	UNITY 400	✓	-10	-30	✓	✓	DataCenter:MA-HOP-DC3 BusinessUnit:Sales +2
70	HR_Remote	000296800647	VMAX950F	✓	✓	-30	-5	✓	DataCenter:MA-HOP-DC3 BusinessUnit:HR +2
80	Security DC	SIOLIC1124	PowerFlex	-20	✓	✓	✓	✓	
80	Finance Data Ce...	ELMISLFAGEF123	Isilon Cluster	-20	✓	✓	✓	✓	DataCenter:MA-HOP-DC3 BusinessUnit:Finance +2
85	Remote DC	92252	SC5020F	✓	-15	-5	✓	✓	DataCenter:MA-HOP-DC3 BusinessUnit:Engineering +2
90	Market Research	FCNCH0972C32...	UNITY XT 880F	✓	-10	-5	✓	✓	DataCenter:TX-RR-DC1 BusinessUnit:Engineering +2
90	Finance	000197900049	PowerMax_2000	✓	✓	-10	✓	✓	DataCenter:TX-RR-DC1 BusinessUnit:Finance +2
90	Research and De...	MJLZWGR	ME4024	-10	-5	✓	✓	✓	DataCenter:TX-RR-DC1 BusinessUnit:Engineering +2
94	ERP Remote	SIO00174657731	X2-T	✓	✓	✓	✓	-6	DataCenter:MA-HOP-DC3 BusinessUnit:Finance +2
95	Manufacturing...	RV429L63	PowerStore 9000	✓	✓	-5	✓	✓	DataCenter:MA-HOP-DC1 BusinessUnit:Manufacturing +2
95	APEX Block-Bos...	6CC0643	APEX Block Stor...	✓	✓	-5	✓	✓	

3.2 Health Issues

The Health Issues page displays a comprehensive view of all the current health issues across the environment. The user can click the Filter icon to show a subset of systems based on the system name or product type. When the user starts typing the name of the system, a prepopulated list of system names is displayed that contains the entered text.



The screenshot shows the CloudIQ interface with the Health Issues page selected. The left sidebar contains navigation options: Overview, Health, System Health, Health Issues, Alerts, System Updates, Inventory, Capacity, Performance, Cybersecurity, Reports, Lifecycle, and Admin. The main content area displays a list of health issues for three systems: Test_Dev (UnityVSA), Account Management (ME4012), and Security Office (PowerScale Cluster). Each system entry shows a Health Score (60) and the number of issues (3, 6, and 1 respectively). The issues are listed with severity scores, descriptions, categories, and timestamps.

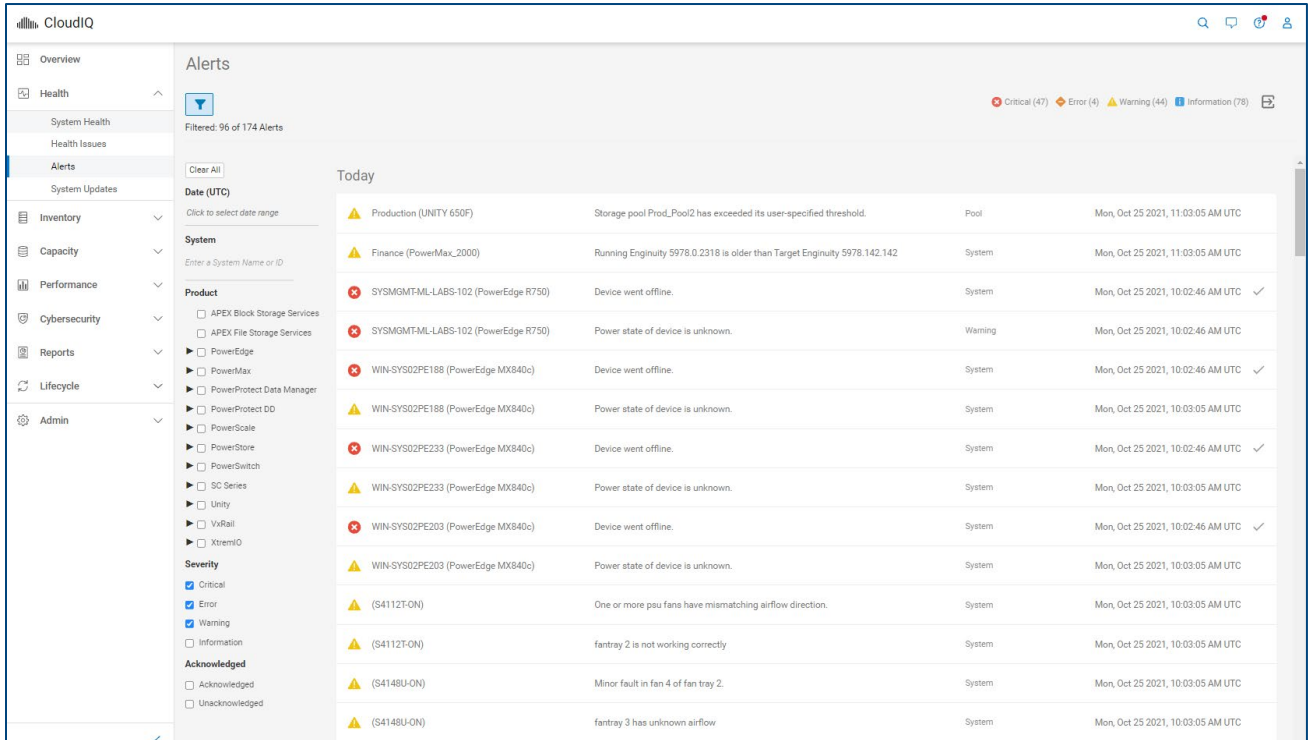
System	Health Score	Issues	Last Health Scan
Test_Dev (UnityVSA)	60	3	Mon, Oct 25 2021, 1:05:09 PM UTC (1 hour ago)
Account Management (ME4012)	60	6	Mon, Oct 25 2021, 1:17:09 PM UTC (43 minutes ago)
Security Office (PowerScale Cluster)	60	1	Mon, Oct 25 2021, 1:10:09 PM UTC (1 hour ago)

3.3 Alerts

The **Alerts** page displays all alerts associated with the monitored systems. The Filter icon allows the user to filter alerts based on the following criteria:

- **Date** – Date range
- **System** – System Name or ID
- **Product** – Product type
 - APEX Block Storage Services
 - APEX File Storage Services
 - PowerEdge
 - PowerMax
 - PowerProtect Data Manager
 - PowerProtect DD
 - PowerScale
 - PowerStore
 - PowerSwitch
 - SC Series
 - Unity
 - VxRail
 - XtremIO

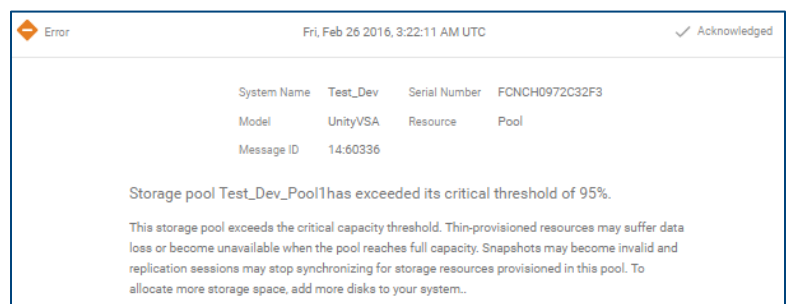
- **Severity**
 - **Critical** – Event that has significant impact on the system and needs to be remedied immediately
 - **Error** – Event that has minor impact on the system and needs to be remedied
 - **Warning** – Event that administrators should be aware of but has no significant impact on the system
 - **Information** – Event that does not impact the system functions
- **Acknowledged**
 - **Acknowledged** – Event that has been reviewed and acknowledged on the system
 - **Unacknowledged** – Event that has not been acknowledged on the system



Note: Alerts shown in CloudIQ originate from the system and can only be acknowledged, unacknowledged, and cleared on the system.

Note: Alerts for PowerFlex, PowerVault ME4, Connectrix, and VxBlock systems are not yet supported.

The alerts are grouped in current and weekly sections. A checkmark on the right side of the alert row indicates that the alert has been acknowledged. More details pertaining to an alert can be seen by selecting the alert.



3.4 System Updates

The System Updates page displays a list of all available system code, management software, drive firmware, and switch firmware updates across all supported systems. It includes the system name, update category, update type, the current version, and update version. The Update Version column is a hyperlink to the code allowing the user to quickly access the update code. Selecting the “>” icon expands the row to display the Release Summary with more details about the update and a link to the release notes for the system update.

This page also allows users to stage Unity code updates to the array. By selecting the Unity arrays and the Stage to Array button, the code in the Recommended Update column is downloaded to the arrays. The user can log in to Unisphere and initiate the code upgrade at an appropriate time.

The user can filter the results by selecting the Filter icon, sort any of the columns and export the list to a CSV file.

	System	Identifier	Model	Update Category	Update Type	Drive Count	Current Version	Recommended Update	Staged
- >	Account Management	CIQAPU1	ME4012	Recommended	System Code	-	GT280R006-02	GT280R006-03	
- >	Business Analytics	95148	SC7020F	Recommended	System Code	-	07.03.01.999	07.03.05	
- >	Dev SAN	JPQ2128002T	Connectrix MDS-9...	Recommended	Switch Firmware	-	8.3(2)	8.3(2a)	
- >	Dev SAN	JPQ2128002T	Connectrix MDS-9...	Recommended	Switch Firmware	-	8.3(2)	8.3(3a)	
<input type="checkbox"/> >	Disaster Recovery	FCNCH0972C32F2	Unity 400	! Urgent	System Code	-	4.2.0.9433914	4.2.1.951234	
- >	Disaster Recovery	FCNCH0972C32F2	Unity 400	Recommended	Drive Firmware	4	C332,C333	C334	
- >	Finance	000197900049	PowerMax_2000	Recommended	System Code	-	5882.309.401	5978.221.221	
- >	Finance	000197900049	PowerMax_2000	Recommended	Mgmt Software	-	V9.0.2.5	V9.0.2.10	
<input type="checkbox"/> >	Production	FCNCH0972C32F1	Unity 650F	Recommended	System Code	-	4.2.0.9433914	4.4.0.1534750794	<input type="checkbox"/>
- >	Production SAN Exten...	EAF300M001	Connectrix ED-DC...	Recommended	Switch Firmware	-	8.2.1a	v8.2.2a	

Note: The System Updates listing in CloudIQ does not support PowerScale/Isilon, PowerFlex, XtremIO, PowerProtect DD, PowerEdge, PowerSwitch, and VxRail.


Note: System Updates are not applicable to APEX Data Storage Services since Dell Technologies Managed Services Account Teams maintain these systems.

4 Inventory

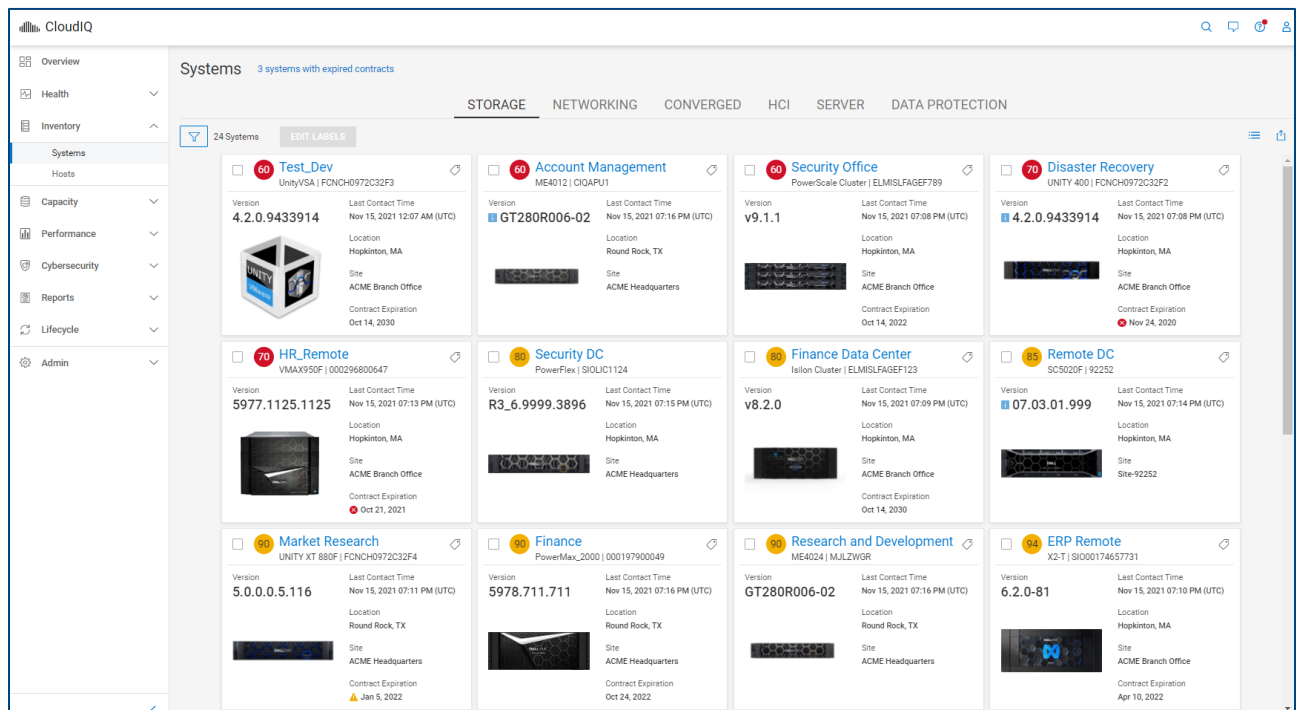
4.1 Systems

The Systems page is the multisystem view showing the configuration information for all systems in the environment. With the addition of recently added products, there can be five tabs in the multisystems inventory view: STORAGE, NETWORKING, CONVERGED, HCI, SERVER, and DATA PROTECTION. The information displayed on the Systems pages includes:

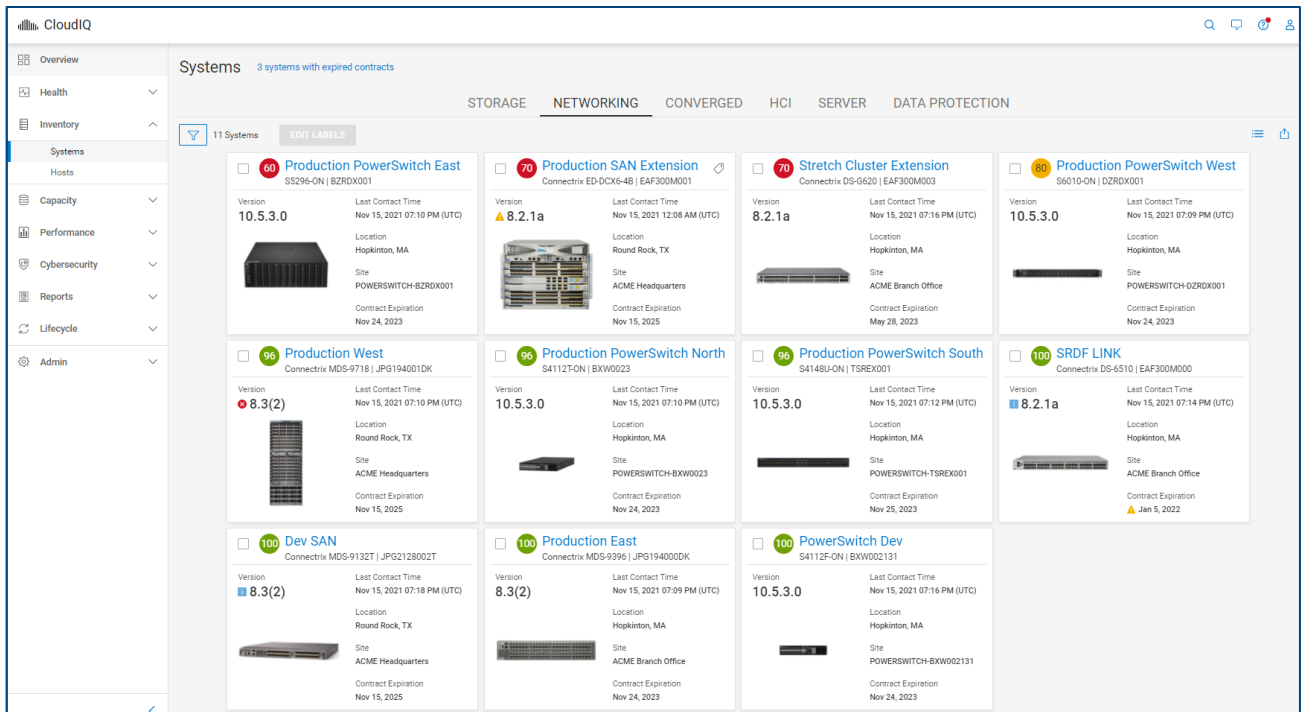
- **Version (vCenter Version for Converged)** – Version of installed software
- **Last Contact Time** – The last time that CloudIQ received data from the system
- **Managed by (Converged only)** – Type of AMP managing the Converged System
- **Location** – Location where the system is installed
- **Site** – Site ID with which the system is associated
- **Contract Expiration** – Expiration date for the service contract. Contract expiration is not supported for PowerFlex, PowerVault, or SC Series. It is not applicable to APEX Data Storage Services.

For systems that support the identification of system updates, there will also be an indication when a code update is available. Hovering over the information icon () opens a window showing the update version. Clicking the “Learn More” link from within the window opens a dialog with summary information and links to the Release Notes and the software download.

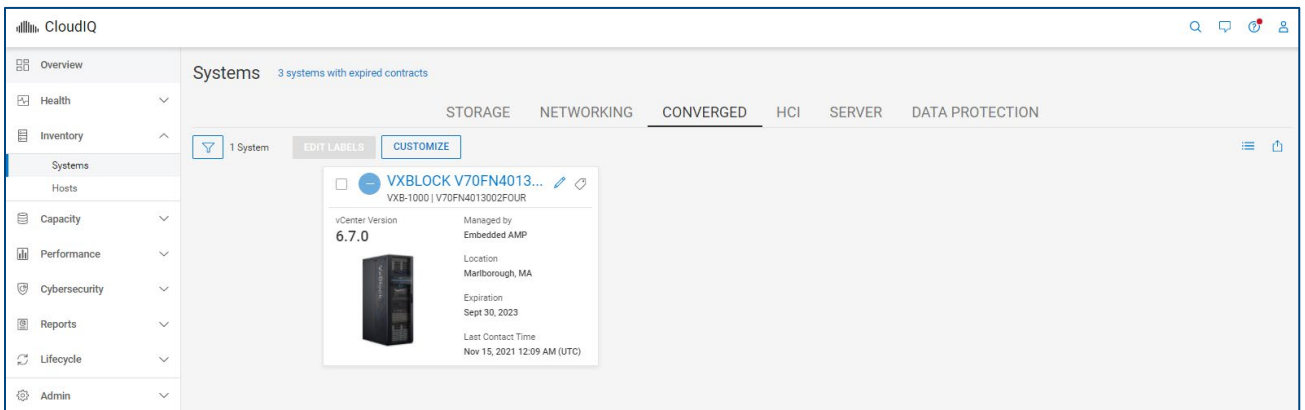
The following shows an example of the STORAGE tab.



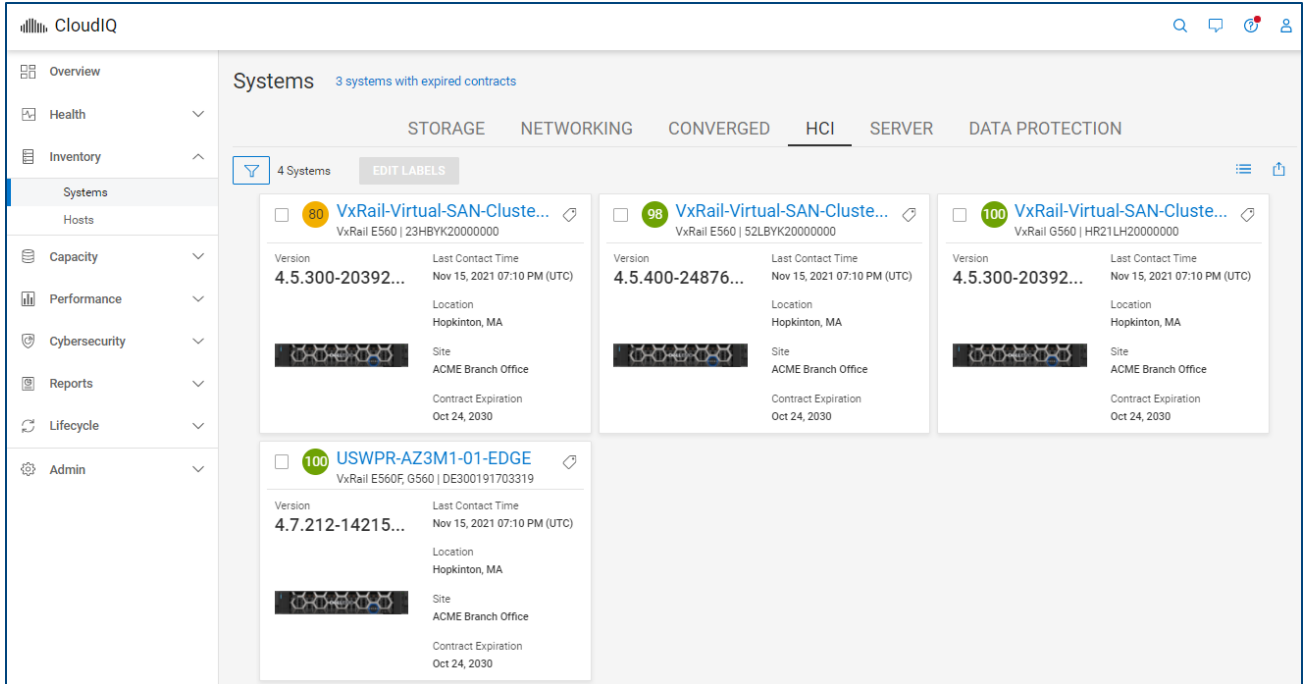
An example of the NETWORKING tab is displayed below showing similar attributes to those displayed in the STORAGE tab.



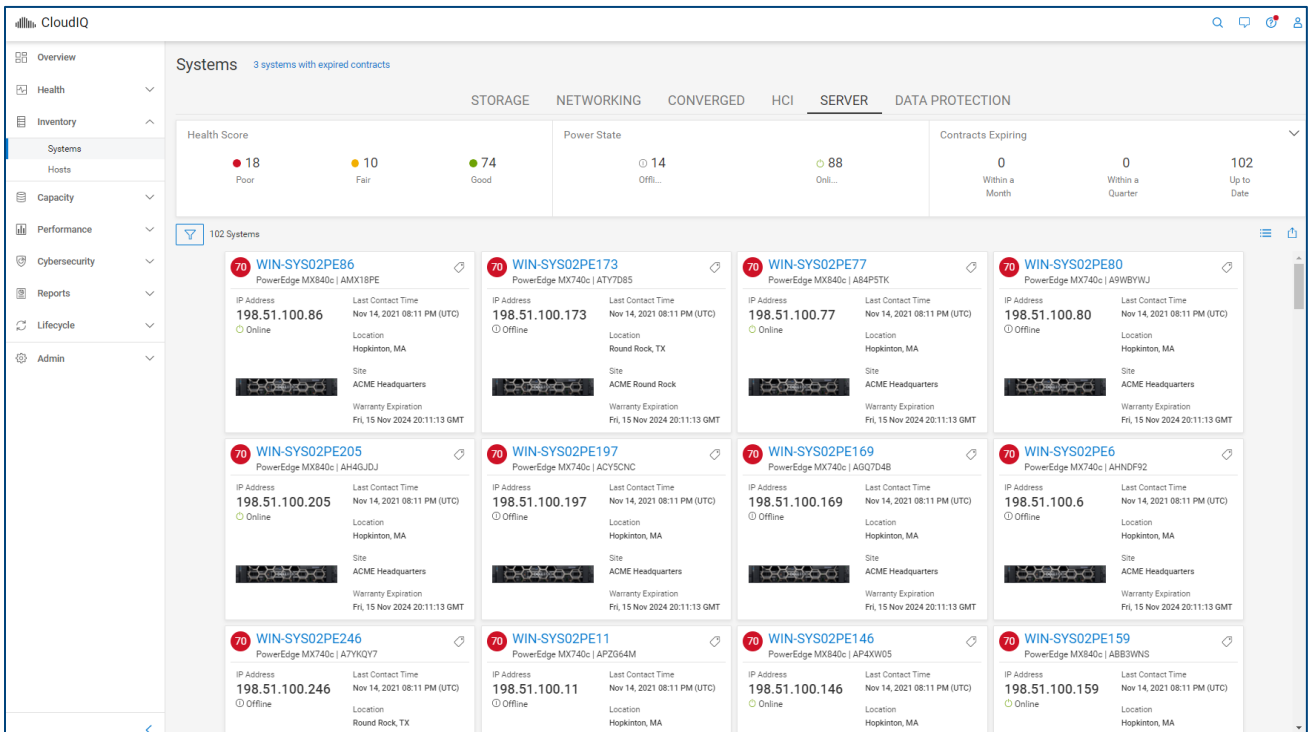
An example of the CONVERGED tab is shown below. The user can edit the system name in the card to provide a more user-identifiable name and differentiate it when multiple systems are being monitored. Users can also use the Customize button to display different attributes in the card view.



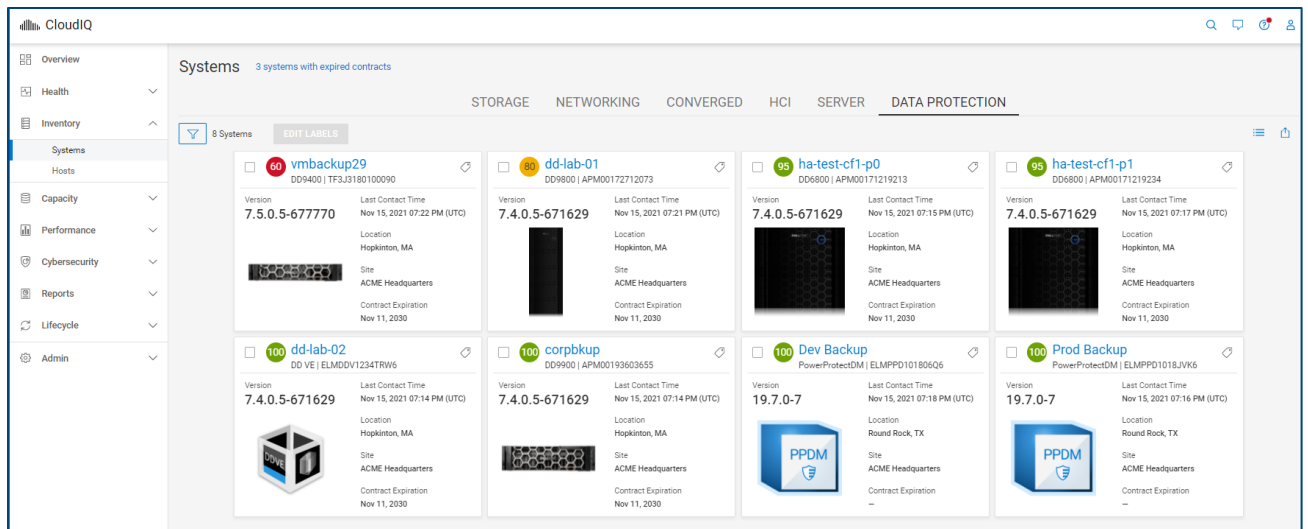
An example of the HCI tab shown below displays the inventory of VxRail systems.



The following shows an example of the SERVER tab. There is a top banner summarizing total number of servers by Health Score, Power State, and Contracts Expiring. This banner is available for servers due to the potentially large number of devices that could be monitored by CloudIQ.



An example of the Data Protection tab shows both PowerProtect DD systems and PowerProtect Data Manager instances monitored by CloudIQ.



4.2 Hosts

The Hosts page shows a list of all hosts or servers attached to storage systems in CloudIQ. Users can click the filter icon to specify one or more storage system names to restrict the view to display only those hosts on the selected systems. Hosts are supported for Unity, SC Series, XtremIO, and PowerVault ME4.

The Hosts listing shows:

- **Issues** – Health of the host represented by:
 - The number of issues on the host
 - A green checkmark if no issues are detected
 - A dash if the health has not been calculated

Note: Health issues are supported for hosts attached to Unity, PowerVault ME4, and SC Series storage systems.

- **Name** – Host name
- **Network Address** – IPv4 or IPv6 IP address (Not reported for hosts attached to XtremIO and PowerVault ME4 systems).
- **Operating System** – Host operating system (Not reported for hosts attached to PowerVault ME4 systems).
- **Initiator Protocol** – Type of initiator used by the Host.
- **Initiators (#)** – Number of initiators connected between the host and the monitored system.
- **Total Size** – Total size of all LUNs or Volumes provisioned to the host from the system.
- **System** – Storage system connected to the host. If a host is connected to multiple storage systems, a line displays for each system.
- **Model** – Model of the system connected to the host.

The screenshot shows the CloudIQ interface with the 'Hosts' page selected. The table lists 14 hosts with the following columns: Issues, Name, Network Address, Operating System, Initiator Protocol, Initiators (#), Total Size (TB), System, and Model. Each host has a green checkmark in the 'Issues' column, indicating no issues are detected.

Issues	Name	Network Address	Operating System	Initiator Protocol	Initiators (#)	Total Size (TB)	System	Model
✓	2001000e1e09efa4	-	-	FC	1	23.4	Research and Development	ME4024
✓	2001000e1e09efa5	-	-	FC	1	22.1	Research and Development	ME4024
✓	Analytics-Host-1	-	Linux	FC	2	0	Prod with iCDM	X1
✓	Analytics-Host-2	-	Linux	FC	2	0	Prod with iCDM	X1
✓	BA_App1_Server1	10.0.0.60	VMware ESXi 5.5.0	FC	2	54.6	Business Analytics	SC7020F
✓	BA_App1_Server2	10.0.0.61	Windows Server 2012	FC	2	54.6	Business Analytics	SC7020F
✓	BA_App2_Server3	10.0.0.62	Windows Server 2012	FC	2	54.6	Business Analytics	SC7020F
✓	BA_App2_Server4	10.0.0.63	Windows Server 2012	FC	2	46.8	Business Analytics	SC7020F
✓	Backup-I6001	-	ESX	FC	2	0	ERP Remote	X2-T
✓	ERP-Host-1	-	ESX	FC	2	7.8	ERP Production	X2-R
✓	ERP-Host-2	-	ESX	FC	2	7.8	ERP Production	X2-R
✓	ERP-Host-3	-	ESX	FC	2	7.8	ERP Production	X2-R
✓	ERP-Host-4	-	ESX	FC	2	7.8	ERP Production	X2-R
✓	ICM-Host-ESX1	-	ESX	FC	6	4.6	Prod with iCDM	X1
✓	Initiator7e00	-	-	SAS	1	5.5	Account Management	ME4012
✓	Initiator7e01	-	-	SAS	1	4.6	Account Management	ME4012
✓	LocalESX1	10.0.0.14	VMware ESXi 5.5.0	FC	1	10.2	Market Research	UNITY XT 880F
✓	LocalESX1	10.0.0.14	VMware ESXi 5.5.0	FC	1	19.5	Production	UNITY 650F

As with other listings, the user can sort the list by clicking any of the column headings and export data to a CSV file by selecting the Export icon.

Note that hosts are reported on a per storage system basis. This means that if a host is attached to multiple storage systems, there will be one row per storage system. An example is host LocalESX1 shown at the bottom of the Hosts listing above. It shows one row for storage array Market Research and a second row for storage array Production.

Each hostname is a hyperlink which opens the Host Details page for that specific host with respect to the associated storage system. The following sections discuss the Host Details page in more depth.

4.2.1 Host Details – Properties

The Properties tab displays configuration data for a host including the operating system, IP Address, and initiator protocol. It also displays any health issues associated to the host with suggested remediation. Details about storage objects attached to the host, virtual machines residing on the host, and initiators are provided in the tabs at the bottom of the page. The information in each of the tabs can be exported to a CSV file.

Disaster Recovery > Remote_ESX1 LAUNCH UNISPHERE

Properties | Capacity | Performance

Description: — PAUSE CONNECTIVITY HEALTH CHECKS

Operating System: VMware ESXi 5.5.0
 Network Address: 10.0.0.30
 Initiator Protocol: FC

Total Issues: 1 | **Configuration: 1 Issue**

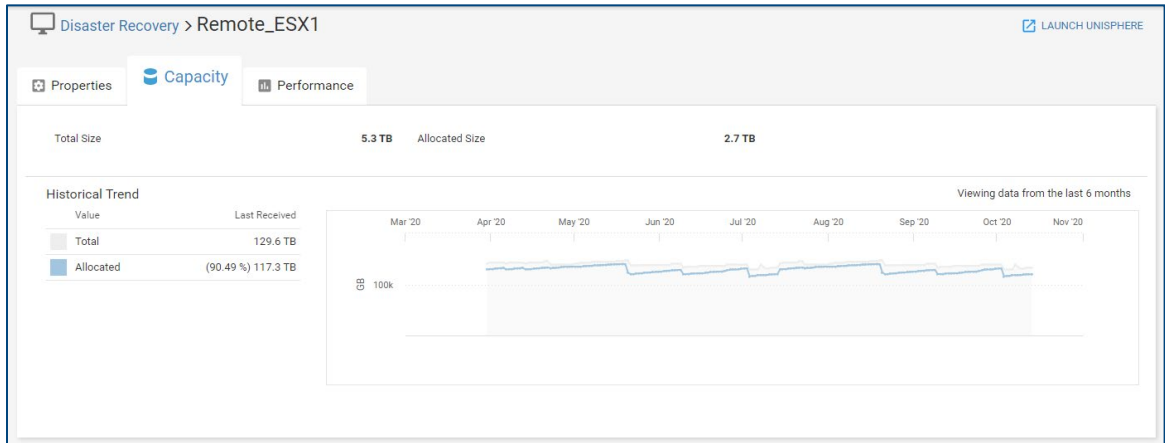
Configuration Issue: 2 days ago Host 'Remote_ESX1' is not logged in to both SPs; this host will lose connectivity in the event of failover.

Resolution: This host does not have logged-in paths to both SPA and SPB. Review your connectivity to ensure that all hosts have a connection to both SPs to ensure High Availability.

STORAGE	VIRTUAL MACHINES	INITIATORS	4 Storage Objects					
Issues	Name	Type	Thin	Size (GB)	Allocated (GB)	Pool	Consistency Group	Host I/O Limit
✓	DR_Pool3_SAN_Dat...	VMware VMFS	Yes	1000	550	Disaster Recovery_Pool3	MRApp2CG	5K IOPS
✓	DR_Pool3_SAN_Dat...	VMware VMFS	Yes	1500	825	Disaster Recovery_Pool3	MRApp2CG	5K IOPS
✓	DR_Pool3_SAN_Dat...	VMware VMFS	Yes	1500	825	Disaster Recovery_Pool3	TD_CG1	5K IOPS
✓	DR_Pool3_SAN_Dat...	VMware VMFS	Yes	1500	825	Disaster Recovery_Pool3	TD_CG1	5K IOPS

4.2.2 Host Details – Capacity

The Capacity tab for a host provides details for the current capacity from the associated storage system. These details include provisioned and allocated size, and historical capacity trends, of all the block objects provisioned to that host.



4.2.3 Host Details – Performance

The Performance tab for a host provides the 24-hour average values of key performance indicators (Latency, IOPS, and Bandwidth) of each block object provisioned the host. It also displays the names of other hosts to which the block objects are also provisioned.

The screenshot displays the Performance tab for the host Remote_ESX1. At the top, it shows the breadcrumb 'Disaster Recovery > Remote_ESX1' and a 'LAUNCH UNISPHERE' link. Below the breadcrumb are three tabs: 'Properties', 'Capacity', and 'Performance' (which is selected). The main content area shows '4 Storage Objects' and 'Viewing data from the Last 24 hours'. Below this is a table with the following columns: Name, Pool, Other Hosts, Latency (ms), IOPS (K), and Bandwidth (MBps). The table contains four rows of data. A tooltip is visible over the 'Remote_ESX3' link in the 'Other Hosts' column of the first row.

Name	Pool	Other Hosts	Latency (ms)	IOPS (K)	Bandwidth (MBps)
DR_Pool3_SAN_Datastore1	Disaster Recovery_Pool3	Remote_ESX2 and 1 other Remote_ESX3	1.1	0.9	9.7
DR_Pool3_SAN_Datastore2	Disaster Recovery_Pool3	Remote_ESX2 and 1 other	1.1	0.9	9.7
DR_Pool3_SAN_Datastore5	Disaster Recovery_Pool3	Remote_ESX2 and 1 other	1.1	0.8	9.6
DR_Pool3_SAN_Datastore6	Disaster Recovery_Pool3	Remote_ESX2 and 1 other	1.1	0.5	9.5

5 Capacity

5.1 System Capacity

The System Capacity views display the system level storage capacity for traditional storage systems, APEX Data Storage Services, VxRail hyperconverged systems, and PowerProtect DD systems. For Connectrix and PowerSwitch, it displays port capacity.

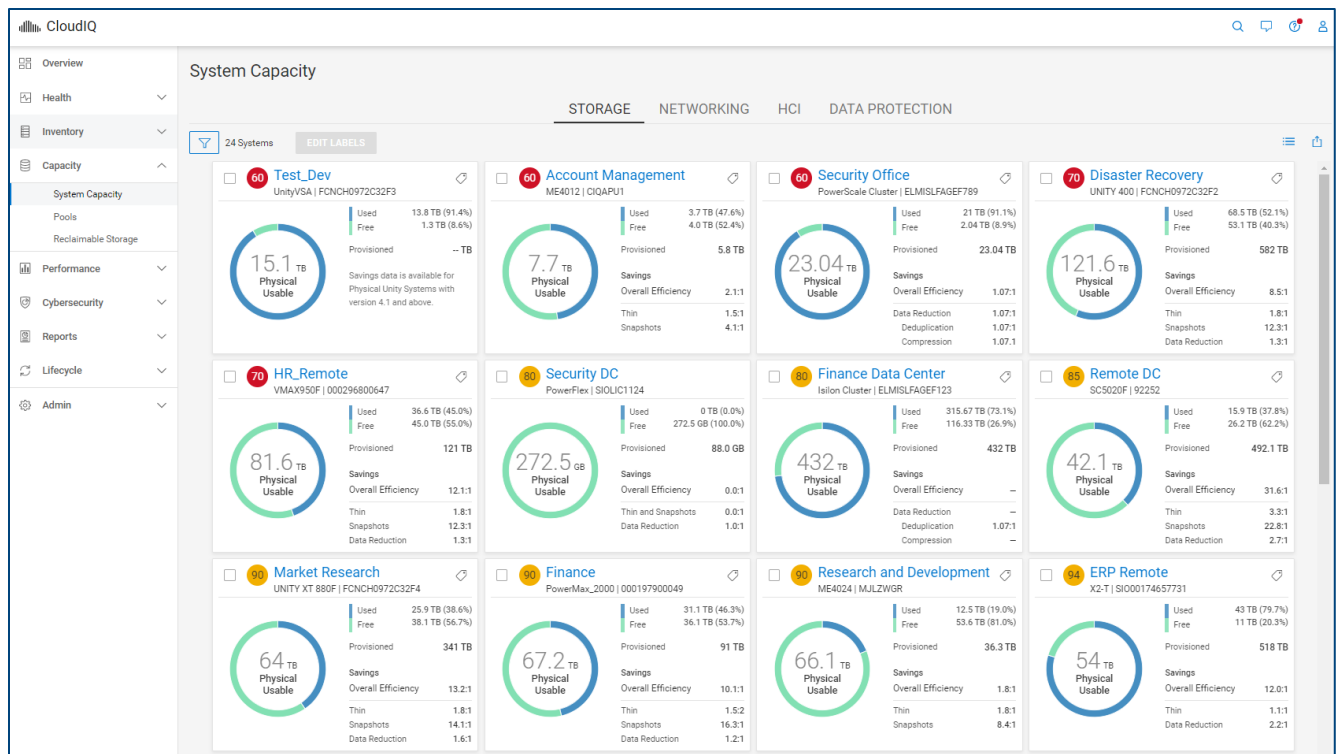
An example of each of the tabs in the System Capacity page is shown below.

The information for traditional storage systems includes:

- **Usable** – Total disk capacity, which is the sum of Used and Free space
- **Used** – Disk capacity that is allocated to an object, such as a LUN, Volume, or file system
- **Free** – Disk capacity provisioned to a storage pool but not yet allocated to an object, such as a LUN, Volume, or file system
- **Provisioned** – Total capacity visible to hosts attached to this system
- **Overall Efficiency** – System-level storage efficiency ratio, based on the following combined savings ratios:
 - **Thin** – Ratio of thin provisioned objects on the system (Dell EMC Unity, PowerStore, SC Series, VMAX/PowerMax, PowerVault ME4)
 - **Snapshots** – Ratio of snapshots on the system (Dell EMC Unity, PowerStore, SC Series, VMAX/PowerMax, PowerVault ME4),
 - **Thin and Copy** – Ratio of thin provisioned objects (XtremIO volumes, including snapshots).
 - **Data Reduction** – Ratio of data that has data reduction applied, using compression or deduplication. (Not supported for PowerVault ME4)
 - **Deduplication** – Ratio gained by savings from deduplication (PowerScale/Isilon only)

The information for APEX Data Storage Services includes:

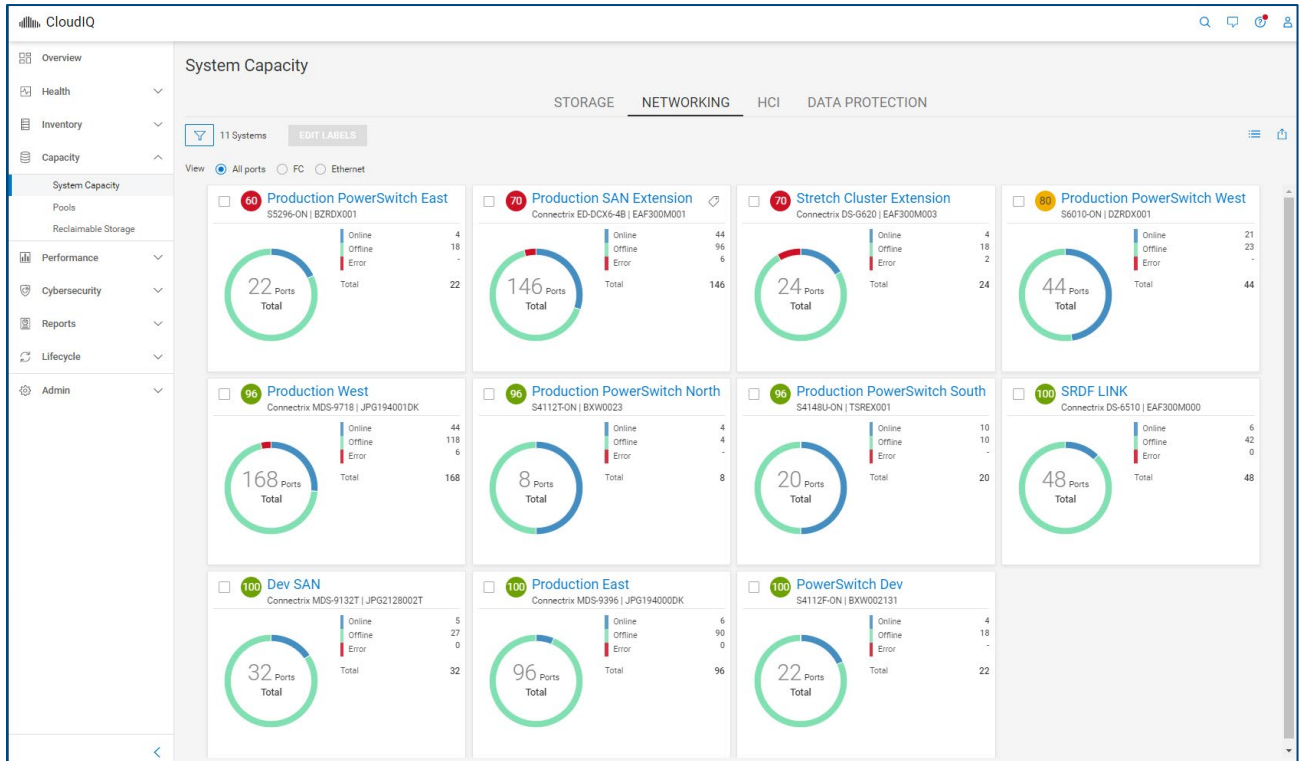
- **Effective Usable** – Total of Base and On-Demand Usable capacity
- **Used** – Amount of host written data including both Base and On-Demand capacity
- **Free** – Remaining available space from the combined total of Base and On-Demand capacity
- **Subscriptions** – Number of subscriptions for a given cluster (APEX File Storage Services)
- **On-Demand Used** – Amount of used capacity from On-Demand



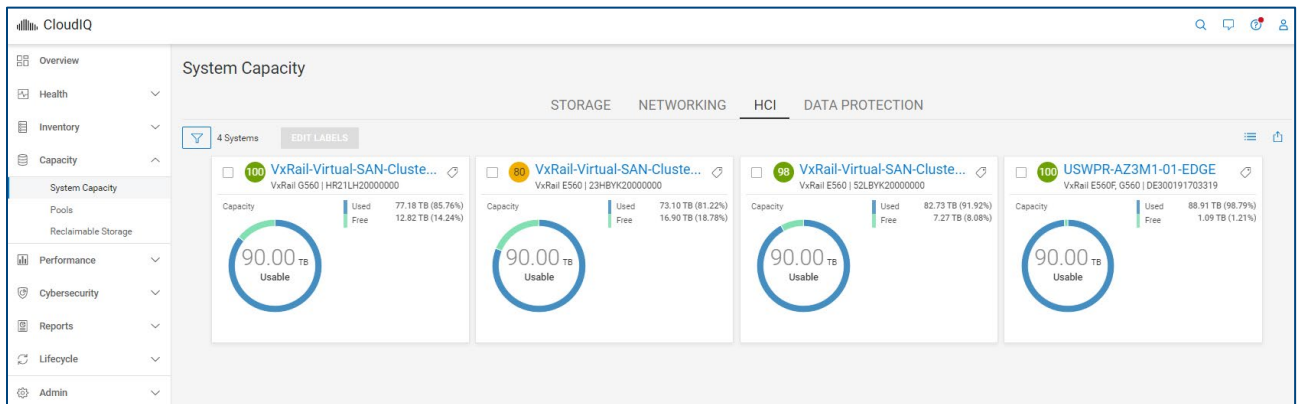
Note: For Dell EMC Unity systems running version 4.3 and later and SC Series running version 7.3, Data Reduction includes Compression or Deduplication.

For switches, the user can filter the view to show All ports, FC ports, or Ethernet ports. For each selection, the displayed information includes:

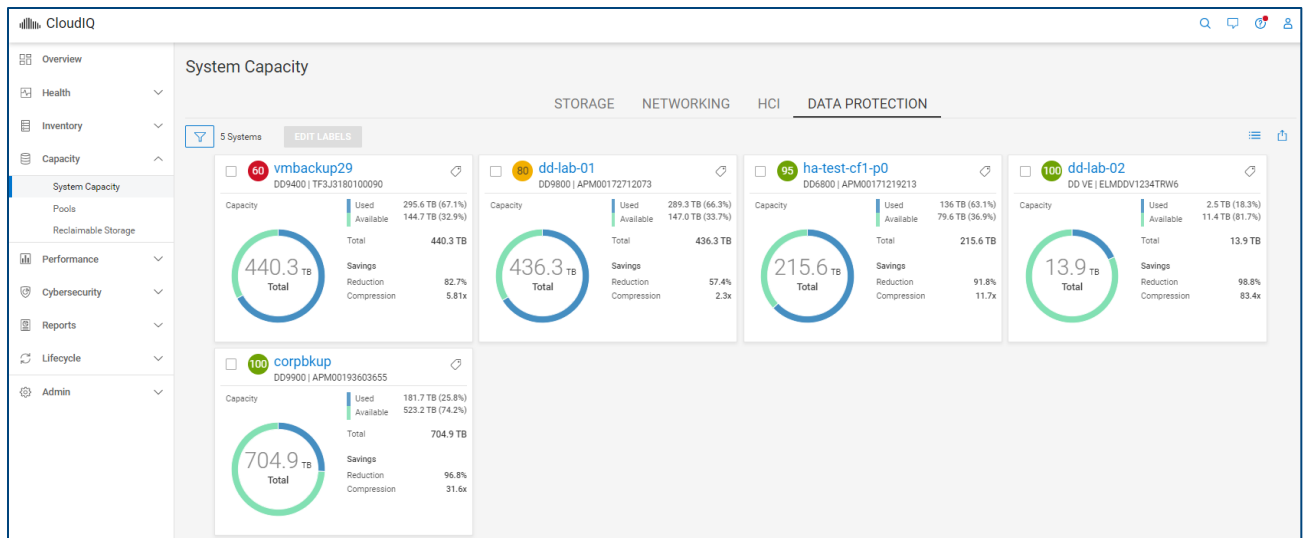
- **Total Ports** – Total number of ports (All ports, FC ports, or Ethernet ports depending on previous selection)
- **Online** – Number of ports in an online state
- **Offline** – Number of ports in an offline state
- **Error** – Number of ports in an error state



For VxRail systems, CloudIQ displays Usable and a breakdown of Used and Free capacity.



The Data Protection tab summarizes the capacity for DD systems. Total storage is broken down to Used and Available. Savings due to Reduction and Compression is also provided for each system.



5.2 Pools

The Pools page provides an aggregated listing of storage pools including PowerMax storage resource pools. The **Issues** column displays the number of health issues associated with any pool or storage object in that pool or a green check mark for items with no associated issues. Issues can be calculated for Unity, SC Series, PowerScale/Isilon, and PowerVault. The pool name and system name are hyperlinks to the details for the item.

The Pools listing represents the raw storage on the system that is available to be provisioned as either block storage or file storage. This listing provides the Total Size (TB), Used and Subscription percentages, and Free (TB) storage within the pool that has not been provisioned for storage objects. The Time to Full range is also shown. Time to Full is based on the storage consumption measurements. The longer the pool is configured, the more accurate the prediction of Time to Full. This Time to Full measurement identifies pools that are at greatest risk of running out of storage space, and that require attention.

Issues	Name	System	Model	Total Size (TB)	Used (%)	Subscription (%)	Time To Full	Free (TB)
1	Account Management_PoolA	Account Management	ME4012	1.0	94.8	130	Imminent	0.05
✓	Account Management_PoolB	Account Management	ME4012	6.7	41.8	67.2	Within a quarter	3.9
✓	Business Analytics_Pool1	Business Analytics	SC7020F	85.2	18.7	65.5	Greater than quarter	63.3
✓	Cache Pool	Finance Data Center	Isilon Cluster	192 TB	82.4	100.0%	Learning	33.8 TB
1	Camera Recording Data Pool	Security Office	PowerScale Cluster	23.04 TB	91.1	100.0%	Within a day	0.46 TB
✓	Disaster Recovery_Pool1	Disaster Recovery	UNITY 400	24.7	45.3	145.5	Unpredictable	13.6
1	Disaster Recovery_Pool2	Disaster Recovery	UNITY 400	13.7	54.7	145.5	Imminent	6.2
✓	Disaster Recovery_Pool3	Disaster Recovery	UNITY 400	82.5	54.5	145.5	Within a month	37.5
—	Finance_SRP1	Finance	PowerMax_2000	90.0	88.0	90.0	Within a month	10.9
—	Finance_SRP2	Finance	PowerMax_2000	40.8	51.0	99.3	Greater than quarter	20.0
—	HR_Remote_SRP1	HR_Remote	VMAX950F	40.8	45.0	148.3	Greater than quarter	22.5
—	HR_Remote_SRP2	HR_Remote	VMAX950F	40.8	45.0	148.3	Greater than quarter	22.5
1	Main Pool	Finance Data Center	Isilon Cluster	391 TB	71.0	100.0%	Learning	113.4 TB
✓	Main Pool	HR Data Center	Isilon Cluster	30.2 TB	45.6	100.0%	Learning	16.4 TB

5.2.1 Pool Details – Properties

The information in the **Properties** tab for a pool varies depending on array type. It provides various pool attributes and any health issues associated with the pool. Expanding the issue will provide a suggested resolution. Where supported, there is a hyperlink in the upper right of the window to launch the associated element manager. The bottom of the Pool Details page has different tabs of information depending on array type.

The following series of screenshots show the information for each array type.

Unity and SC Series:

- Storage
- Virtual Machines
- Drives

The screenshot shows the 'Disaster Recovery > Disaster Recovery_Pool2' page. It features tabs for 'Properties', 'Capacity', and 'Performance'. The 'Capacity' tab is active, showing a 'Total Issues' count of 1 and a 'Capacity' issue count of 1. A message indicates the storage pool is oversubscribed and predicted to run out of space within 5 hours. A resolution suggests adding drives or migrating data. Below this is a table of storage objects with columns: Issues, Name, Type, Size, Used, Alloc., Thin Enabled, Data, Consistency, Host I/O Limit, NAS Server, and Time to Full.

Issues	Name	Type	Size (...)	Used ...	Alloc...	Thin Enabled	Data ...	Consistency...	Host I/O Limit	NAS Server	Time to Full
1	DR_Pool2_FS1	File System	6000	1320	1650	Yes	1.1:1...	-	-	NAS_Server...	Imminent
1	DR_Pool2_FS2	File System	6000	1320	1650	Yes	1.1:1...	-	-	NAS_Server...	Within a week
✓	DR_Pool2_LU...	LUN	4000	-	1100	Yes	1.1:1...	ProdApp2CG	10K IOPS	-	-
✓	DR_Pool2_LU...	LUN	4000	-	1100	Yes	1.1:1...	ProdApp2CG	10K IOPS	-	-

PowerVault:

- Storage
- Drives

The screenshot shows the 'Research and Development > B' page. It features tabs for 'Properties', 'Capacity', and 'Performance'. The 'Configuration' tab is active, showing a 'Total Issues' count of 1 and a 'Configuration' issue count of 1. A message indicates a virtual disk group is missing one or more disks. A resolution suggests ensuring spare disks are available and replacing failed disks. Below this is a table of storage volumes with columns: Name, Type, Size (GB), and Allocated (GB).

Name	Type	Size (GB)	Allocated (GB)
Research_Volume3	BASE	1500.0	760.0
Research_Volume4	BASE	2750.0	1230.8
Research_Volume7	BASE	2500.0	2098.0
Research_Volume8	BASE	1000.0	123.3

PowerScale and Isilon

- Nodes

Finance Data Center > Main Pool

Properties Capacity

Tier —

Node Count 8

Protection Scheme

L3 Cache Disabled

Total Issues 0 Total

Components ✓

Configuration ✓

Capacity ✓

Performance ✓

Data Protection ✓

All health checks were successful.

8 Storage Objects

Issues	Name	Type	Size (GB)	Used (GB)	Pool
✓	Node 1	Node	18.6	0.7	Main Pool
✓	Node 2	Node	18.6	0.7	Main Pool
✓	Node 3	Node	18.6	0.7	Main Pool
✓	Node 4	Node	18.6	0.7	Main Pool

PowerMax

- No tabs

Finance > Finance_SRP1 LAUNCH UNISPHERE

Configuration Capacity Performance

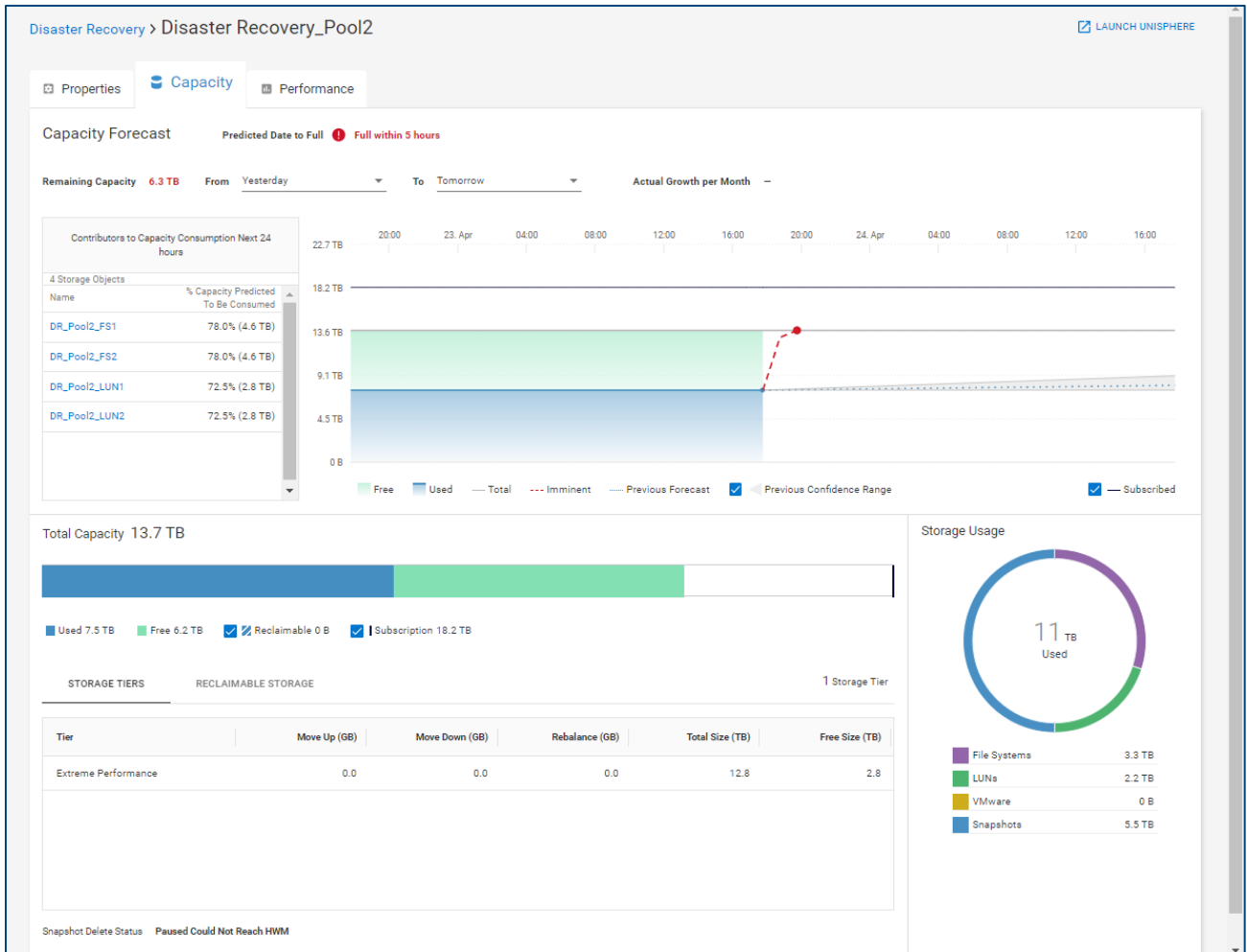
Compression Enabled Reserved Capacity 12 Description Storage Resource Pool for Finance Production

5.2.2 Pool Details – Capacity

The **Capacity** tab for a pool varies based on array type.

5.2.2.1 Unity, PowerScale, Isilon, PowerVault

The graph along the top displays the historical pool capacity data and the Predicted Date to Full date (Unity, PowerVault, and PowerScale/Isilon). The graph shows Free, Used, Total, Forecast Used, Confidence Range, and Subscribed. The Confidence Range represents the confidence level in predicting the date to full; the wider the range, the lower the confidence level. When an imminent full condition exists, the graph also shows the Previous Forecast and Previous Confidence Range. It also shows the top storage objects predicted to contribute to capacity consumption over the next 24 hours as shown below. If the pool is in a Learning, Full, or Unpredictable state, only the historical trend graph is displayed.



The beginning of the chart is based on the selection in the “From:” field. By default, the setting is set to “3 months ago.” For pools at imminent risk, the “From:” field is set to yesterday. The following times are available from the pull-down:

- Yesterday
- 1 week ago
- 1 month ago
- 3 months ago (default)
- 6 months ago

- 1 year ago
- 2 years ago
- Custom

The end of the chart is based on the selection in the “To:” field. By default, the setting is set to “Predicted Full.” The following times are available in the pull-down:

- Today (Only historical data is shown)
- Tomorrow
- 1 week from today
- 1 month from today
- 3 months from today
- 6 months from today
- Predicted Full (default)
- Custom

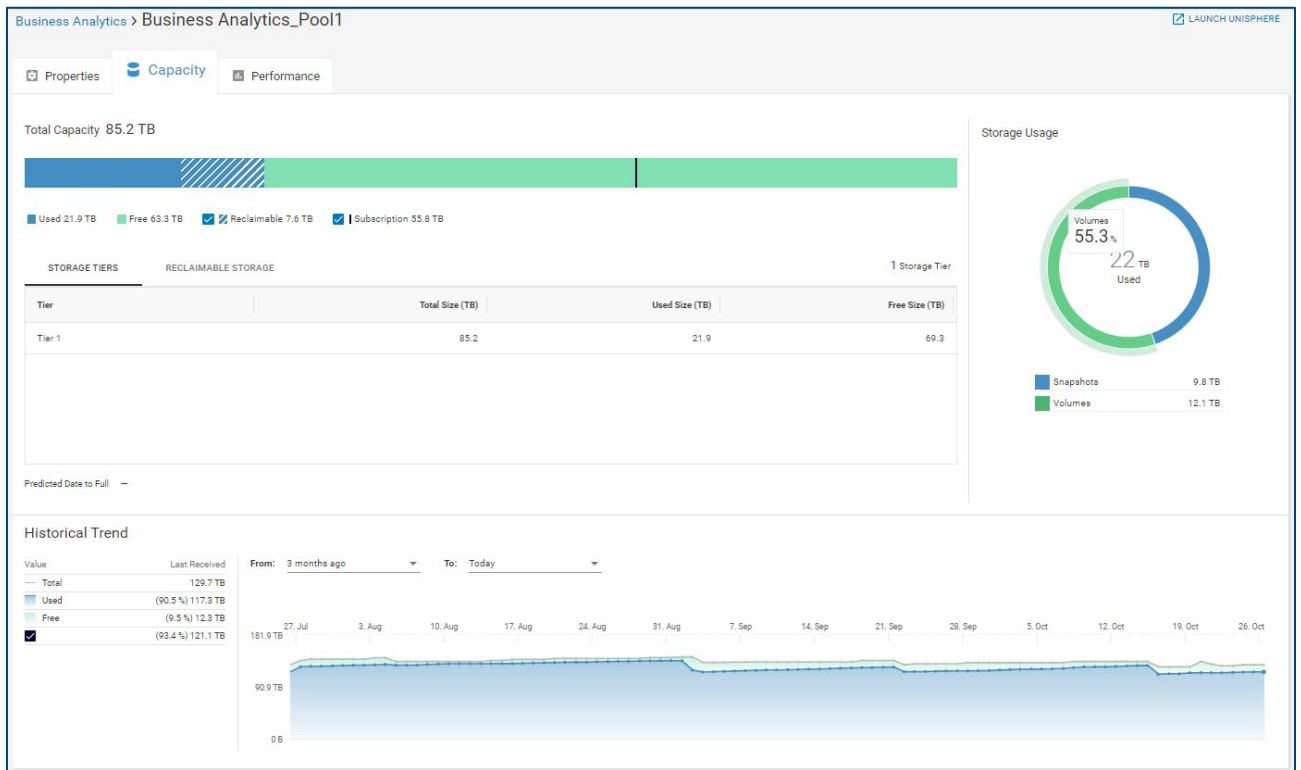
The **Subscribed** checkbox enables the user to view or hide the pool subscription data on the graph.

The **Confidence Range** checkbox enables the user to view or hide the upper and lower confidence range forecasts.

The bottom of the Pools Capacity tab provides details for the pool capacity, showing Used, Free, Reclaimable, and Subscribed. The Storage Usage ring shows how the used storage is configured.

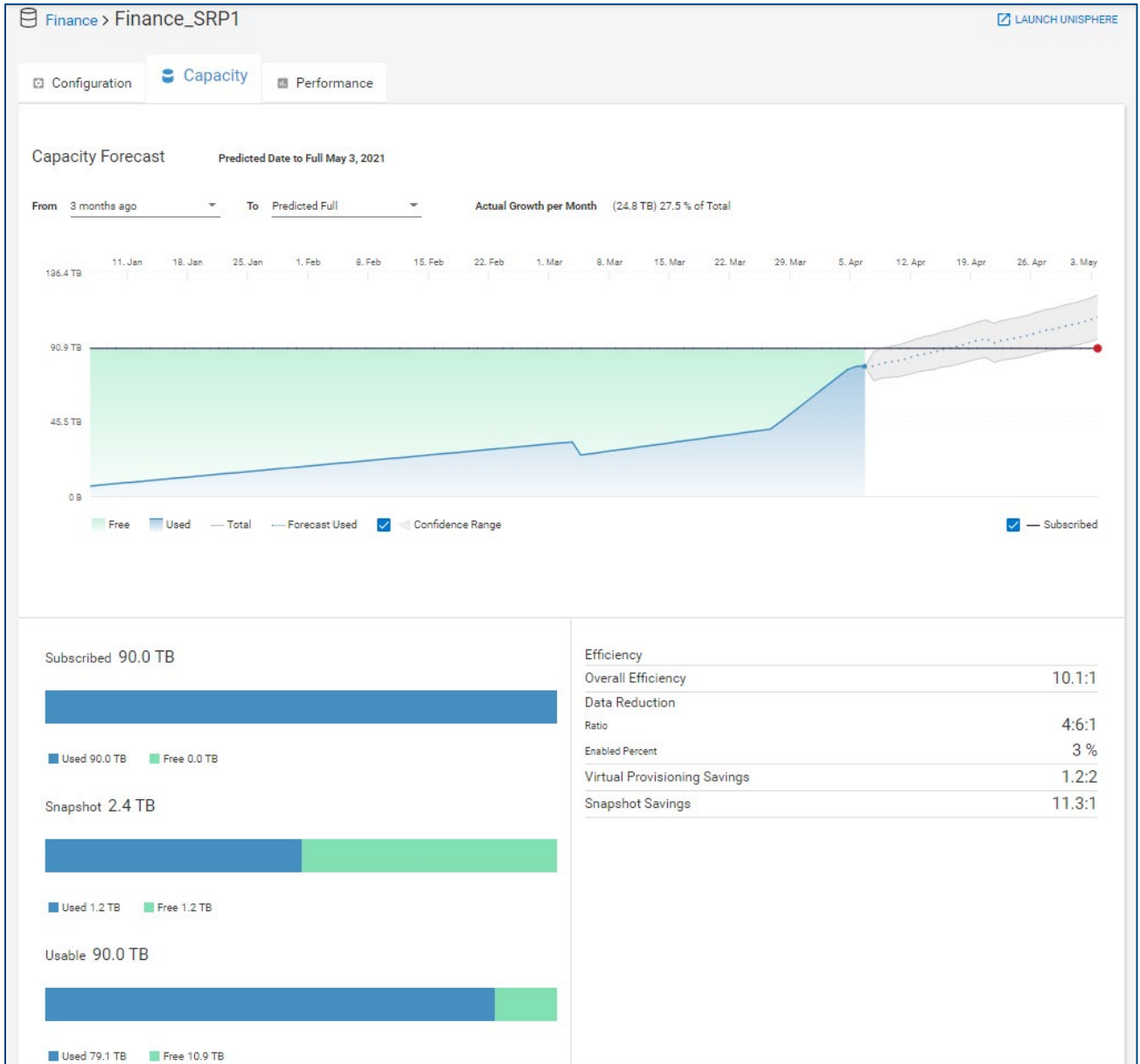
5.2.2.2 SC Series

For SC Series, the historical trend of Total, Used, Free, and Subscribed storage is provided along with a Predicted Date to Full. However, the chart does not display forecasting data.



5.2.2.3 PowerMax and VMAX3

For PowerMax and VMAX3 arrays, the Capacity tab displays a capacity forecast chart for storage resource pools. The bottom half of the page shows Used and Free storage in bar charts for Subscribed, Snapshot, and Usable space. It also displays the Overall Efficiency ratio. This ratio is calculated as the sum of all TDEVs plus snapshot sizes (based on 128 K track size) divided by the physical used storage (based on the compressed track size). Data Reduction ratio and enabled percentage, Virtual Provisioning savings, and Snapshot savings are also displayed.

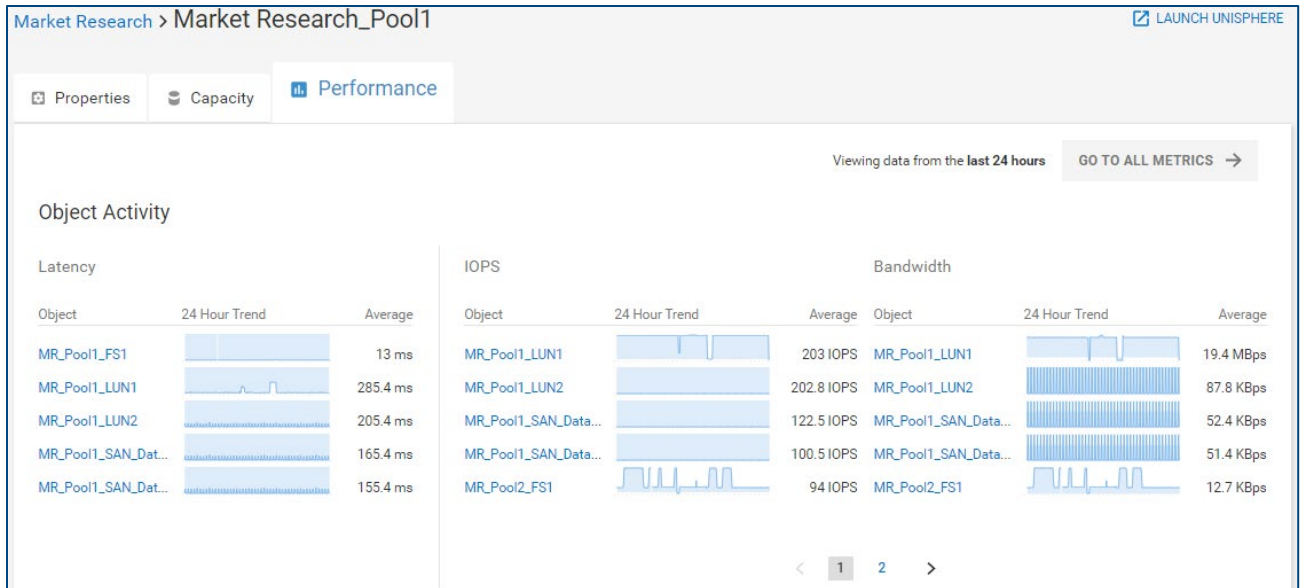


5.2.3 Pool Details – Performance

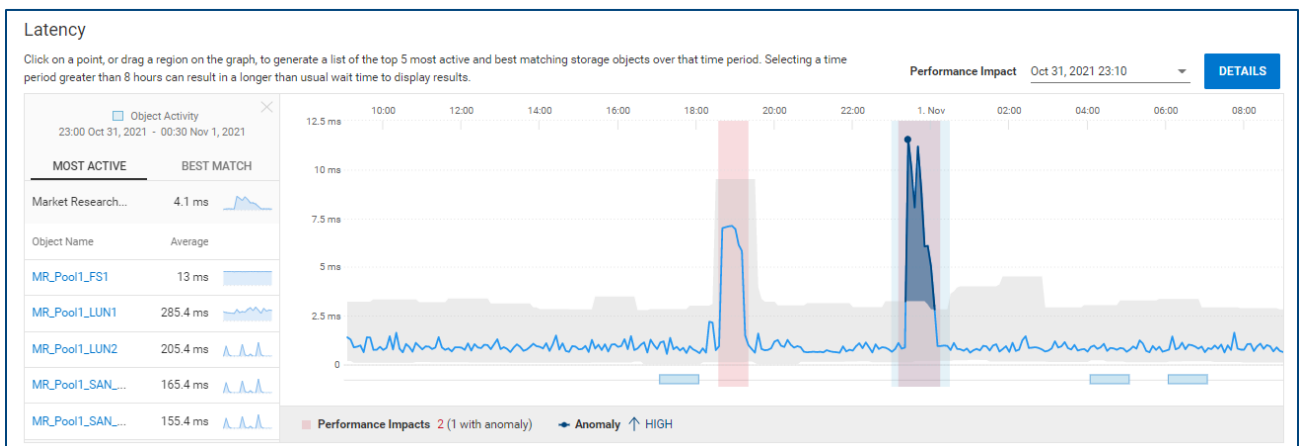
The Performance tab for pools is available for Unity, SC Series, PowerMax/VMAX, and PowerVault systems. The information under the Performance tab differs slightly for each supported array type.

5.2.3.1 Unity

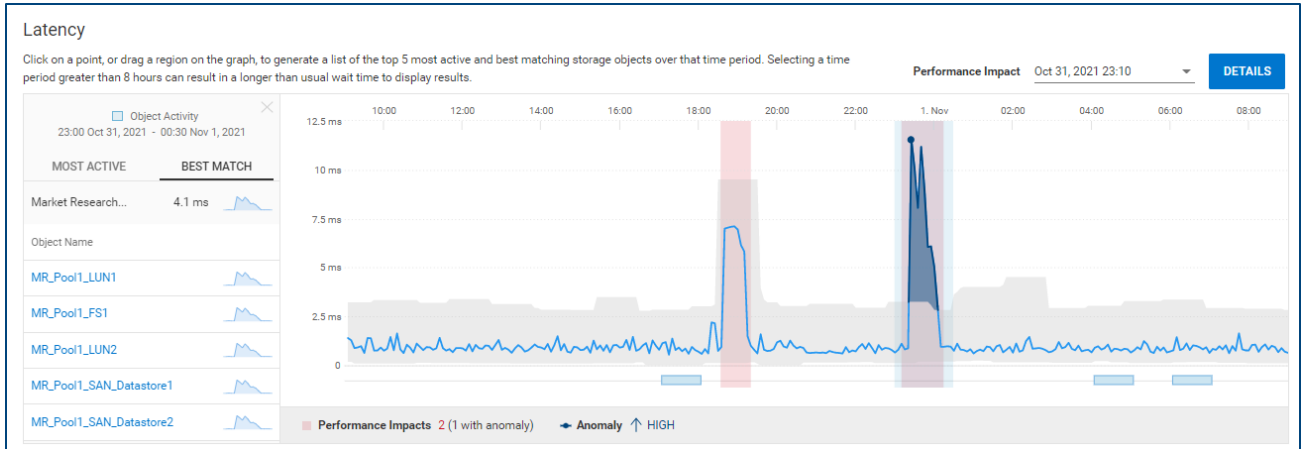
For Unity pools, the top of the page displays 24-hour trend lines and a 24-hour average for Latency, IOPS, and Bandwidth for both block objects and file systems. CloudIQ presents the top five objects associated to the pool. The user can scroll to see additional objects.



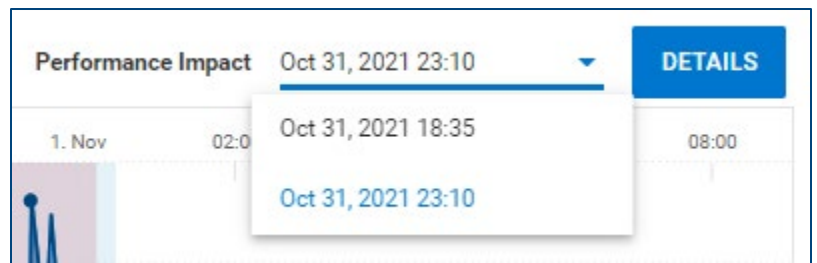
Scrolling down this view provides the user with detailed performance graphs for Latency, IOPS, Bandwidth, and Backend IOPS (one chart per tier). CloudIQ identifies and highlights not only performance anomalies on the Latency chart, but also performance impacts. Performance anomalies are highlighted in dark blue while performance impacts are highlighted in pink. Highlighting an area on the Latency, IOPS or Bandwidth performance graphs identifies up to the top five most active objects contributing to that metric over the highlighted period.



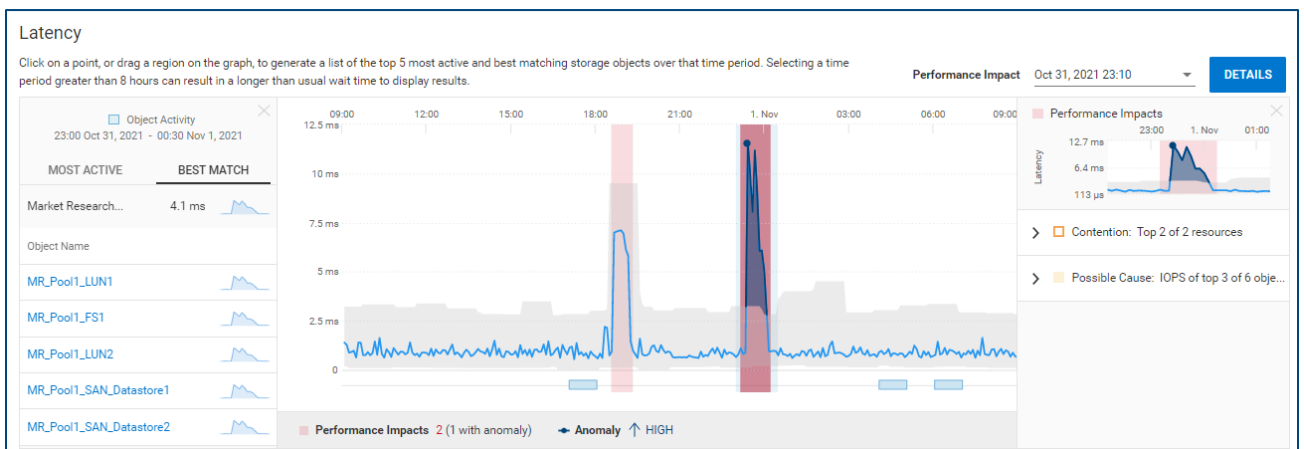
When the user selects Best Match on the left side of the chart, CloudIQ identifies up to five objects that have the highest correlation to the selected period. Best Match is available on the Block Latency, IOPS, and Bandwidth performance charts.



When there are performance impacts detected by CloudIQ, the user can view details of them by selecting the Details button in the upper right of the chart. If there are multiple performance impacts displayed on the chart, the user can select which impact to investigate by selecting the drop-down menu next to the date.

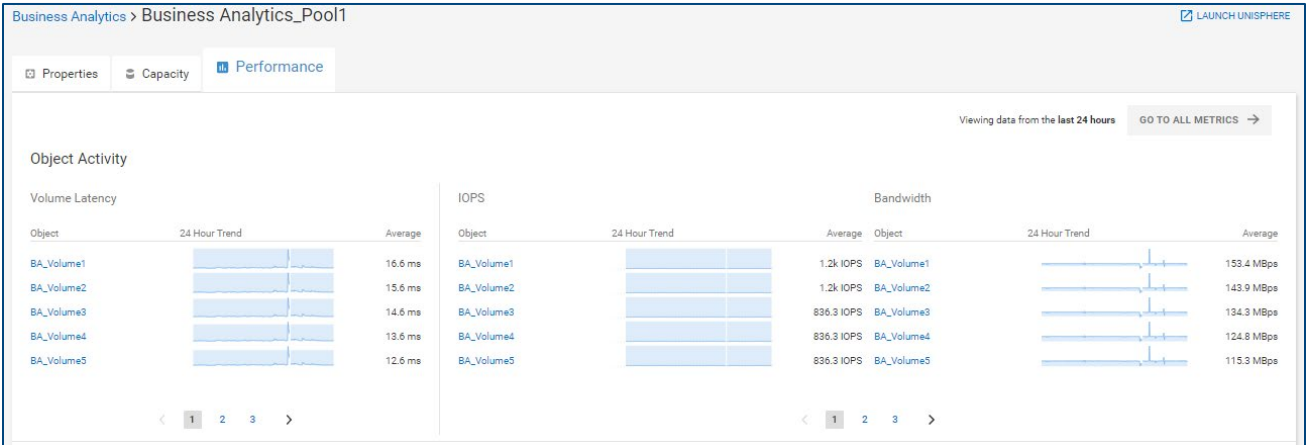


The following shows the results of the details of a performance impact. The right side of the chart shows the time of the selected performance impact and identifies the most likely causes (competing workloads) for the impact and if there is any resource contention.

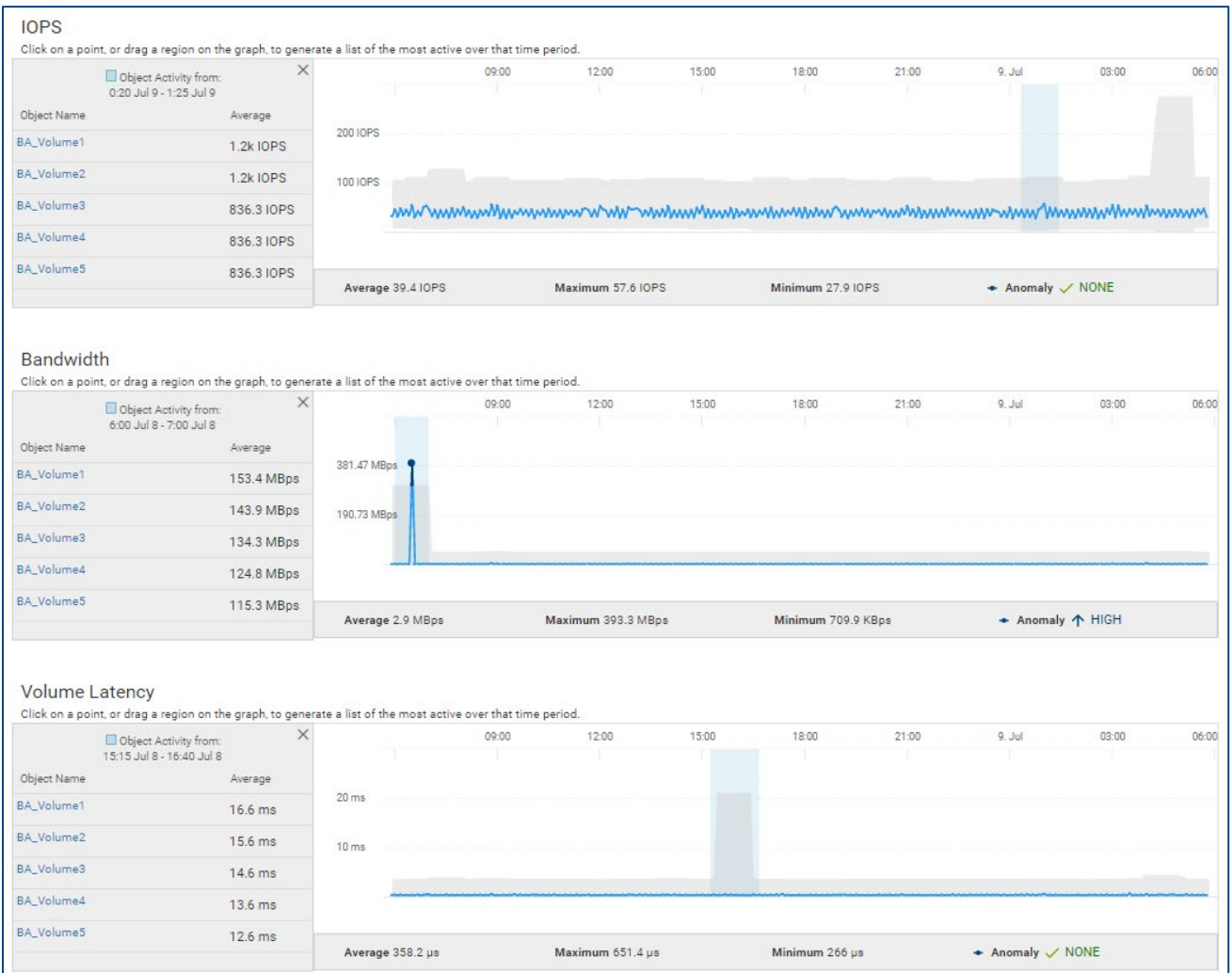


5.2.3.2 SC Series

Similar to Unity, the top half of the Performance tab for SC Series pools displays 24-hour trend lines and a 24-hour average for Latency, IOPS, and Bandwidth.

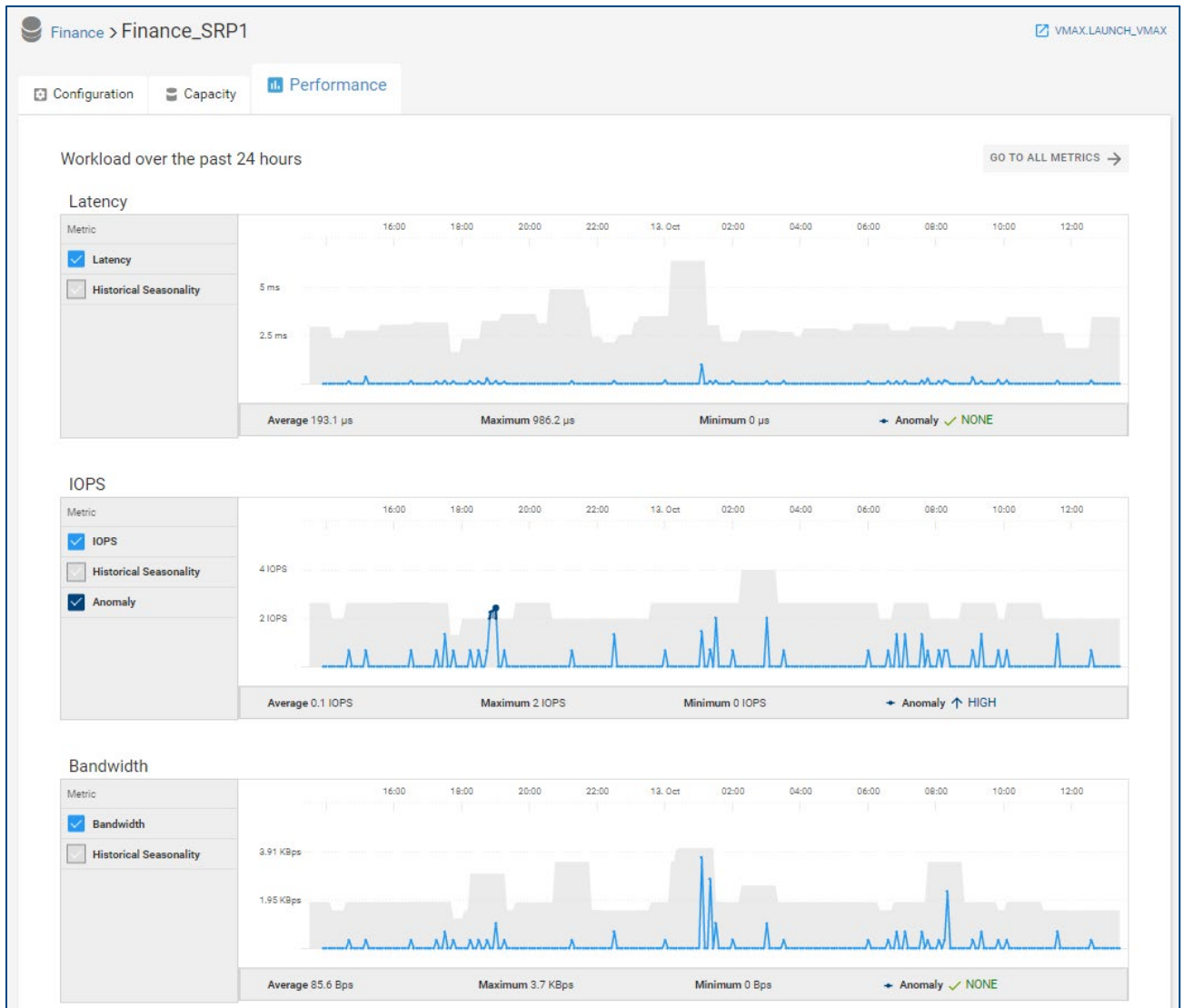


Scrolling down provides displays 24-hour performance graphs for IOPS, Bandwidth, and Volume Latency. CloudIQ identifies and highlights performance anomalies on each performance chart for SC Series pools. Highlighting an area in any of these graphs identifies the top volumes contributing to that metric during the highlighted period.



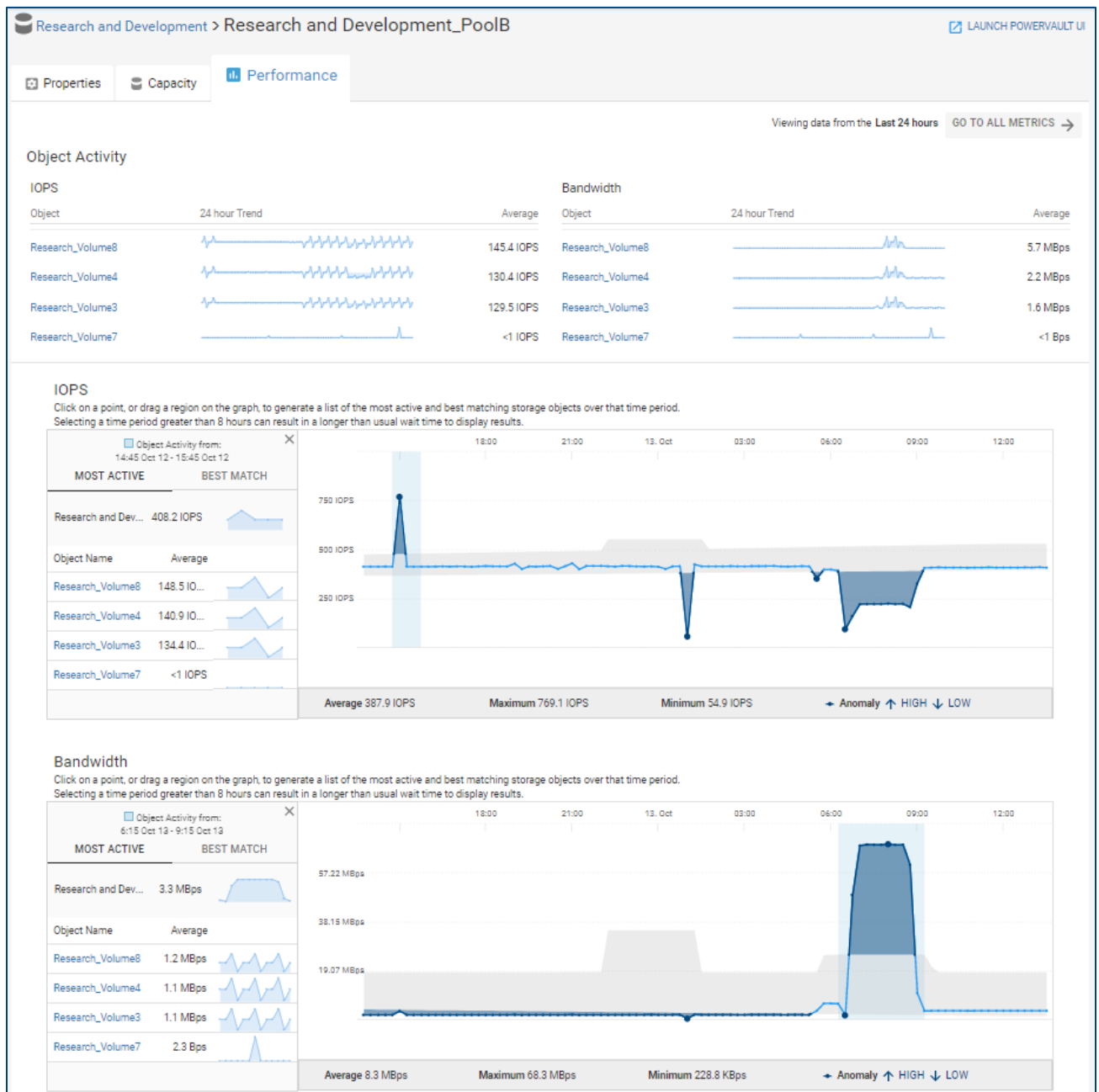
5.2.3.3 PowerMax

The Performance tab for PowerMax Storage Resource Pools provides 24-hour charts for Latency, IOPS, Bandwidth, %Read, IO Size, and Queue Length. CloudIQ identifies and highlights performance anomalies for each chart in the SRP Performance tab. The pool performance charts for PowerMax are not selectable.



5.2.3.4 PowerVault

The Performance tab for PowerVault pools also displays top object activity on the top half of the page and 24-hour charts at the bottom of the page. Metrics displayed include IOPS and Bandwidth. Selecting an area in the IOPS and Bandwidth charts displays the top volumes contributing to that metric during that time period.



Note: The Performance tab is not yet supported for PowerScale/Isilon pools.

5.3 Reclaimable Storage

The **Reclaimable Storage** page shows block and file objects that may no longer be in use. Reclaimable storage is supported for PowerMax, Unity, SC Series, and PowerVault systems. It shows the total number of storage objects and the total amount of potentially reclaimable space across all systems. The following criteria is used to identify potentially reclaimable storage:

- Block Objects with no front-end I/O activity
- File Objects with no front-end I/O activity
- Block Objects with no Hosts attached

Note: The Reclaimable Storage report intelligently filters out objects that are array-based replicas, since those replicas are not attached to hosts and do not have front-end I/O.

The **Group By** drop-down menu in the upper right of the page allows the user to group the storage objects by storage system or by the rule types mentioned above.

Group by System (Default) shows the total number of storage objects and reclaimable space per system. A more detailed view of the objects identified under each rule can be seen by selecting the line item to expand to display the associated details.

The Filter button allows the user to filter the results based on System or Rule Type.

The screenshot displays the 'Reclaimable Storage' dashboard. At the top, it shows '26 Total Storage Objects' and '35.0 TB Total Reclaimable Space'. A 'Group by: System' dropdown menu is visible in the top right. On the left, there is a 'System' filter section with a search box and a 'Rule Type' section with several checkboxes: 'Block Objects with no Hosts Attached', 'Block Objects with no front end I/O activity in at least the past week', and 'File Objects with no front end I/O activity in at least the past week'. The main content area is a table with columns for System, Rule Type, Storage Objects, Reclaimable Space, and a list of objects with their respective Reclaimable Space.

System	Rule Type	Storage Objects	Reclaimable Space
Production (Unity 650F) Storage Objects 8 Reclaimable Space 19.0 TB			
5	Block Objects with no front end I/O activity in at least the past week		Reclaimable Space 10.0 TB
2	Block Objects with no Hosts Attached		Reclaimable Space 2.0 TB
1	File Objects with no front end I/O activity in at least the past week		Reclaimable Space 7.0 TB
Market Research (Unity XT 880F) Storage Objects 4 Reclaimable Space 7.0 TB			
1	Block Objects with no front end I/O activity in at least the past week		Reclaimable Space 1.0 TB
3	Block Objects with no Hosts Attached		Reclaimable Space 6.0 TB
Business Analytics (SC7020F) Storage Objects 6 Reclaimable Space 7.61 TB			
2	Block Objects with no front end I/O activity in at least the past week		Reclaimable Space 1.63 TB
4	Block Objects with no Hosts Attached		Reclaimable Space 5.98 TB
Product Design (ME4084) Storage Objects 5 Reclaimable Space 2.02 TB			
3	Block Objects with no front end I/O activity in at least the past week		Reclaimable Space 1.7 TB
2	Block Objects with no Hosts Attached		Reclaimable Space 321.4 GB
Finance (PowerMax 2000) Storage Objects 3 Reclaimable Space 300.0 GB			
2	Block Objects with no front end I/O activity in at least the past week		Reclaimable Space 200.0 GB
1	Block Objects with no Hosts Attached		Reclaimable Space 100.0 GB

The **Group by Rule Type** shows reclaimable storage for each rule. In this view, the total number of storage objects and reclaimable capacity is summarized for each rule.

Reclaimable Storage

26 Total Storage Objects 35.0 TB Total Reclaimable Space

Group by Rule Type

System	Block Objects with no front end I/O activity in at least the past week	Storage Objects	Reclaimable Space
Enter a System Name or ID	Block Objects with no front end I/O activity in at least the past week Storage Objects 13 Reclaimable Space 14.0 TB		
	Production	Storage Objects 5	Reclaimable Space 10.0 TB
	Market Research	Storage Objects 1	Reclaimable Space 1.0 TB
	Business Analytics	Storage Objects 2	Reclaimable Space 1.63 TB
	Product Design	Storage Objects 3	Reclaimable Space 1.7 TB
	Finance	Storage Objects 2	Reclaimable Space 200.0 GB
	Block Objects with no Hosts Attached Storage Objects 12 Reclaimable Space 14.0 TB		
	Production	Storage Objects 2	Reclaimable Space 2.0 TB
	Market Research	Storage Objects 3	Reclaimable Space 6.0 TB
	Business Analytics	Storage Objects 4	Reclaimable Space 5.98 TB
	Product Design	Storage Objects 2	Reclaimable Space 321.4 GB
	Finance	Storage Objects 1	Reclaimable Space 100.0 GB
	File Objects with no front end I/O activity in at least the past week Storage Objects 1 Reclaimable Space 7.0 TB		
Production	Storage Objects 1	Reclaimable Space 7.0 TB	

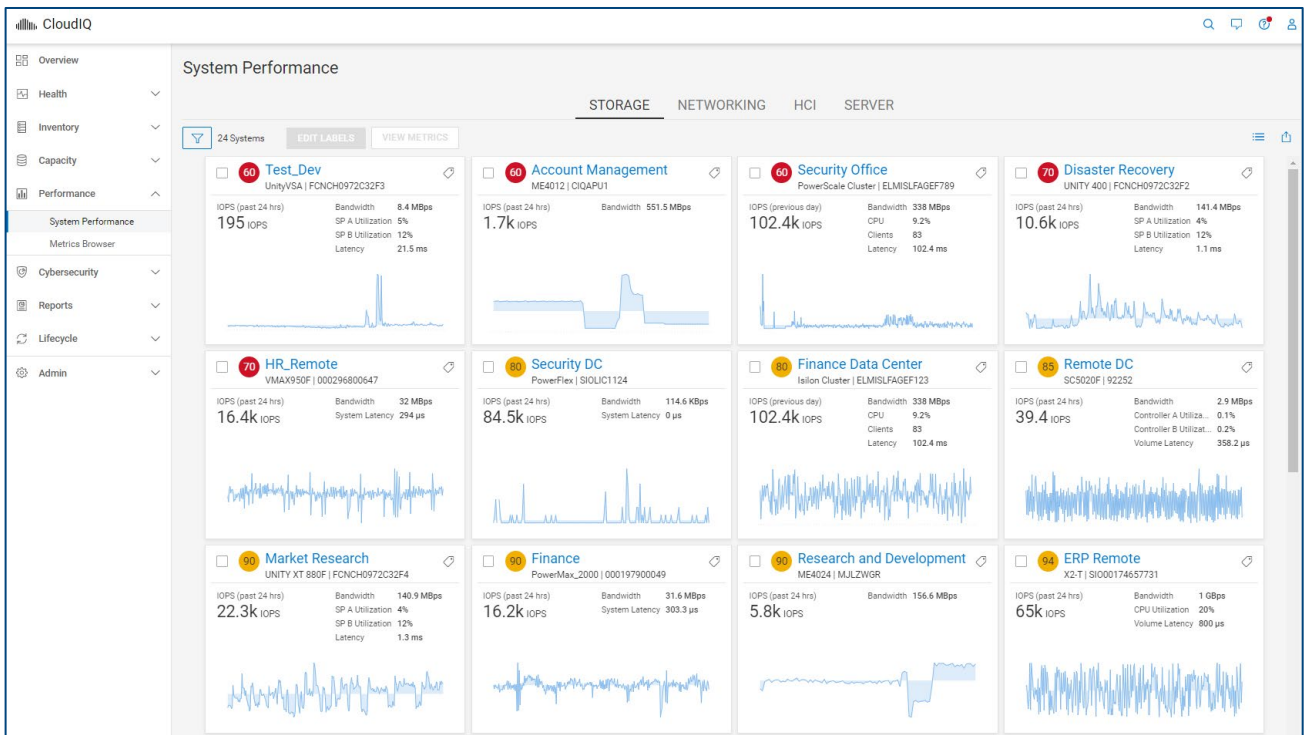
6 Performance

6.1 System Performance

The System Performance page displays system-level performance metrics across all systems.

The information displayed for storage systems includes:

- **IOPS** – Average I/O requests per second over the last 24-hour period.
- **Bandwidth** – System bandwidth showing average host bytes per second over the last 24-hour period.
- **Utilization (Card View Only)** – Average percent of time the Storage Processors (Unity) or Controllers (SC and XtremIO) are busy over the last 24-hour period.
- **Latency** – The average time required for a packet to travel from the host to the objects over the last 24-hour period. For PowerMax and VMAX, displays the response time for read and write I/O requests for the system.
- **Performance Trend graph** – Chart showing IOPS over the past 24 hours with a data point on every update (varies slightly per product type).

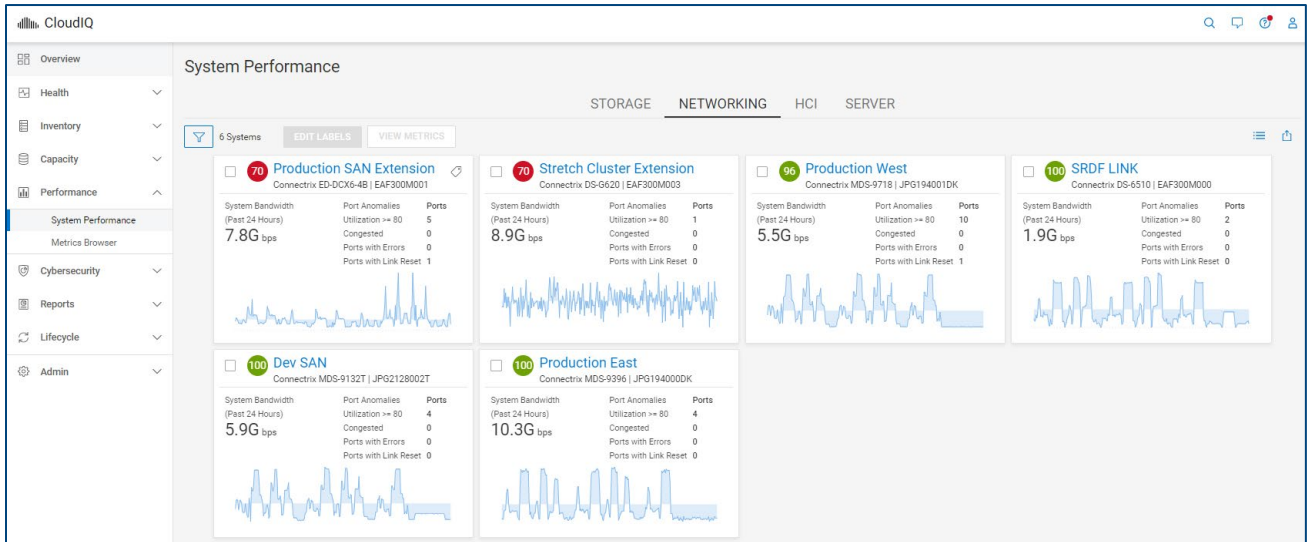


For storage systems and Connectrix, CloudIQ offers the additional feature of enabling the user to select multiple systems (up to 10) to compare performance metrics. The user can click the checkbox to select the systems to compare, and then click the **Compare Metrics** button. In the Card view, the checkbox is in the upper left corner of each card, and in the List view, the checkbox is in the leftmost column. The “Compare Metrics” button only appears on the UI after you have chosen more than one system.

Note: Only systems of the same product type can be selected for comparison.

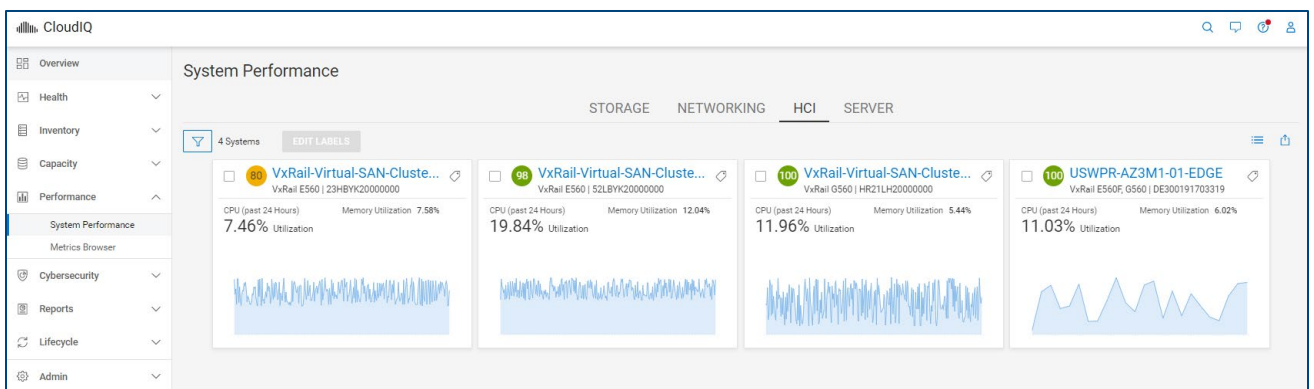
The System Performance information displayed for switches includes:

- **System Bandwidth** – Average bandwidth for the switch over the last 24-hour period.
- **Utilization >= 80%** - Number of ports with utilization greater than or equal to 80%
- **Congested** – Number of ports with congestion
- **Errors** – Number of ports with errors
- **Link Reset** – Number of ports with link resets



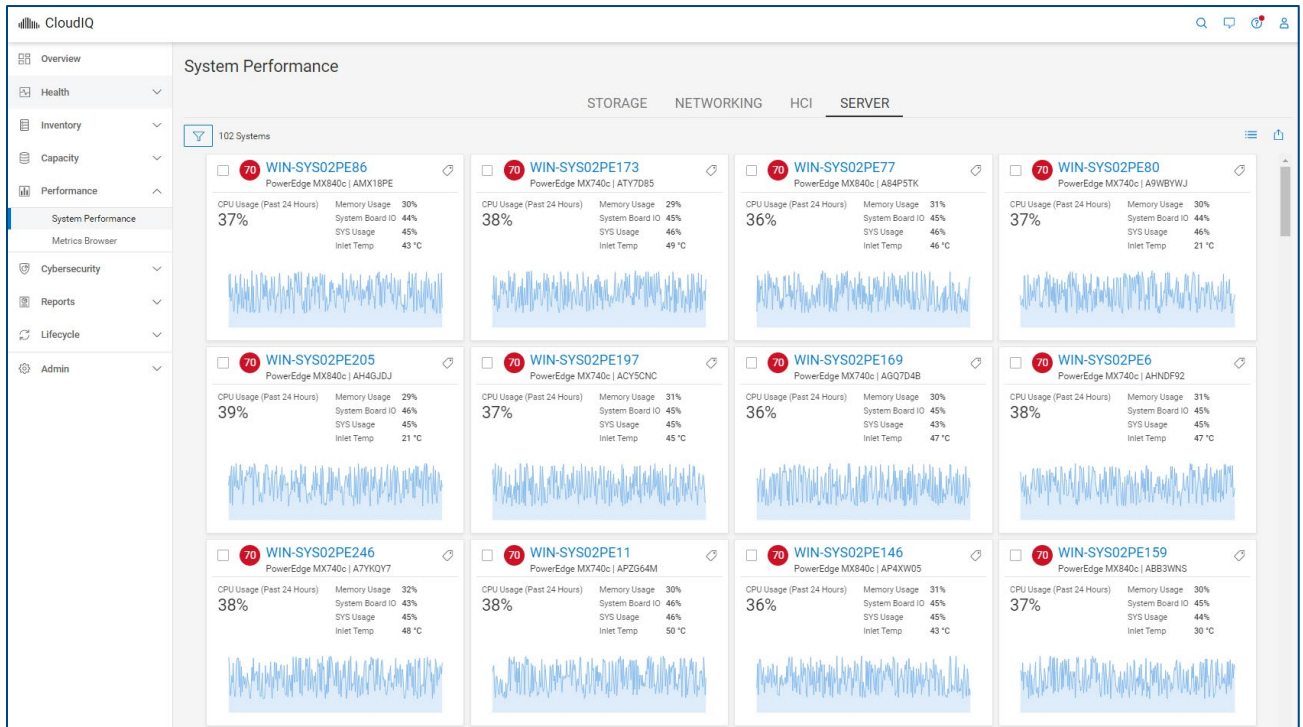
Note: PowerSwitch performance is not yet supported at the time of this publication.

VxRail systems display a 24-hour chart of CPU utilization and the 24-hour average for CPU and Memory Utilization.



PowerEdge servers show the following performance metrics:

- CPU Usage – Percentage of CPU consumed by the server
- Memory Usage – Percentage of RAM the server uses based on what is allocated
- System Board IO
- SYS Usage
- Inlet Temp – Temperature reading in Celsius



6.2 Metrics Browser

Note: There are plans to remove support for Metrics Browser in the future. This functionality will be replaced by the Custom Reporting feature.

The Metrics Browser section allows the user to create custom performance dashboards. Different performance metrics are available based on the selected System type and Category, as shown in the tables below. The Metrics Browser supports APEX Block Storage Services, Unity, PowerStore, PowerMax, PowerVault, SC Series, XtremIO, Connectrix, and VMware.

APEX Block Storage Services

Metric	System	Volume	Volume Group
Bandwidth	X	X	X
CPU Utilization			
IOPS	X	X	X
Latency	X	X	X
% Read			
IO Size		X	X
Queue Depth		X	

Dell EMC Unity Metrics

Metric	Block	Drive	Ethernet	Fibre Channel	File	iSCSI	Pool	Pool Backend	System	System Backend	System-Cache
Bandwidth	X	X	X	X	X	X	X	X	X	X	
Block Latency	X						X		X		
CPU Utilization									X		
IO Size	X				X		X	X	X	X	
IOPS	X	X			X		X	X	X	X	
% Read	X	X			X		X	X	X	X	
Queue Length	X						X		X		
VVol Latency							X		X		
Errors			X								
Packets			X								
Requests				X		X					
Total Link Errors				X							
% Clean											X
% Dirty											X
% Free											X
% Read Hits											X
% Write Hits											X
Flushed											X

PowerStore Metrics

Metric	Appliance	File System	System	Volume	Volume Group
Bandwidth	X	X	X	X	X
CPU Utilization	X				
IOPS	X	X	X	X	X
Latency	X	X	X	X	X
% Read		X			
IO Size		X		X	X
Queue Depth				X	

SC Series Metrics

Metric	Drive	FC, SAS, iSCSI	Pool	Pool Backend	System	System Backend	Volume
Bandwidth	X	X	X	X	X	X	X
Latency	X	X	X	X	X	X	X
CPU Utilization					X		
IO Size		X	X	X	X	X	X
IOPS	X	X	X	X	X	X	X
% Read	X	X	X	X	X	X	X
Queue Length	X	X	X	X	X	X	X

PowerVault Metrics

Metric	Controller	Drive	Host	Pool	Pool Backend	System	System Backend	Volume
% Read	X	X	X	X	X	X	X	X
Bandwidth	X	X	X	X	X	X	X	X
IO Size	X	X	X	X	X	X	X	X
IOPS	X	X	X	X	X	X	X	X
% Read Hits								X
% Write Hits								X

XtremIO Metrics

Metric	Initiator	System	Target	Volume
Bandwidth	X	X	X	X
Block Latency	X	X	X	X
IOPS	X	X	X	X
CPU Utilization		X		

PowerMax/VMAX Metrics

Metric	FE Director FE Port	RDF Director	RDF Port	RDFA Group	RDFS Group	Storage Group	Storage Resource Pool	System
Bandwidth	X	X	X		X	X	X	X
Latency					X	X	X	X
IOPS	X	X	X		X	X	X	X
IO Size		X				X	X	
% Read						X	X	
Queue Length						X	X	
% Busy	X	X	X					
Queue Depth Utilization	X							
Read Latency	X							
Write Latency	X							
Avg IO Service Time				X				
Compressed Bandwidth				X				
RDF R1 to R2 Bandwidth				X				
RDF R1 to R2 IOPS				X				
RDF R2 to R1 Bandwidth				X				
RDF R2 to R1 IOPS				X				
RDF/A WP Count				X				
% Hit					X			
% Write					X			

VMware Metrics

Metric	ESXi	Virtual Machine	Datastore
Active Memory	X	X	
Bandwidth per Datastore		X	

CPU Readiness		X	
CPU Usage	X		
IOPS per Datastore		X	
Latency per Datastore		X	
Storage Latency		X	
Capacity			X
Free Space			X
Uncommitted			X

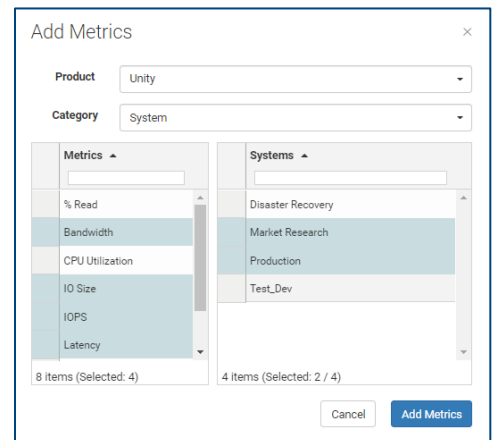
Connectrix Metrics (Fibre Channel Only)

Metric	Switchport	System
Buffer Errors	X	
Class-3 Discards	X	
Congestion Ratio	X	
CRC Errors	X	
Link Resets	X	X
Physical Layer Errors	X	
Protocol Errors	X	
Throughput	X	X
Time at Zero Tx Credit	X	
Utilization	X	X
B2B Credit Zero/sec		X
Errors		X

6.3 Creating a Dashboard

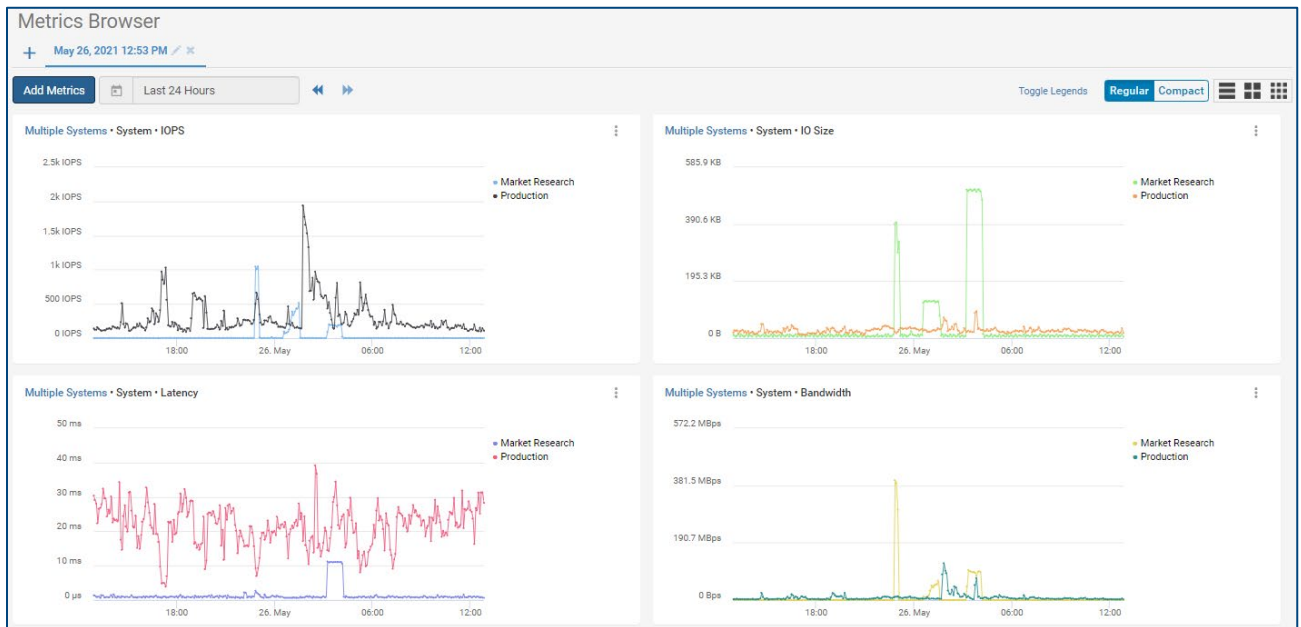
Selecting **Add Metrics** from the Metrics Browser page opens a window that allows the user to select which metrics and objects to add to the performance dashboard.

1. Select the Product.
2. Select the Category.
3. Select System (for nonsystem metrics)
4. Select the performance metrics from the Metrics list.
5. Select one or more Systems or Objects.
6. Select Add Metrics.



The resulting dashboard shows the performance graphs for each selected metric and object. Scrolling across the graph with the mouse displays vertical lines on each graph with the associated metric values in the legends for quick correlation of performance at any given time. These charts can be viewed with one, two, or three charts per row. By default, the time range is set to Last 24 Hours, but can be changed using a predefined value ranging from Last Hour to Last 7 Days. The user can also enter a custom time range allowing for longer and specific time ranges.

The user can also remove the legends by selecting Toggle Legends. This expands the horizontal space to view the chart. Changing from Regular charts to Compact charts reduces the chart height allowing the user to see more information in a smaller area.



Note: VVol data is not included in object-level (LUN, file system, and drive) metrics because VVol object data is not collected.

7 Cybersecurity

Cybersecurity is a new feature within CloudIQ that adds the ability to monitor Dell resources for security risks. CloudIQ compares configurations and setups to a set of security-related evaluation criteria, notifying users of any deviations from the configured plan. Cybersecurity is supported for PowerMax and PowerStore storage systems and will continue to expand coverage to other Dell systems.

Note: In order to gain access to Cybersecurity, users must be given either the Cybersecurity Viewer or Cybersecurity Admin role. A CloudIQ Admin user must assign these roles to users. See Section 20.6 User Access for additional details.

7.1 System Risk

The System Risk page is the multisystem view for Cybersecurity. It displays all systems that are enabled for Cybersecurity along with the Risk Level, percentage of tests enabled in the Evaluation Plan, and summary of Issues. The Risk Level provides an overall assessment for the system and has one of the following values:

- Normal
 - No active Cybersecurity issues.
- Low
 - One or two active Low severity Cybersecurity issues.
 - There are at least five enabled tests and the number of enabled tests is greater than 70%.
- Medium
 - One to five active non-High severity Cybersecurity issues with at least one being Medium and number of enabled tests greater than five.
 - Greater than two active Low severity Cybersecurity issues and the number of enabled tests is greater than five.
- High
 - One or more active High severity Cybersecurity issues and the number of enabled tests is greater than five.
 - More than five non-High active issues where at least one issue is Medium severity and the number of enabled tests is greater than five.
- Unknown
 - Evaluation Plan is disabled.
 - Number of enabled tests is less than or equal to five.
 - There are no active Cybersecurity issues and the number of enabled tests is less than 70%.
 - There are one or two active Low severity Cybersecurity issues and the number of enabled tests is less than 70%.

7.2 Cybersecurity Issues

The Cybersecurity Issues page provides an overall listing of Cybersecurity issues that have been identified in the environment. The Active tab lists out all active issues and provides the severity, issue name, associated system, and when it was created. Expanding the issue provides the issue description and the recommended remediation, creation timestamp, security control family, and evaluation test. The Resolved tab lists out all issues that have been corrected and the timestamp for when the issue was resolved.

The screenshot shows the 'Cybersecurity Issues' page in CloudIQ. The left sidebar contains navigation options: Overview, Health, Inventory, Capacity, Performance, Cybersecurity (expanded), System Risk, Cybersecurity Issues (selected), Policy, Reports, Lifecycle, and Admin. The main content area is titled 'Cybersecurity Issues' and has tabs for 'ACTIVE (4)' and 'RESOLVED (1)'. Below the tabs, it says '4 Issues on 1 Systems'. A table lists the issues:

Severity	Issue	System	Created
Medium	Data at Rest Encryption is disabled	Finance	67 days ago
Medium	LDAP server certificate verification is disabled	Finance	117 days ago
Low	SNMP trap destination is not configured	Finance	117 days ago
High	PowerMax system requires a software upgrade	Finance	77 days ago

The expanded view for the first issue shows:

- Description:** This test verifies whether Data at Rest Encryption (D@RE) is enabled. D@RE prevents data visibility in the event of its unauthorized access or theft.
- Remediation:** Enabling D@RE requires re-installation of the PowerMax system. Contact [Dell Technical Support](#) for help.
- Created:** Thu, April 01 2021, 07:00:00 AM UTC
- Security Control Family:** System and Communications Protection
- Evaluation Test:** Data At Rest encryption enabled

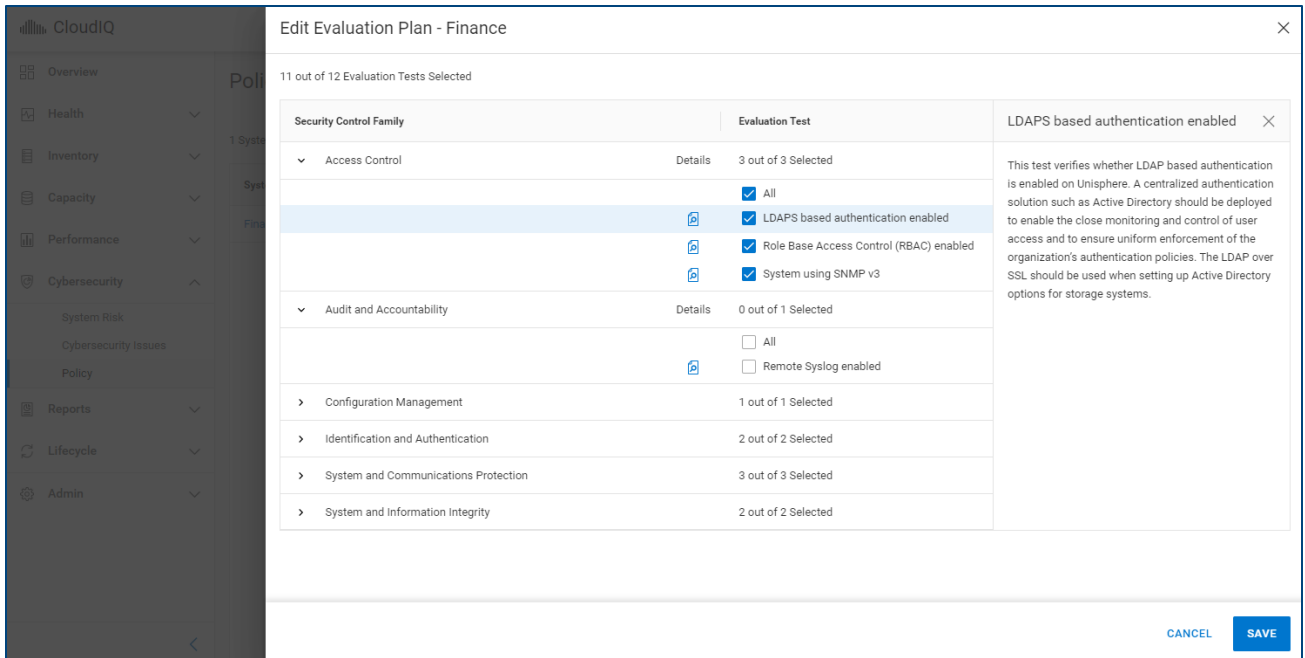
7.3 Policy

The Policy Page is where users enable, disable, and configure the tests in the Evaluation Plan. This page lists the Cybersecurity enabled systems, and allows a CyberSecurity Admin user to enable or disable the Evaluation Plan for each system by clicking the Enable Evaluation Plan button. It also shows how many evaluation tests are selected, system name, model, location, and the last time the Evaluation Plan was updated.

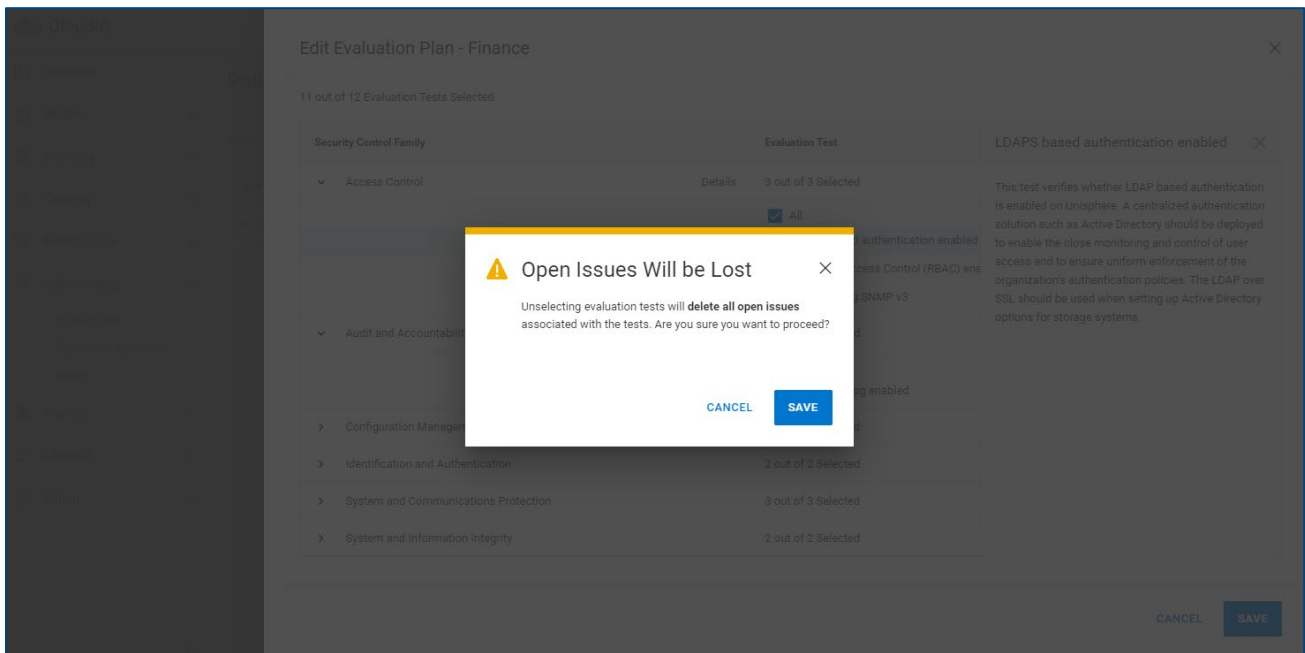
The screenshot shows the 'Policy' page in CloudIQ. The left sidebar is the same as in the previous screenshot. The main content area is titled 'Policy' and shows '2 Systems (2 Enabled)'. A table lists the systems:

System	Enable Evaluation Plan	Tests Selected	Identifier	Model	Location	Last Update Time	
Finance	<input checked="" type="checkbox"/> 12	12 out of 12	Finance	PowerMax_2000	Round Rock, TX	Sep 12 2021, 02:04...	EDIT
Manufacturing...	<input checked="" type="checkbox"/> 6	6 out of 7	Manufacturing_Prod	PowerStore 1000X	Hopkinton, MA	Oct 29 2021, 02:04...	EDIT

Selecting the Edit button opens the Edit Evaluation Plan window for the system. Each of the possible evaluation tests is listed and grouped by Security Control Family (based on NIST 800-53 R5). Each test can be selected or cleared for inclusion in the Evaluation Plan. Selecting the Details icon provides a detailed description of the test.



When an Evaluation Test is cleared and removed from the Evaluation Plan, any associated active issues for that test will be deleted. The following warning is provided anytime the user removes an Evaluation Test and saves the Evaluation Plan.



Users will be notified in the What's New section when new tests are added to the product. By default, those tests will be disabled by default.

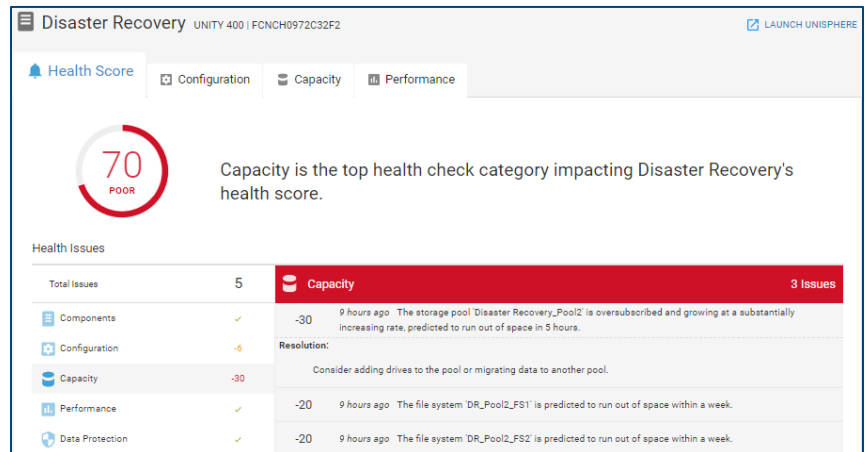
8 Storage System Details

Selecting the storage system hyperlink in the overview page or any of the multisystem views opens the System Details page for that system. The following sections discuss each tab of the Storage System Details page in greater depth.

8.1 Storage System Details – Health Score

The Health Score tab shows the details for a selected system driving the health score number. The view provides a listing of issues found in each of the following categories:

- Components
- Configuration
- Capacity
- Performance
- Data Protection



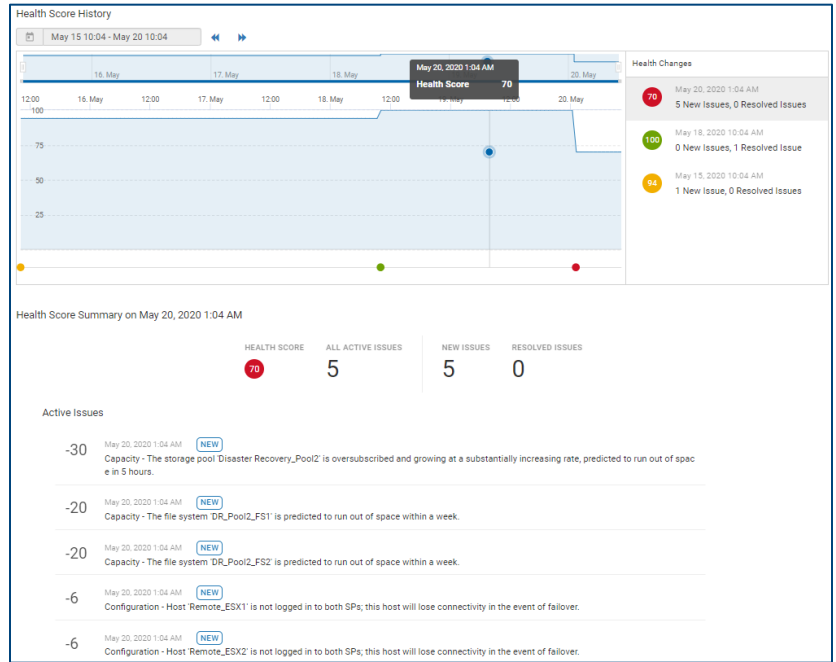
In this example there are five issues, two in the Configuration category and three in the Capacity category. Selecting the category and then selecting one of the issues will display the recommended resolution.

For issues reported against APEX Data Storage Services, CloudIQ directs the user to the DTMS Team. The DTMS team is notified of the issue, and they are responsible for maintaining the system.

Notes: The Components and Data Protection categories do not apply for PowerMax/VMAX systems. The Performance and Data Protection categories do not apply for PowerVault ME4 systems. The Data Protection category does not apply for VxRail systems. Only the Components category is currently used for PowerEdge, Connectrix, and PowerSwitch.

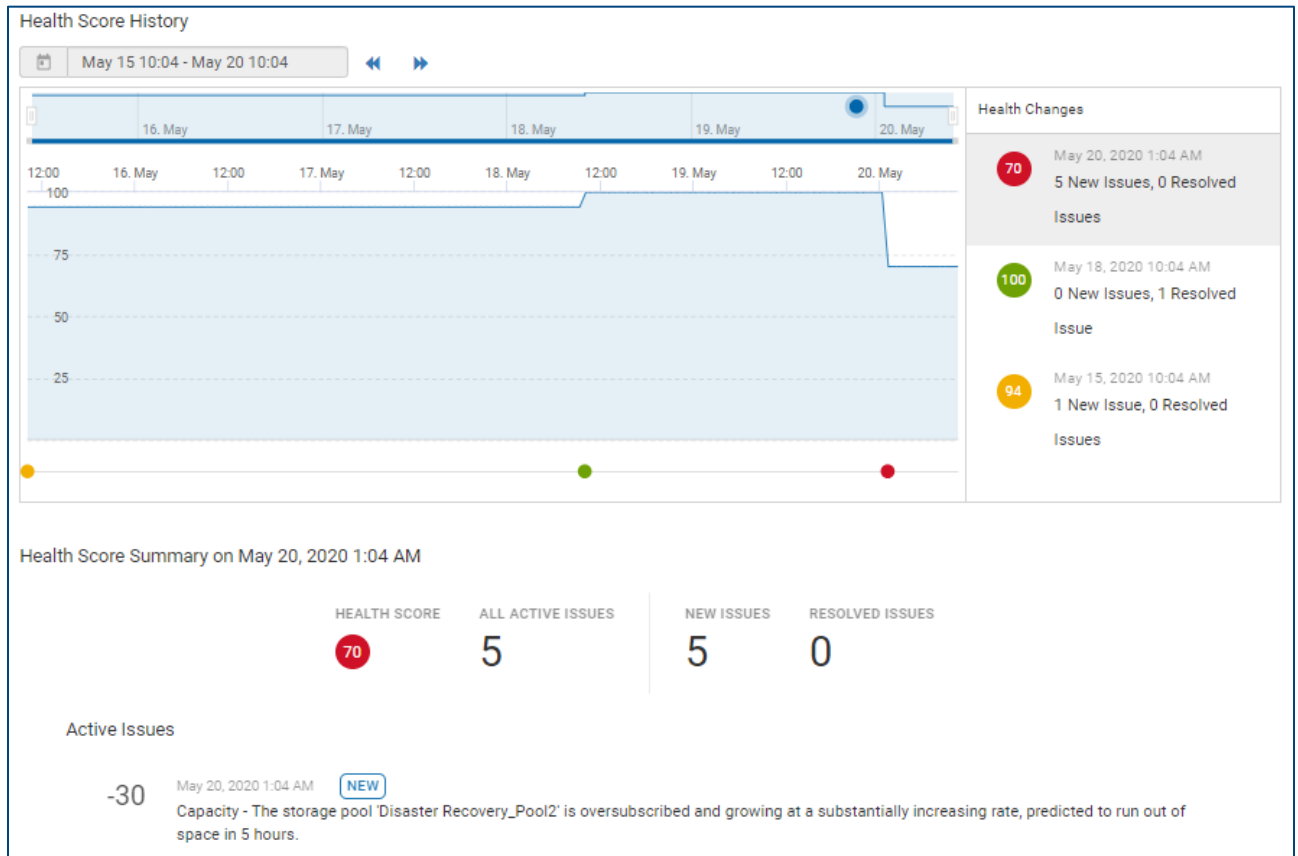
Scrolling down in this view shows the history of the health score for the system as shown below. This graph displays the historical trend of the health score and details of any issues over the displayed range of time.

Selecting an issue listed to the right of graph will mark the change on the timeline and a summary of the active issues will be displayed below the graph. Selecting an individual active issue will open a recommended resolution.



Selecting the calendar will open a drop-down, allowing users to select one of the predefined ranges or enter a custom time range. A custom view is the default. Selecting any of the dates on the right will present the list of issues for that date.

Viewing a history of health issues across a longer-term time range can be helpful in identifying recurring issues in the environment.



8.2 Storage System Details – Configuration

The Configuration tab shows the configuration data and contract information of the selected system as well as the physical and logical components of the system. For traditional storage systems, the upper portion of this view provides the system attributes such as Serial Number/ServiceTag, Model, Location, Code Version, IP Address, and Contract Expiration. Some attributes vary by system type (such as Uptime and Hotfixes which are specific to Unity).

For APEX Data Storage Services, not all of this information is applicable. APEX Data Storage Services will show Site ID, Site Location and Last Contact Time.

Issues	Name	Type	Total Size (TB)	Used (%)	Subscription (%)	Time To Full	Free (TB)
✓	Disaster Recovery_Pool1	Traditional	24.7	45.3	145.5	Unpredictable	13.6
1	Disaster Recovery_Pool2	Traditional	13.7	54.7	145.5	Imminent	6.2
✓	Disaster Recovery_Pool3	Traditional	82.5	54.5	145.5	Within a month	37.5

As noted earlier, CloudIQ indicates when a storage system has a code update available. In this single system view, there is also an indication if the management software has an available update. Clicking the “Learn More” link opens a dialog with summary information and relevant links to support resources.

The bottom half of the page provides details about the physical and logical components of the system. The tabs differ based on product type but could include:

- Pools (Unity, SC Series, PowerVault, and PowerScale/Isilon) / Storage Resource Pools (PowerMax/VMAX)
- Storage (APEX Block Services, Unity, PowerStore, SC Series, and PowerVault) / Volumes (XtremIO) / Storage Groups (PowerMax/VMAX)
- Virtual Machines (APEX Block Storage Services, Unity, PowerStore, SC Series, XtremIO, and PowerMax/VMAX)
- Drives (Unity, PowerStore, SC Series, and PowerVault)
- Hosts (APEX Block Services, Unity, PowerStore, and XtremIO) / Servers (SC Series) / Initiators (PowerVault)
- Consistency Groups (XtremIO)
- Service Levels (PowerMax/VMAX)
- System Health Checks (PowerMax)
- Nodes (PowerScale/Isilon and APEX File Storage Services)
- Appliances (PowerStore)
- Storage Containers (APEX Block Storage Services and PowerStore)

The **Pools** or **Storage Resource Pools** tab shows various information about the configured storage pools including Total Size, Used %, Subscription %, Time to Full, and Free. This information helps in understanding the pools at risk where subscription rate is greater than the total free storage and the Time to Full has a defined prediction.

The **Storage** or **Volumes** tab shows all the storage objects in the system. Depending on product type, this tab displays various used and free capacity information for the storage objects.

- PowerStore, APEX Block Storage Services: Volumes and File Systems
- Unity: LUNs, File Systems, VMware vStorage VMFS, and VMware NFS
- SC Series: Volumes
- XtremIO: Volumes

This view can help to determine which specific object is consuming the greatest amount of storage.

The **Storage Groups** tab lists the storage groups on the system with the capacity, the associated storage resource pool, service level, and the status of compliance with the service level objective.

The **Virtual Machines** tab lists the VMs on the storage system along with various details including the operating system and associated vCenter, ESXi Server, and ESXi Cluster.

The **Drives** tab gives the details on the drives for the given storage system and their location in the system. It includes remaining endurance, storage tier, and firmware version. There will also be an indication if there is a firmware update available.

The **Hosts, Servers, or Initiators** tab gives the details about the hosts attached to this storage system. It includes hostname, IP Address, operating system, initiator protocol, and total accessible storage for each host from the specific storage system. For PowerVault initiators, it lists the initiator name, protocol, and total provisioned storage to each initiator from the storage system.

The **Consistency Groups** tab lists the XtremIO consistency groups on the system including their mapped status, number of volumes and total and used capacities.

The **Service Levels** tab lists the configured service levels on PowerMax systems along with the expected response times.

The **System Health Checks** tab (PowerMax) provides pass or fail information for various system checks.

The **Nodes** tab provides information about each PowerScale/Isilon node such as node type, total, and capacity, used capacity, and associated pool.

The **Appliances** tab lists each appliance in the PowerStore cluster along with attributes such as State, Serial Number, CPU, Used, and Provisioned storage.

The **Storage Containers** tab provides capacity information for the storage containers in the PowerStore cluster or APEX Block Storage Service.

8.3 Storage System Details – Capacity

The Capacity tab shows slightly different information depending on the product type. The storage capacity details for APEX Block Storage Services, APEX File Storage Services, Unity, PowerStore, SC Series, PowerVault, PowerFlex, and PowerScale/Isilon include:

- Total Capacity
- Storage Usage
- Drive Type Usage (Not applicable for Isilon or PowerFlex)
- Pools (Not applicable for PowerStore or PowerFlex)

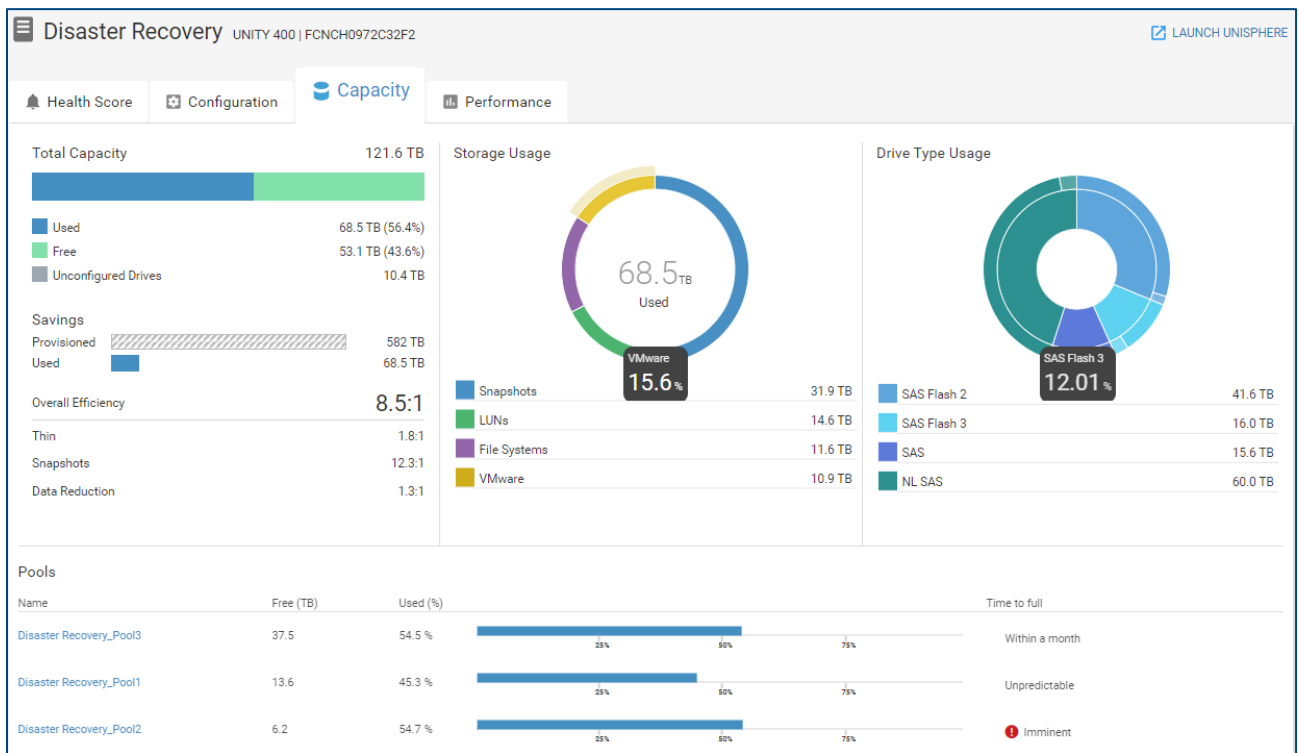
The **Total Capacity** graph provides a breakdown of raw storage to Used, Free, and Unconfigured Drives (Unprovisioned Capacity for Isilon).

Savings includes a breakdown of the Logical and Used capacity of the total storage visible to the hosts, and the Efficiency Savings explained previously.

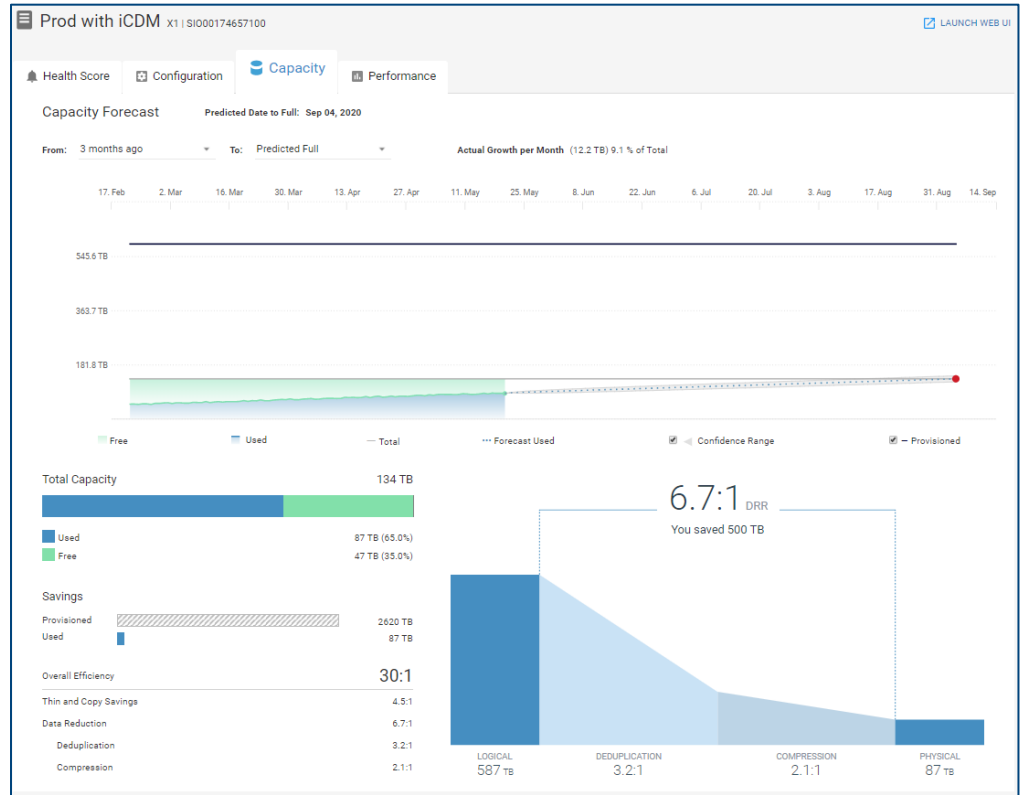
Storage Usage shows the consumed capacity of these categories of storage objects: Block (LUNs for Unity, Volumes for PowerStore, SC Series, and PowerVault), File Systems (Unity and PowerStore), Virtual Hot Spares (PowerScale/Isilon), User data (PowerScale/Isilon), VMware (VMware datastores for Unity and PowerStore), and Snapshots.

Drive Type Usage (not available for PowerScale/Isilon or APEX File Storage Services) shows the drive types installed in the system, with configured and unconfigured capacity. Hovering over the rings will show the details related to that configuration.

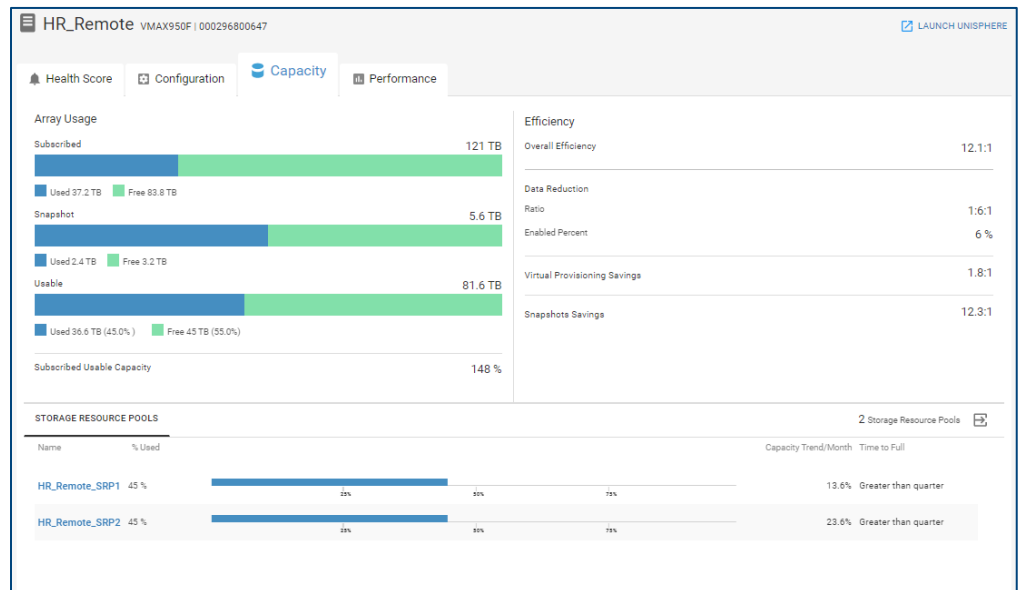
The **Pools** table lists the configured storage pools on the system. It includes the Free, Used, and Time to Full details for each pool. Selecting a pool name navigates the user to the Pool Details page.



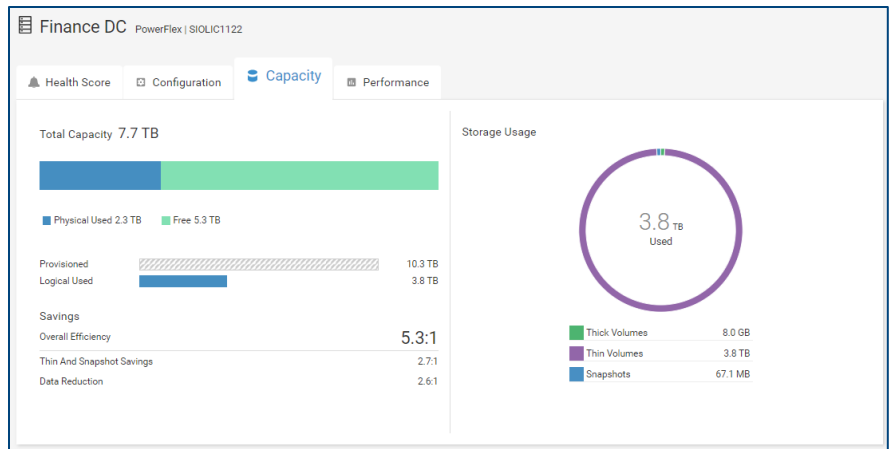
XtremIO systems include the total capacity broken down by used and free along with a detailed data reduction chart.



PowerMax/VMAX systems display Used and Free capacities for Subscribed, Snapshot, and Usable storage as well as the storage efficiency ratios and the percent used per storage resource pool.



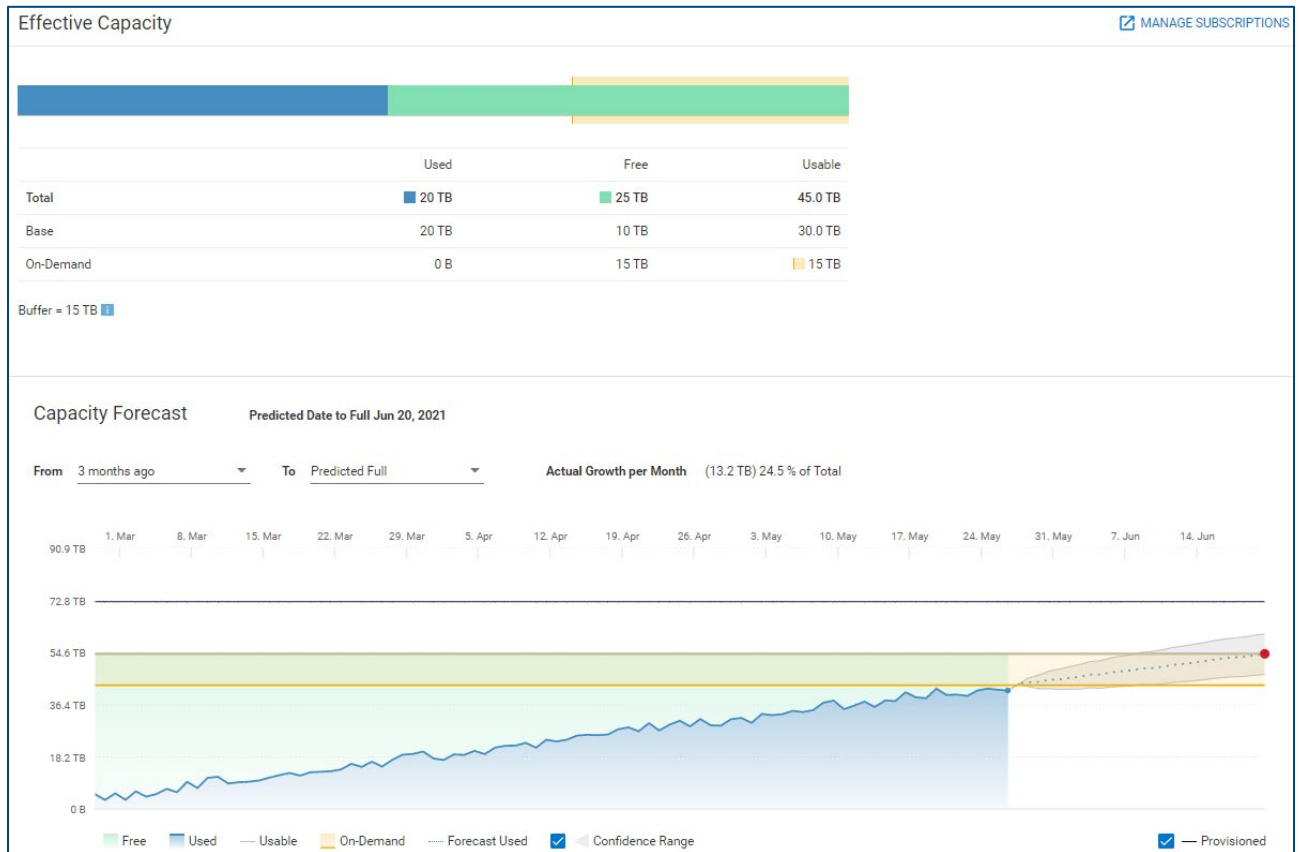
PowerFlex provides a breakdown of Total Capacity based on physical used and free. It also provides total provisioned and logical used charts and overall efficiency based on thin and snapshot savings and data reduction.



For APEX Block Storage Services, the Capacity tab displays the Effective Capacity of the subscription. The table displays the Usable, Used, and Free capacities for the Total storage as well as for the Base and On-Demand storage. The total storage available in the subscription is the sum of the Base and the On-Demand storage.

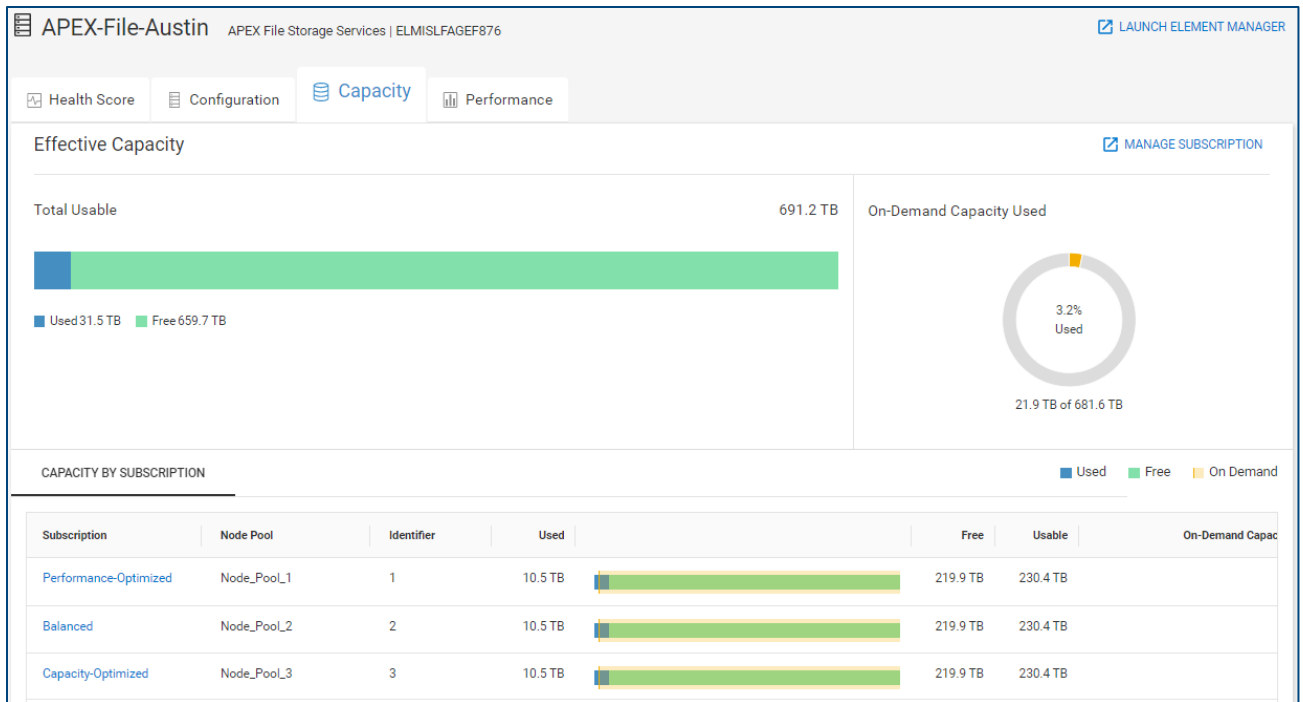
The Capacity Forecast chart provides historical and forecasting predictions for Free, Used, and Usable storage and highlights the On-Demand storage range. This brings attention to the user how often they are using storage from the On-Demand category. If consistently using On-Demand storage, they may want to consider modifying their subscription to increase the Base capacity, which results in a lower cost per GB.

The Manage Subscriptions link directs the user to the APEX Console.

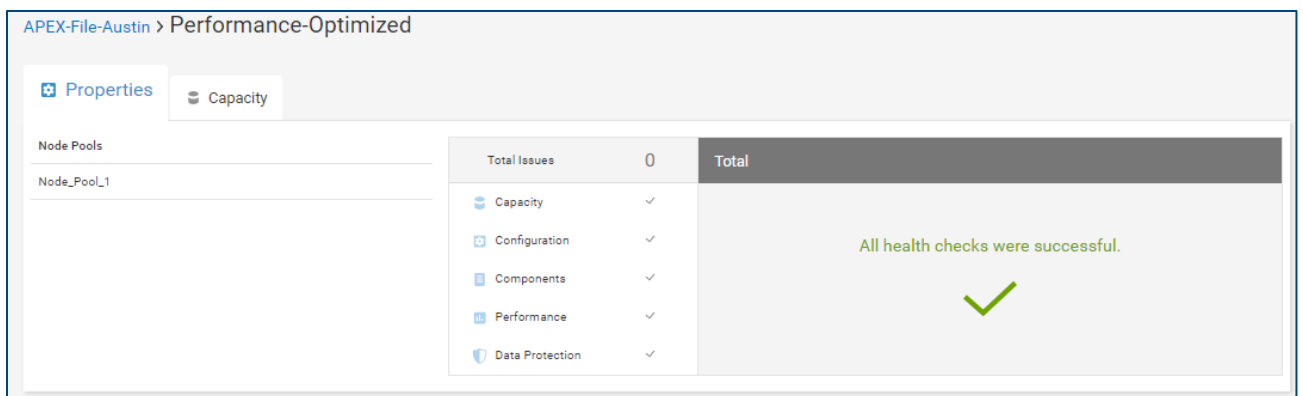


For APEX File Storage Services, the top portion of the page displays the Effective Capacity, breaking down the Total Usable capacity to Used and Free. There is a doughnut chart showing the percentage of On-Demand capacity in use.

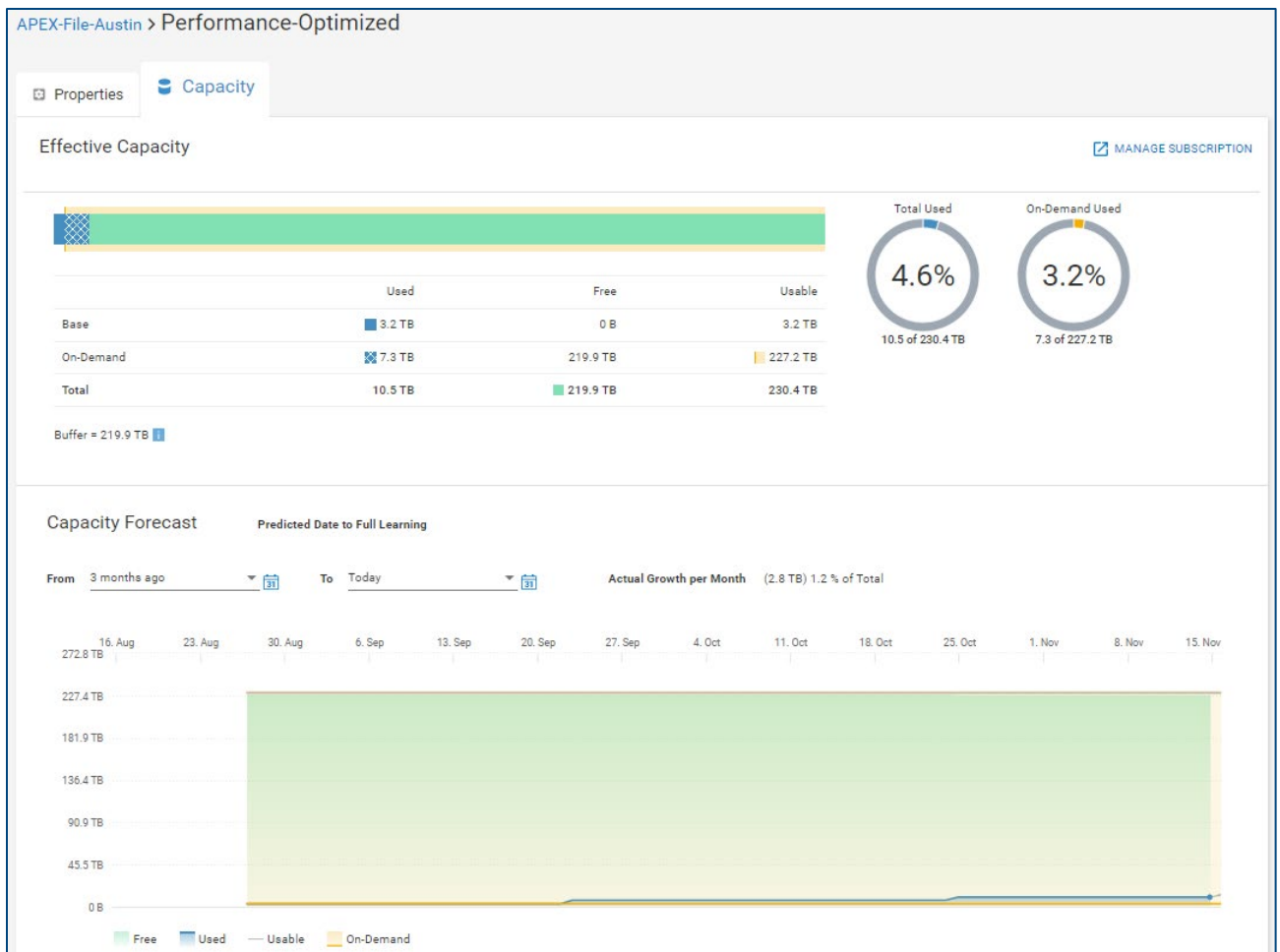
The bottom portion of the page breaks out the total capacity by subscription. The table shows the Usable, Used, and Free capacities per subscription. The percentage of On-Demand Capacity in use is also displayed.



Selecting the Subscription link opens a subscription details page with a Properties and Capacity tab. The Properties tab lists the Node Pools and the summary of any health issues.



The Capacity tab provides a breakdown of the Total, Base, and On-Demand capacities for the subscription based on Used, Free, and Usable. The bottom of the page provides a capacity forecast chart.

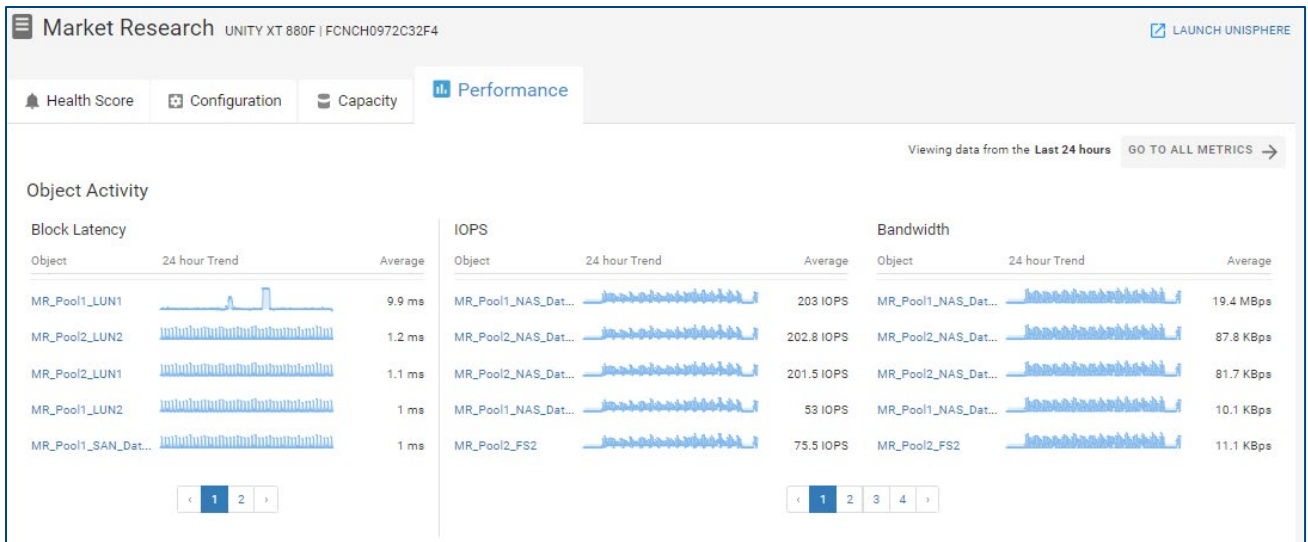


8.4 Storage System Details – Performance

The Performance tab is supported for all storage systems and APEX Data Storage Services. It is similar to the Performance tab for Pools discussed earlier in this paper. The top portion of this tab is the Object Activity and it shows key performance metrics for storage objects sorted by their 24-hour averages. The result is the user immediately sees the top contenders for resources on the system.

The following metrics are displayed with a 24-hour trend line and the 24-hour average. It is sorted to show objects with the highest averages over the last 24 hours allowing the user to immediately see the top contenders for resources on the system.

- Latency (PowerStore, PowerMax/VMAX, Unity, PowerScale, PowerFlex, XtremIO, APEX Block, and APEX File), Volume Latency (SC Series)
- IOPS (all platforms)
- Bandwidth (all platforms)



Note: For PowerMax/VMAX systems, CloudIQ displays these performance metrics at the Storage Group level.

Note: Top Object Activity is not displayed for PowerScale/Isilon, PowerFlex, or APEX File Storage Services.

The remaining charts show 24-hour history of key system level performance metrics with an overlay of historic seasonality. The metrics vary slightly by product type:

- Latency (APEX Block Storage Services, Unity, PowerStore, PowerMax/VMAX, PowerScale/Isilon, PowerFlex, and XtremIO / Volume Latency (SC Series))
- IOPS (all platforms)
- Backend IOPS (for Unity - if multiple storage tiers exist, each tier has a separate chart)
- Bandwidth (all platforms)
- Storage Processor Utilization (Unity) / Controller Utilization (SC Series) / CPU Utilization (XtremIO, PowerScale/Isilon, and APEX File Storage Services)
- Client (PowerScale/Isilon, and APEX File Storage Services)
- Protocol: Latency (PowerScale/Isilon, and APEX File Storage Services)
- Protocol: IOPS (PowerScale/Isilon, and APEX File Storage Services)
- Protocol: Bandwidth (PowerScale/Isilon, and APEX File Storage Services)

For additional performance metrics, the user can select the **Go To All Metrics** button in the upper right corner of the Object Activity window to access the Metrics Browser. Section 6.2 (The Metrics Browser) provides more information about performance charts and how to create customized performance dashboards.

CloudIQ identifies performance anomalies on all system level performance charts for all system types except PowerScale and APEX File Storage Services. A shaded blue area identifies performance anomalies. For APEX Block Storage Services, Unity, PowerStore, PowerMax, and PowerFlex systems, CloudIQ identifies areas of performance impacts on the Latency chart. A pink shaded area identifies performance impacts. Similar to the latency chart for Unity storage pools, the user can select the DETAILS button to see the most likely competing workloads causing the impact.

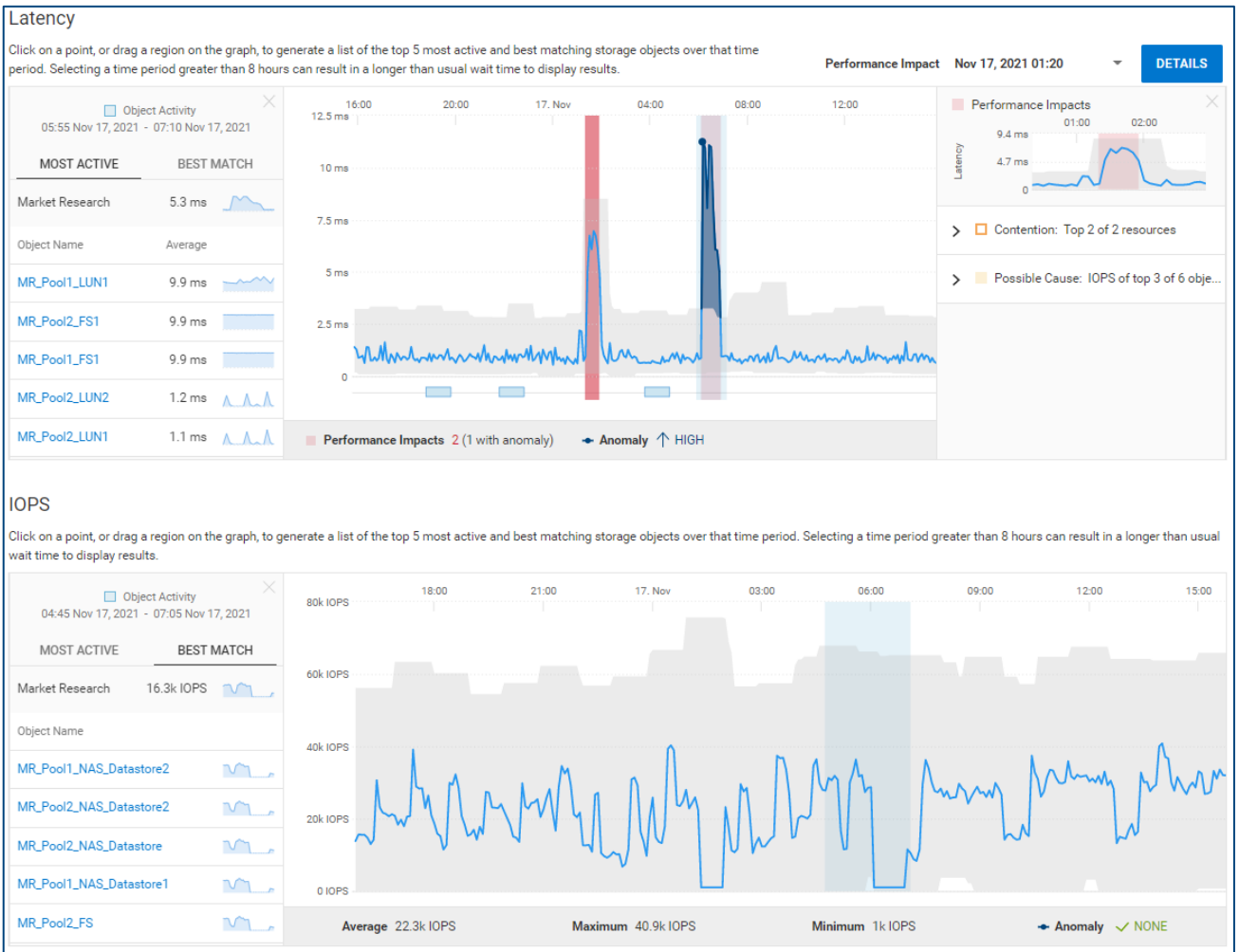
For APEX Block Data Storage Services, Unity, and PowerStore systems, configuration changes are identified as rectangles along the X-axis of the charts. Selecting the configuration change rectangle opens the Storage Configuration Changes window which contains details of the changes. By identifying when configuration

changes occur, CloudIQ helps the user potentially correlate configuration changes in the environment to performance impacts.

Selecting any area in the Latency, IOPS and Bandwidth charts for any system type (except PowerScale, APEX File Storage Services, and PowerFlex) displays the top five most active storage objects during that time period in the left side of the chart. Objects would be LUNs for Unity, Volumes for APEX Block Storage Services, PowerStore, SC Series, PowerVault and XtremIO, and Storage Groups for PowerMax/VMAX. In the example below, the area around the second impact with the performance anomaly is highlighted and it shows the most active objects in the left side of the screen. For PowerStore, Unity, and APEX Block Storage Services, CloudIQ also provides the Best Match tab identifying objects whose performance characteristics most closely correlate to the selected range in the performance chart. The Best Match tab is shown in the IOPS chart below.

As with Pools performance, the user can select the Details button and see possible causes and resource contention for performance impact.

Note: Currently, resource contention is supported for Unity only.



8.5 Storage System Details – Cybersecurity

The Cybersecurity tab is available for systems that have Cybersecurity enabled. Cybersecurity is supported for PowerMax and PowerStore systems, and will continue to expand coverage to other Dell assets. The top of the page shows information provided in the multisystem view: The System Risk Level, the summary of active issues, and the percentage of enabled tests in the Evaluation Plan. The bottom of the page has two tabs: Cybersecurity Issues and Evaluation Plan.

The Cybersecurity Issues tab lists all active issues identified on this system. Expanding each issue provides a detailed issue description and the recommended remediation. Users can also see the time the issue was created, the security control family (defined by NIST 800-53 R5), and the name of the evaluation test.

The screenshot displays the Cybersecurity interface for a system named 'Finance' (PowerMax_2000 | 000197900049). The top navigation bar includes tabs for Health Score, Configuration, Capacity, Performance, and Cybersecurity. The main content area is divided into three sections: System Risk Level (High), Cybersecurity Issues (4 Total, 1 Last 24 Hours), and Evaluation Plan (100% Selected, 12 of 12 Tests). Below these are two tabs: CYBERSECURITY ISSUES and EVALUATION PLAN. The CYBERSECURITY ISSUES tab is active, showing a table of 4 issues. The first issue is expanded, showing its description, remediation steps, creation time, security control family, and evaluation test.

Severity	Issue	Creation Time
> High	PowerMax system requires a software upgrade	27 days ago
> Medium	Data At Rest encryption is disabled	20 days ago
> Medium	LDAP server certificate verification is disabled	27 days ago
> Low	SNMP trap destination is not configured	27 days ago

Expanded Issue Details:



- Severity:** Medium
- Issue:** Data At Rest encryption is disabled
- Creation Time:** 20 days ago
- Description:** This test verifies whether Data at Rest Encryption (D@RE) is enabled. D@RE prevents data visibility in the event of its unauthorized access or theft.
- Remediation:** Enabling D@RE requires re-installation of the PowerMax system. Contact [Dell Technical Support](#) for help.
- Created:** Tue, May 18 2021, 07:46:00 AM UTC
- Security Control Family:** System and Communications Protection
- Evaluation Test:** Data At Rest encryption enabled

The Evaluation Plan tab lists all possible tests for this system type. The evaluation tests are grouped into Security Control Families. Each family can be expanded to show the individual tests that make up the group and one of the following statuses for each test:

- OK – Test is enabled and no issues identified.
- Deviation – Test is enabled and an active issue exists.
- Not In Plan – Test is not enabled.

When an active issue exists, the Last Detected Column shows the first time the issue was detected. When an issue does not exist, it shows the last time this data was changed (as reported by the system).

There is a details icon which shows the details of each test. In instances where there is a deviation, it will also show the recommended remediation.

CYBERSECURITY ISSUES		EVALUATION PLAN	
12 Evaluation Tests			
Evaluation Tests	Status	Last Detected	Details
> Access Control			
> Audit and Accountability			
Remote Syslog enabled	OK	Wed, Feb 10 2021, 1...	
> Configuration Management	1 Deviation		
Determine if any SNMP trap destination is configured	Deviation	Wed, Feb 10 2021, 1...	
> Identification and Authentication	1 Deviation		
> System and Communications Protection	1 Deviation		
> System and Information Integrity	1 Deviation		

CYBERSECURITY ISSUES		EVALUATION PLAN	
12 Evaluation Tests			
Evaluation Tests	Status	Last Detected	Details
Determine if any SNMP trap destination is configured ✕			
This test verifies whether an SNMP destination is configured according to the organizational policy.			
Issue:			
<div style="display: flex; align-items: center;"> ▾ I SNMP trap destination is not configured </div>			
This test verifies whether an SNMP destination is configured according to the organizational policy.			
Remediation:			
Configure the SNMP trap by following the instructions in the "Configure SNMP Notifications" topic of the Unisphere online help.			

9 Block Object Details

Block objects include LUNs for Unity systems and volumes for PowerStore, SC Series, XtremIO, and PowerVault. They can be accessed from the Storage listing for individual Systems and Pools and can also be found using global search.

9.1 Block Object Details – Properties

The **Properties** tab for a Block object displays attributes for the object and any Health issues associated with this object. The bottom of the page varies slightly depending on storage type. It displays the Hosts (for Unity and XtremIO systems), Servers (for SC Series), or Initiators (for PowerVault) associated to the object. The Virtual Machines tab lists information for VMs residing on the object and is available for Unity, SC Series, and XtremIO objects. The Consistency Groups tab is available for XtremIO volumes listing consistency group information to which the volume belongs.

Market Research > MR_Pool1_LUN1 LAUNCH UNISPHERE

Properties | Capacity | Performance | Data Protection

Pool: Market Research_Pool1
 Type: LUN
 FAST Cache: -
 FAST VP Policy: Start High Then Auto-Tier
 Consistency Group: MRApp1CG
 Thin: Yes
 SP Owner: SP A
 CLI ID: sv_10
 WWN: 60:06:01:60:0A:30:3E:00:AB:2D:48:58:26:AE:B2:23
 Data Reduction: On

Total Issues: 0 **Total**

Components ✓
 Configuration ✓
 Capacity ✓
 Performance ✓
 Data Protection ✓

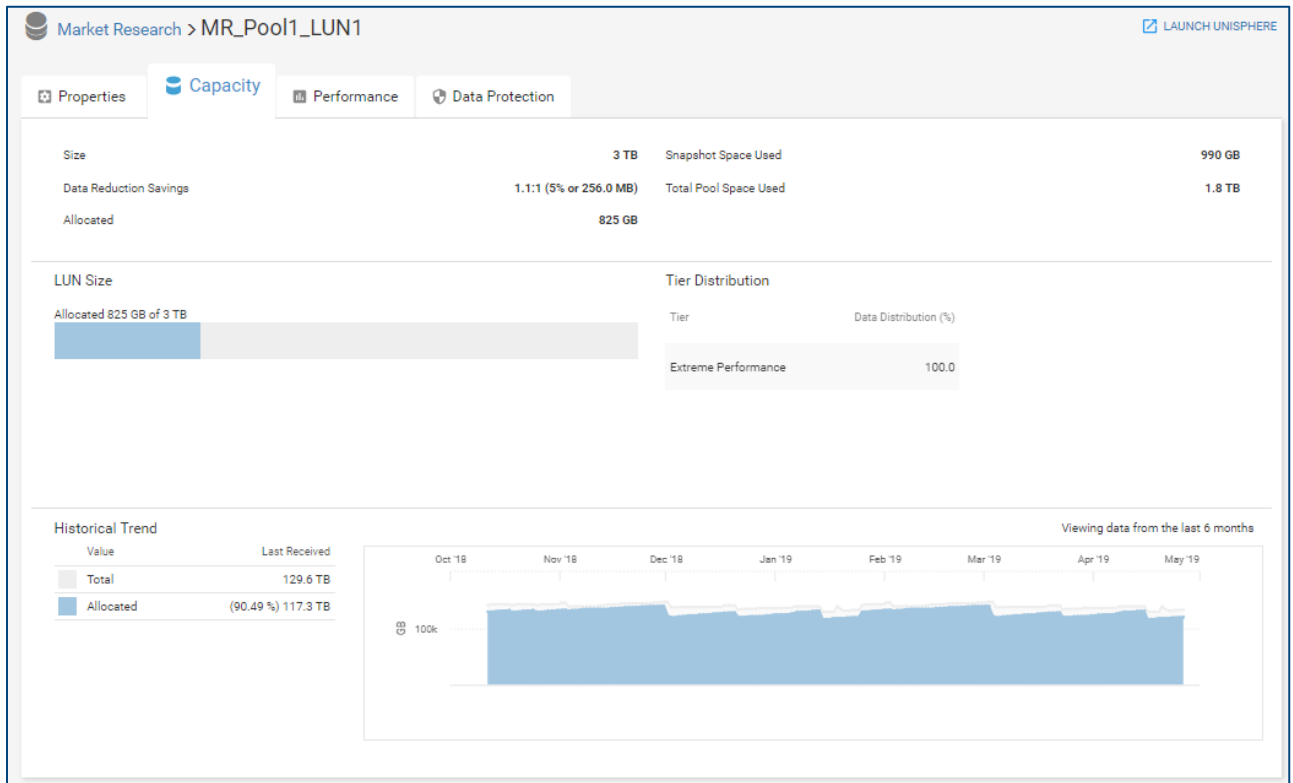
All health checks were successful.

HOSTS | VIRTUAL MACHINES 2 Hosts

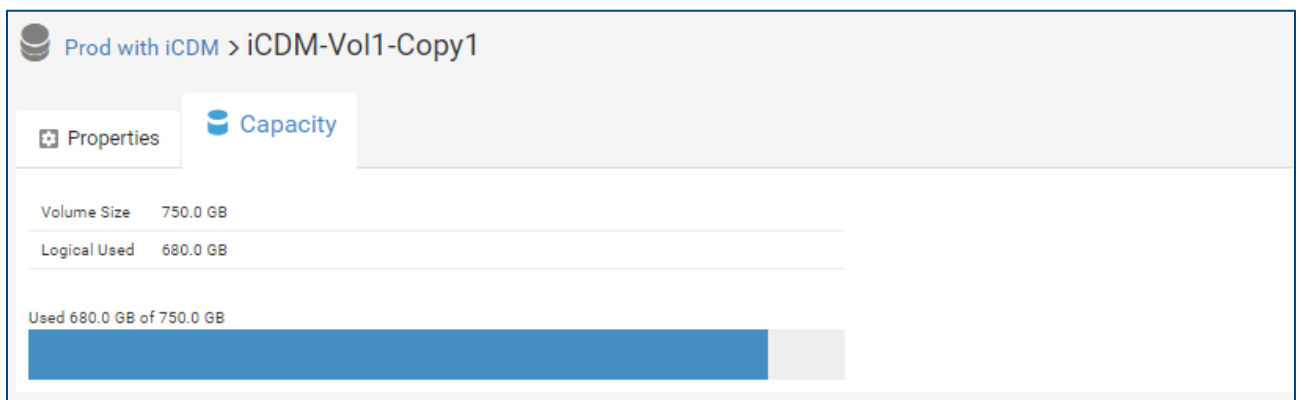
Issues	Name	Network Address	Operating System	Initiator Protocol	Initiators (#)	Total Size (TB)
1	MRApp1_Host1	10.0.0.20	Windows Server 2012	FC	2	5.8
1	MRApp1_Host2	10.0.0.21	Windows Server 2012	FC	2	5.8

9.2 Block Object Details – Capacity

The **Capacity** tab for Unity, SC Series, and PowerVault block objects provides details for the capacity being used including Data Reduction savings and capacity utilization by Snapshots. The Historical Trend shows the capacity changes over time helping users identify increasing trends to anticipate future capacity usage.



The Capacity tab for an XtremIO volume does not support the historical trend. Volume Size and Logical Used metrics are reported as shown below.

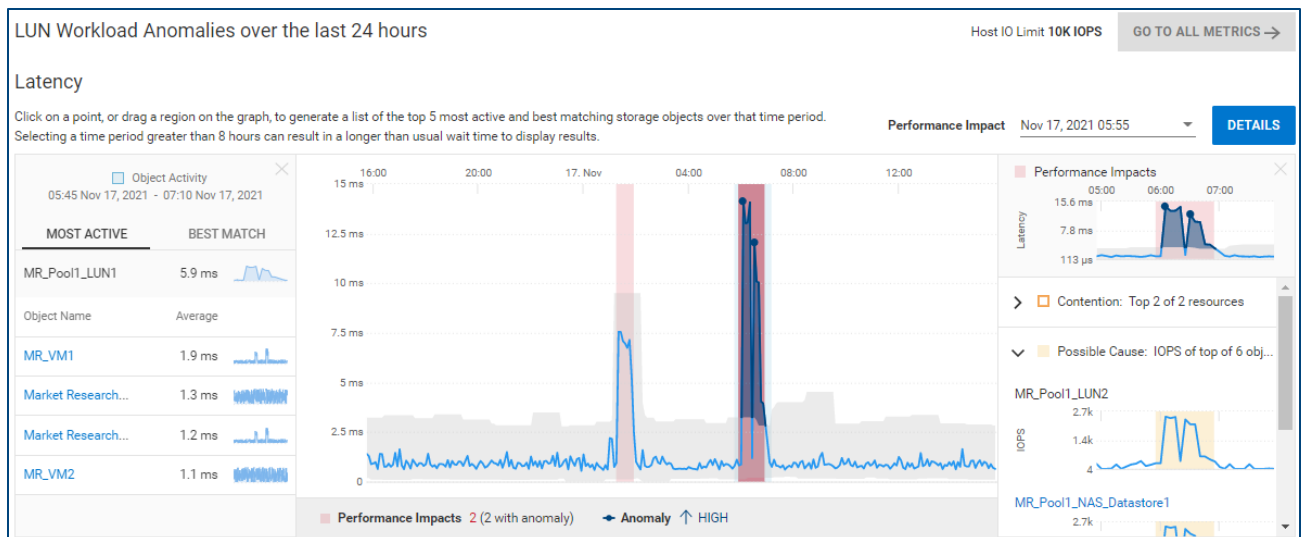


9.3 Block Object Details – Performance

The **Performance** tab for block objects (Unity, SC Series, and PowerVault) provides performance details for the block object activity. Similar to the system and pool level performance charts, CloudIQ identifies performance anomalies for each performance metric. For Unity systems, CloudIQ also identifies performance impacts at the object level.

Highlighting an area in the performance charts for a block object identifies up to the five most active virtual machines contributing to the metric during that time period. Unity systems have the additional feature of providing the virtual machines that most closely correlate to the behavior in the selected time range. This correlation is shown under the Best Match tab.

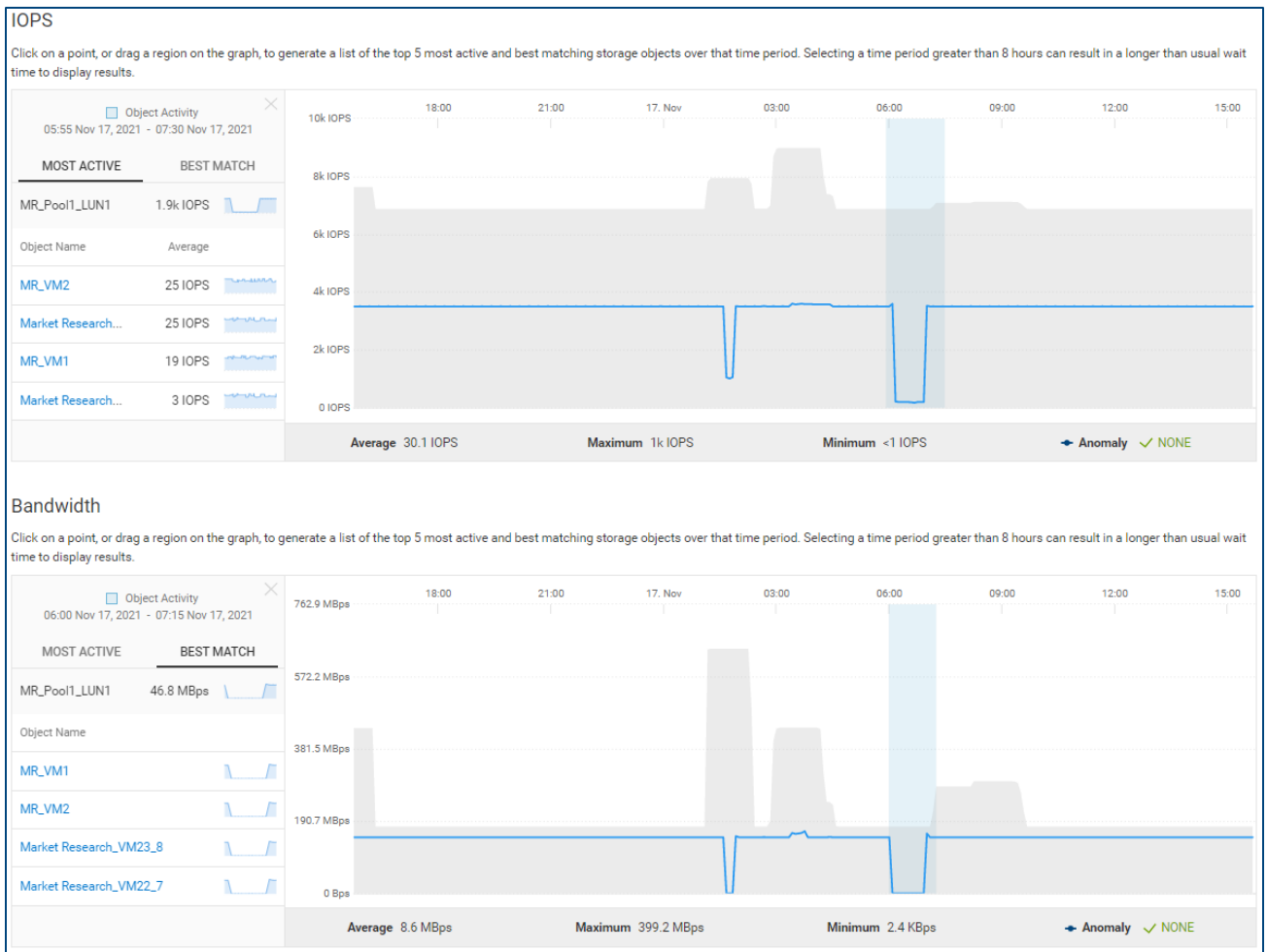
The following shows two performance impacts on a Unity block latency chart. The first is an impact only, the second is an impact with a performance anomaly. Selecting the Details button opens a window in the right side of the chart identifying storage objects whose IOPS are correlated with the rise in latency for the impacted LUN. These objects are the most likely candidates causing workload contention and the performance impact. CloudIQ also identifies if there is possible resource contention for Unity LUNs experiencing a performance impact.



The bottom of the page displays LUN or Volume performance charts for the following metrics:

- Latency (Unity and SC Series)
- IOPS (all)
- Bandwidth (all)
- % Read (Unity and PowerVault)
- IO Size (Unity and PowerVault)
- Queue Length (Unity)

In the following screenshot, a region of the IOPS chart is highlighted. The left side of the chart displays the Most Active tab which displays the most active virtual machines contributing to the metric during that time period. In the Bandwidth chart, the Best Match tab is selected which identifies the VM whose bandwidth most closely correlates to the metric during the selected time period.



9.4 Block Object Details – Data Protection

The **Data Protection** tab for Unity and SC Series block objects displays how data protection has been configured for the selected object. There are two levels of data protection available:

- Replication – remote protection from system to system
- Snapshots – local protection within the system

The **Replication** section on the top of the page shows replication details and status of the replication session. The **Snapshots** section at the bottom half of the page shows how data is backed up within the system using snapshot technology. Snapshot schedules and deletion policies are displayed. The snapshot list can be exported to a CSV file.

Market Research > MR_Pool1_LUN1
LAUNCH UNISPHERE

Properties | Capacity | Performance | **Data Protection**

Replication

Session Name	rep_async
Mode	Asynchronous (60 minutes)
Local Role	Source
Sync Progress	80% complete, about 30 minutes remaining
Sync Transfer Rate	395.2 MB/Sec
Time of Last Sync	Mon, Oct 17 2016, 5:50:21 PM UTC

Snapshots

<p>Schedule: Snap Schedule all rules</p> <p>Rule 1: Every Tuesday, Wednesday, Thursday, Friday, Saturday, and Sunday at 11:00 PM, retain for 14 days</p> <p>Note: Schedule times are in UTC displayed in 12-hour format.</p>	<p>Pool Automatic deletion policy</p> <p>Start deleting snapshots when the total pool consumption reaches 95%, and continue deleting until the total pool consumption reaches 85%</p> <p>Start deleting snapshots when the pool consumption by the snapshots reaches 25%, and continue deleting until the pool consumption by the snapshots reaches 20%</p>
--	--

7 Snapshots 📄

Name	Source	State	Taken	Taken By	Attached	Last Writable Time	Modified	Auto Delete	Expiration Time
mySnap-1556112110020	MR_Pool1_LUN1	Ready	Sun, Mar 31 2019, 2:39:23 ...	Snap Schedule all r...	No	Fri, Mar 29 2019, 2:39:23 P...	No	No	Tue, Apr 16 2019, 2:39...
mySnap-1556112110021	MR_Pool1_LUN1	Ready	Thu, Mar 21 2019, 2:39:23 ...	Snap Schedule all r...	No	Tue, Mar 19 2019, 2:39:23 ...	Yes	No	Tue, Apr 2 2019, 2:39...
mySnap-1556112110021	MR_Pool1_LUN1	Ready	Tue, Mar 19 2019, 2:39:23 ...	Snap Schedule all r...	No	Fri, Mar 15 2019, 2:39:23 P...	Yes	No	Sun, Mar 31 2019, 2:3...
mySnap-1556112110021	MR_Pool1_LUN1	Ready	Tue, Mar 5 2019, 2:39:23 P...	Snap Schedule all r...	No	Sun, Mar 3 2019, 2:39:23 P...	Yes	No	Thu, Mar 21 2019, 2:3...
mySnap-1556112110024	MR_Pool1_LUN1	Ready	Mon, Mar 11 2019, 2:39:23 ...	Snap Schedule all r...	No	Thu, Mar 7 2019, 2:39:23 P...	Yes	No	Tue, Mar 19 2019, 2:3...
mySnap-1556112110024	MR_Pool1_LUN1	Ready	Mon, Feb 25 2019, 2:39:23 ...	Snap Schedule all r...	No	Sat, Feb 23 2019, 2:39:23 P...	Yes	No	Mon, Mar 11 2019, 2:3...
mySnap-1556112110024	MR_Pool1_LUN1	Ready	Mon, Feb 11 2019, 2:39:23 ...	Snap Schedule all r...	No	Sat, Feb 9 2019, 2:39:23 P...	Yes	No	Mon, Feb 25 2019, 2:3...

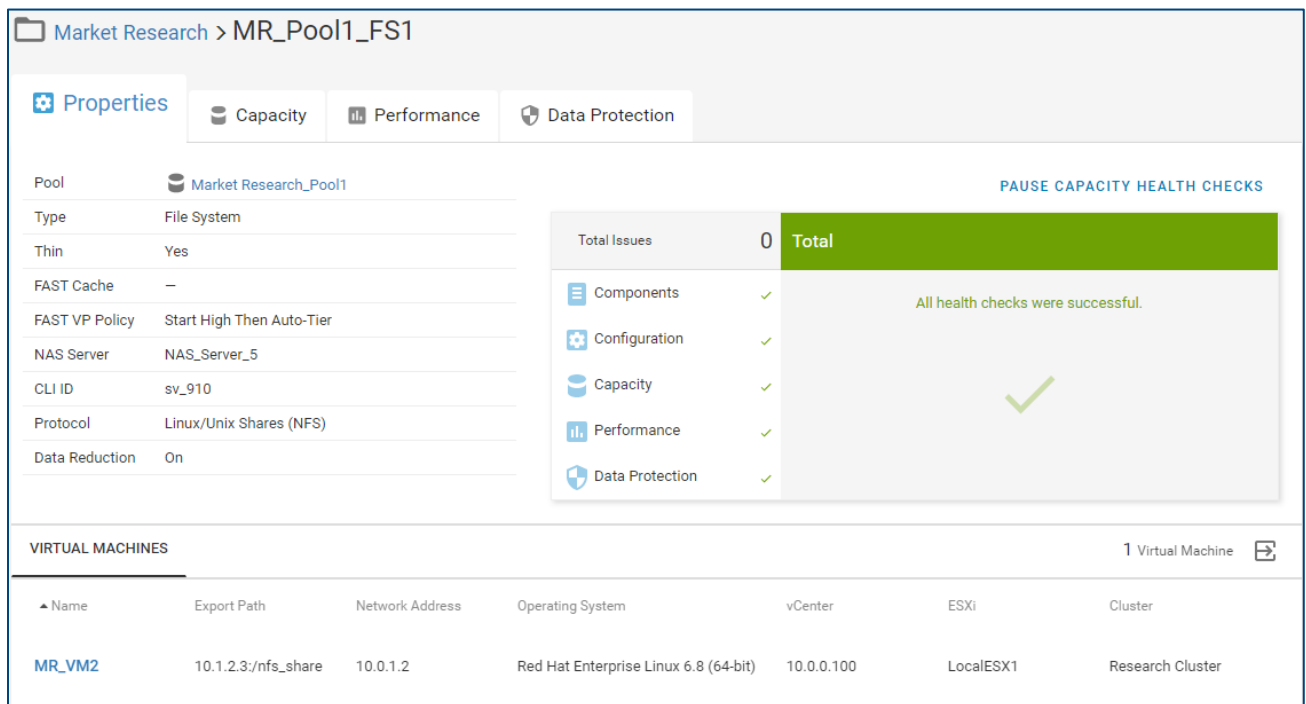
10 File Object Details

File Objects (Unity systems only) are accessible in the Storage listing for individual Systems and Pools. File objects can also be accessed using global search.

10.1 File Object Details – Properties

The **Properties** tab displays various attributes for the file object and any health issues found for the object. Attributes include the Pool, FAST VP Policy, NAS Server, Protocol, and Data Reduction status. It also allows users to pause the capacity health check for the file system. This can also be accomplished from the Customization menu under Admin. See Chapter 20 for more details.

The bottom half of the view shows any virtual machines that reside on the file object.



Market Research > MR_Pool1_FS1

Properties | Capacity | Performance | Data Protection

Pool: Market Research_Pool1 PAUSE CAPACITY HEALTH CHECKS

Type: File System

Thin: Yes

FAST Cache: –

FAST VP Policy: Start High Then Auto-Tier

NAS Server: NAS_Server_5

CLI ID: sv_910

Protocol: Linux/Unix Shares (NFS)

Data Reduction: On

Total Issues: 0 **Total**

Components: ✓

Configuration: ✓

Capacity: ✓

Performance: ✓

Data Protection: ✓

All health checks were successful.

VIRTUAL MACHINES 1 Virtual Machine

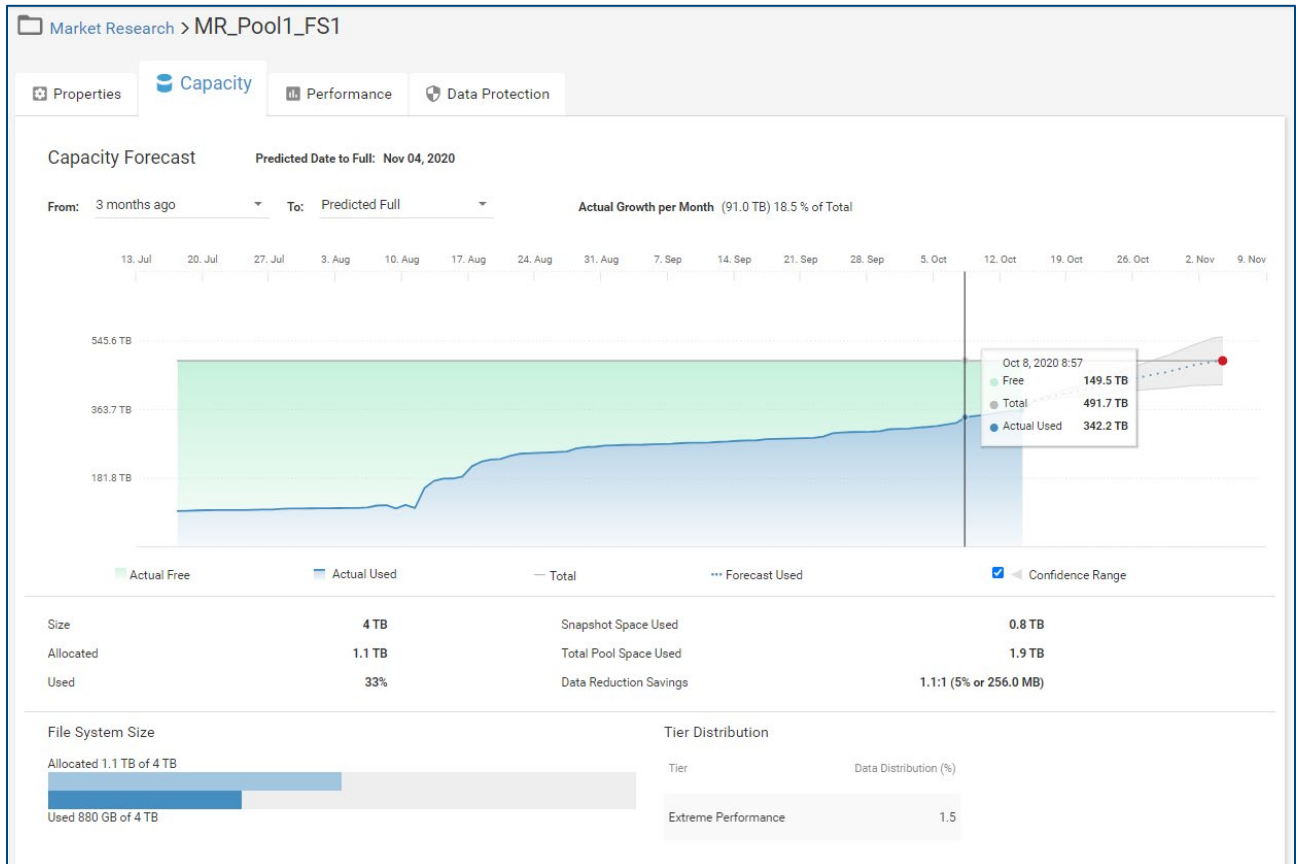
Name	Export Path	Network Address	Operating System	vCenter	ESXi	Cluster
MR_VM2	10.1.2.3:/nfs_share	10.0.1.2	Red Hat Enterprise Linux 6.8 (64-bit)	10.0.0.100	LocalESX1	Research Cluster

10.2 File Object Details – Capacity

The **Capacity** tab for a File object provides details for how the file capacity is being used, including capacity utilization for snapshots and Data Reduction Savings. The file used percentage is based on the actual data written to the file system.

The Capacity Forecast shows a historical trend and capacity changes since the object was created. CloudIQ’s predictive analytics algorithms are applied to provide ongoing predictions as to when the file system will become full.

Hovering across the trend line displays the specific total, used and free values for that selected point in time.



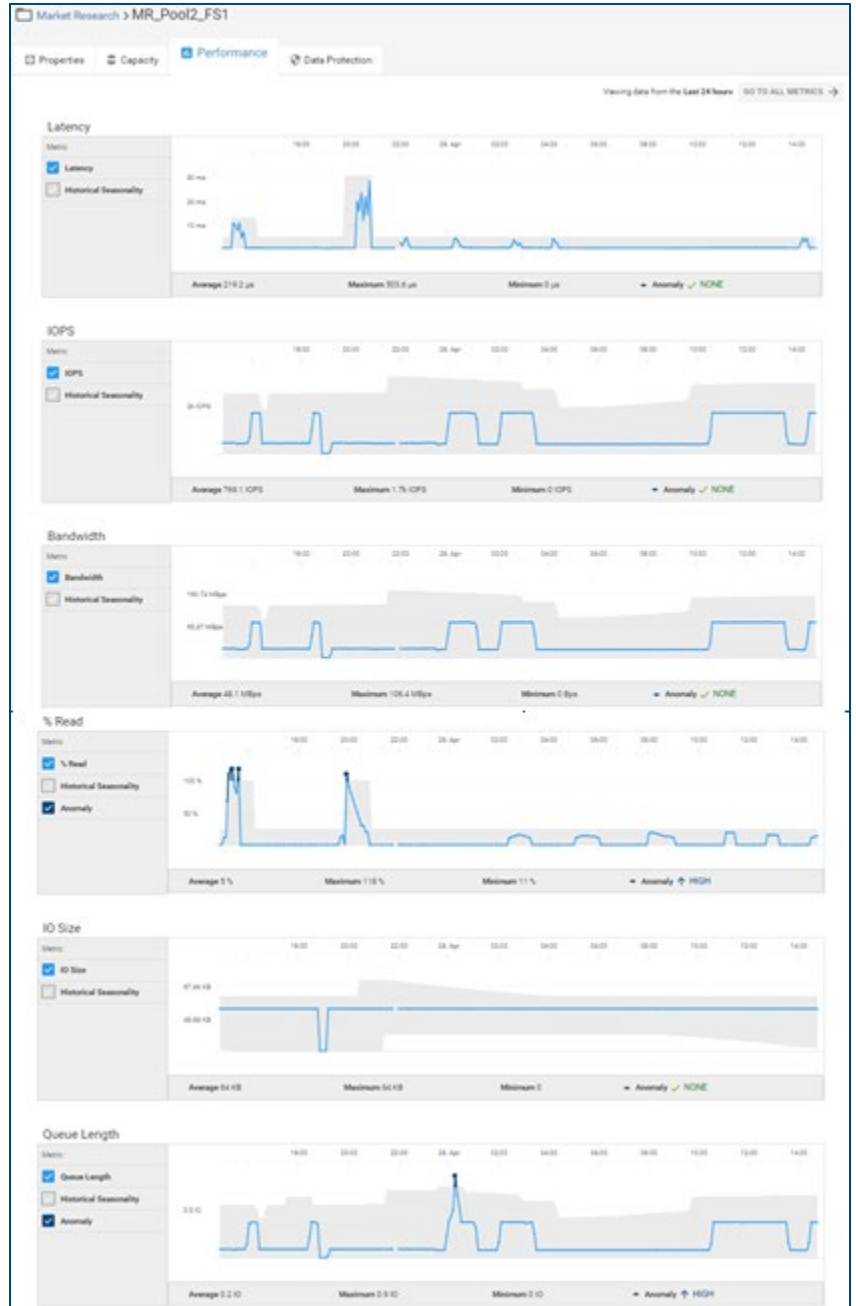
10.3 File Object Details – Performance

The **Performance** tab for a file object 24-hour performance charts for the following metrics:

- Latency
- IOPS
- Bandwidth
- %Read
- IO Size
- Queue Length

Performance anomalies are supported for each of these metrics.

Note: Latency and Queue Length metrics are available for Unity v5.0 and higher.



10.4 File Object Details – Data Protection

The **Data Protection** tab for a file object displays how data protection has been configured for that object. There are two levels of data protection available:

- Replication – remote protection from system to system
- Snapshots – local protection within the system

The **Replication** section on the top of the page shows remote replication details and status of the replication session. The **Snapshots** section at the bottom half of the page shows how data is backed up within the system using snapshot technology. Snapshot schedules are also displayed. The snapshot list can be exported to a CSV file.

📁 Disaster Recovery > DR_Pool1_FS1

Properties
Capacity
Performance
Data Protection

Replication

Session Name	rep_async
Mode	Asynchronous (60 minutes)
Local Role	Destination
Sync Progress	80% complete, about 30 minutes remaining
Sync Transfer Rate	395.2 MB/Sec
Time of Last Sync	Mon, Oct 17 2016, 5:50:21 PM UTC

I/O

Snapshots

Schedule	Snap Schedule
Rule 1	Every Tuesday, Wednesday, Thursday, Friday, Saturday, and Sunday at 11:00 PM, retain for 14 days
<small>Note: Schedule times are in UTC displayed in 12-hour format.</small>	

7 Snapshots 📄

▲ Name	Source	State	Taken	Taken By	Shared	Last Writable Time	Modified	Auto Delete	Expiration Time	Access Type
mySnap-1555084...	DR_Pool1_FS1	Ready	Sun, Apr 14 2019, 5:2...	Snap Schedule	No	Wed, Apr 10 2019, 5:...	No	No	Wed, Apr 24 2019, 5:...	Share
mySnap-1555084...	DR_Pool1_FS1	Ready	Thu, Apr 4 2019, 5:24...	Snap Schedule	No	Sun, Mar 31 2019, 5:2...	Yes	No	Sun, Apr 14 2019, 5:2...	Share
mySnap-1555084...	DR_Pool1_FS1	Ready	Mon, Mar 25 2019, 5:...	Snap Schedule	No	Thu, Mar 21 2019, 5:2...	Yes	No	Thu, Apr 4 2019, 5:24...	Share
mySnap-1555084...	DR_Pool1_FS1	Ready	Mon, Mar 11 2019, 5:...	Snap Schedule	No	Sat, Mar 9 2019, 5:24:...	Yes	No	Tue, Mar 19 2019, 5:2...	Share
mySnap-1555084...	DR_Pool1_FS1	Ready	Fri, Mar 1 2019, 5:24:...	Snap Schedule	No	Mon, Feb 25 2019, 5:...	Yes	No	Fri, Mar 15 2019, 5:24...	Share
mySnap-1555084...	DR_Pool1_FS1	Ready	Fri, Mar 1 2019, 5:24:...	Snap Schedule	No	Wed, Feb 27 2019, 5:...	Yes	No	Mon, Mar 11 2019, 5:...	Share
mySnap-1555084...	DR_Pool1_FS1	Ready	Thu, Feb 21 2019, 5:2...	Snap Schedule	No	Sun, Feb 17 2019, 5:2...	Yes	No	Wed, Feb 27 2019, 5:...	Share

11 Storage Group Details (PowerMax/VMAX systems)

Each PowerMax/VMAX system lists the storage groups with key information including the associated Storage Resource Pool, the assigned Service Level and whether the Storage Group is in compliance. The storage group name is hyperlinked to enable easy navigation to the details pages for a given storage group. The Storage Group Details Page is also accessible using global search of the storage group name.

11.1 Storage Group Details – Configuration

The **Configuration** tab for a storage group displays the attributes of the storage group. In the upper right is a link to “Launch Unisphere.” Selecting this link will open the Unisphere element manager for the system hosting this storage group.

Finance > Finance_SG_11 LAUNCH UNISPHERE

Configuration Capacity Performance

SRP Finance_SRP1 Volumes 10

VIRTUAL MACHINES 3 Virtual Machines

Name	Network Address	Operating System	vCenter	ESXi	Cluster
Finance_VM1	10.0.1.1	Red Hat Enterprise Linux 5 (64-bit)	10.0.0.100	DistESX1	Research Cluster
Finance_VM1_8	10.186.1.8	Red Hat Enterprise Linux 5 (64-bit)	10.0.0.100	Finance1 ESX	Finance Cluster
Finance_VM2	10.0.1.2	Red Hat Enterprise Linux 6.8 (64-bit)	10.0.0.100	DistESX1	Research Cluster

11.2 Storage Group Details – Capacity

The **Capacity** tab for a Storage Group provides details for the Storage Group capacity, showing Used and Free Allocation. Also, Storage Efficiency information is provided, including virtual provisioning (VP) savings and the compression ratio.

Finance > Finance_SG_13 LAUNCH UNISPHERE

Configuration Capacity Performance

Usage

Allocated 100

Used 10.2 Free 90.8

VP Saved 10.2

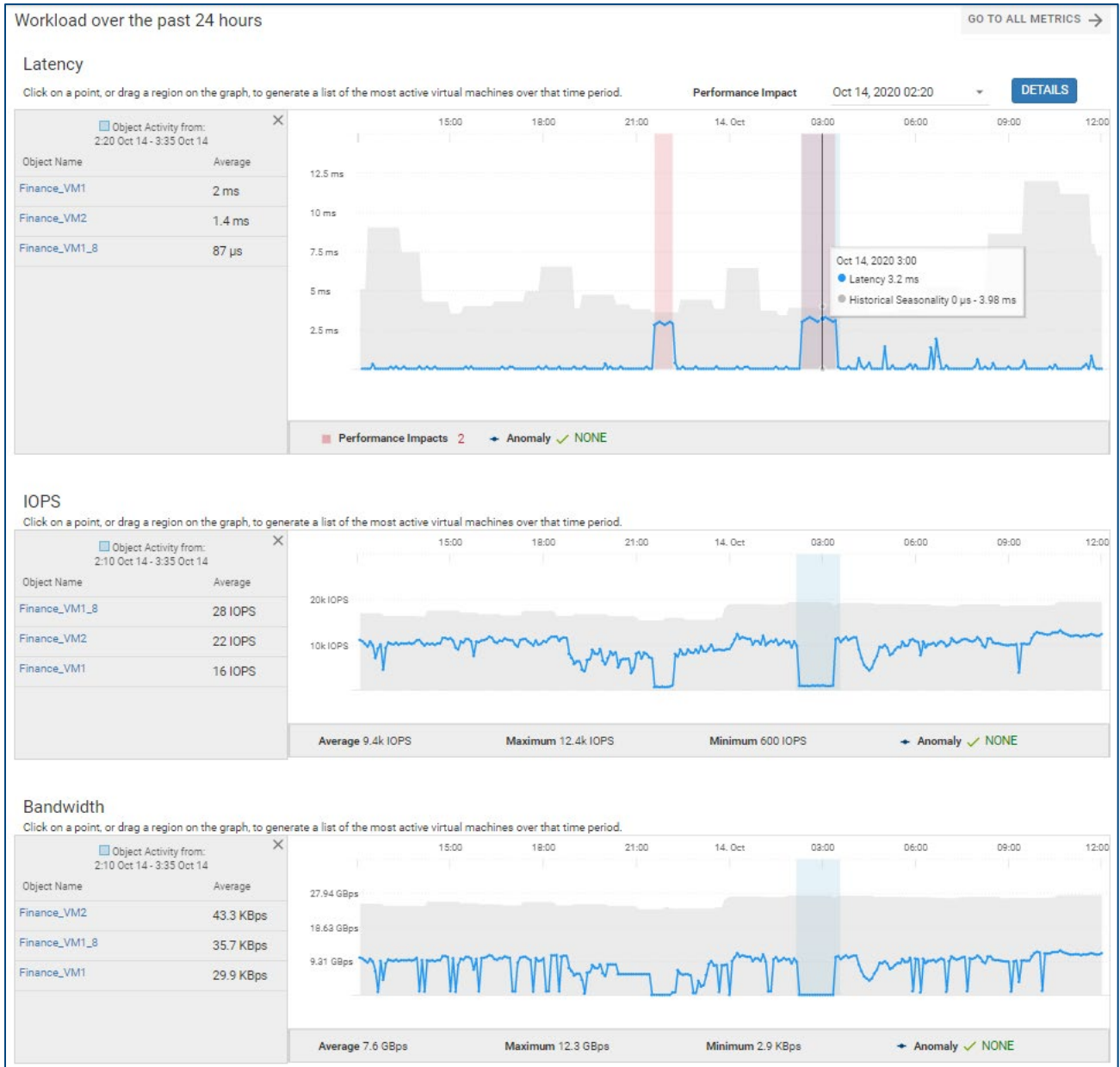
Compression Yes

Compression Ratio 10.5:1

11.3 Storage Group Details – Performance

The **Performance** tab for a Storage Group provides performance details over a 24-hour period. Performance charts include Latency, IOPS, Bandwidth, %Read, IO Size, and Queue Length. CloudIQ identifies performance impacts on the Latency chart as pink shaded areas. CloudIQ identifies performance anomalies on all storage group performance charts as blue shaded areas.

Highlighting an area in the Latency, IOPS or Bandwidth charts displays the top contributing VMs in the left side of the chart.



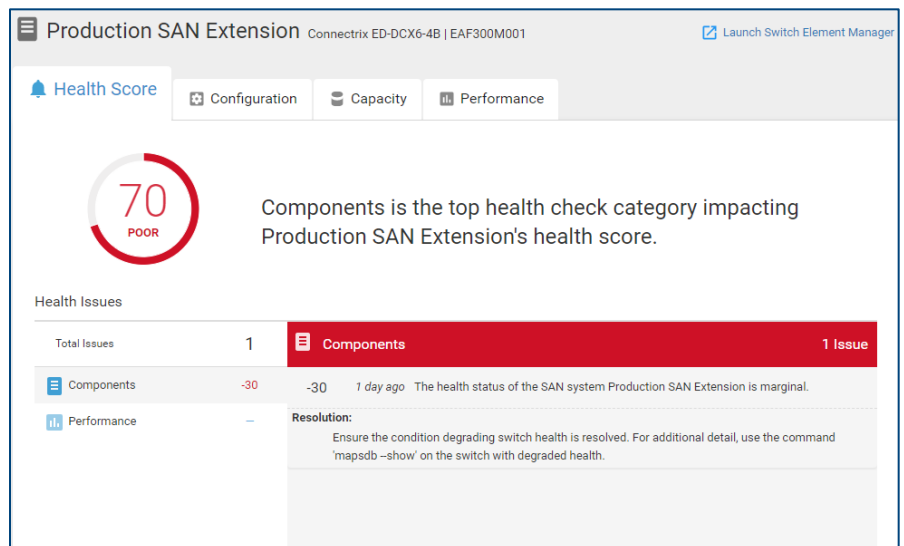
12 Connectrix and PowerSwitch Details

CloudIQ can monitor both Connectrix and PowerSwitch networking devices. For Connectrix, CloudIQ leverages a local collector that communicates to the switches using a read-only privilege and the collector sends the data back to CloudIQ through the Secure Remote Services Gateway. PowerSwitch sends data to CloudIQ through a direct connection to SupportAssist.

Selecting the switch hyperlink in the overview page or any of the multisystem views opens the System Details page for that switch. The following sections discuss each tab of the Switch System Details page in greater depth.

12.1 Switch System Details – Health Score

The Health Score tab shows the details for a selected switch driving the health score number. Only the Components category is used in calculating the switch health score. Selecting any issue provides a corresponding recommendation for obtaining additional information and resolution. The Health Score History is displayed at the bottom of the page for Connectrix, but is not yet supported for PowerSwitch at the time of this publication.



12.2 Switch System Details – Configuration

The Configuration tab differs slightly between Connectrix and PowerSwitch. For Connectrix, it contains various switch attributes at the top half of the screen, including the serial number, model, location, site, firmware, management IP address, and contract information. It also highlights if a model had reached End of Life (EOL) or End of Service Life (EOSL) and identifies if recommended firmware updates are available. The bottom half of the window contains the following tabs: Fabrics, Partitions, Zones, Attached Devices, Virtual Machines, and Components.

Production SAN Extension Connectrix ED-DCX6-4B | EAF300M001 [Launch Switch Element Manager](#)

Health Score | **Configuration** | Capacity | Performance

Serial Number	EAF300M001	Firmware Version	8.2.1a	Chassis WWN	10:00:C4:F5:7C:2D:AA:02
Model	Connectrix ED-DCX6-4B	Last Contact Time	20 hours ago	Contract Expiration	Nov 17, 2025
Location	Round Rock, TX	Collector	ciqc.conn.emc.com	Service Plan	ProSupport MC
Site	ACME Headquarters	Management IP Address	10.0.12.1	Contract Number	32678017TM
Switch Up Time	14 days	Switch WWN	10:00:C4:F5:7C:2D:AA:01	Switch Model EOSL	May 17, 2022

FABRICS | PARTITIONS | ZONES | ATTACHED DEVICES | VIRTUAL MACHINES | **COMPONENTS** 2 Fabrics

Principal Switch WWN	Principal Switch IP Address	Partition ID	Total Switches	Monitored Switches	Total End Devices	Used %
10:00:C4:F5:7C:2D:11:A1	10.0.12.1	8	1	1	0	0.0
10:00:C4:F5:7C:2D:AA:01	10.0.12.1	128	2	1	32	-

The top half of the Configuration tab for PowerSwitch includes the service tag, serial number, model, OS type, location, site, BIOS/software versions, management IP address and contract information. The bottom half of the page has the Components tab.

Production PowerSwitch North S4112T-ON | BXW0023

Health Score | **Configuration** | Capacity

Service Tag	BXW0023	Switch Up Time	16 seconds	Chassis WWN	-
Serial Number	VMS5248F00674000ABCJ	Bios Version	3.40.0.9-9	Switch MAC	14:18:77:20:4d:cf
Model	S4112T-ON	Software Version	10.5.3.0	Contract Expiration	Nov 24, 2023
OS Type	OS10	Last Contact Time	9 minutes ago	Service Plan	AE
Location	Hopkinton, MA	Management IP Address	10.12.29.2	Contract Number	1135134567
Site	POWERSWITCH-BXW0023	Switch WWN	-		

COMPONENTS

7 Component Objects

Type ↑	Slot/Unit	State	Part Number	Serial Number
FANTRAY	1	ONLINE	70-1003226-09	DZD3208M012
FANTRAY	2	ONLINE	70-1003226-10	DZD3208M01M
FANTRAY	3	ONLINE	70-1003226-11	DZD3208M01M
FANTRAY	4	ONLINE	70-1003226-12	DZD3208M01M
POWER_SUPPLY_UNIT	1	ONLINE	70-1003155-13	GQV9247LL0B
POWER_SUPPLY_UNIT	2	ONLINE	70-1003155-14	GQV9247LL0B
SWITCH_UNIT	1	ONLINE	04YGWF	VMS5248F00674000ABCJ

12.2.1 Fabrics

The Fabrics tab (Connectrix only) provides the following information about the fabrics in which the switch participates:

- Principal Switch WWN – Worldwide name of the principal switch in the fabric.
- Principal Switch IP – The IP address of the principal switch in the fabric.
- Partition ID
 - Brocade: If Virtual Fabrics (VF) are enabled, this field displays the VF ID for each VF defined on the switch. If not enabled, this field is set to 128.
 - Cisco: This field shows the VSAN ID.
- Total Switches – Total number of switches participating in the fabric that this VF or VSAN or switch is a member of. This number is a hyperlink which, when selected, displays a window listing all switches in the fabric.
- Total End Devices – Total number of N_Ports participating in the fabric that this VF or VSAN or switch is a member of.
- Monitored Switches – Total number of switches participating in the fabric that are also monitored by CloudIQ.
- Used % - Percentage of ports in this fabric that are in use.

FABRICS	PARTITIONS	ZONES	ATTACHED DEVICES	VIRTUAL MACHINES	COMPONENTS	2 Fabrics		
▲ Principal Switch WWN		Principal Switch IP Address		Partition ID	Total Switches	Monitored Switches	Total End Devices	Used %
10:00:C4:F5:7C:2D:11:A1		10.0.12.1		8	1	1	0	0.0
10:00:C4:F5:7C:2D:AA:01		10.0.12.1		128	2	1	32	–

12.2.2 Partitions

The Partitions tab (Connectrix only) provides information about Virtual Fabrics (Brocade) and VSANs (Cisco).

- Partition ID
 - Brocade: If Virtual Fabrics (VF) are enabled, this field displays the VF ID for each VF defined on the switch. If not enabled, this field is set to 128.
 - Cisco: This field shows the VSAN ID.
- Switch Name – Switch name as defined by the end user. If no switch name is set, this field displays the switch serial number.
- Management IP – IP address of the switch.
- Number of switches – Total number of switches participating in the fabric that this VF or VSAN or switch is a member of.
- Total end devices – Total number of N_Ports participating in the fabric that this VF or VSAN or switch is a member of.
- End devices, this switch only – Total number of N_Ports that are members of this VF or VSAN and are also directly attached to this switch.

FABRICS	PARTITIONS	ZONES	ATTACHED DEVICES	VIRTUAL MACHINES	COMPONENTS	2 Partitions	
▲ Partition ID		Switch Name	Management IP	Number of switches	Total end devices	End devices, this switch only	
8		Production SAN Extension	10.0.12.1	1	0	0	
128		Production SAN Extension	10.0.12.1	2	32	32	

12.2.3 Zones

The Zones tab (Connectrix only) lists out zoning information for the zones in the active configuration.

- Active Configuration – Name of the enabled zoning configuration.
- Zone Name – Name of the zone.
- Symbolic Name – Symbolic name of a zone member (only shown if zone member is logged into the switch).
- Member Name – Name of the zone member. This is typically the WWPN of the attached device but could also be the WWPN of the switch port or the WWNN of the attached device. It could also be in the “Domain, Port” format or “switch wwn, port” format.
- Alias – User-defined alias associated with the zone member.
- Is Logged In – Identifies if the end device is a member of a zone and logged into the fabric.
- Interface – Identifies the interface on the switch where the end device is logged in.
- Partition ID
 - Brocade: If Virtual Fabrics (VF) are enabled, this field displays the VF ID for each VF defined on the switch. If not enabled, this field is set to 128.
 - Cisco: This field shows the VSAN ID.

FABRICS	PARTITIONS	ZONES	ATTACHED DEVICES	VIRTUAL MACHINES	COMPONENTS	16 Zones			
Active Configuration		Zone Name	Symbolic Name	Member Name	Alias	Is Logged In	Interface	Partition ID	
PRDConfig		PrdSQL_IOP063182_VMAX_240_FA_1D_1	[61] *Emulex LPe12002-E FV1.11A5 DV12.0.0.2. H...	10:00:00:00:C9:9D:E0:31	PrdSQL_182_hba0	Yes	3/0	128	
PRDConfig		PrdSQL_IOP063182_VMAX_240_FA_1D_1	[98] *SYMMETRIX:000197600240:FAN-2f00:FN:...	50:00:09:73:98:03:C5:A6	VMAX_240_FA_1D_1	Yes	3/16	128	
PRDConfig		PrdSQL_IOP063182_VMAX_240_FA_1D_2	[61] *Emulex LPe12002-E FV1.11A5 DV12.0.0.2. H...	10:00:00:00:C9:9D:E0:32	PrdSQL_182_hba1	Yes	3/1	128	
PRDConfig		PrdSQL_IOP063182_VMAX_240_FA_1D_2	[98] *SYMMETRIX:000197600240:FAN-2f01 2:FN...	50:00:09:73:98:03:C5:B6	VMAX_240_FA_1D_2	Yes	3/17	128	

12.2.4 Attached Devices

The Attached Devices tab (Connectrix only) lists out various information for devices that are physically attached to the switch.

- WWPN – Worldwide Port Name of the attached device
- Symbolic Name – Symbolic name of the attached device (only shown if the zone member is logged into the switch).
- Zoned – Identifies if the attached device is a member of the zone that is present in the active configuration.
- Interface – Identifies the interface on the switch where the end device is logged in.
- Speed (Gbps) – Speed that the attached device negotiated with the switch during the login process.
- Partition ID
 - Brocade: If Virtual Fabrics (VF) are enabled, this field displays the VF ID for each VF defined on the switch. If not enabled, this field is set to 128.
 - Cisco: This field shows the VSAN ID.

FABRICS	PARTITIONS	ZONES	ATTACHED DEVICES	VIRTUAL MACHINES	COMPONENTS	40 Attached Devices			
WWPN		Symbolic Name	Zoned	Interface	Speed (Gbps)	Partition ID			
		10:00:00:00:C9:9D:E0:31	[61] *Emulex LPe12002-E FV1.11A5 DV12.0.0.2. HN:iop063182. OS:Linux.	Yes	3/0	32	128		
		10:00:00:00:C9:9D:E0:32	[61] *Emulex LPe12002-E FV1.11A5 DV12.0.0.2. HN:iop063182. OS:Linux.	Yes	3/1	32	128		
		10:00:00:00:C9:9D:E0:33	[61] *Emulex LPe12002-E FV1.11A5 DV12.0.0.2. HN:iop063182. OS:Linux.	Yes	3/2	32	128		

12.2.5 Virtual Machines

The Virtual Machines tab (Connectrix only) shows virtual machines residing on ESXi servers that are connected to the switch.

- Name – Name of the virtual machine.
- Network Address – IP address of the virtual machine.
- Operating System – Operating system installed on the virtual machine.
- vCenter – Hostname of vCenter managing the virtual machine.
- ESXi – Hostname of ESXi server hosting the virtual machine.
- Cluster – Name of ESXi Cluster hosting the virtual machine.

FABRICS	PARTITIONS	ZONES	ATTACHED DEVICES	VIRTUAL MACHINES	COMPONENTS	11 Virtual Machines
▲ Name	Network Address	Operating System	vCenter	ESXi	Cluster	
Market_Research_VM16_1	10.1.16.1	Red Hat Enterprise Linux 5 (64-bit)	10.0.0.100	LocalESX4	Market Research Cluster	
Market_Research_VM20_1	10.1.20.1	Red Hat Enterprise Linux 5 (64-bit)	10.0.0.100	LocalESX4	Market Research Cluster	
Test_VM0_1	10.178.0.1	Red Hat Enterprise Linux 5 (64-bit)	VC-Test-27T42L.infra.lab	TD_ESX_2	Test Cluster	
Test_VM1	10.0.7.243	Red Hat Enterprise Linux 5 (64-bit)	VC-Test-27T42L.infra.lab	TD_ESX_1	Test Cluster	

12.2.6 Components

The Components tab lists out the system hardware for both Connectrix and PowerSwitch.

- Type – The type of component installed in the chassis.
- Slot/Unit – Location of the component in the chassis.
- State – For optics, this field provides the strength of the optical signal being received. For other hardware components, this field provides the operational state of the component.
- Part Number – Part number of the component.
- Serial Number – Serial number of the component.
- EOSL Date (Connectrix only) – Identifies components with upcoming End of Life (EOL) and End of Support Life (EOSL) dates.

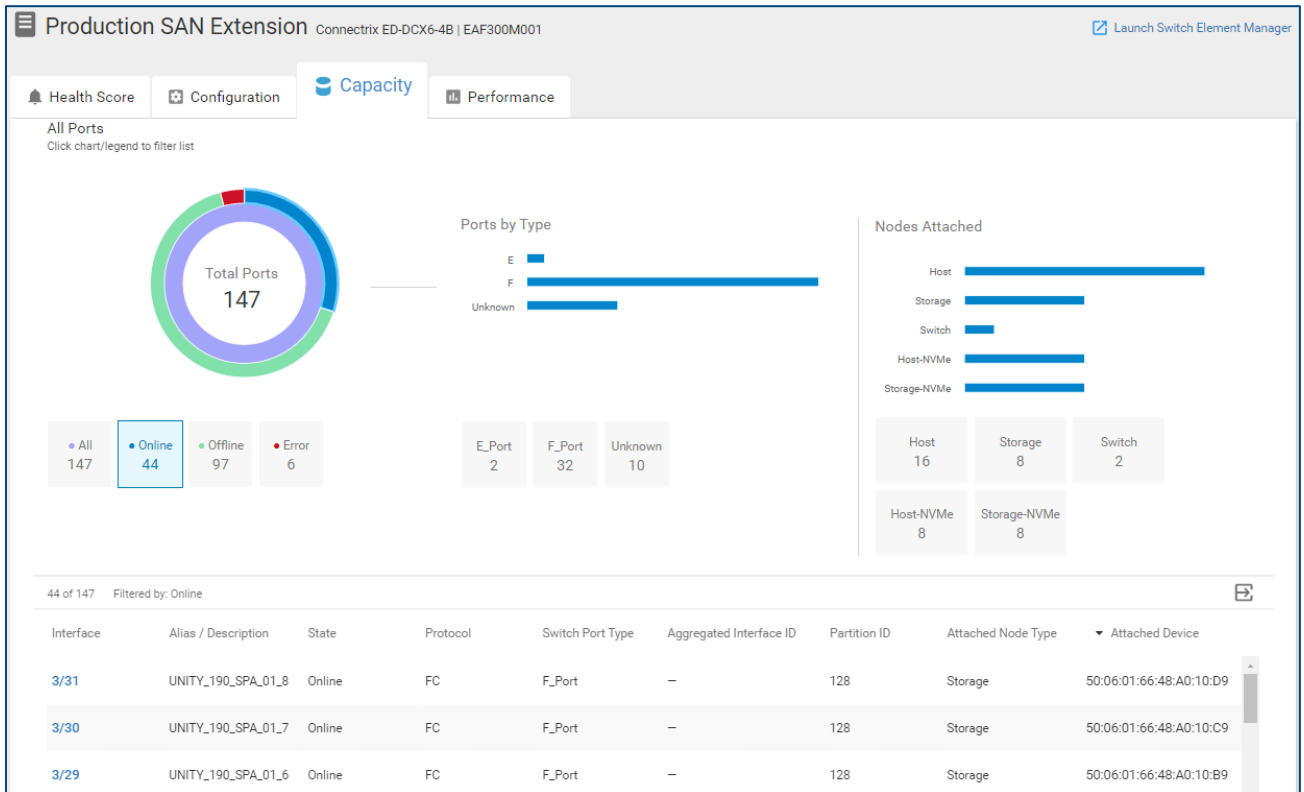
FABRICS	PARTITIONS	ZONES	ATTACHED DEVICES	VIRTUAL MACHINES	COMPONENTS	65 Components
▲ Type	Slot/Unit	State	Part Number	Serial Number	EOSL Date	
Fan	49	Ok	DS-C9718-FAN	JAE1935073E	–	
Fan	51	Ok	DS-C9718-FAN	JAE19350754	–	
Fan	50	Ok	DS-C9718-FAN	JAE1935074C	–	
Module (1/10 Gbps Ethernet Module)	1	ok	DS-X9848-480K9	–	–	
Module (1/10/40G IPS,2/4/8/10/16G FC Module)	5	ok	DS-X9334-K9	–	Nov 18, 2021	
Module (2/4/8/10/16 Gbps Advanced FC Module)	2	ok	DS-X9448-768K9	–	May 17, 2024	
Module (40 Gbps FCoE Module)	4	ok	DS-X9824-960K9	–	–	

12.3 Switch System Details – Capacity

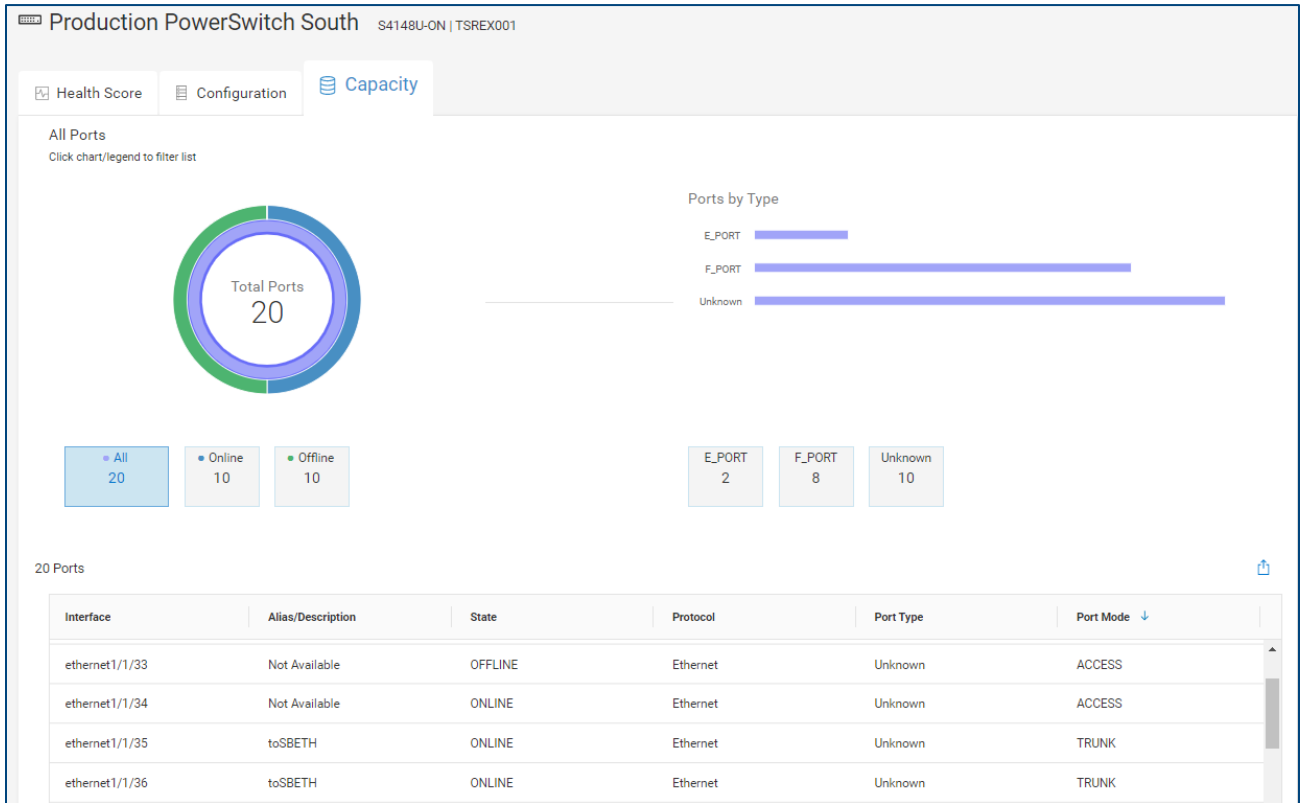
The capacity tab for a switch provides port usage details for both Connectrix and PowerSwitch. The upper left portion of the view shows a breakdown of the ports on the switch broken down by Online, Offline, and Error status. The Ports by Type bar charts show a filtered list of ports broken down by port type. For Connectrix, the Nodes Attached bar charts show a breakdown of attached nodes by Host Ports, Storage Ports, and Switch ports. The bottom of the page displays a filtered list of ports based on the filters selected in the top half of the page. The following columns are displayed at the bottom of the page:

- Interface – Location of the port, shown as slot/port number. For Connectrix, it is also a hyperlink which directs user to port performance charts.
- Alias/Description – Switch port alias, if defined.
- State – Status of the switch port.
- Protocol – Protocol configured for the switch port.
- Switch Port Type – Logical configuration of the switch port. Possible values include F_PORT, N_PORT, E_PORT, Unknown, or Disabled for FC ports. Set to Unknown for Ethernet ports.
- Port Mode (PowerSwitch only) – Logical configuration of the interface, such as Access or Trunk.
- Aggregated Interface ID (Connectrix only) – Value of trunk or port channel if the physical port is being aggregated.
- Partition ID (Connectrix only)
 - Brocade: If Virtual Fabrics (VF) are enabled, this field displays the VF ID for each VF defined on the switch. If not enabled, this field is set to 128.
 - Cisco: This field shows the VSAN ID.
- Attached Node Type (Connectrix only) – Describes the device attached to the switch port.
- Attached Device (Connectrix only) – Worldwide name of the attached device.

Capacity tab for Connectrix:



Capacity tab for PowerSwitch:

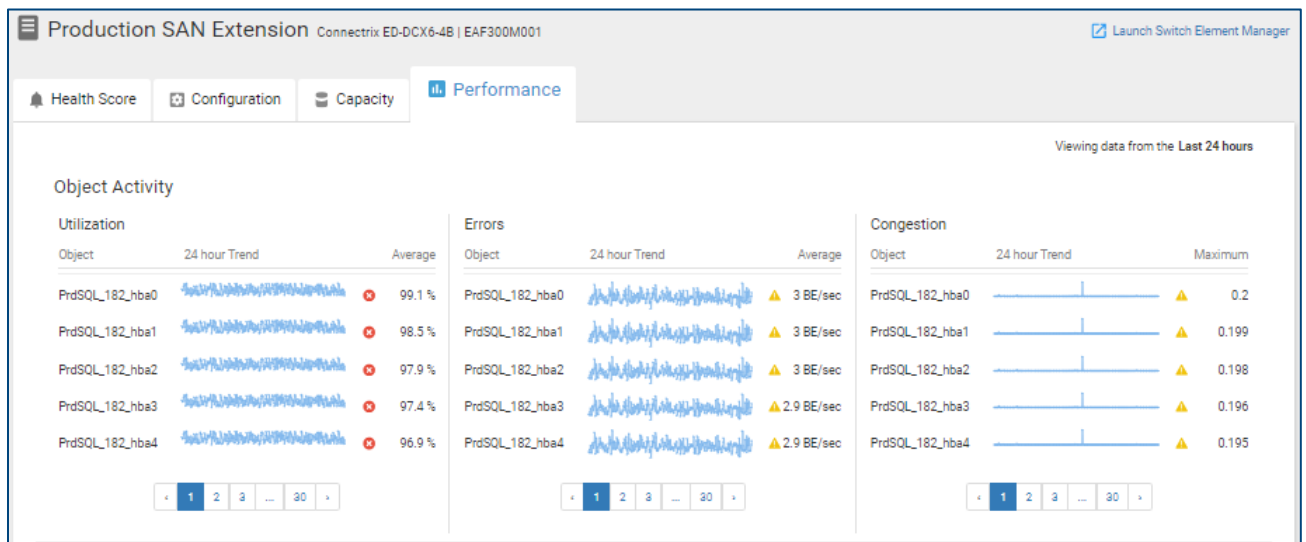


12.4 Switch System Details – Performance

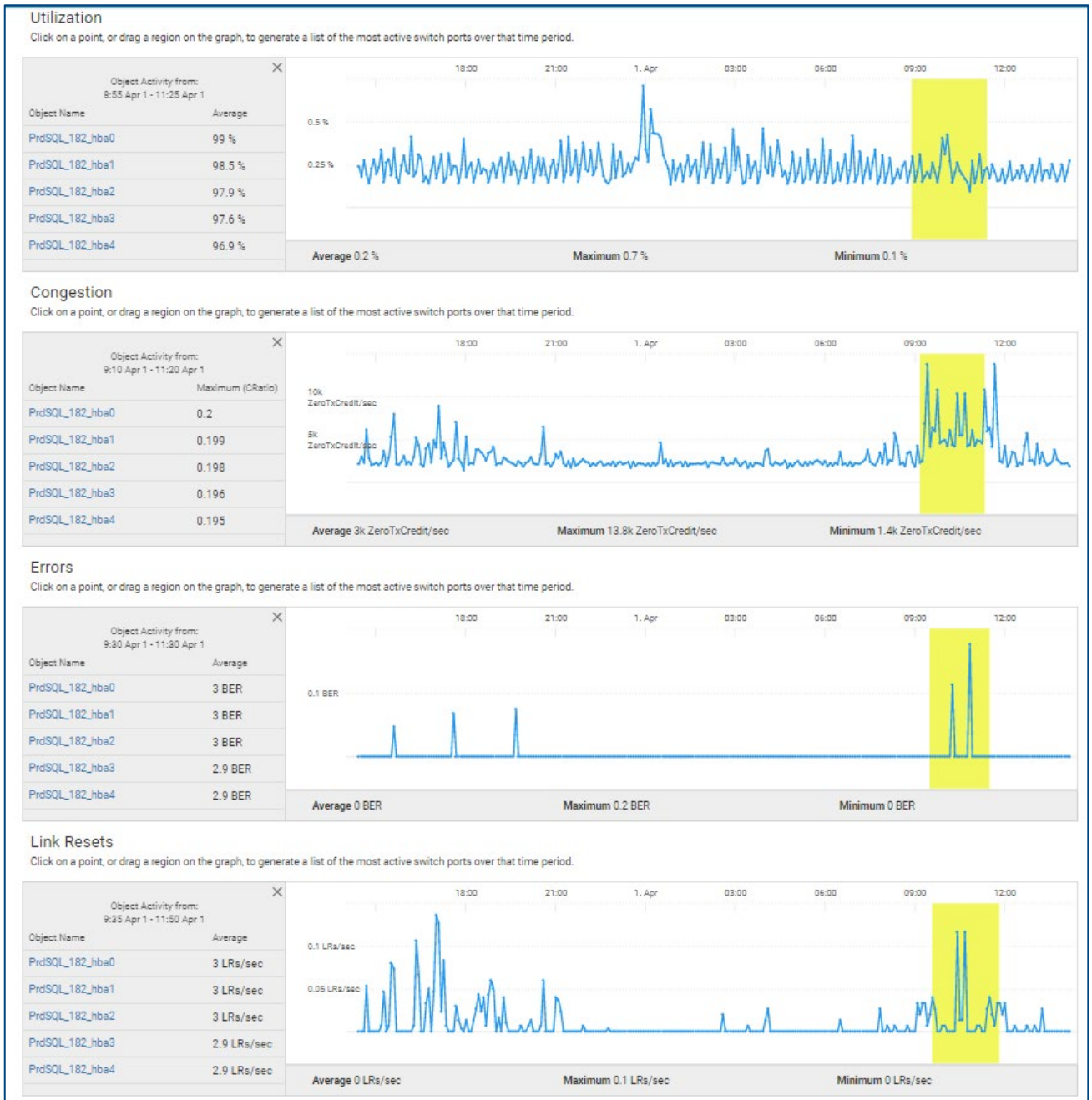
The Performance tab is only supported for Connectrix at the time of this publication. The top section of the Performance tab is Object Activity and it displays the top ports contributing to Utilization, Errors, and Congestion sorted by their 24-hour average. Showing the top objects first allows the user to quickly identify ports using the most resources and experiencing the most errors in the last 24 hours.

The user can scroll down to see 24-hour charts for the following switch performance metrics:

- Utilization – The percentage of system bandwidth in use. This value represents the percentage of transmit bandwidth being used across all switch interfaces.
- Congestion – The sum of all “time spent at zero transmit” counters across all switch interfaces.
- Errors – The sum of all bit error counters across all switch interfaces.
- Link Resets – The sum of all Link Reset primitives that have been either transmitted or received across all switch interfaces.



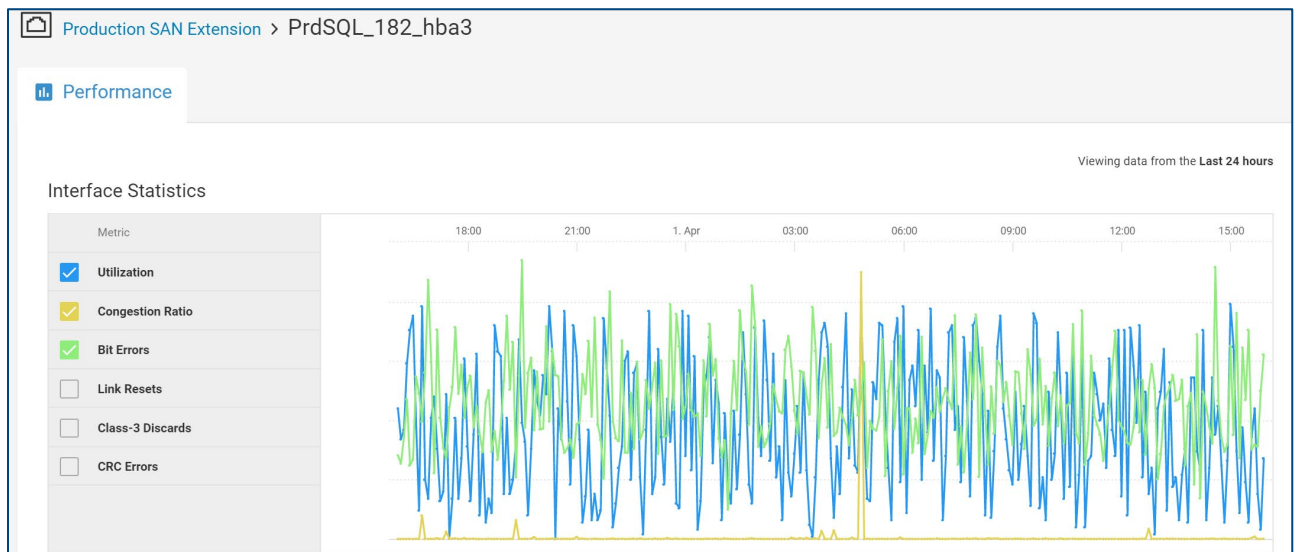
Highlighting an area in any of these performance charts shows the top five port contributors to that performance metric during that time period in the left side of the chart. The ports listed in the left side of each chart are hyperlinks that direct the user to port-level performance charts.

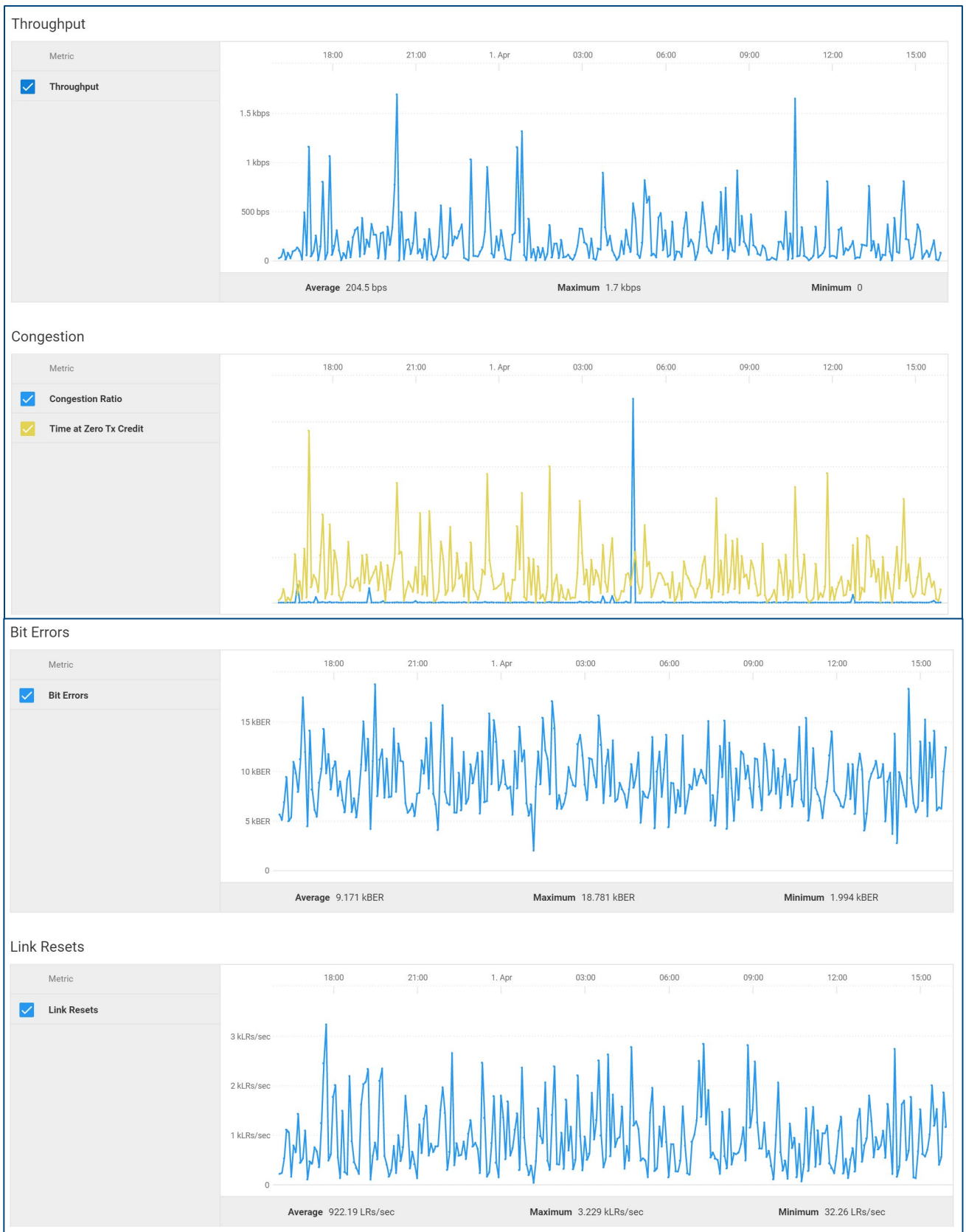


12.5 Switch Port Details – Performance

Users can access port-level performance metrics by selecting the port from the Interface column in the Switch Capacity page, or by selecting the port hyperlink in the top object activity shown in the previous section. Port-level performance metrics are shown in the following charts:

- Interface Statistics
 - Utilization
 - Congestion Ratio
 - Bit Errors
 - Link Resets
 - Class-3 Discards
 - CRC Errors
- Throughput
- Congestion
 - Congestion Ratio
 - Time at Zero Tx Credit
- Bit Errors
- Link Resets





13 VxRail Hyperconverged Infrastructure Systems

CloudIQ supports VxRail HCI systems. The HCI tab in the various multisystem views has been discussed earlier in this paper. This section describes the information provided in the system details view for a VxRail cluster. Each cluster has the Health Score, Configuration, Capacity, and Performance tabs. Each tab provides the Launch MyVxRail hyperlink to easily go to MyVxRail. The details of each tab are presented below.

13.1 VxRail System Details – Health Score

The Health Score tab for VxRail clusters is similar to other systems. The Health Score is determined by monitoring issues in the following categories: Components, Configuration, Capacity, and Performance. Each issue provides a recommended remediation or link to an applicable knowledge base article. Health Score history is also supported for VxRail.

The screenshot displays the Health Score interface for a VxRail cluster. At the top, the cluster name is 'VxRail-Virtual-SAN-Cluster-523f5813' with ID 'VxRail E560 | 23HBYK20000000'. A 'LAUNCH MyVxRail' button is in the top right. Below the title bar are tabs for 'Health Score', 'Configuration', 'Capacity', and 'Performance'. The 'Health Score' tab is active, showing a circular gauge with a score of 80 and the label 'FAIR'. A message states: 'Components is the top health check category impacting VxRail-Virtual-SAN-Cluster-523f5813's health score.' Below this is a 'Health Issues' section with a table:

Category	Count	Details																				
Total Issues	4																					
Components	4	<table border="1"> <thead> <tr> <th>Score</th> <th>Time</th> <th>Host</th> <th>Message</th> </tr> </thead> <tbody> <tr> <td>-2</td> <td>2 days ago</td> <td>c3-esx01.racke09.local</td> <td>Host health - Error. An error was detected on this ESXi host. See detailed status in vCenter Server.</td> </tr> <tr> <td colspan="4">Resolution: Please reference KB 198308.</td> </tr> <tr> <td>-2</td> <td>2 days ago</td> <td>c3-esx02.racke09.local</td> <td>Host health - Error. An error was detected on this ESXi host. See detailed status in vCenter Server.</td> </tr> <tr> <td>-2</td> <td>2 days ago</td> <td>c3-esx03.racke09.local</td> <td>Host health - Error. An error was detected on this ESXi host. See detailed status in vCenter Server.</td> </tr> </tbody> </table>	Score	Time	Host	Message	-2	2 days ago	c3-esx01.racke09.local	Host health - Error. An error was detected on this ESXi host. See detailed status in vCenter Server.	Resolution: Please reference KB 198308 .				-2	2 days ago	c3-esx02.racke09.local	Host health - Error. An error was detected on this ESXi host. See detailed status in vCenter Server.	-2	2 days ago	c3-esx03.racke09.local	Host health - Error. An error was detected on this ESXi host. See detailed status in vCenter Server.
Score	Time	Host	Message																			
-2	2 days ago	c3-esx01.racke09.local	Host health - Error. An error was detected on this ESXi host. See detailed status in vCenter Server.																			
Resolution: Please reference KB 198308 .																						
-2	2 days ago	c3-esx02.racke09.local	Host health - Error. An error was detected on this ESXi host. See detailed status in vCenter Server.																			
-2	2 days ago	c3-esx03.racke09.local	Host health - Error. An error was detected on this ESXi host. See detailed status in vCenter Server.																			
Configuration	✓																					
Capacity	✓																					
Performance	✓																					

13.2 VxRail System Details - Configuration

The Configuration tab provides various cluster attributes at the top half of the screen, including the serial number, cluster ID, location, site, version, various vCenter information, and contract information. The bottom half of the window contains the following tabs: Appliances, Hosts, and Drives.

The screenshot shows the 'Configuration' tab for a VxRail cluster. At the top, there are tabs for 'Health Score', 'Configuration', 'Capacity', and 'Performance'. The 'Configuration' tab is active, displaying various cluster attributes in a grid format. Below this, there are tabs for 'APPLIANCES', 'HOSTS', and 'DRIVES', with 'APPLIANCES' selected. A table lists three appliances with their serial numbers, models, and service tags.

Serial # / PSNT	Model	Service Tag
23HBYK20000002	VxRail E560	23HBYK22
23HBYK20000001	VxRail E560	23HBYK21
23HBYK20000000	VxRail E560	23HBYK20

13.2.1 Appliances

The Appliances tab lists the appliances that comprise the cluster as well as their models and service tags.

The screenshot shows the 'APPLIANCES' tab selected. It displays a table with three columns: 'Serial # / PSNT', 'Model', and 'Service Tag'. The table lists three appliances, all of which are VxRail E560 models with different service tags.

Serial # / PSNT	Model	Service Tag
23HBYK20000002	VxRail E560	23HBYK22
23HBYK20000001	VxRail E560	23HBYK21
23HBYK20000000	VxRail E560	23HBYK20

13.2.2 Hosts

The Hosts tab lists the ESXi servers that are in the VxRail cluster along with their serial number, ESXi version, BIOS, and service tag.

The screenshot shows the 'HOSTS' tab selected. It displays a table with six columns: 'Name', 'Appliance Serial # / PSNT', 'ESXi', 'Dell PTAgent', 'BIOS', and 'Service Tag'. The table lists three ESXi servers, each associated with an appliance serial number and a service tag.

Name	Appliance Serial # / PSNT	ESXi	Dell PTAgent	BIOS	Service Tag
c3-esx03.racke09.local	23HBYK20000002	6.5.0 build-13644318	2.2.0.32	2.6.3	23HBYK6
c3-esx02.racke09.local	23HBYK20000001	6.5.0 build-13644318	2.2.0.32	2.6.3	23HBYK5
c3-esx01.racke09.local	23HBYK20000000	6.5.0 build-13644318	2.2.0.32	2.6.3	23HBYK4

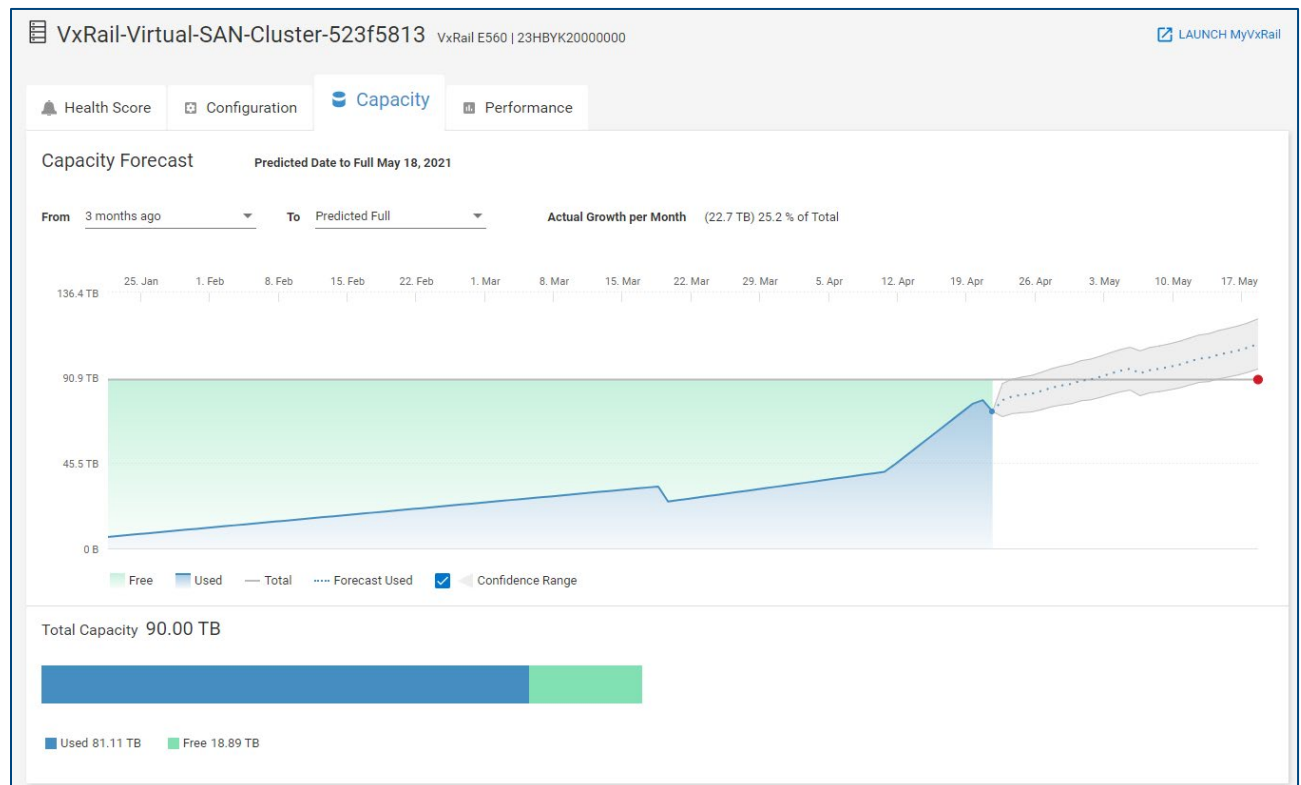
13.2.3 Drives

The Drives tab provides a listing of the hard drives in the cluster. This tab includes the ESXi host, slot and enclosure, serial number, and firmware. Capacity shows a dash as it is not yet supported for HCI systems.

APPLIANCES						HOSTS		DRIVES		6 Drives	
Hostname	Slot	Enclosure	Serial #	Firmware	Capacity (GB)						
c3-esx03.racke09.local	0	0	25HB56G7	AS10	–						
c3-esx03.racke09.local	1	0	25HB56G8	AS10	–						
c3-esx02.racke09.local	0	0	25HB56G5	AS10	–						
c3-esx02.racke09.local	1	0	25HB56G6	AS10	–						
c3-esx01.racke09.local	0	0	25HB56G3	AS10	–						
c3-esx01.racke09.local	1	0	25HB56G4	AS10	–						

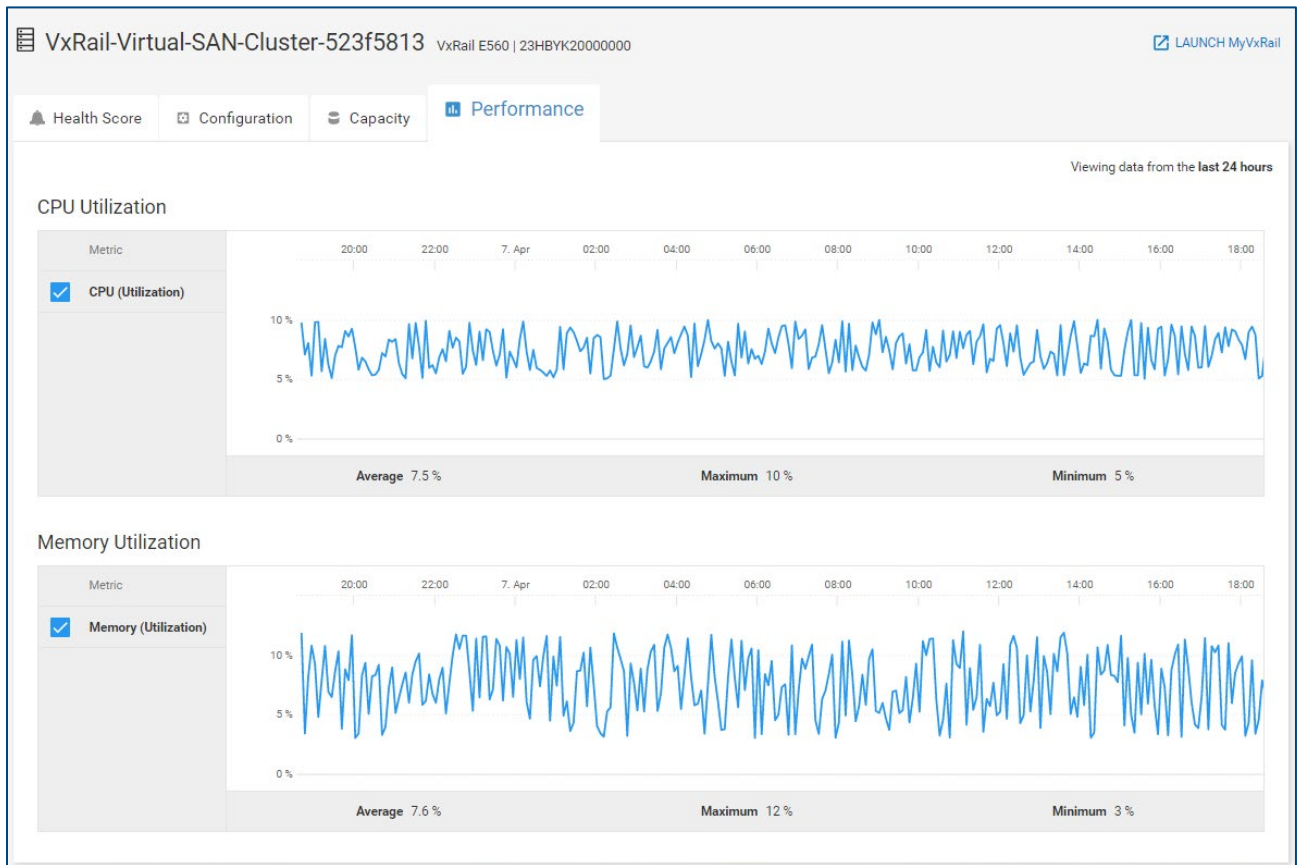
13.3 VxRail System Details – Capacity

The capacity tab provides a capacity forecast chart on the top of the page. As with other systems, the chart displays the predicted full date along with a confidence range. The time range of the chart can be changed using the “From” and “To” drop-down menus. The bottom of the page displays a simple horizontal bar chart showing the breakdown of Total, Used, and Free capacity on the cluster.



13.4 VxRail System Details – Performance

The Performance tab provides 24-hour charts of CPU and Memory on the system.



14 Servers

CloudIQ now supports the monitoring of PowerEdge servers through a plug-in to OpenManage Enterprise (OME). The multisystem views for servers have been discussed earlier in this paper. This section documents the available information in the system details page for a PowerEdge server. Each server has the Health Score, Inventory, and Performance tab. Each tab provides a link to view the server in OpenManage Enterprise. The details of each tab are presented in the following sections.

14.1 PowerEdge System Details – Health Score

CloudIQ provides the Proactive Health Score for each server monitored by CloudIQ. Only the Components category is used to calculate the Health Score. As with other systems, each health issue identified in CloudIQ has a corresponding recommended remediation. The Health Score History is tracked at the bottom of the page to help identify recurring issues.

The screenshot displays the 'Health Score' tab for a server. At the top, there are navigation tabs for 'Inventory' and 'Performance'. The main area features a large circular gauge showing a score of 70, labeled 'POOR'. Below this, a text box states: 'Components is the top health check category impacting WIN-SYS02PE173's health score.'

Below the gauge, there are two tabs: 'HEALTH ISSUES' (selected) and 'SYSTEM ALERTS'. The 'HEALTH ISSUES' section shows a summary table:

Total Issues	5
Components	5 Issues

The 'Components' category is expanded to show a list of issues:

- Components** (-30): 1 day ago. FAN0029: Fan 5 is either removed, incorrectly installed, or not present.
- Components** (-30): 1 day ago. CPU0001: CPU 1 has a thermal trip (over-temperature) event.
- Resolution:** Review logs for fan failures, replace failed fans. If no fan failures are detected, check inlet temperature (if available) and reinstall processor heatsink.
- Components** (-10): 1 day ago. PWR1002: The system performance degraded because of thermal protection.

At the bottom, the 'Health Score History' section shows a timeline from Nov 12 16:51 to Nov 17 16:51. A line chart plots the health score over time, with a significant drop on Nov 16. To the right of the chart, the 'Health Changes' log provides details:

- Nov 16, 2021 4:51 PM:** 70. 1 New Issue, 0 Resolved Issues.
- Nov 14, 2021 4:51 PM:** 100. 0 New Issues, 1 Resolved Issue.
- Nov 12, 2021 4:51 PM:** 90. 1 New Issue, 0 Resolved Issues.

14.2 PowerEdge System Details – Inventory

The Inventory page provides configuration, firmware, contract, and license information for the server. The top half of Inventory provides various attributes about the server including operating system name and version, memory and CPU information, and Chassis information.

The bottom of the page has the following tabs: Hardware, Firmware, Licenses, Contract, and Management Info. A Virtual Machines tab is available and populated for servers running ESXi. Virtual machine information requires discovery of vCenter using the CloudIQ Collector. See Appendix A.12 VMware for additional details.

The screenshot shows the 'Inventory' tab selected. It displays system details in a grid format:

- OS Name: Windows Server 2012 R2
- OS Version: 6.3
- Hostname: WIN-02PE86
- MAC Address: 01:00:5E:90:10:42
- Total Memory: 16.0 GB
- Processor Summary: 2 Processors: Intel(R) Xeon(R) CPU E5-2630 v3 @ 2.40GHz
- Chassis Health: Ok
- Chassis Name: ML Research Chassis 02
- Chassis Service Tag: AMX70PE
- Chassis Slot Name: Slot 1
- Chassis Slot: 1

Below the details are tabs for HARDWARE, FIRMWARE, LICENSES, CONTRACT, and MANAGEMENT INFO. The 'View' dropdown is set to 'Device Card Information', showing 3 device cards in a table:

Description	Manufacturer	FQDD	Slot Length	Slot Type	Bus Width
FCH SATA Controller [AHCI mode]	Advanced Micro Devices, Inc. [AMD]	AHCI.Embedded.3-1	Long Length	PCI Express Gen 3 x16	8x or x8
Family 17h (Models 00h-0fh) PCIe Dummy Host Bridge	Advanced Micro Devices, Inc. [AMD]	HostBridge.Embedded.3-5	Long Length	PCI Express Gen 3 x16	8x or x8
Family 17h (Models 00h-0fh) PCIe Dummy Host Bridge	Advanced Micro Devices, Inc. [AMD]	HostBridge.Embedded.3-2	Long Length	PCI Express Gen 3 x16	8x or x8

14.2.1 Hardware

The Hardware tab has an additional drop-down menu to view information for the following components:

- Device Card Information
- Processors
- Network Devices
- PowerSupplies
- Physical Disks
- Memory Information
- FRU
- Virtual Flash
- Storage Enclosures
- Storage Controllers
- FC Ports

The screenshot shows the 'HARDWARE' tab selected. A 'View' dropdown menu is open, displaying the following options:

- FC Ports
- Device Card Information
- Processors
- Network Devices
- Power Supplies
- Physical Disks
- Memory Information
- FRU

The background shows a table with columns for 'Name' and 'Port 0: Emule'.

14.2.2 Firmware

The Firmware tab lists out BIOS and Firmware versions and the installation date.

HARDWARE	FIRMWARE	LICENSES	CONTRACT	MANAGEMENT INFO	VIRTUAL MACHINES
8 Firmware Entries 🔗					
Description	Type	Version	Install Date		
Backplane 0	FRMW	4.26	November 18, 2020, 4:15:43 PM		
BIOS	BIOS	1.6.11	August 20, 2021, 5:15:43 PM		
BIOS	BIOS	1.0.2	November 18, 2020, 4:15:43 PM		
Integrated Dell Remote Access Controller	FRMW	4.11.11.11	May 22, 2021, 5:15:43 PM		
Backplane 0	FRMW	4.27	November 18, 2020, 4:15:43 PM		
OS Drivers Pack	APAC	0	September 4, 2021, 5:15:43 PM		
OS COLLECTOR 3.2, X00	APAC	3.2	September 4, 2021, 5:15:43 PM		
BIOS	BIOS	1.6.11	November 18, 2020, 4:15:43 PM		

14.2.3 Licenses

The Licenses tab shows various information about the license including the status, the license type (perpetual or evaluation), a description, license expiration (for evaluation licenses), and the Entitlement ID.

HARDWARE	FIRMWARE	LICENSES	CONTRACT	MANAGEMENT INFO	VIRTUAL MACHINES
1 License 🔗					
Status	Type	Description	Expiration	Entitlement ID	
🔗 Unknown	Perpetual	iDRAC8 Enterprise License	—	FN-469545409	

14.2.4 Contract

The Contract tab shows support contract information. This includes Status, a description, the contract type, and start and end dates.

HARDWARE	FIRMWARE	LICENSES	CONTRACT	MANAGEMENT INFO	VIRTUAL MACHINES
2 Contracts VIEW ON DELL SUPPORT SITE 🔗					
Status	Service Level Description	Contract Type	Start Date	Expiration	
🟢 Active	Prosupport Plus	Extended	November 18, 2020, 4:18:28 PM	November 18, 2022, 4:18:28 PM	
🔴 Expired	Onsite Diagnosis Service	Full	November 18, 2019, 4:18:28 PM	November 18, 2020, 4:18:28 PM	

14.2.5 Management Info

The Management Info tab provides the IP Address, MAC Address, Name, and DNS Name of the iDRAC. There is also a hyperlink to launch the iDRAC management URL so that users can quickly go to the iDRAC and perform any necessary remote management tasks.

HARDWARE	FIRMWARE	LICENSES	CONTRACT	MANAGEMENT INFO	VIRTUAL MACHINES
1 Management Agent 🔗					
IP Address	MAC Address	Name	Management Url	DNS Name	
198.51.100.69	01:00:5E:90:10:53	SYSMGMT-ML-LABS	https://198.51.100.69/	idrac-arhh1qy.devops.acme.com	

14.2.6 Virtual Machines

The Virtual Machines tab is visible for servers running ESXi and lists out various information about each VM including name, IP address, operating system, vCenter name, and ESXi Cluster.

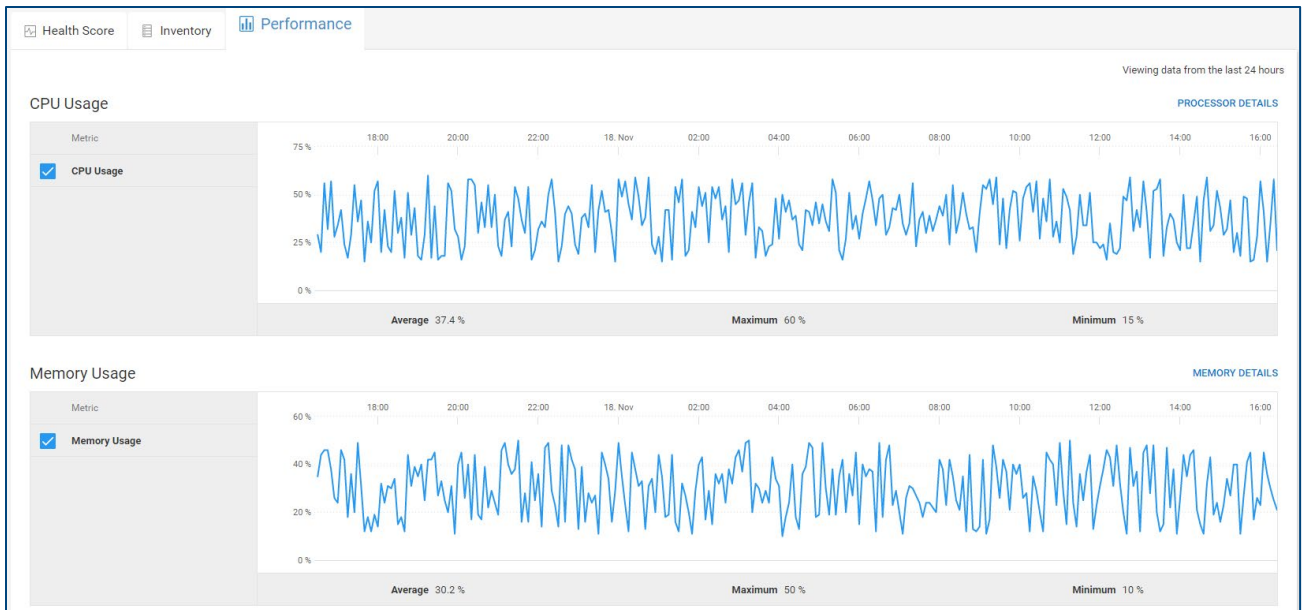
HARDWARE	FIRMWARE	LICENSES	CONTRACT	MANAGEMENT INFO	VIRTUAL MACHINES
0 Virtual Machines 🔗					
Name	Network Address	Operating System	vCenter	Cluster	
HR_Remote_VM1	10.0.2.1	Red Hat Enterprise Linux 5 (64-bit)	DistESX1	HR_Remote Cluster	

14.3 PowerEdge System Details – Performance

The Performance tab provides 24-hour charts for key performance metrics including:

- CPU Usage
- Memory Usage
- SYS Usage
- System Board IO Usage
- CPU Temperature
- System Inlet Temperature
- System Net Airflow
- Power Consumption

Each chart provides the average, minimum and maximum values of the metric during the time period. An example of the CPU and Memory Usage chart is shown below.



Note: Available metrics vary based on license type, hardware, and firmware levels. See the CloudIQ section of the [OpenManage Portfolio Software Licensing Guide](#) for additional details.

15 Data Protection

CloudIQ has added the ability to monitor PowerProtect DD backup storage systems and PowerProtect Data Manager. This chapter describes the current use cases for each.

15.1 PowerProtect DD

There are three tabs available on the system details page for PowerProtect DD: Health Score, Configuration, and Capacity. The “Launch DD System Manager” hyperlink is available on each tab to allow users to quickly go to the element manager in circumstances where additional detailed information is needed. The details available in each tab are presented below.

15.1.1 PowerProtect DD System Details – Health Score

All five categories are supported for determining the Health Score of each DD system. As with all other systems, each issue has a recommended resolution and the health score history is available at the bottom of the page.

dd-lab-01 DD9800 | APM00172712073 LAUNCH DD SYSTEM MANAGER

Health Score Configuration Capacity

80
FAIR

Capacity is the top health check category impacting dd-lab-01's health score.

Health Issues

Total Issues	1	Capacity	1 Issues
Components	✓	-20	about 16 hours ago Capacity threshold has exceeded 80% of the total cloud tier capacity
Configuration	✓		
Capacity	-20	Resolution:	Free space in the specified tier or unit by deleting unneeded items and running cleaning on the tier. If items cannot be deleted, storage must be added to the appropriate tier. If you need assistance recovering space, contact your contracted support provider. To purchase additional storage, please contact your Dell EMC sales representative or channel partner.
Performance	✓		
Data Protection	✓		

15.1.2 PowerProtect DD System Details – Configuration

The top portion of the Configuration tab provides various attributes including the serial number, model, site, location, version, and contract information. The bottom of the page contains the following tabs: Services, Replication, MTrees, and Disks. Each tab is discussed below.

The screenshot shows the configuration page for system 'dd-lab-01' (DD9800 | APM00172712073). It features three tabs: Health Score, Configuration (selected), and Capacity. The Configuration tab displays system attributes in a grid:

Serial Number	APM00172712073	Last Contact Time	Apr 7 2021, 10:03:40 PM UTC	Contract Expiration	Nov 11, 2030
Model	DD9800	Version	7.4.0.5-671629	Service Plan	ProSupport 4HR/Mission Critical
Location	Hopkinton, MA	Hostname	dd-lab-01.hopkinton.dell.com	Contract Number	1
Site	ACME Headquarters				

Below the system details are four tabs: SERVICES, REPLICATION, MTREES, and DISKS. The SERVICES tab is active, showing a list of 9 services with their status:

Service	Status
CIFS	Enabled
Cloud	Enabled
DDBoost	Enabled
Encryption	Enabled
File System	Enabled
High Availability	Enabled
NFS	Enabled
VTL	Disabled

15.1.2.1 Services

The Services tab provides a listing of the various services running on the system along with their status.

The screenshot shows the Services tab selected, displaying a list of 9 services with their status:

Service	Status
CIFS	Enabled
Cloud	Enabled
DDBoost	Enabled
Encryption	Enabled
File System	Enabled
High Availability	Enabled
NFS	Enabled
VTL	Disabled

15.1.2.2 Replication

The Replication tab provides a listing and status of the replication sessions on the system. This information includes the source and destination, the state, the time of the last sync, and amount of remaining data to replicate from the source to the destination.

SERVICES					REPLICATION	MTREES	DISKS	2 Replications	
Source	Destination	State	Synced As Of Time	Remaining(GB)					
mtree://dd-lab-01.hopkinton.dell.com...	mtree://corpbkup.hopkinton.dell.com...	Normal	Fri Dec 18 09:55	12.4					
mtree://dd-lab-01.hopkinton.dell.com...	mtree://corpbkup.hopkinton.dell.com...	Normal	Fri Dec 18 09:48	0.0					

15.1.2.3 MTrees

The MTrees tab lists each of the configured MTrees, Storage Units, VTL (Virtual Tape Library) Pools, and so on, with the logical used, physical used, and compression factor for the last 24 hours.

SERVICES					REPLICATION	MTREES	DISKS	3 MTrees	
					Last 24 hours				
Name	Logical Used(GB)	Physical Used(GB)	Compression Factor						
/data/col1/finance	217.6	308.3	0						
/data/col1/payroll	120.1	198.5	0						
/data/col1/backup	2.8	1.1	2.5						

15.1.2.4 Disks

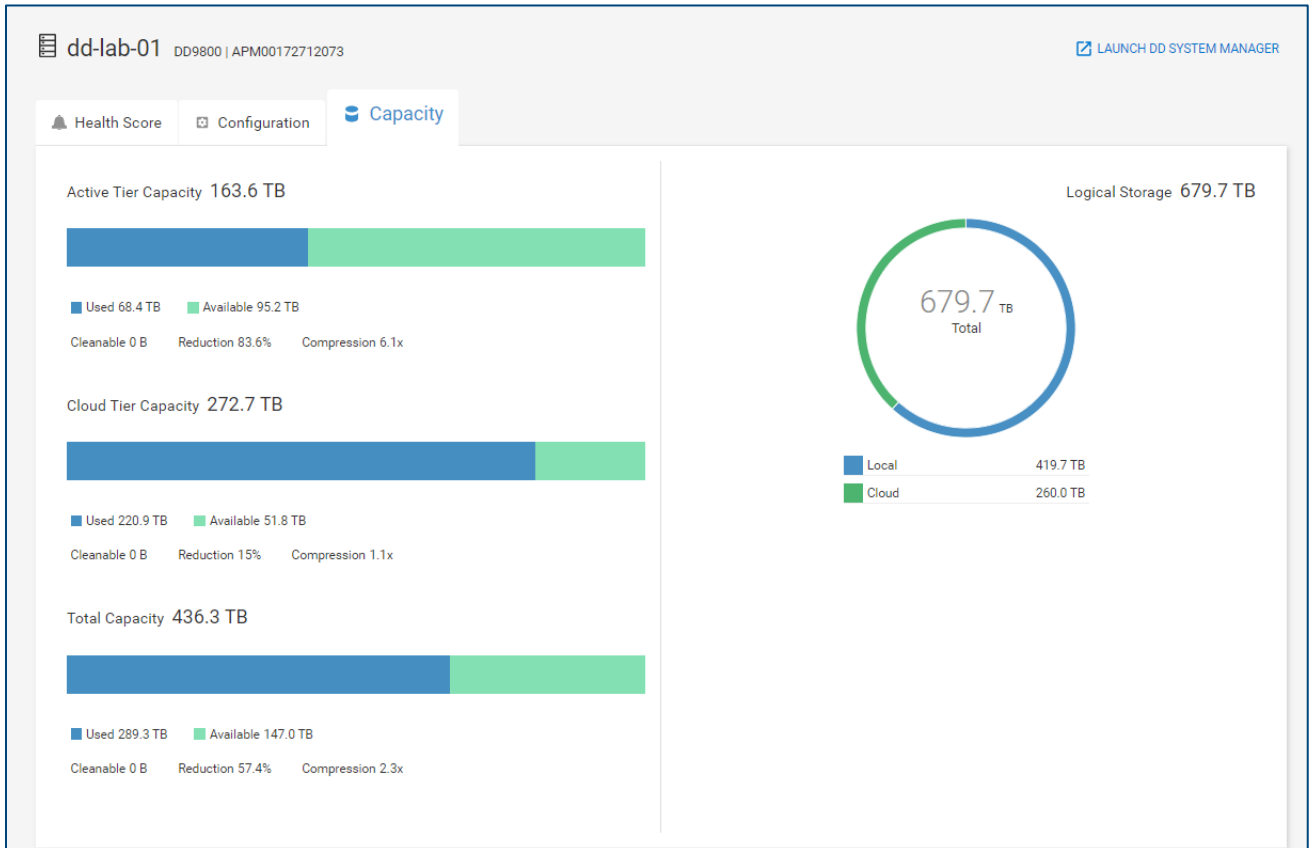
The final tab is the Disks tab. Each disk is listed with its slot, model, firmware, serial number, capacity, and type.

SERVICES								REPLICATION	MTREES	DISKS	139 Disks	
Disk	Slot	Manufacturer/Model	Firmware	Serial Number	Capacity(TB)	Type						
1.1	0	M500DC400-MTFDBAK4...	0154	1711164A8586	0.3	SATA-SSD						
1.2	1	M500DC400-MTFDBAK4...	0154	1711164A5B00	0.3	SATA-SSD						
1.3	2	M500DC400-MTFDBAK4...	0154	1711164A5656	0.3	SATA-SSD						
1.4	3	M500DC400-MTFDBAK4...	0154	1711164A5B25	0.3	SATA-SSD						
2.1	0	HITACHI H4SMR328_CLA...	S142	74V0J17X	0.7	SAS-SSD						
2.10	9	HITACHI H4SMR328_CLA...	S142	74V0LBOX	0.7	SAS-SSD						
2.11	10	HITACHI H4SMR328_CLA...	S142	74V0H11X	0.7	SAS-SSD						
2.12	11	HITACHI H4SMR328_CLA...	S142	74V07TJX	0.7	SAS-SSD						

15.1.3 PowerProtect DD System Details – Capacity

The Capacity tab breaks down the physical and logical capacity on the DD system. The left side of the page displays horizontal bar charts for Active Tier and Cloud Tier Capacity. A third chart shows the total of active and cloud tier capacity. Each chart provides the total, used and free capacity. The amount of cleanable storage is also displayed as well as the reduction percentage and compression factor.

The right half of the page provides a doughnut chart of total logical storage broken down between local and cloud. This page allows users to gain insight into the capacity utilization on the system and savings due to reduction and compression.



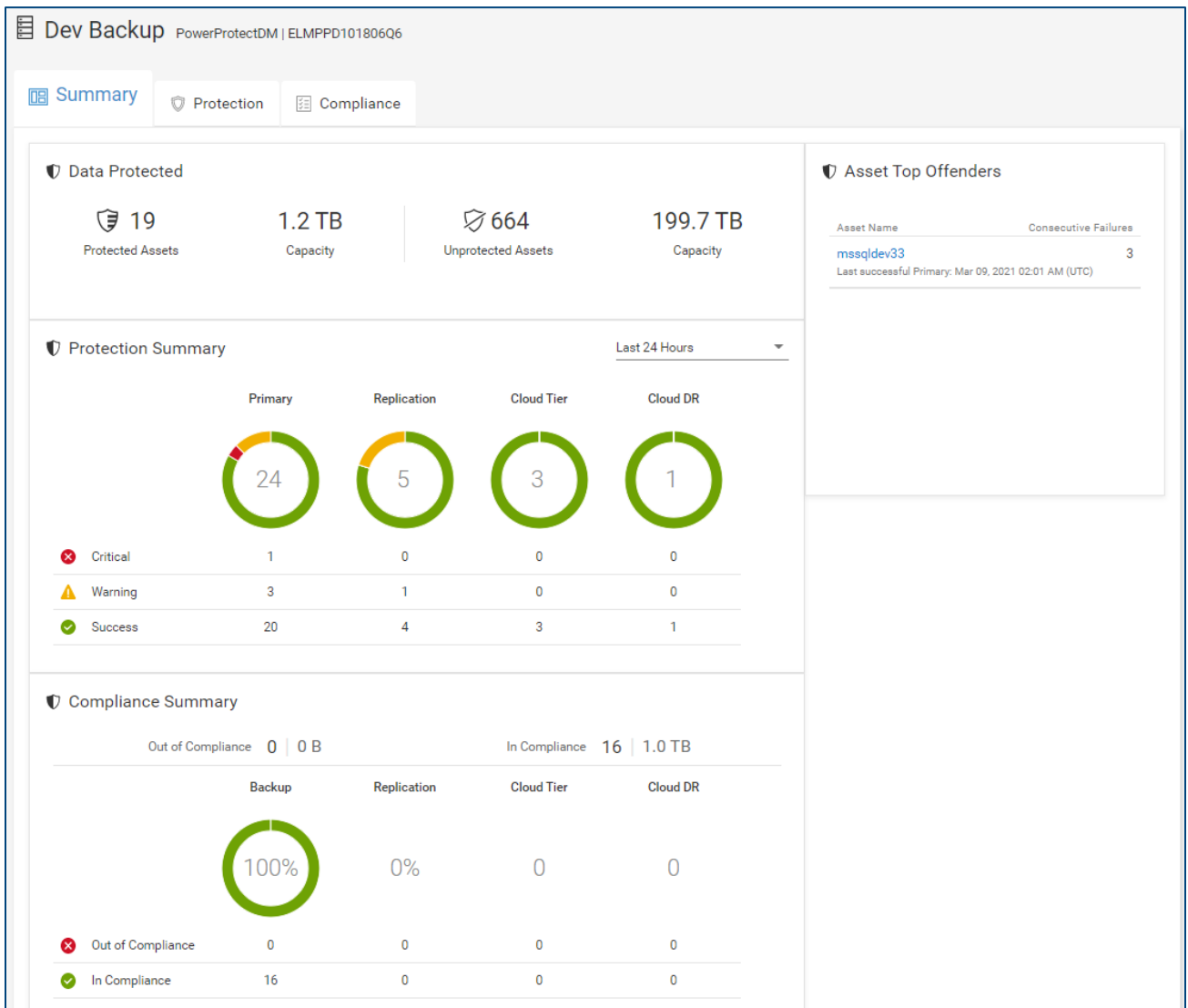
15.2 PowerProtect Data Manager

In addition to PowerProtect DD, CloudIQ can monitor instances of PowerProtect Data Manager. This allows users to see reports from Data Manager directly in the CloudIQ UI. We saw earlier that instances of PowerProtect Data Manager are displayed in Data Protection tab in the multisystem view for Inventory. Selecting an individual instance of Data Manager directs the user to the details page which has three tabs: Summary, Protection, and Compliance. Each tab is discussed below.

15.2.1 PowerProtect Data Manager Details – Summary

The summary tab allows the user to quickly see status and resource information for the protection environment. The Data Protected section provides total amount of protected and unprotected assets with their capacity.

The Protection Summary section summarizes the number of assets that are protected within a specified time range. The last 24 hours is the default time range, but this can be changed to either last 3 days or last 7 days. The status is critical if all protection activities failed during the selected time range. Warning means that the asset has both failed and successful protection activities. Success means all protection activities completed



successfully. The assets are grouped into one of the following four backup categories: Primary, Replication, Cloud Tier, and Cloud DR.

The Compliance Summary section displays the number and percentage of assets in each of the four backup categories that are in and out of compliance with their protection policy.

The Asset Top Offenders section lists those assets with the most consecutive failures. For those assets listed in this section, a link to the asset details page is available. The asset details page shows the status of the last backup and the protection history of the asset. Users can filter the Protection History table by time range, status, or activity.

ppdmdev > mssqldev33

Asset Name mssqldev33 System ppdmdev Active Policy Bronze ● Enabled
 Asset Type VM Asset Host sq|dev33.*****

Protection Summary

Asset
mssqldev33

- Primary Backup**
ppdmdev.*****
Last backup: 3/29/21, 3:19 PM UTC
Last successful: none
- Cloud Tier**
ppdmdev.*****
Last backup: none
- Replication**
ppdmrepl.*****
Last backup: none

Protection History

10 Activities

Clear All

Time Range (UTC)
Click to select a date range

Status
 Critical
 Success

Activity
 Primary
 Replicate
 Cloud Tier
 Cloud DR
 Promote

Details	Protection Type	Status	Start Time	Completion Ti...	Duration	Initiated By	Transfer Rate
...	Primary	✘ Critical	Thu, Apr 1 20...	Thu, Apr 1 20...	00:00:03	ADHOC	—
...	Primary	✘ Critical	Thu, Apr 1 20...	Thu, Apr 1 20...	00:00:03	ADHOC	—
...	Primary	✘ Critical	Thu, Apr 1 20...	Thu, Apr 1 20...	00:00:03	ADHOC	—
...	Primary	✘ Critical	Thu, Mar 4 20...	Thu, Mar 4 20...	00:00:03	POLICY	—
...	Primary	✘ Critical	Tue, Feb 16 2...	Tue, Feb 16 2...	00:00:03	POLICY	—
...	Primary	✘ Critical	Sat, Feb 13 2...	Sat, Feb 13 2...	00:00:03	POLICY	—
...	Primary	✘ Critical	Fri, Feb 5 202...	Fri, Feb 5 202...	00:00:03	POLICY	—
...	Primary	✘ Critical	Thu, Feb 4 20...	Thu, Feb 4 20...	00:00:02	POLICY	—
...	Primary	✘ Critical	Thu, Feb 4 20...	Thu, Feb 4 20...	00:00:03	POLICY	—
...	Primary	✘ Critical	Mon, Feb 1 2...	Mon, Feb 1 2...	00:00:03	POLICY	—

15.2.2 PowerProtect Data Manager Details – Protection

The Protection tab provides additional details of the protection status for each asset. This tab includes the asset name and the host on which it is running, the asset type (VM, Database, File System, VMAX Storage Group, or Kubernetes), the name of the active protection policy, and the status of each protection activity for the asset. A dash indicates that protection activity is not configured for the asset.

The screenshot shows the 'Dev Backup' environment with the 'Protection' tab selected. It displays a table with 4 assets. The table columns are: Asset, Host, Asset Type, Active Policy, Primary Status, Replication Status, Cloud Tier Status, and Cloud DR Status. The assets listed are mssqldev33, TestVM7, TestVM5, and TestVM16. The Primary Status for mssqldev33 is 'Critical', while the others are 'Success'. Replication Status for all is 'Success'. Cloud Tier and DR Status are all dashes.

Asset	Host	Asset Type	Active Policy	Primary Status	Replication Status	Cloud Tier Status	Cloud DR Status
mssqldev33	sqldev33.*****	VM	Bronze	Critical	Success	–	–
TestVM7	ldpdb011.*****	VM	29Policy	Success	Success	–	–
TestVM5	ldpdb011.*****	VM	29Policy	Success	Success	–	–
TestVM16	ldpdb014.*****	VM	29Policy	Success	Success	–	–

15.2.3 PowerProtect Data Manager Details - Compliance

The Compliance tab displays details of each asset's compliance for each configured activity to the defined service level agreements in the protection policy. This tab includes the asset name and the host on which it is running, the asset type, the active policy, SLA name, activity type, status, and the number of failed objectives.

Details	Asset	Host	Asset Type	Active Policy	SLA Name	Activity	Status	Failed Object...
	TestVM12	ldpdb016.*****	VM	59Policy	59BackupSLA	Protect	Failed	1
	TestVM13	ldpdb016.*****	VM	59Policy	59BackupSLA	Protect	Failed	1
	TestVM12	ldpdb016.*****	VM	59Policy	59CloudTierSLA	Cloud Tier	Success	0
	TestVM12	ldpdb016.*****	VM	59Policy	59PromotionSLA	Promotion	Success	0
	TestVM12	ldpdb016.*****	VM	59Policy	59ReplicationSLA	Replicate	Success	0
	TestVM13	ldpdb016.*****	VM	59Policy	59CloudTierSLA	Cloud Tier	Success	0
	TestVM13	ldpdb016.*****	VM	59Policy	59ReplicationSLA	Replicate	Success	0
	TestVM13	ldpdb016.*****	VM	59Policy	59PromotionSLA	Promotion	Success	0

For instances where there is a compliance failure, the Details button provides additional information. This information includes the failed objective, the error code, the reason, and remediation.

Failed Objectives for TestVM12 ✕

Failed Objective

Recovery Point

Error Code

CPLE0002

Reason

No copies found for protection stage between [Mar 21, 2021 08:00:00 PM UTC] and [Mar 23, 2021 12:00:00 AM UTC].

Remediation

.Please check whether protect job succeed and copies generated for this asset.

16 Converged System Details

CloudIQ can monitor VBlock and VxBlock Converged Systems. Converged Systems component information is displayed in the Inventory multisystems view under the CONVERGED tab. The Lifecycle menu provides the various milestone dates for each of the components in the Converged System. Each of these areas is described in the following sections.

16.1 Converged Systems - Inventory

Selecting the system name hyperlink for the Converged System from the Inventory menu opens the system details page. The top of the system details page provides information similar to what is displayed in the multisystem view. The bottom of the page has six tabs: Overview, Compute, Storage, Networking, Virtualization, and Management for more detailed information.

The screenshot shows the CloudIQ interface for a VxBlock system. The system name is VXBLOCK V70FN4013002FOUR. The managed by is Embedded AMP, and the location is Marlborough, MA. The vCenter version is 6.7.0. The storage component is selected, showing a table of storage arrays.

Model	Unity 650F	XtremIO HW X2-R
Name	UNITY650F	X2R-3Brick
Version	4.2.0.9433914	6.2.0-81

Note: Users can onboard VMware, Connectrix, and Storage components of a VxBlock individually to use other CloudIQ features described in this document.

16.1.1 Overview

The Overview tab (shown in the above screenshot) provides a high-level view of the components, software, and firmware versions that make up the converged system. The components include storage, networking, compute, and AMP (management).

- **Storage** – Listing of the types of storage arrays in the Converged System along with the names and firmware versions of the arrays.
- **Networking** – Listing of the LAN and SAN switches in the Converged System along with switch model, name, and firmware version.
- **Compute** – Listing of compute resources including the fabric interconnects per domain, chassis information, FEX information, and server profiles.
- **AMP** – Details of the storage array, managed applications, and server profiles for the AMP (Advanced Management Pod).

16.1.2 Compute

The Compute tab provides information about the UCS servers in the Converged System and their resources. There can be up to four tabs under computer including server profiles, fabric interconnects, chassis, and fabric extenders (FEX).

Server Profiles – Provides number of Cisco UCS servers aggregated by server type and the number of UCS blade and rackmount servers. Also displays server profile information including profile name, number of servers in each profile, type of UCS server, and software version running on the server. The details of each profile can be opened and displays information in the following tabs: Summary and Servers.

- **Summary** – Displays hardware and software information about the profile including the operating system, storage, and MLOMs and mezzanines.
- **Servers** – Displays the location, serial number, hostname, and CPU information for each server in the server profile.

Fabric Interconnects – Provides the number of each type of fabric interconnect switch and the number and type of each of UCS server. Also displays a list of FI switches including the switch name, model number, fabric connected to the FI, UCS manager version of the FI and the FI serial number. The details of each FI switch can be opened and displays information in the following tabs: Summary, Configuration, Ports, and Hardware.

- **Summary** – Displays versions of Cisco switch operating system and UCS software running on the FI switch.
- **Configuration** – Displays number of ports for each role, including server, LAN, and SAN uplink ports. Also displays LAN and FC aggregate bandwidth for LAN and SAN ports, respectively.
- **Ports** – Displays port information including connections, port speed, and port role. The user can filter the port list.
- **Hardware** – Displays hardware information about FI switch including number of fan bays, number of fans and number of power supplies.

Chassis – Displays information about the UCS Chassis including the number of each type of UCS Blade servers and the number of used and available slots in the chassis. Also displays high-level chassis information including the UCS domain, chassis name, and serial number. The details of the chassis can be opened and displays information in the following tabs: IOMs and Hardware.

- **IOMs** - Displays the chassis model, serial number, number of active links, aggregated bandwidth, and firmware version for each IOM.
- **Hardware** – Displays number of fans, fan bays, and power supplies for the chassis.

Fabric Extenders – Displays the number of each type of UCS server connected to the FEX. Also displays high-level information about the FEX switches including UCS domain name, FEX name, model number, the fabric interconnect to which the FEX is connected and the FEX serial number. The details of each FEX can be opened and displays information in the following tabs: Configuration, Ports, and Hardware.

- **Configuration** – Displays number of ports connected to UCS servers and uplinks as well as the uplink bandwidth and aggregate bandwidth for each fabric.
- **Ports** – Displays port information including connections, port speed, and port role. The user can filter by port role to see only those ports connected to servers or FI uplinks.

- **Hardware** – Displays hardware information for each FEX including name, product ID, serial number, and software version running on the FEX. Hardware Summary provides number of fans and power supplies for the FEX.

The following shows an example of the Server Profiles tab under Compute.

The screenshot displays the 'Server Profiles' tab under the 'Compute' section. The interface includes a navigation bar with 'Overview', 'Compute', 'Storage', 'Networking', 'Virtualization', and 'Management'. Below this, there are tabs for 'SERVER PROFILES', 'FABRIC INTERCONNECT', and 'CHASSIS'. A dropdown menu shows 'UCS Domain All Domains'. Summary statistics for 'Server Types' and 'Connection Models' are displayed. A table lists server profiles with columns for Profile, Servers, Model, and Operating Env. A 'Profile 1 Details' panel is open, showing a 'SUMMARY' section with fields like Servers (3), Model (UCSB-B200-M5), Server Firmware (4.0(4e)), Ethernet Version, Fibre Channel Version, Operating Environment (VMware ESXi), Operating Environment Build (13004448), and Operating Environment Ver... (6.7.0).

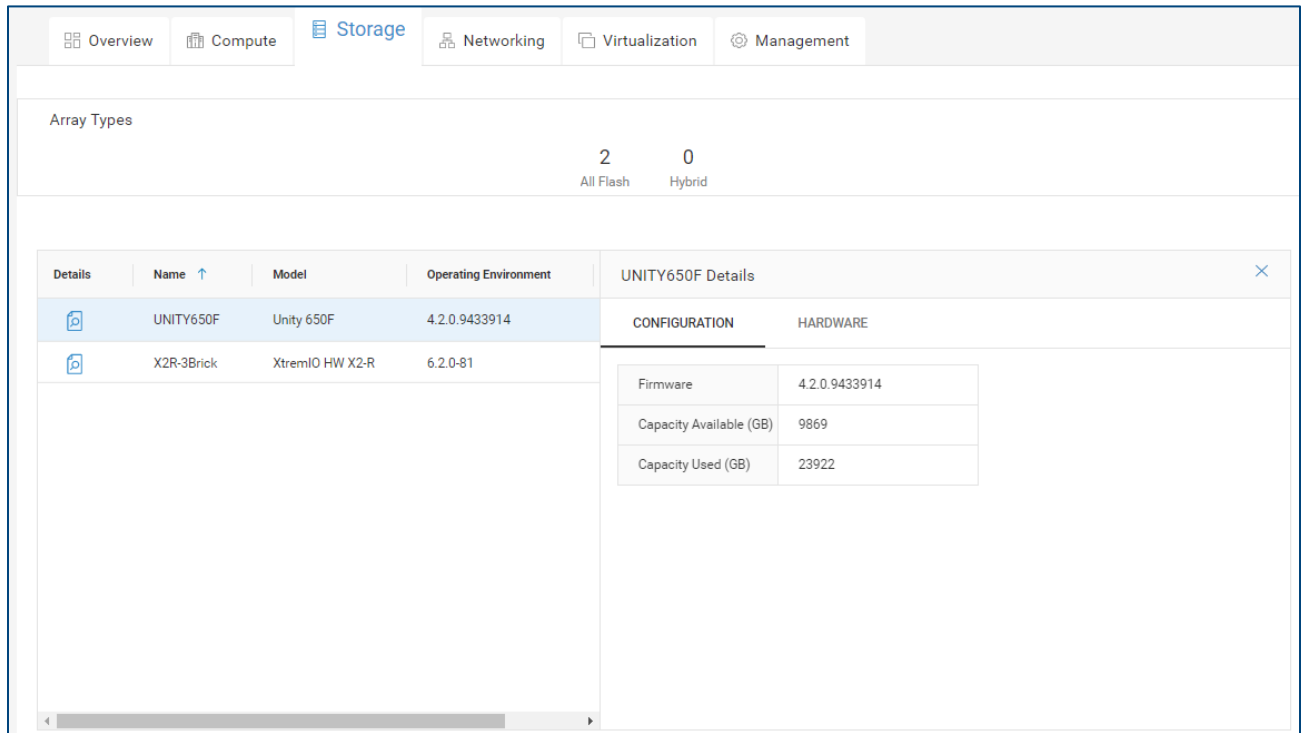
Details	Profile	Servers ↓	Model	Operating Env
	Profile 1	3	UCSB-B200-M5	6.7.0
	Profile 2	3	UCSB-B200-M4	6.7.0
	Profile 3	3	UCSC-C220-M4S	6.7.0
	Profile 4	3	UCSB-B200-M5	6.7.0

Profile 1 Details	
SUMMARY	
Overview	
Servers	3
Model	UCSB-B200-M5
Server Firmware	4.0(4e)
Ethernet Version	1.0.29.0-10EM.650.0.0.4598673
Fibre Channel Version	Version 1.6.0.50, Build: 2494585, Interface: 9.2 Built on: Mar 14 ...
Operating Environment	
Operating Environment	VMware ESXi
Operating Environment Build	13004448
Operating Environment Ver...	6.7.0

16.1.3 Storage

The Storage tab provides information about each storage array. Configuration and hardware information is provided for each storage array; additional information will differ depending on the array type.

- **Configuration** – Listing of software versions, firmware versions, and capacity information.
- **Hardware** – Listing of drive enclosures and disks.



Array Types

2 All Flash 0 Hybrid

Details	Name ↑	Model	Operating Environment	UNITY650F Details	
	UNITY650F	Unity 650F	4.2.0.9433914	CONFIGURATION	HARDWARE
	X2R-3Brick	XtremIO HW X2-R	6.2.0-81	Firmware	4.2.0.9433914
				Capacity Available (GB)	9869
				Capacity Used (GB)	23922

16.1.4 Networking

The networking tab provides information about the network switches in the system including role, name, model, software version, and serial number.

Opening the details about each switch provides the following tabs: Overview, Ports, and Hardware.

- **Overview** – shows port breakout utilization and port usage
- **Ports** – shows port, port speed and connected to device
- **Hardware** – summary of fans, fan bays, power supplies, and power supply bays

The screenshot shows the Dell CloudIQ interface with the 'Networking' tab selected. It displays a table of network switches and a detailed view of the selected switch's ports.

Details	Role	Name	Model	Version	Serial #	VXB-FRA21-M-9396T-A.qa.lab.dell.com Details		
	LAN	VXB-FRA21-N-9336C-FX2-A.qa.lab.dell.com	N9K-C9336C-FX2	9.3(1)	LAN123	OVERVIEW	PORTS	HARDWARE
	LAN	VXB-FRA21-N-9336C-FX2-B.qa.lab.dell.com	N9K-C9336C-FX2	9.3(1)	LAN321			
	OOB-LAN	VXB-FRA21-N-31108-A.lab.dell.com	N3K-C31108TC-V	7.0(3)I7(6)	O0B123	Port	Speed	Connected To
	OOB-LAN	VXB-FRA21-N-31108-B.lab.dell.com	N3K-C31108TC-V	7.0(3)I7(6)	O0B321	fc1/1	16 Gbps	FRA21-FI-6332/switch-A - fc1/1
	SAN	VXB-FRA21-M-9396T-A.qa.lab.dell.com	DS-C9396T-K9	8.3(2)	SAN123	fc1/8	16 Gbps	FRA21-FI-6332/switch-A - fc1/2
	SAN	VXB-FRA21-M-9396T-B.qa.lab.dell.com	DS-C9396T-K9	8.3(2)	SAN321	fc1/15	16 Gbps	FRA21-FI-6332/switch-A - fc1/3
						fc1/19	16 Gbps	FRA21-FI-6332/switch-A - fc1/4
						fc1/25	16 Gbps	FRA21-FI-6332/switch-A - fc1/5
						fc1/31	16 Gbps	FRA21-FI-6332/switch-A - fc1/6
						fc1/38	16 Gbps	FRA21-FI-6332/switch-A - fc1/7

16.1.5 Virtualization

The Virtualization tab provides information about each VMware vCenter in the Converged System. Summary level information at the top of this view includes number of clusters, hosts, and datastores associated with the vCenter server. There are two tabs under Virtualization: Summary and Clusters.

Summary – vCenter Configuration information including name of the vCenter server, hostname, vCenter version, and workload type (AMP or Production).

Clusters – Name of the cluster, name of the vCenter managing the cluster and the data center name. The details of each cluster can be opened and displays information in the following three tabs: Summary, Hosts, and Datastores.

- **Summary** – Summary level information for the cluster and the HA/DRS configuration.
- **Hosts** – Listing of ESXi hosts that make up the cluster including ESXi version, Ethernet version, Fibre Channel version, and server type.
- **Datastores** – Listing of associated datastores for the cluster including datastore name, total capacity, and free capacity.

The screenshot shows the Dell CloudIQ interface for the Virtualization tab. At the top, there are navigation tabs: Overview, Compute, Storage, Networking, Virtualization (selected), and Management. Below the navigation is a dropdown menu for 'vCenter' set to 'All vCenters'. A summary bar displays: Clusters: 4, Hosts: 12, and Datastores: 12. Below this is a tabbed interface with 'SUMMARY' and 'CLUSTERS' tabs. The 'CLUSTERS' tab shows a table of clusters:

Details	Name ↑	vCenter	Data Center
	Cluster2-B200M4	fra21psc02-a.qa.lab.dell.com	FRA21PROD-...
	Cluster3-B200M5	fra21psc02-a.qa.lab.dell.com	FRA21PROD-...
	NSX_Compute	fra21psc02-a.qa.lab.dell.com	FRA21PROD-...
	NSX_Edge	fra21psc02-a.qa.lab.dell.com	FRA21PROD-...

The 'Cluster2-B200M4' row is selected, opening a 'Cluster2-B200M4 Details' panel with three tabs: SUMMARY, HOSTS, and DATASTORES. The 'SUMMARY' tab is active, showing the following information:

Cluster	
vCenter	fra21psc02-a.qa.lab.dell.com
Data Center	FRA21PROD-DC
Cluster	Cluster2-B200M4
HA/DRS	
Proactive HA	Off
vSphere DRS	On
DRS Automation Level	FULLY_AUTOMATED

16.1.6 Management

The Management tab provides information about the AMP and is divided into the following tabs: Server Profiles, Storage, Virtualization Summary, and Workload.

Server Profiles – Includes name of the server profile, number of UCS servers in the server profile, model of UCS servers and firmware version of each UCS Blade server. The details of each profile can be opened and displays information in the following tabs: Summary and Servers.

- Summary – Hardware and software information about the server profile including the operating environment, storage, and MLOMs and mezzanines.
- Servers – Displays the serial number, hostname, and memory for each server in the server profile.

Storage – Information about the storage for the AMP including the name, model, and operating system. The details of each storage system can be opened and displays information in the following tabs: Configuration and Hardware

- Configuration – Displays firmware and total and free capacity.
- Hardware – Displays number of drive enclosures and disks.

Virtualization Summary – Virtualization information about the AMP including vCenter configuration and virtual resources.

Workload – Provides virtual machine information about the AMP including VM name, ESXi host, VM operating system, and the running state of the VM

The screenshot shows the Management tab in the Dell CloudIQ interface. The top navigation bar includes Overview, Compute, Storage, Networking, Virtualization, and Management. Below this, there are sub-tabs for SERVER PROFILES, STORAGE, VIRTUALIZATION SUMMARY, and WORKLOAD. The main content area displays a table of server profiles. The first profile, 'Profile 1', is selected, showing 3 servers, model UCSC-C220-M4S, and firmware 4.0(4e). A 'Profile 1 Details' panel is open, showing a 'SUMMARY' tab with the following information:

Profile 1 Details	
Servers	3
Model	UCSC-C220-M4S
Server Firmware	4.0(2f)
Operating Environment	VMware ESXi
Operating Environment Build	13004448
Version	6.7.0
VM Cluster	AMP-CORE
MLOM	UCSC-MLOM-CSC-02

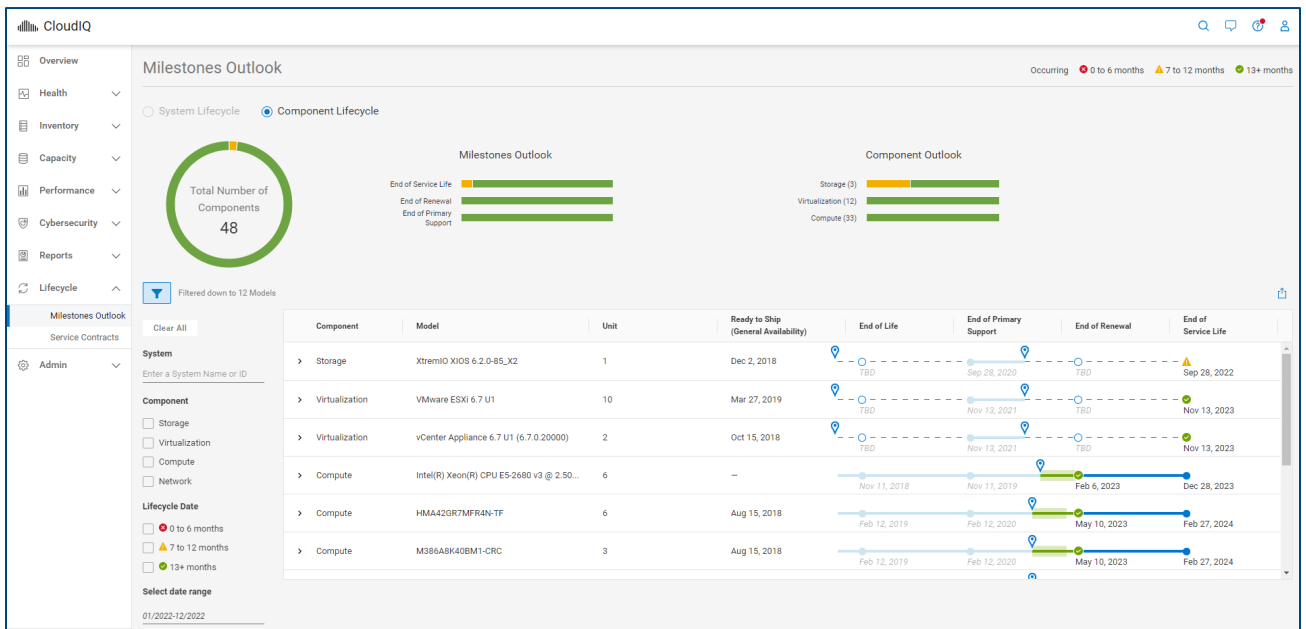
16.2 Converged Systems – Milestones Outlook

CloudIQ helps provide life-cycle support for the various components of a Converged System. The Milestones Outlook page lists out the various components that make up the Converged System and provides timelines with the following dates: General Availability, End of Life, End of Support Life, End of Renewal and End of Service Life.

The information provided in the timeline helps users to:

- Develop plans to order next generation of components to replace existing components reaching their end of service life date.
- Determine financial needs and budget for components that need replacing in the next 0-6, 7-12, or 12+ months.
- Schedule upgrades and hardware replacements during off peak hours that do not impact operations.

The top of the page provides a graphical representation of the total number of components and highlights in red the number of components reaching a milestone date within 6 months. The bottom of the page provides the timelines for each component. The Refine button allows the user to filter the information based on System Name or Component Type. It also allows the user to select from a predefined set of life-cycle dates or enter a custom date range. For example, to see all components with a milestone date during 2022, enter a date range of 01/2022-12/2022 as shown below.



17 VMware Details

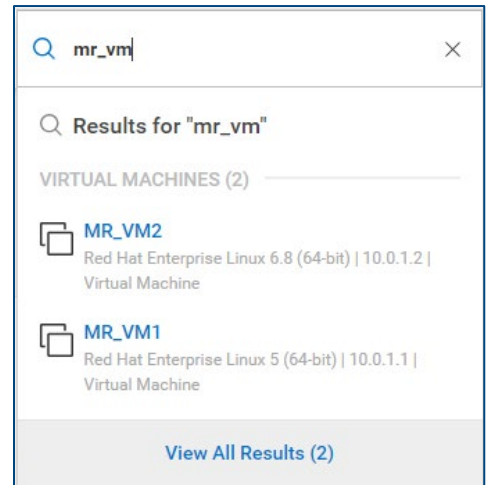
CloudIQ supports integration with VMware environments. It leverages a local collector that communicates to vCenter using a read-only privilege and the collector sends the data back to CloudIQ through the Secure Remote Services Gateway.

In addition to seeing VMs in the Virtual Machines tabs detailed earlier in this document, users can search to find a VM and access the Virtual Machines Details page.

The search results immediately provide some initial information about the VM including name, operating system, and IP address. Selecting “View All Results” provides additional details including vCenter, ESXi, Datacenter, and ESXi Cluster.

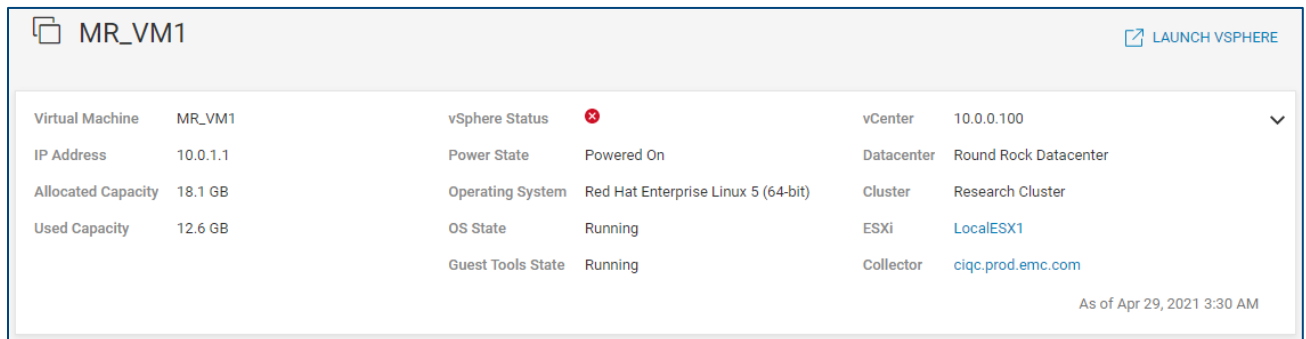
The search feature will find the following VM-related properties:

- VM name
- vCenter
- ESXi Server
- ESXi Cluster
- Datacenter

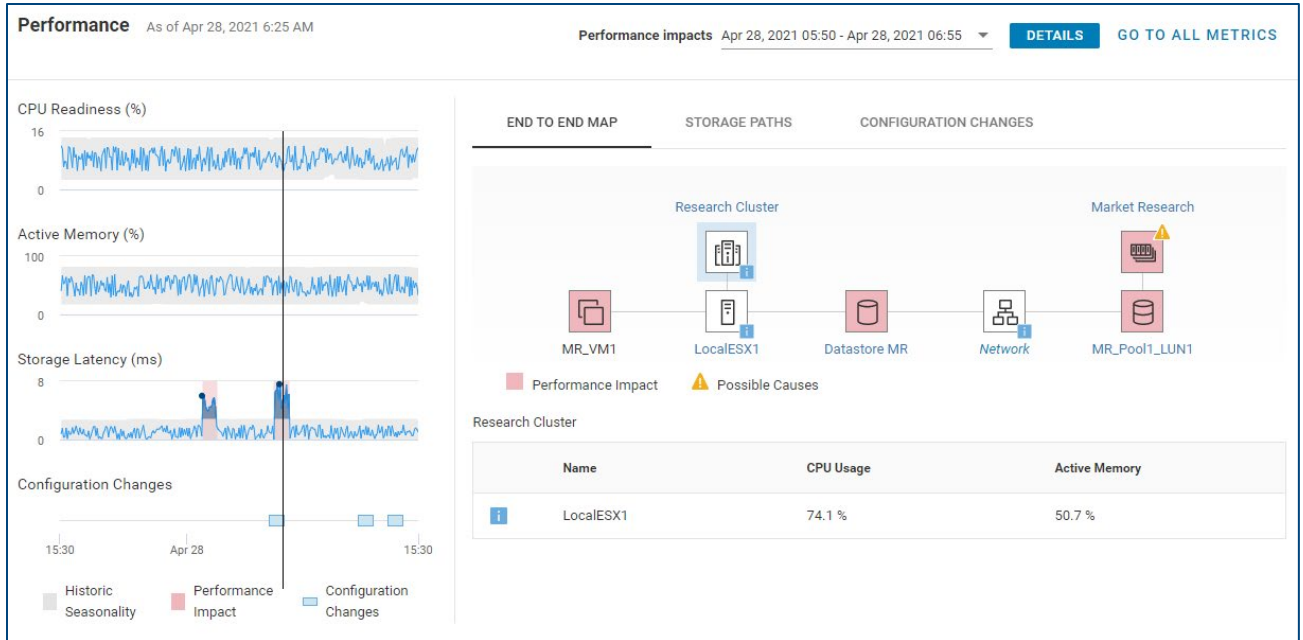


Selecting the VM name hyperlink directs the user to the Virtual Machine Details page.

The top of the VMware Details page contains various property and attributes for the VM. It includes capacity information to understand the amount of storage allocated and used by the VM as well as vCenter and ESXi cluster information to understand where the VM resides. The downward pointing carat in the upper right of the window will minimize this section of the UI.



The bottom half of the page is dedicated to performance and storage path information. The left side of the window displays three 24-hour charts for the following key performance metrics: CPU Readiness (%), Active Memory (%), and Storage Latency (ms). Performance anomalies are identified in any of the charts as shaded blue areas. CloudIQ identifies performance impacts on the storage latency chart with pink shading. There is also a 24-hour chart identifying configuration changes. Selecting a box along the horizontal axis opens a window with details of the configuration change. Selecting a point in the performance charts displays a window showing the values of the historic seasonality and actual value at the selected time.



The right side of the window has three tabs: End to End Map, Storage Paths, and Configuration Changes.

End to End Map (shown above) – This tab is an interactive end-to-end map of the virtual machine, ESXi Server, ESXi Cluster, Datastore, Network, Storage Object (LUN, volume or storage group), and Storage System. Key performance metrics are displayed for the selected items in the map. By default, the latest value is displayed for each metric. However, if the user selects a point in time in the VM performance charts on the left, this view is updated to show the corresponding values at the selected time. Users can select a time of interest in the VM performance charts and then select various objects in the data path to view their corresponding performance metrics.

Storage Paths – This tab maps each datastore to the storage object (LUN, volume, or storage group) on each system. This information allows users to map different datastores to different storage objects. If a performance impact is selected in the performance charts, the impacted components are highlighted with a pink square.

The screenshot shows the 'STORAGE PATHS' tab with a table of datastore information:

Datastore	Type	Storage	System
▼ Datastore MR	VMFS	MR_Pool1_LUN1	90 Market Research

Host Adapter	Fabric/Partition ID	Array Adapter
10:00:00:90:FA:53:56:72	17	SP A FC PORT 7

Configuration Changes – This tab provides a summary of VM-related and infrastructure-related configuration changes over that last 24-hour time period.

END TO END MAP	STORAGE PATHS	CONFIGURATION CHANGES
Last 24 Hours		
VM/ESXi	0 <i>vMotion/DRS</i>	2 <i>CPUs/RAM</i>
Related Infrastructure	1 <i>Storage</i>	1 <i>Network</i>

Selecting the number in the Configuration Changes view opens a window that displays details about the configuration change(s). This allows the user to correlate configuration changes in the environment with potential performance impacts.

Date	Property	Previous Value	New Value
Apr 10, 2020, 9:11:00 AM	Memory Size	8.0 GB	12.0 GB
Apr 10, 2020, 9:11:00 AM	Number of CPU	1	2

[CLOSE](#)

18 Custom Labels and Reports

Users can enhance the collected data in CloudIQ with customer-specific metadata called labels. Labels can be used to tag systems with business-specific data. Object level labels will be supported in the future. Labels are supported for Storage, SAN, and Hyperconverged systems and are entered as a Key:Value pair. For example, BusinessUnit:Engineering is a label where BusinessUnit is the label key and Engineering is the label value.

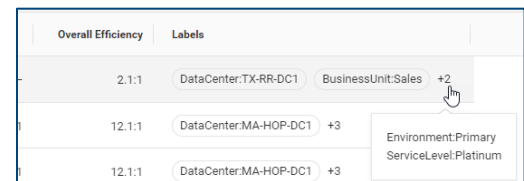
Users can also create custom reports in CloudIQ. A report can consist of a mixture of tables and line charts. Line charts are supported for those performance metrics available in the Metrics Browser. Integration between labels and reports is a key feature that will be delivered in the future. Reports can be manually exported or scheduled for automated delivery to a specified list of recipients.

18.1 Accessing Labels

Labels are input and visible in any of the multisystem views when switched to the List View. Once systems are labeled, views can be filtered based on one or more labels. The following figure shows the multisystem view for capacity for storage in the list view. The Labels column is visible on the right side of the page.

Health Score	System	Identifier	Model	Used (TB)	Free (TB)	Usable (TB)	Provisioned (TB)	Data Red.	Overall Efficiency	Labels
60	Account Management	CIQAPU1	ME4012	3.7 TB	4.0 TB	7.7 TB	5.8 TB	-	2.1:1	DataCenter:TX-RR-DC1 BusinessUnit:Sales +2
95	Manufacturing_Dev	RV429L63	PowerStore 9000	6.25	18.75	25.0	25.0	4.7:1	12.1:1	DataCenter:MA-HOP-DC1 +3
100	Manufacturing_Prod	RV429L62	PowerStore 100...	6.25	18.75	25.0	25.0	4.7:1	12.1:1	DataCenter:MA-HOP-DC1 +3
100	Product Design	C9NJBC1	ME4084	12.3 TB	16.7 TB	29.0 TB	22.9 TB	-	2.9:1	DataCenter:MA-HOP-DC3 +3
91	Research and Devel...	MJLZWGR	ME4024	12.5 TB	53.6 TB	66.1 TB	36.3 TB	-	1.8:1	DataCenter:TX-RR-DC1 +3
100	HR Data Center	ELMISLFAGEF456	Isilon Cluster	13.8 TB	16.4 TB	30.2 TB	30.2 TB	-	-	DataCenter:MA-HOP-DC1 BusinessUnit:HR +2
60	Test_Dev	FCNCH0972C32F9	UnityVSA	13.8	1.3	15.1	-	-	-	DataCenter:MA-HOP-DC3 +3
85	Remote DC	92252	SC5020F	15.9	26.2	42.1	492.1	2.7:1	31.6:1	DataCenter:MA-HOP-DC3 +3
100	Software_Dev	000194900732	VMAX-1SE	20.8	20.0	40.8	60.5	-	-	DataCenter:UK-CO-DC1 +3
60	Security Office	ELMISLFAGEF789	PowerScale Clu...	21 TB	2.04 TB	23.04 TB	23.04 TB	1.07:1	1.07:1	DataCenter:MA-HOP-DC3 BusinessUnit:IT +2

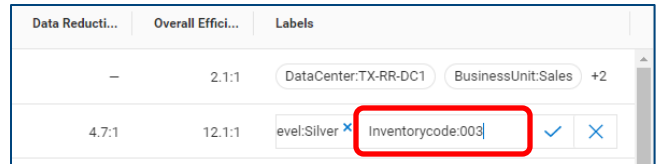
When the text in the Labels field exceeds the column width, a +X is shown where X is the additional number of labels defined for that system. To view the additional labels, hover over the +X.



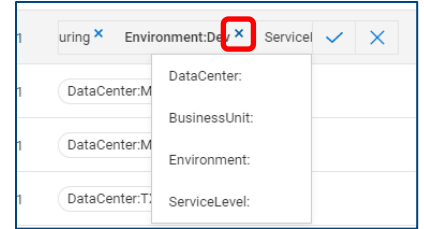
18.2 Editing Labels

There are two ways to manipulate labels: Directly in the Labels column or in the Edit Panel. The Labels column is useful to enter or delete individual labels. To enter an individual label, click the mouse in the Labels column.

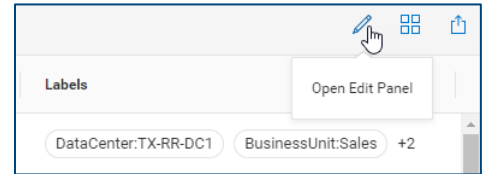
For example, to enter an InventoryCode label for an individual system and assign it a value of 003, select in the Labels column for that system and enter "InventoryCode:003". Select the check mark to save the label.





To delete an individual label, select the small blue X next to the individual label. Select an individual label and use the left and right arrow keys to scroll through the various labels.

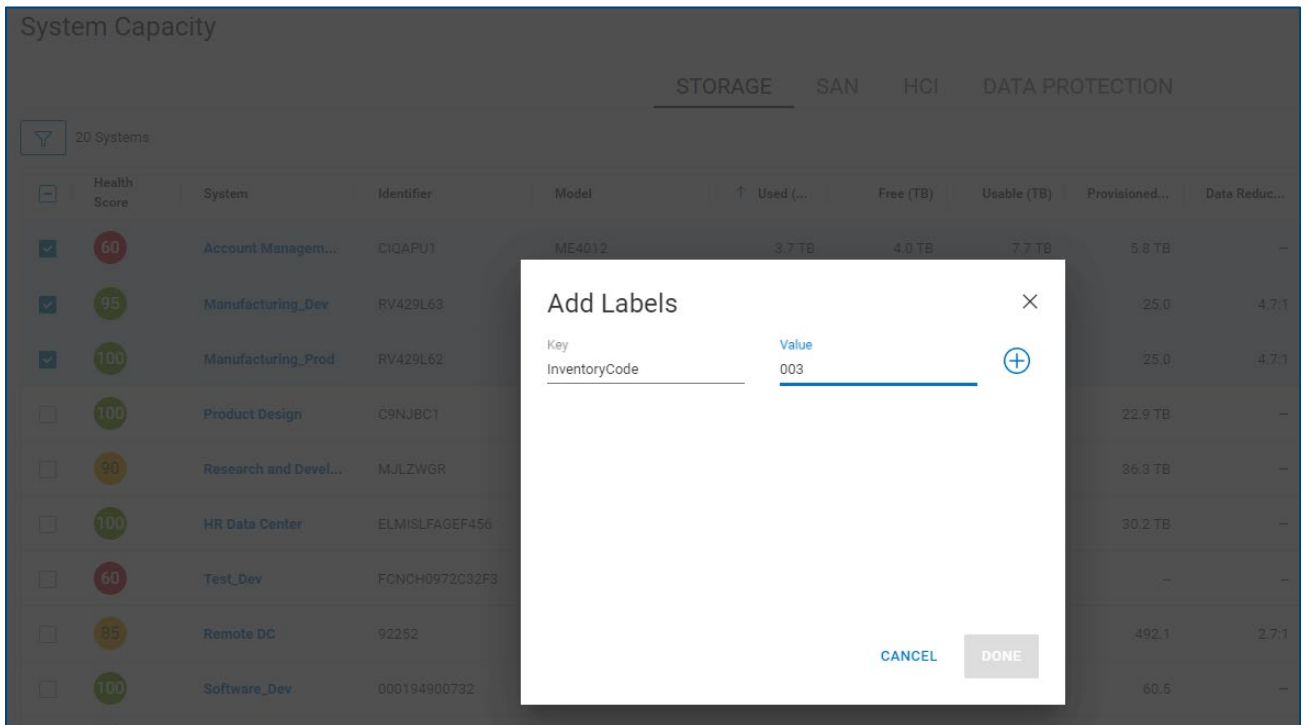


The second method of label manipulation is through the Edit Panel. The Edit Panel is useful for bulk edits. It allows a user to delete all labels for a system or add one or more labels to multiple systems.

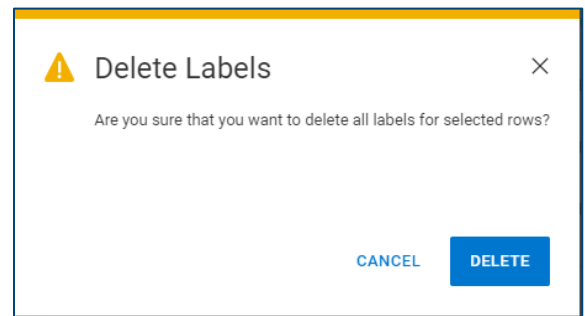


To open the Edit Panel, select the pencil icon .

The screen now has selection boxes next to each system as well as the ADD LABELS and DELETE LABELS boxes. These boxes become available once one or more systems are selected. To add labels, select the boxes next to the system names and then select ADD LABELS. The Add Labels window opens where one more key:value pairs can be entered. This example shows the addition of the InventoryCode label with a value of 003 being assigned to the top three systems. Select the  icon and then select DONE to add the labels.



To delete labels, select the systems on the left hand side and then select the DELETE LABELS button. Note that this deletes all labels from each selected system.



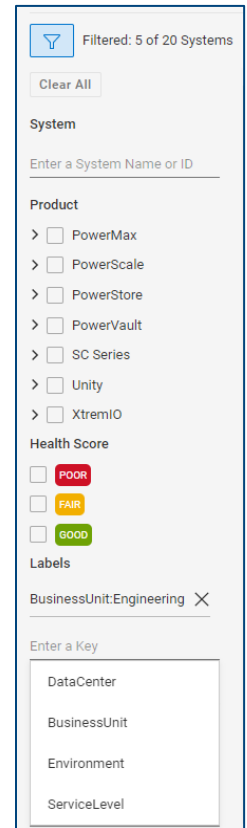
18.3 Filtering Labels

Once labels have been assigned to systems, the multisystem views can be filtered using the labels.

Select in the "Enter a Key" field and begin typing the label key or select the key label from the list of defined keys. Once the key is chosen, select in the "Enter a Value" field and begin typing the label value or select it from the list of defined values.

Select ADD to add the label filter.

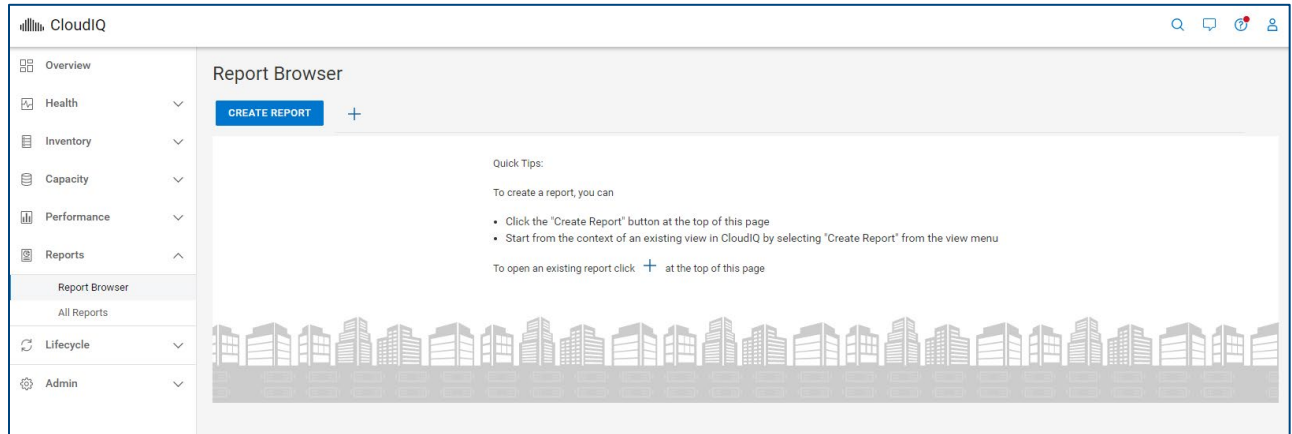
Multiple labels can be added.



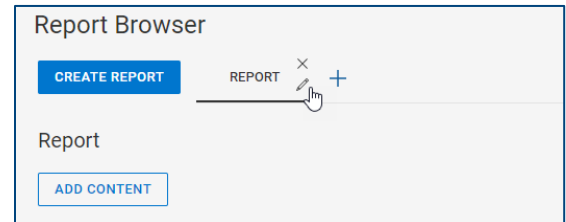
18.4 Report Browser

The Report Browser acts as a user's reporting workspace and dashboard. It allows users to create, view, and modify reports. Reports can be scheduled, duplicated, bookmarked, and exported in PDF format. Reports can consist of any combinations of tables and line charts.

The Report Browser is accessed from under the Reports menu in the left-hand navigation pane. The "CREATE REPORT" button is used to create a new report. The + icon is used to open an existing report.

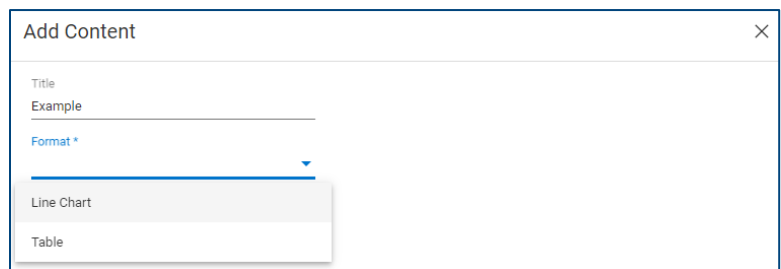


A default name is given to a new report. To edit the name, select the edit icon next to the report name. The icon becomes visible when the mouse is moved over that area. To remove the report from the Report Browser, select the X icon. Note that removing the report from Report Browser does not delete the report. It is still available from All Reports which is discussed in section 18.5.



The ADD CONTENT button is used to add tables and charts to the report.

It opens the Add Content window shown here. This window presents a series of pull-down menus to define the content including the format. The remaining menus differ based on the selected format.



18.4.1 Tables

A table allows the user to select one of the following categories:

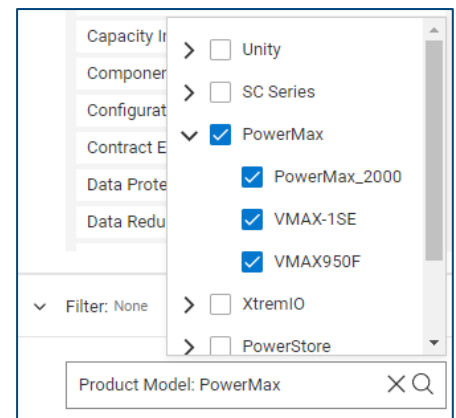
- Data Protection System
- Filesystem
- Host
- MTree
- Network System
- Pool
- Replication
- Server
- Storage System
- Volume

The screenshot shows the 'Add Content' dialog box. At the top, there is a 'Title' field with the value 'Example'. Below it is the 'Format' dropdown menu, which is currently set to 'Table'. The 'Category' dropdown menu is open, displaying a list of categories: Filesystem, Host, Network System, Pool, Storage System, and Volume. The 'Storage System' category is currently selected and highlighted.

Once the user selects the Category, a list of available and selected columns is displayed. CloudIQ prepopulates the report with with common columns. The user can either drag and drop or double-click on a column name to add or remove it.

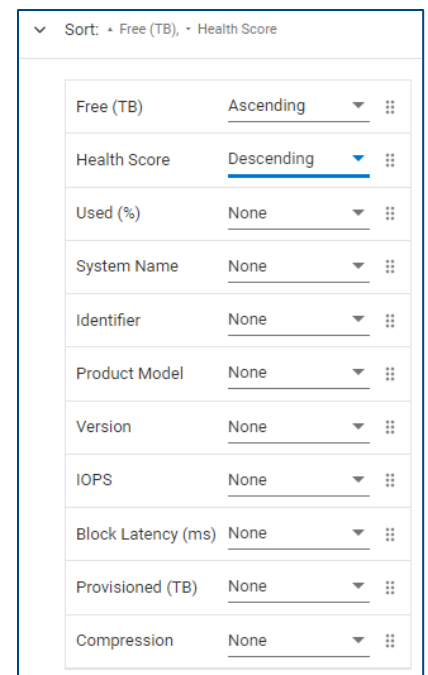
The screenshot shows the 'Add Content' dialog box with the 'Category' dropdown set to 'Storage System'. Below the category selection, there is a section for column management. It shows 'Columns 11 selected' and a search bar for columns. The 'Available Columns' list includes: Bandwidth (Mbps), Capacity Impact, Components Impact, Configuration Impact, Contract Expiration, Data Protection Impact, and Data Reduction. The 'Selected columns (11)' list includes: Health Score, System Name, Product Model, IOPS, Identifier, Version, and Block Latency (ms). At the bottom, there are options for 'Filter: None' and 'Sort: None'.

The next section is the filter. The user can select in the Search Filters field and scroll through the full list of columns, or they can begin typing to find a specific one. Once the column is selected, the user can choose from an applicable value. The example below shows a filter on the Product Model column and then on all PowerMax systems.



The final section is Sort. Sort allows the user to add one or more columns to sort the table. Sort columns can be ordered by dragging and dropping the columns to the desired sort order.

In this example, the first sort is an ascending sort based on Free capacity. The second sort is a descending sort on Health Score.



18.4.2 Line Charts

A line chart requires the user to select Product, Category, System, and Metric. If the chosen category is System, then the System selection is not necessary.

Metrics available for line charts are currently equivalent to those available in the Metrics Browser (see Section 6.2) with the exception of PowerEdge which is not available in Metrics Browser. PowerEdge metrics are provided in Appendix D.

Once the desired metric is selected, the user selects which Objects to including in the chart.

This example shows the configuration of a chart that includes IOPS for the Finance_SG_11 and Finance_SG_12 storage groups.

The screenshot shows a web form titled "Add Content" with several dropdown menus and a list of objects. The form is configured as follows:

- Title: Line Chart Example
- Format *: Line Chart
- Product: PowerMax
- Category: Storage Group
- System: Finance
- Metric: IOPS

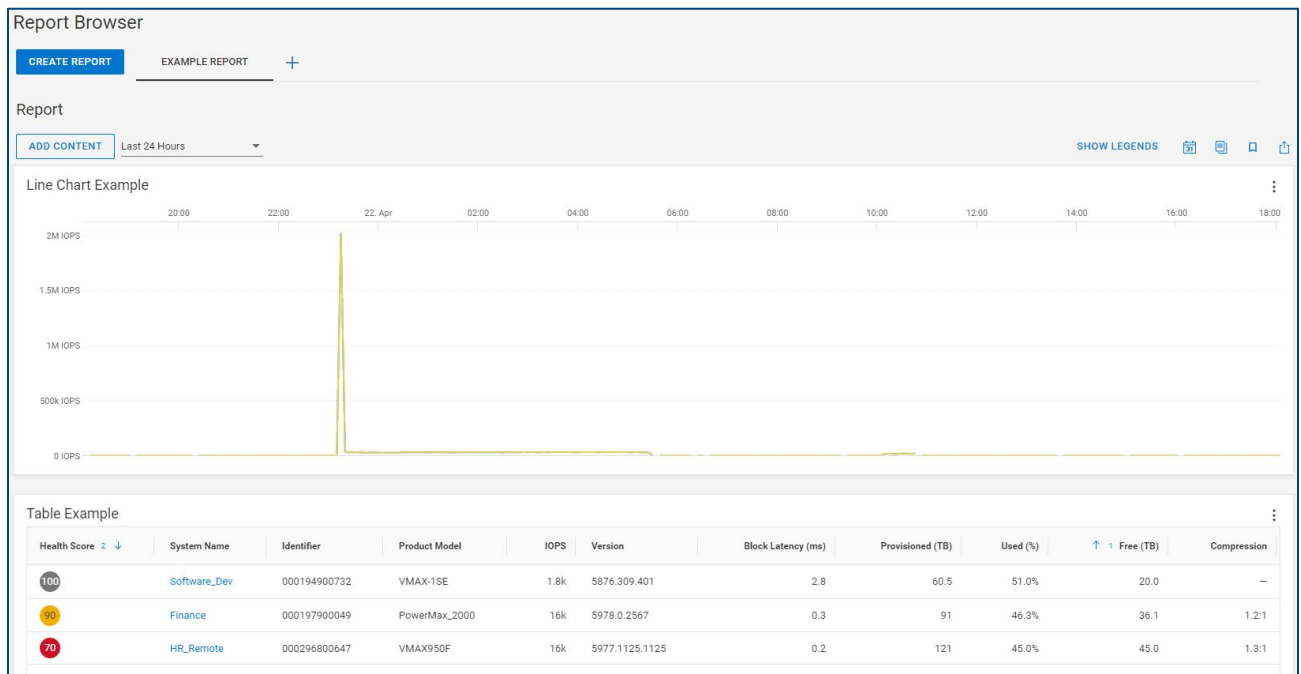
Below the dropdowns is a section titled "Objects" with a list of storage groups and checkboxes:

Object	Selected
Finance_SG_11	<input checked="" type="checkbox"/>
Finance_SG_12	<input checked="" type="checkbox"/>
Finance_SG_13	<input type="checkbox"/>
Finance_SG_14	<input type="checkbox"/>
Finance_SG_21	<input type="checkbox"/>

18.4.4 Report Options

Once a report is created, there are several options that are available for the user at the report level.

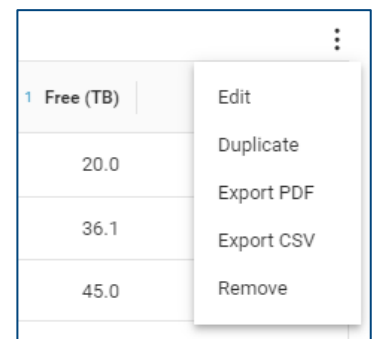
- **SHOW LEGENDS** - For line charts, it provides a legend of each object on the right-hand side of the chart. The legend shows the data timestamp and value for each object as the user hovers the mouse over the chart.
- **Schedule** (📅) – Schedules the report. Choose initial runtime as well as one of the following intervals: Daily, Weekly, Bi-weekly, Monthly, or Quarterly. Choose format of PDF or CSV. Enter email addresses for recipients.
- **Duplicate** (📄) – Creates a duplicate copy of the report in the Report Browser. This is used to create multiple similar reports where the user wants to make minor changes to a report.
- **Bookmark** (🔖) – Adds or removes the bookmark on the report. Bookmarks allow the user to easily find and view the report in the Report Browser from the Add Report icon (+).
- **Export** (📄) – Exports the report in PDF format.



18.4.5 Chart and Table Options

For each individual chart or table, the user is presented several options after selecting the options icon (⋮).

- **Edit** – Modify the individual chart or table.
- **Duplicate** – Create a duplicate chart or table in the same report.
- **Export PDF** – Exports the individual chart or table in PDF format.
- **Export CSV** – Exports the individual chart or table in CSV format.
- **Remove** – Deletes the chart or table.



18.5 All Reports

The All Reports window is where the user can access any report. In situations where there are many reports, the search field can be used to find a report. The list of reports shows if a report is bookmarked, when it was last modified, and when it is scheduled to run next. The options icon on the right side of each row allows the user to edit the report or delete the report from CloudIQ. The CREATE REPORT button directs the user to the Report Browser to create a report.

All Reports

[CREATE REPORT](#)

Title	Last Modified	Next Scheduled	
<input type="checkbox"/> Unity Capacity	Apr 22, 2021, 12:40:38 PM	–	⋮
<input checked="" type="checkbox"/> PowerMax Capacity	Apr 22, 2021, 12:40:37 PM	2021-04-26T20:15:00Z	⋮
<input checked="" type="checkbox"/> PowerStore Capacity	Apr 22, 2021, 12:40:35 PM	–	⋮
<input checked="" type="checkbox"/> PowerScale Capacity	Apr 22, 2021, 12:40:33 PM	–	⋮
<input checked="" type="checkbox"/> PowerVault Capacity	Apr 21, 2021, 4:57:13 PM	–	⋮
<input type="checkbox"/> XtremIO Capacity	Apr 21, 2021, 4:57:12 PM	–	⋮
<input type="checkbox"/> SC Series Capacity	Apr 21, 2021, 4:57:11 PM	–	⋮
<input type="checkbox"/> Report	Apr 22, 2021, 6:30:24 PM	–	⋮

19 Mobile Application

CloudIQ also has a mobile application available for both iOS and Android phones. The mobile app has an Overview screen that shows similar information to the Overview Page in the browser version of the UI. It also includes support for Health, Capacity, and Performance details for the supported Dell storage platforms. The user can also configure push notifications to be updated in the app for any health change notifications.

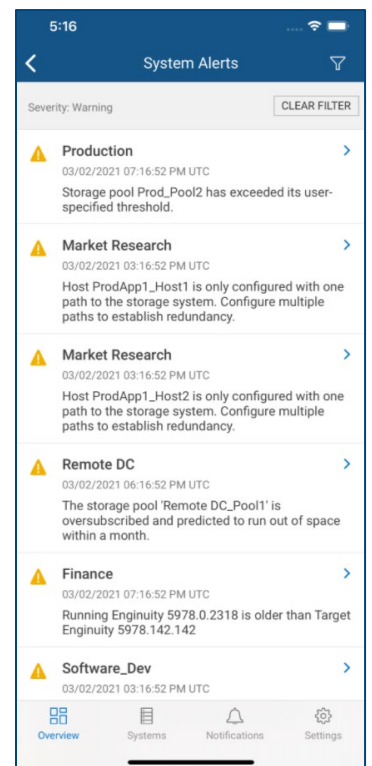
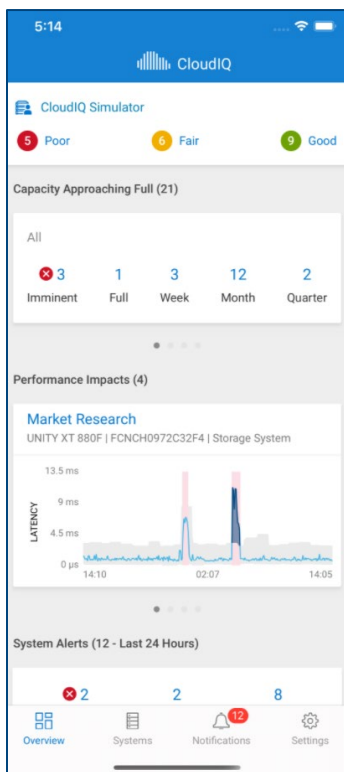
Users can see additional details of the health for any given system and can even text or email the recommended remediation to a colleague for help with performing the resolution.

Users can also see if there are any connectivity issues in the environment.

Finally, users can manage push notifications by turning them on or off and can also submit feedback to the CloudIQ team.

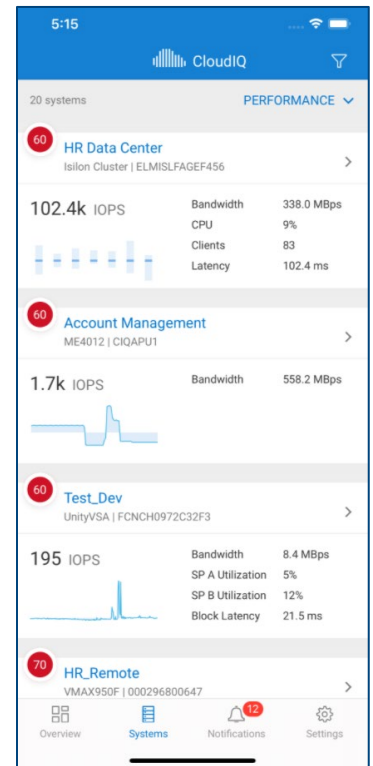
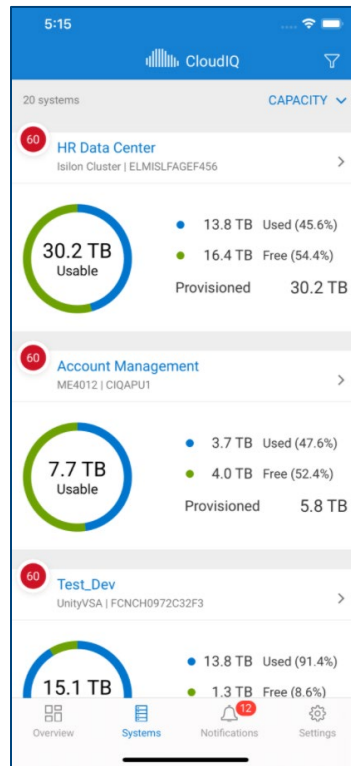
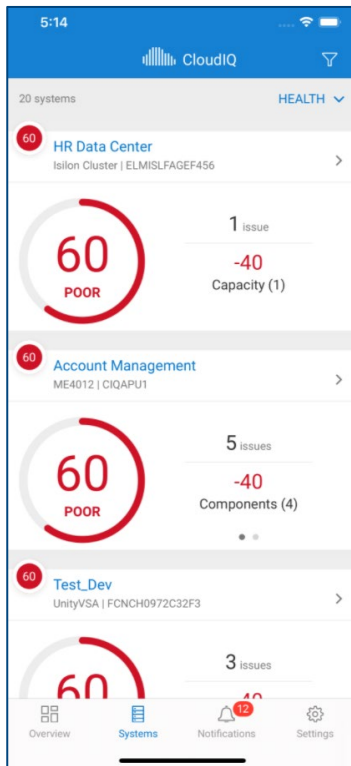
19.1 Overview

The Overview screen of the mobile app summarizes the health scores, alerts, system connectivity, and capacity approaching full. These views are similar to the tiles on the Overview page of browser version of CloudIQ. Selecting items in the Overview screen will show additional details. The following images show the Overview screen, the drill-down into the Capacity Approaching Full tile, and the drill-down into System Alerts.



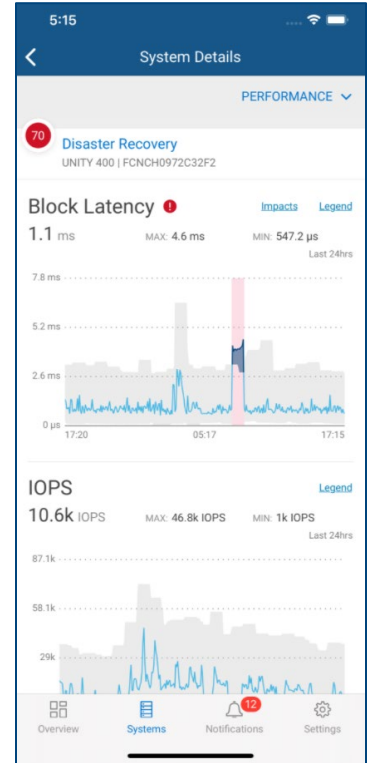
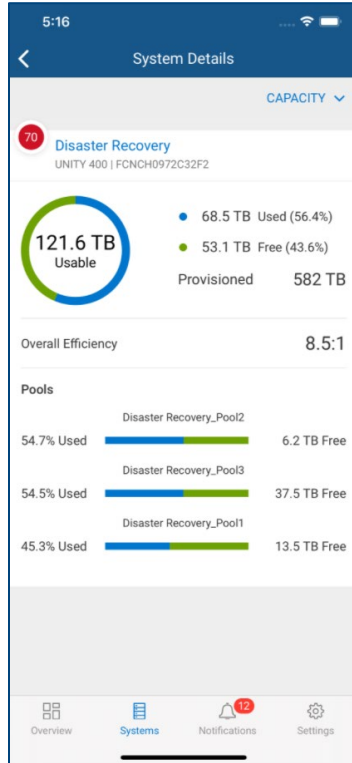
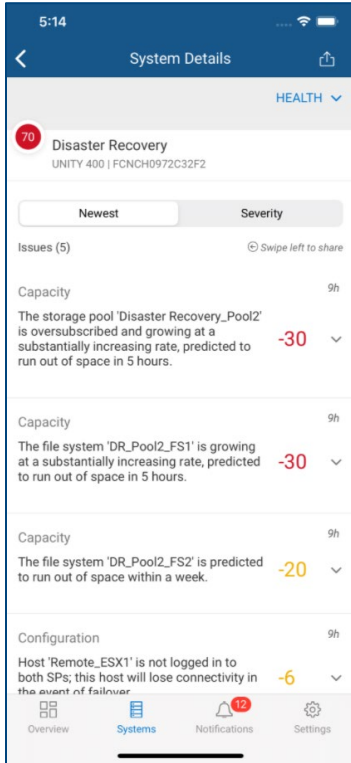
19.2 System Views

The user can select Systems at the bottom of the screen to see System level views for Health, Capacity, and Performance. Utilize the drop-down menu in the upper right of the screen to switch between the various views: Health, Capacity, and Performance. An example of each is shown below



19.3 System Details

The user can drill down into single system details for Health, Capacity, and Performance. These details include the identification and remediation recommendations for health issues, capacity summaries including efficiencies and pool details, and 24-hour performance charts for key system level performance metrics. The health issue and remediation can be emailed or texted using controls in the app.



20 CloudIQ Administration

20.1 Customization

CloudIQ allows end users to temporarily pause host connectivity health checks and file system capacity checks from being included in the system health score. Users may want to do this for nonproduction hosts or during times of maintenance when single-pathed hosts may be expected. Host connectivity checks are supported for both Unity and SC Series systems. File system capacity checks are supported for Unity systems.

20.2 Collectors

The CloudIQ Collector is used to collect VMware and Connectrix data and sends that data back to CloudIQ using Secure Remote Services Gateway. This area shows the connectivity status and versions of installed collectors. It also provides a download link to obtain the collector. The user can select the hyperlink in the Collector Name column to open the Collector Details page.

Issues	Connectivity Status	Name	Technology	Secure Remote Services Type	Collected Systems	Collector Configuration	Update Status
	Connected	ciqc.conn.emc.c...	Connectrix	Centralized	6	Launch	1.2
	Connected	ciqc.prod.emc.c...	VMware	Centralized	2	Launch	1.1
2	Connected	ciqc.test.emc.com	VMware	Integrated	1	Launch	1.2

Download a collector

Deploying a new CloudIQ Collector may be needed when:

- Your existing collectors are below the required version and you do not want to update them.
- There are more than 60,000 virtual machines or 128 physical switches/virtual fabrics/VSANs collected on a single instance.
- You are collecting from datacenters on multiple unrelated virtual networks.

- Download the Collector vApp.
- Deploy the vApp.
- Follow the onboarding wizard, which will guide you to set up the vApp.
- Continue to the Collector Management UI to configure systems from which to collect data.

VMware data will appear in CloudIQ within 24 hours and will be accessible:

- On a system configuration page.
- On a hosting storage object like a Pool, LUN/Volume or Storage Group and on a Host/Server properties page.
- Via the Global Search tool by searching the IP address of a VM or by the name of a VM, vCenter, ESX server, Cluster, or Datacenter.

Connectrix data will appear in CloudIQ within 24 hours and will be accessible on the System SAN tab.

To set up the CloudIQ Collector:

[Download Collector vApp](#)

This page provides health-related information for the selected collector. It also provides as an inventory of the vCenters and Connectrix switches for which it is configured.

ciqc.conn.emc.com LAUNCH COLLECTOR CONFIGURATION

Serial Number: CIQC-ELMCIQ...
 Version: 1.2
 SRS Type: Centralized
 SRS gateway Serial Number: ELMESRCON...
 Update Policy: Download Only
 Last Update: Feb 4, 2020
 Connectivity Status: Connected
 Last Contacted: Feb 6, 2020 9...

Total Issues: 0
 Performance:

All health checks were successful.

St...	Switch Name	Serial Number	Firmware Version	Management IP Address	Last Contact Time
✖	Production SAN Extens...	EAF300M001	v8.2.1a	10.0.12.1	about 20 hours ...
✔	Stretch Cluster Extension	EAF300M003	v8.2.1a	10.0.12.3	12 minutes ago
✔	SRDF LINK	EAF300M000	v8.2.1a	10.0.12.4	6 minutes ago
✔	Dev SAN	JPG2128002T	8.3(2)	10.0.12.2	11 minutes ago
✔	Production East	JPG194000DK	8.3(2)	10.0.12.5	11 minutes ago
✔	Production West	JPG194001DK	8.3(2)	10.0.12.6	6 minutes ago

20.3 Connectivity

The Connectivity page shows customers all systems that are connected, have lost connection or need additional configuration work before CloudIQ can display data for them. It also provides links to onboard SC Series, PowerVault and VxBlock systems. These systems require the user to enter information into CloudIQ in order to complete the onboarding process. See Appendix A for additional onboarding details.

ACME Connectivity Status

Connectivity Status: All 23, Connected 23

Type: Storage System 17, SAN System 6

Product: Connectrix 6, Isilon 2, PowerMax 3, PowerVault 3, SC Series 2, Unity 4, XtremIO 3

23 of 23 Filtered by: All

Connectivity Status	Identifier	Product/Model	Type	Site ID	Location	Last Contacted	Instructions
Connected	FCNCH0972C32F3	Unity/UnityVSA	Storage System	ACME Branch Office	Hopkinton, MA	Tue, Feb 4 2020, 6:54:52...	—
Connected	FCNCH0972C32F2	Unity/UNITY #00	Storage System	ACME Branch Office	Hopkinton, MA	Tue, Feb 4 2020, 6:54:52...	—
Connected	FCNCH0972C32F4	Unity/UNITY XT 880F	Storage System	ACME Headquarters	Round Rock, TX	Tue, Feb 4 2020, 6:54:52...	—
Connected	FCNCH0972C32F1	Unity/UNITY 650F	Storage System	ACME Headquarters	Round Rock, TX	Tue, Feb 4 2020, 6:54:52...	—
Connected	95148	SC Series/SC7020F	Storage System	Site-95148	Round Rock, TX	Tue, Feb 4 2020, 6:54:52...	🗑️
Connected	92252	SC Series/SC5020F	Storage System	Site-92252	Hopkinton, MA	Tue, Feb 4 2020, 6:54:52...	🗑️
Connected	000197900049	VMAX/PowerMax_2000	Storage System	ACME Headquarters	Round Rock, TX	Tue, Feb 4 2020, 6:54:52...	—

20.4 Settings

The Settings section allows customers to control asset visibility, enable access to Dell advisors, and set up email notifications.

20.4.1 Controlling Asset Visibility

Users can set filters on which systems are available to view and receive notifications for in CloudIQ and the CloudIQ mobile app. This also filters the systems from Webhook configuration. For example, an administrator can set their view to see systems from certain sites or see systems of one or more storage types such as Unity and PowerMax. The filtering is set on a per-user basis and can be configured based on site, product type, or at the individual system level. This feature is accessible under the Sites and Systems tab under the Admin > Settings > Your Account menu pick. This view shows a user that has removed the visibility of their XtremIO and PowerVault systems.

CloudIQ

← Your Account

Mary Kimball

Logged in as a Team Member of ACME

Name: Mary Kimball
Contact: mary.kimball@acme.com
First Login: 06/09/2017
Default Customer

SITES AND SYSTEMS | EMAIL PREFERENCES

Viewing and Notification Preferences in CloudIQ

Choose which products, sites and systems you wish to view and receive notifications for in CloudIQ and CloudIQ mobile.

14 products and 44 systems available RESET TO DEFAULT

Unity (5)
 SC Series (2)
 XtremIO (3)
 PowerMax (4)
 PowerVault (3)
 VxBlock (1)
 PowerScale (3)
 APEX File Storage Services (1)
 PowerStore (2)
 APEX Block Storage Services (1)
 Connectrix (6)
 VxRail (4)
 PowerProtect DD (7)
 PowerProtect Data Manager (2)

41 systems of 44 systems enabled

Your Sites

Enable	Site Name	Site ID	Location	Systems	Enabled
<input checked="" type="checkbox"/>	ACME Branch Office	67895555	Hopkinton, MA	12	11
<input checked="" type="checkbox"/>	ACME Headquarters	12345555	Round Rock, TX	21	20

SC Series

Enable	System Name	Model	Serial Number	Connectivity Status
<input checked="" type="checkbox"/>	Business Analytics	SC7020F	95148	🟢
<input checked="" type="checkbox"/>	Remote DC	SC5020F	92252	🟢

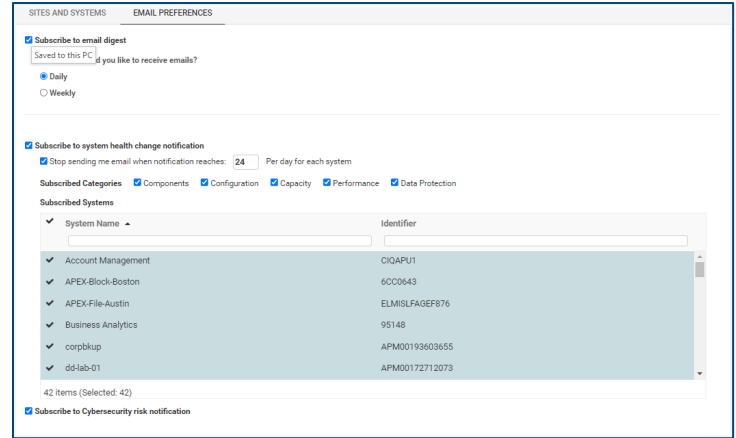
PowerVault

Enable	System Name	Model	Identifier	Connectivity Status
<input checked="" type="checkbox"/>	Product Design	ME4084	C9NJBC1	🟢
<input checked="" type="checkbox"/>	Research and Development	ME4024	MJLZWR	🟢
<input checked="" type="checkbox"/>	Account Management	ME4012	CIQAPU1	🟢

20.4.2 Email Preferences

Users can set their email preferences to receive a daily or weekly digest summarizing the health and connectivity status of the systems. They can also configure CloudIQ to send an email notification when a change occurs in health score. In this case, the user can filter and choose which systems to monitor for health score changes.

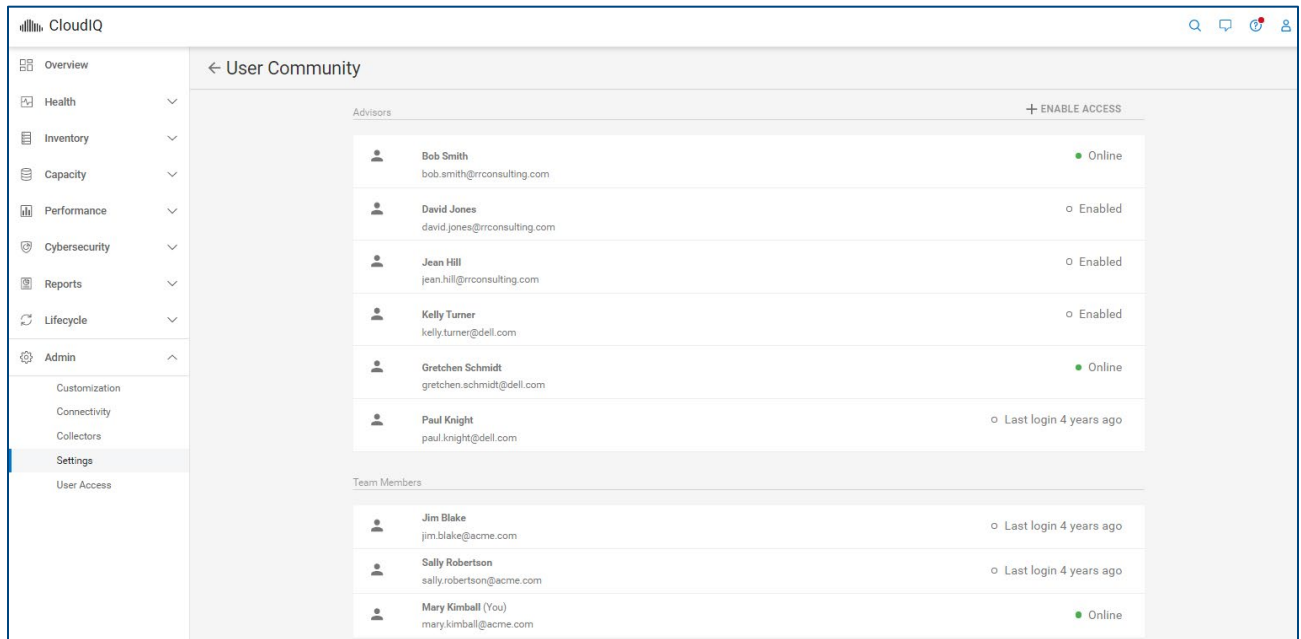
The bottom of the window shows the option to send Cybersecurity risk notifications. When this option is selected, users are notified any time a Cybersecurity risk is identified.



20.4.3 User Community

Users can enable and disable CloudIQ access for Dell Trusted Advisors and Partners in the User Community section. They can also see the login status of other members of their company under Team Members. Dell Trusted Advisors are members of the account team or other Dell employees whom customers want to proactively and routinely view their systems in CloudIQ. The purpose of this role is to provide assistance and recommendations to customers to help them optimize their storage usage. Dell employees and Partners must explicitly be provided access to CloudIQ from the customer. See the following KB article for details:

<https://www.dell.com/support/kbdoc/000020659>



20.5 Integrations

The Integrations section allows users with the CloudIQ Advanced role to configure Webhooks. Users must have the role of CloudIQ Advanced to access the Integrations menu. This is discussed in detail in section 20.6 User Access.

Webhooks is a push mechanism to integrate with third-party applications such as ServiceNow and Slack. Notifications are sent from CloudIQ when a health issue change is identified on a system. A brief tutorial for ServiceNow and Slack integration can be found at the Dell API Marketplace (<https://api-marketplace.dell.com/#/overview-doc/4138/8318/docs/01-Introduction.md>).

Configuration of Webhooks requires the user to enter a Name, the Payload URL (destination to send the Webhook), and a Secret. The secret is a user supplied string sent along with the payload and is used to create a signature that is passed as a header during the POST request. The URL server can create its own matching signature using its stored secret and the POST payload to verify that the signature in the header matches its own generated signature. Users can then select which systems to monitor. The Test Webhook button sends a test notification to the server with a NULL payload. This is used to quickly test connectivity to the Webhook destination

Add Webhook ✕

Event: Health Issue Change

Whenever health issues change for the systems selected below, we'll send a POST request to the URL below with details of the event.

Name

Payload URL

Secret 👁

37 of 37 system selected

<input checked="" type="checkbox"/>	System ↑	Model	Identifier
<input checked="" type="checkbox"/>	APEX-Block-Boston	APEX Block Storage ...	6CC0643
<input checked="" type="checkbox"/>	APEX-File-Austin	APEX File Storage Se...	ELMISLFAGEF876
<input checked="" type="checkbox"/>	Account Management	ME4012	CIQAPU1
<input checked="" type="checkbox"/>	Business Analytics	SC7020F	95148
<input checked="" type="checkbox"/>	Dev SAN	Connectrix MDS-9132T	JPG2128002T

Once a Webhook is configured and triggered, those events are captured on the Integrations page showing the time and status of the delivery.

Integrations

WEBHOOKS

Webhooks allow external services to be notified whenever health issues change by sending a POST request to each of the URLs you provide.

Name ↑	URL	Last Delivery	Delivery Status	Errors (Recent deliveries)
My Webhook	https://www.webhookmgr.acme.com	Tue, May 21 2019, 1:39:04 PM UTC	✔	0

Event (Recent deliveries)

Event (Recent deliveries)	Delivered ↓	Delivery Status
Health Issue Change: Production	Tue, May 21 2019, 1:39:04 PM UTC	✔
Health Issue Change: Disaster Recovery	Mon, Apr 22 2019, 3:12:12 PM UTC	✔

The user can select an event to see the Headers and Payload of the request and the response. A Redeliver button allows users to resend the event which is helpful for testing Webhook integration.

Health Issue Change: Production

✓ Tue, May 21 2019, 1:39:04 PM UTC REDELIVER

REQUEST RESPONSE: 200

Headers

```
{
  "x-ciq-signature": "3Erl/DwnFPMCmjBAPUQaN0T08gPnKcltqbaEU9LV4KA=",
  "x-ciq-event-version": "1.0",
  "x-ciq-delivery-id": "7f91ed6e-4b1f-439a-9e4a-836a04ba1c94",
  "x-ciq-event": "health-score-change",
  "user-agent": "x-ciq-webhook"
}
```

Payload

```
{
  "system": "FCNCH0972C32F1",
  "timestamp": 1558445944,
  "score": 100,
  "categories": [
    {
      "category": "DATA_PROTECTION",
      "impact": 0,
      "issueCount": 0,
      "issues": []
    },
    {
      "category": "PERFORMANCE",
      "impact": 0,
      "issueCount": 0,
      "issues": []
    },
    {
      "category": "CAPACITY",
      "impact": 0,
      "issueCount": 0,
      "issues": []
    },
    {
      "category": "CONFIGURATION",
      "impact": 0,
      "issueCount": 0,
      "issues": []
    }
  ]
}
```

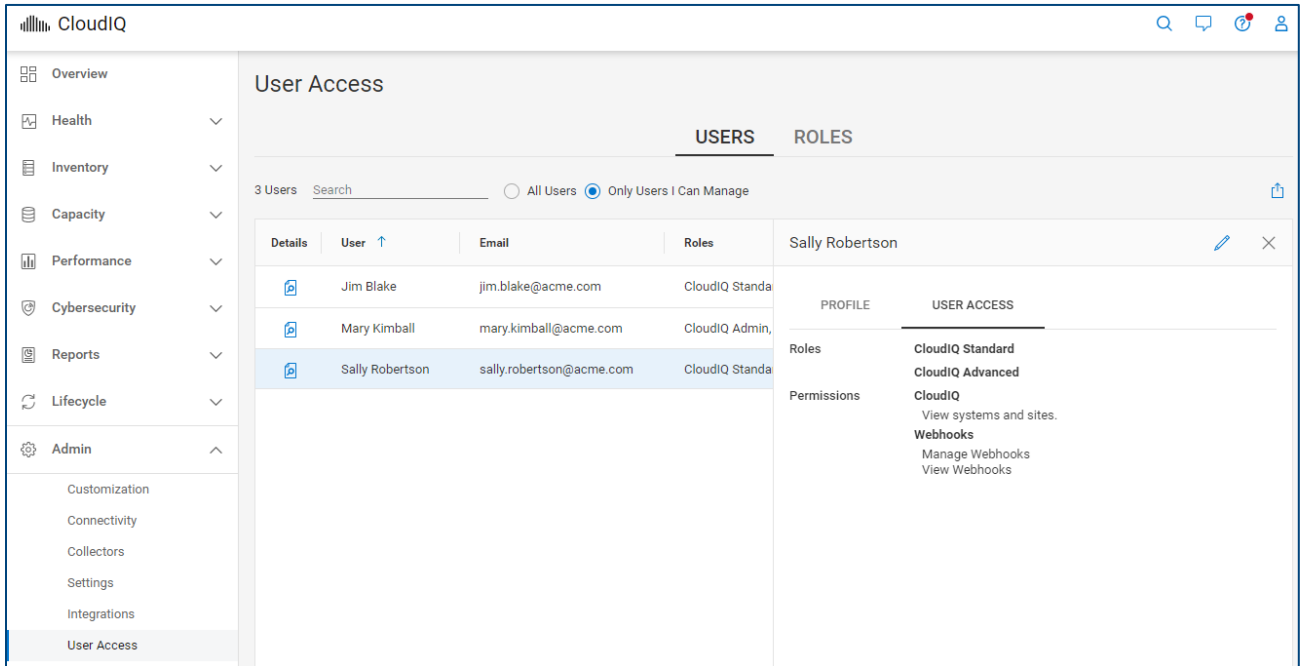
CLOSE

20.6 User Access

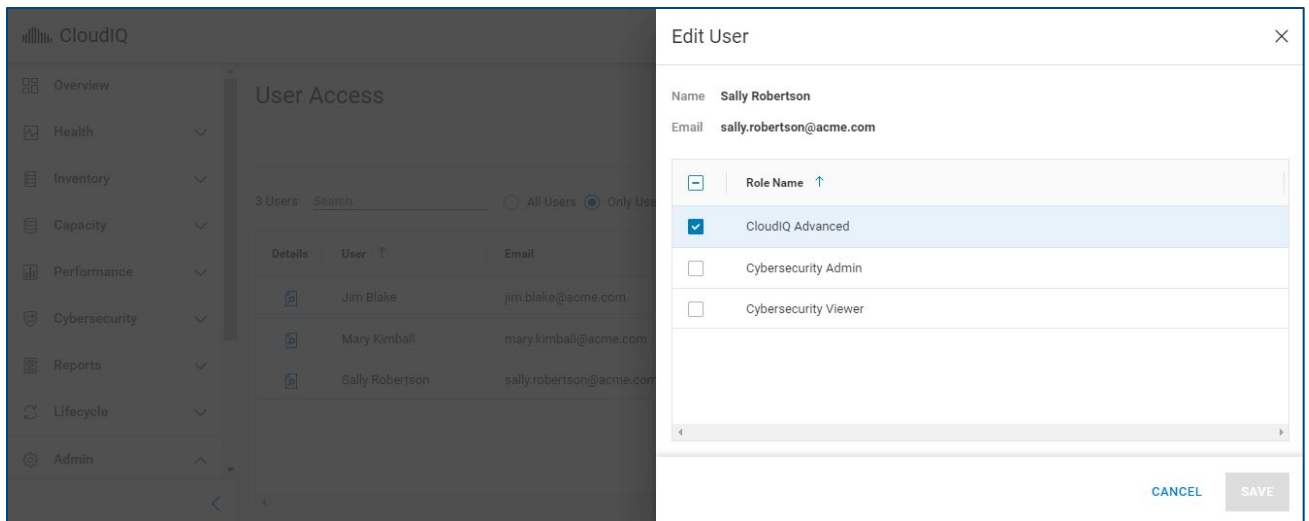
The User Access section allows CloudIQ administrators to set up access controls by assigning users to predefined roles. The administrator of an organization uses MyService360 to define the organization profile. See [KB#000183704](#) for details on using MyService360 for company administration. See [KB#000191817](#) for details on determining CloudIQ Admins for a company.

Note: MyService360 users with a company admin role are automatically mapped to the CloudIQ Admin role.

There are two tabs in the User Access page: The **USERS** tab lists out all users who have logged into CloudIQ at least once. This tab shows the username, email address, and assigned roles. Selecting the Details icon for an individual user provides details about the user profile and assigned roles and permissions.



CloudIQ Administrators can select the Edit button to assign a role to a user.



The ROLES tab lists out the available roles with their description. There are five roles in CloudIQ: CloudIQ Admin, CloudIQ Standard, CloudIQ Advanced, Cybersecurity Admin, and Cybersecurity Viewer. Users with an Administrator role in an organization are automatically assigned the CloudIQ Admin role. Users who do not have an Administrator role are automatically assigned the CloudIQ Standard role. These roles are automatically assigned based on the user's role in their organization and cannot be managed within CloudIQ. Only Users in the CloudIQ Admin role have access to the User Access page.

The CloudIQ Advanced role allows users access to the Integrations menu to view and configure Webhooks. CloudIQ Admins can assign this role to any CloudIQ user, including themselves.

The other two roles are Cybersecurity Admin and Cybersecurity Viewer. Users in the CloudIQ Admin role can manage Cybersecurity access for users by assigning them either the Cybersecurity Admin role or the Cybersecurity Viewer role. Users who are members of the Cybersecurity Admin role have full access to the Cybersecurity feature. They can edit, enable, or disable the Evaluation Plan for a system and select or clear individual Evaluation Tests within the Evaluation Plan. Users who are assigned the Cybersecurity Viewer role can access the Cybersecurity feature and view system risks and Evaluation Plans. They are unable to enable, disable, or edit the Evaluation Plan.

The screenshot shows the CloudIQ interface with the 'User Access' page selected in the left-hand navigation menu. The main content area is titled 'User Access' and has two tabs: 'USERS' and 'ROLES'. The 'ROLES' tab is active, showing a list of 5 roles. A modal window is open for the 'CloudIQ Advanced' role, displaying its permissions and assigned users.

Details	Role Name ↑	Description
	CloudIQ Admin	Admin role for all CloudIQ functionality.
	CloudIQ Advanced	Role for advanced CloudIQ functionality.
	CloudIQ Standard	Default role for CloudIQ users.
	Cybersecurity Admin	Admin role for cybersecurity functionality.
	Cybersecurity Viewer	Viewer role for cybersecurity functionality.

PERMISSIONS	ASSIGNED USERS (2)
Webhooks Manage Webhooks View Webhooks	

CloudIQ Admins can select the Manage Assignments link to assign users to the CloudIQ Advanced, Cybersecurity Admin, or Cybersecurity Viewer role.

The screenshot displays the CloudIQ management console. On the left is a navigation sidebar with categories like Overview, Health, Inventory, Capacity, Performance, Cybersecurity, Reports, Lifecycle, and Admin. The 'User Access' section is active, showing a table of 5 roles. On the right, a 'Manage Assignments' modal window is open for the 'Cybersecurity Admin' role. It shows 1 of 3 users assigned, with a search bar and a 'View Only Assigned Users' checkbox. A table lists three users: Jim Blake, Mary Kimball (selected), and Sally Robertson, each with their assigned roles.

User	Roles
<input type="checkbox"/> Jim Blake	CloudIQ Standard, Cybersecurity Viewer
<input checked="" type="checkbox"/> Mary Kimball	CloudIQ Admin, Cybersecurity Admin, CloudIQ Advanced
<input type="checkbox"/> Sally Robertson	CloudIQ Standard, CloudIQ Advanced

A Enabling CloudIQ at the System

A.1 Dell EMC Unity, XtremIO, PowerMax/VMAX, PowerScale/Isilon, and PowerFlex systems

The Dell EMC Unity, XtremIO, PowerMax/VMAX and PowerScale/Isilon systems leverage Secure Remote Services for CloudIQ data collection. This configuration must be enabled successfully on each individual Dell storage system before users can send data to CloudIQ. Once Secure Remote Services has been configured within the Element Manger interface, CloudIQ must be enabled.

- Dell EMC Unity
 - For Dell EMC Unity 4.2 and later, go to **Settings > Support Configuration > CloudIQ**, and then select Send data to CloudIQ.
 - For Dell EMC Unity 4.1, go to **Settings > Management > Centralized Management**. For the **CloudIQ** tab in **Centralized Management**, ensure the checkmark to **Send data to CloudIQ** is checked, and then click **Apply**.
- XtremIO
 - For XMS 6.2 and higher, access the Top Menu Bar and click the System Settings Icon to display cluster-level and XMS-level setting options. Next, select **XMS > Notifications > CloudIQ Reporting**, and ensure that **CloudIQ Reporting** is set to **YES**.
- PowerMax/VMAX
 - For Unisphere 9.0.1, go to **Settings > Management > CloudIQ**, ensure the checkmark to **Send data to CloudIQ** is checked, and then click **Apply**
 - For Cybersecurity, in Unisphere 9.2.1 or higher, go to **Settings > Management > CyberSecIQ** and select **I agree to send data to CyberSecIQ**.
- PowerScale/Isilon
 - For PowerScale/Isilon systems, connectivity to Secure Remote Services and CloudIQ is established with the following CLI command:

```
isi esrs modify --enabled=true --primary-esrs-gateway=<gateway-server>
--gateway-access-pool=subnetx:poolx --username=<username>
[--password=<password>]
```

- PowerFlex software and Ready Node with PowerFlex Gateway
 - Log in to PowerFlex Installer and go to **Maintain** tab
 - Enter MDM admin username and password, LIA authentication type, and LIA password
 - Select **Retrieve system topology**
 - On **Maintain** tab, select **System Logs & Analysis**
 - Enter Secure Remote Services information
 - Verify **Send data to CloudIQ** box is checked
- PowerFlex Appliance with PowerFlex Manager
 - Log in to PowerFlex manager and go to **Settings > Virtual Appliance Management**
 - Select **Add Alert Connector**
 - Under **Device Registration** section, Enter Device Type, ELMS Software ID, Solution Serial Number
 - Check **SRS** box
 - Check **Enable CloudIQ** box
 - Under **Connector Settings** section, Enter Secure Remote Services information

The user can then go to <https://cloudiq.dell.com> and log in with their valid service account credentials to view their systems in CloudIQ. The amount of time it takes for a system to appear in CloudIQ will vary, but typically will be visible within one hour.

For more information about enabling Secure Remote Services, see the [EMC Secure Remote Services for Dell EMC Unity Requirements and Configuration](#) document that can be found at <https://support.dell.com>.

For detailed information about onboarding the Dell storage arrays, see the following documents:

Dell EMC Unity – <https://www.dell.com/support/kbdoc/000067484>

XtremIO – <https://www.dell.com/support/kbdoc/000155454>

PowerMax/VMAX – <https://www.dell.com/support/kbdoc/000062039>

PowerScale/Isilon - <https://www.dell.com/support/kbdoc/000157794>

PowerFlex – <https://www.dell.com/support/kbdoc/000187624>

A.2 Dell PowerStore

Dell PowerStore systems use SupportAssist for CloudIQ data collection. This must be enabled and configured successfully on each appliance in the PowerStore cluster.

To configure SupportAssist in PowerStore Manager, go to **Settings > Support > SupportAssist**. Click the SupportAssist setting to “Enabled” and configure one of the SupportAssist options. Ensure the checkmark next to Connect to CloudIQ is selected.

For detailed information about onboarding PowerStore systems, see <https://www.dell.com/support/kbdoc/000157595>.

A.3 Dell SC Series

The Dell SC Series CloudIQ solution leverages Dell’s SupportAssist for CloudIQ data collection. This must be enabled and configured successfully on each individual Dell SC Series system before users can send data to CloudIQ.

To configure SupportAssist in Unisphere Central for Dell SC Series, open the Data Collector menu and select **Monitoring > SupportAssist > Turn On SupportAssist**.

To configure SupportAssist in the DSM thick Client, click **Storage > Edit Storage Center Settings > SupportAssist** tab.

Collect the following information from Unisphere as it will be required to complete the onboarding process in CloudIQ:

- System Serial Number
- Service Tag
- Storage Center Version

Login to the CloudIQ UI and go to the **Admin > Connectivity** page. Select the **ADD SC SERIES** button and step through the wizard which prompts the user for the Serial Number, Service Tag, and Storage Center Version that was previously collected.

For detailed information about onboarding Dell SC Series arrays, see:

<https://www.dell.com/support/kbdoc/000155957>.

A.4 Dell PowerVault ME4

The Dell PowerVault ME4 systems use SupportAssist for CloudIQ data collection. This must be enabled in the PowerVault ME Storage Manager.

To configure SupportAssist in ME Storage Manager, go to **System Settings > SupportAssist**, select the SupportAssist box, and verify the system is successfully connected.

Select the **CloudIQ Settings** tab and select the Enable CloudIQ box.

Collect the following information from ME Storage Manager as it is required to complete the onboarding process in CloudIQ:

- WWN
- Service Tag
- Firmware Version

Alternatively, login to the system and use the CLI to collect the above information.

Login to the CloudIQ UI and go to the **Admin > Connectivity** page. Select the **ADD POWERVAULT** button and step through the wizard which prompts the user for the WWN, Service Tag, and Firmware Version that was previously collected.

For detailed information about onboarding Dell PowerVault systems, see:

<https://www.dell.com/support/kbdoc/000022224>.

A.5 Dell VxBlock/VBlock

Dell Converged systems use Secure Remote Services for CloudIQ data collection. This must be enabled and configured successfully within VxBlock Central.

To configure Secure Remote Services in VxBlock Central, go to **Dashboard > SRS**. Confirm the Secure Remote Services Gateway information is properly configured and check the boxes for Send Data to SRS and Send Data to VxBlock Central Lifecycle Management (LCM) powered by CloudIQ.

Collect the following information from VxBlock Central as it is required to complete the onboarding process in CloudIQ:

- System Serial Number
- Network Switch Serial Numbers

Login to the CloudIQ UI and go to the **Admin > Connectivity** page. Select **ADD VXBLOCK** and step through the wizard which prompts the user for the System Serial Number, Core Network Switch A Serial Number, and Core Network Switch B Serial Number.

For detailed information about onboarding Dell VxBlock/VBlock systems, see:
<https://www.dell.com/support/kbdoc/000020473>.

A.6 Dell VxRail

VxRail Hyper-Converged Infrastructure systems use Secure Remote Services for CloudIQ Data Collection. See to the appropriate VxRail Administration Guide (section “Enabling Secure Remote Services”) for correct procedures.

V4.5.x – [VxRail Administration Guide](#)

V4.7.x - [VxRail Administration Guide](#)

V7.0.x – [VxRail Administration Guide](#)

or refer to [Solve Online for VxRail](#)

Telemetry must also be enabled for CloudIQ collections.

For VxRail v4.5.x, you must enable Telemetry Settings. The default and recommended collection level is Basic. This collects samples once per hour.

For VxRail v4.7.x and 7.0.x, you must enable Customer Improvement Program. The default and recommended collection level is Medium. This collects samples once per hour.

For detailed information about onboarding VxRail systems, see:
<https://www.dell.com/support/kbdoc/000184396>

A.7 PowerEdge

OpenManage Enterprise 3.7 or greater is used to collect data from PowerEdge servers and sends the data to CloudIQ. The CloudIQ plug-in is required to be installed in OpenManage Enterprise in order to enable flow of data to CloudIQ.

Install OpenManage Enterprise 3.7 or greater

In OpenManage Enterprise, go to **Application Settings > Console and Plugins**

Select the CloudIQ plug-in and then **Install Plugin**

Select **Accept** on the licensing agreement

Select **I agree that I have captured a snapshot of the OpenManage Enterprise appliance**

Click **Confirm Install**

Once installed, the CloudIQ plug-in must be configured.

In OpenManage Enterprise, go to **Plugins > CloudIQ > Overview**

Select **Activate Now**

On the Authentication page, enter the Access Key and PIN to register OpenManage Enterprise with the Dell Connectivity Service. Generate Access Key and PIN as documented in [KB#000180688](#)

Enter a Collector Name on the Collector Name page.

Click **Select Groups** on the Device Groups page and select devices for monitoring in CloudIQ

Select **Next** to see the summary of the configuration and then **Finish** to complete the configuration

For detailed information about onboarding PowerEdge servers to CloudIQ, see:

<https://www.dell.com/support/kbdoc/000189403>

A.8 Dell PowerProtect DD

PowerProtect DD systems use Secure Remote Services for CloudIQ data collection. To configure Secure Remote Services in DD System Manager, open the **Configuration** tab under **Maintenance > Support**.

Enable Secure Remote Services under the **Channel** section.

Select the Enable button under the **CloudIQ** section.

Verify "Share Data with CloudIQ" is set to Enabled.

For detailed information about onboarding PowerProtect DD systems, see:

<https://www.dell.com/support/kbdoc/000183656>

A.9 Dell PowerProtect Data Manager

PowerProtect Data Manager uses Secure Remote Services for CloudIQ data collection. To configure Secure Remote Services in PowerProtect Data Manager, go to the **Support** menu under the **System Settings** menu.

In the **Secure Remote Services** section, enter the Secure Remote Services gateway Hostname, Username, and Password.

In the **Auto Support** section, switch **Enable Auto Support** to Enabled.

Select **Save** to save the configuration.

For detailed information about onboarding PowerProtect Data Manager systems, see:

<https://www.dell.com/support/kbdoc/000184014>

A.10 Connectrix Switches

Connectrix switches use the CloudIQ Collector to collect the data from the switches and send the data back to CloudIQ using Secure Remote Services Gateway. The collector is a vApp that is downloaded from the Admin > Collectors menu in the CloudIQ user-interface or from <https://support.dell.com>. It must then be installed locally in the data center.

Once deployed, the collector is configured to communicate to the Secure Remote Services Gateway and the Connectrix switches by accessing the collector administration UI using a web browser: `https://<collector hostname or IP>`.

Communication between the Collector and the switches is done using REST API. The following guidelines can be used to verify and enable the REST API interface for both Brocade and Cisco.

Brocade

The following command can be used to verify that the REST API is enabled:

```
mgmtapp --show

REST Interface State: Enabled
REST Session Count: 3

REST Throttling Configurations:

    Sample Requests      : 30
    Sample Time (in sec) : 30
    Idle Time (in sec)   : 3

KeepAlive : Disabled
KeepAliveTimeout : 15sec
```

The following command can be used to enable REST API if it is not enabled:

```
mgmtapp --enable rest
```

Cisco

The following commands can be used to ensure that REST API is enabled:

```
switch# config t
switch(config)# feature nxapi
```

For detailed information about onboarding Connectrix switches, see: <https://www.dell.com/support/kbdoc/000157620>.

A.11 PowerSwitch

Each PowerSwitch must have SupportAssist configured. On each PowerSwitch, enter configuration mode:

```
OS10# configure terminal
OS10(config)#
```

Accept the EULA

```
OS10(config)# eula-consent support-assist accept
```

Enter SupportAssist mode

```
OS10(config)# support-assist
OS10(conf-support-assist)#
```

(Optional) Configure VRF for SupportAssist if using the management VRF

```
OS10(conf-support-assist)# vrf management
```

Specify the SupportAssist server URL as default:

```
OS10(conf-support-assist)# server url default
```

Configure contact information for your company

```
OS10(conf-support-assist)# contact-company name <your company name>
OS10(conf-support-assist-<your company name>)#
OS10(conf-support-assist-<your company name>)#address city <string> state
<string>
country < predefined country code> zipcode <string>
```

Generate Access Key and PIN as documented in [KB#000180688](#)

Enter Access Key and PIN to generate the Universal key.

```
OS10(conf-support-assist)# do support-assist generate universal-key 570E904C
1234
OS10 (conf-support-assist)# success
```

Schedule hourly collections in EXEC mode.

```
OS10# support-assist-activity full-transfer schedule hourly min 59
```

Once SupportAssist is enabled on the PowerSwitch, the switch must be manually added to CloudIQ. Utilize the `show license status` command to collect the required information.

Login to the CloudIQ UI and go to the **Admin > Connectivity** page. Select ADD POWERSWITCH and step through the wizard which prompts the System Serial Number (PPID), System Service Tag (service tag), PowerSwitch Version, and PowerSwitch Model.

For detailed information about onboarding PowerSwitch, see:

<https://www.dell.com/support/kbdoc/000192029>

A.12 VMware

VMware uses the CloudIQ Collector to communicate to vCenter and send data back to CloudIQ using Secure Remote Services Gateway. The collector is a vApp that is downloaded from the Admin > Collectors menu in the CloudIQ user-interface or from <https://support.dell.com>. It is then installed locally in the data center. The collector requires read-only privileges to access and pull data from vCenter.

Once the Collector vApp is deployed, the collector is configured to communicate to the Secure Remote Services Gateway and vCenter by accessing the collector using a web browser: <https://<collector hostname or IP>>.

For detailed information about onboarding VMware, see: <https://www.dell.com/support/kbdoc/000021264>.

B CloudIQ Security

B.1 CloudIQ Security Summary

CloudIQ takes numerous steps to protect your information in transit and at rest. In addition, CloudIQ has been developed using architectural controls as part of the Dell standard secure development life cycle. This standard defines the security-focused activities Dell product teams must follow when building and releasing products, to enable Dell products to minimize the risks to our products and customer environments from security vulnerabilities.

B.2 CloudIQ Data in Transit to Dell

CloudIQ subscribes to notifications from Dell's Secure Remote Services and Dell Phone Home services when storage system metadata (for example, system logs, system configuration, system capacity, and performance metrics) arrives over those channels. No customer data is sent, only data generated by the customer's systems. Customers control which systems send information over these channels.

All data arriving through those channels is protected in transit by industry-standard best practices. Both channels use digital certificates and customer-controlled access policies to establish point-to-point encryption and ensure all data is securely transported to the Dell IT-managed infrastructure. In addition, Secure Remote Services provides for dedicated VPN and multifactor authentication. Once the data arrives, CloudIQ stores data relating to those systems which have CloudIQ management enabled in its own Dell IT-managed infrastructure.

B.3 CloudIQ Data at Rest

CloudIQ data is stored on Dell infrastructure, which is highly available, fault tolerant, and provides a 4-hour Disaster Recovery SLA. Dell's Global Security Organization (GSO), led by a Chief Information Security Officer is responsible for security and protection of Dell's information technology infrastructure. This is accomplished using establishment of governing security policies and procedures, and enforcement of Information Security control. This includes measures such as multilayered firewalls, intrusion detection systems, industry-leading anti-virus, and malware protection.

The Dell cybersecurity team is involved in running continuous vulnerability scans on the application and underlying environment. Any required remediation is handled through an ongoing vulnerability remediation program such as software upgrades, patches, or configuration changes.

All data sent to CloudIQ is stored on infrastructure hosted in Dell data center. The Information Security Policy ensures that all Dell information and resources are properly protected, information owners must ensure all resources are accounted for, and each resource has a designated custodian. All infrastructure is located in the core network behind corporate firewalls, not exposed to external direct access. No individual direct login to the database server and database is allowed, except for the members of System Administrator and Database Administrator teams. Database application accounts are managed using standard database password authentication.

Dell has implemented an industry best practice Change Management process to ensure that Dell production line assets are stable, controlled, and protected. Change Management provides the policies, procedures, and

tools needed to govern these changes, to ensure that they undergo the appropriate reviews, approvals, and are communicated to users.

B.4 Accessing CloudIQ Data

CloudIQ access requires that each user has a valid Dell support account. Customers use their existing support account to log in to CloudIQ. Authentication is handled by Dell's Single-Sign-On (SSO) infrastructure.

CloudIQ leverages information in the user profile stored in Dell Service Center related to company and site mapping for access control. The user profile is created and associated with a valid company profile when the user registers for an account with Dell.

CloudIQ provides each customer with an independent secure view of their systems and ensures that they will only be able to see their own data in CloudIQ. Each user can only see those systems in CloudIQ which are part of that user's site access as per the configuration of that user in Dell Service Center.

C Data Collection Frequencies and Samples

The following chart provides the data collection frequency per system type.

	Performance	Capacity	Configuration
PowerMax/VMAX	5 minutes	1 hour	1 hour
PowerStore	5 minutes	1 hour	1 hour
PowerScale/Isilon	5 minutes	1 hour	1 hour
PowerVault	15 minutes	1 hour	1 hour
PowerFlex	5 minutes	1 hour	1 hour
Unity	5 minutes	1 hour	1 hour
XtremIO	5 minutes	1 hour	1 hour
SC Series	5 minutes	1 hour	1 hour
VxBlock	N/A	N/A	24 hours
PowerEdge	5 minutes	N/A	1 hour
Connectrix	5 minutes	5 minutes	5 minutes
PowerSwitch	N/A	1 hour	1 hour
VMware	5 minutes	5 minutes	5 minutes
APEX Block	5 minutes	1 hour	1 hour
APEX File	5 minutes	1 hour	1 hour
VxRail ¹	5 minutes	5 minutes	24 hours
PowerProtect DD	5 minutes	1 hour	1 hour

1. VxRail sends the 5-minute performance and capacity data to CloudIQ at 30 minute, 60 minute, or 24 hour intervals. The telemetry setting in VxRail manager determines the upload interval.

The following charts display the collected metric types for various components of the systems. The P column represents performance metrics, and the C column represents capacity metrics. See Section 6.2 – Metrics Browser for a full list of individual performance metrics collected for each component type.

Storage Systems

	System		Node / Appliance		Pool		Volume / LUN		File System		Storage Group		Drives		Host / Initiator	
	P	C	P	C	P	C	P	C	P	C	P	C	P	C	P	C
PowerMax / VMAX	✓	✓			✓	✓					✓	✓				
PowerStore	✓	✓	✓	✓			✓	✓	✓	✓			✓		✓	✓
PowerScale / Isilon	✓	✓	✓	✓		✓										
PowerVault	✓	✓			✓	✓	✓	✓					✓	✓	✓	✓

PowerFlex	✓	✓														
Unity	✓	✓			✓	✓	✓	✓	✓	✓			✓	✓	✓	✓
XtremIO	✓	✓					✓	✓								
SC Series	✓	✓			✓	✓	✓	✓					✓	✓	✓	✓

Connectrix Switches

	Switch		Partition		Zone		Attached Devices		Interface		
	Perf	Cap	Perf	Cap	Perf	Cap	Perf	Cap	Perf	Cap	
Connectrix	✓	✓								✓	
PowerSwitch		✓									

VMware

	ESXi Cluster		ESXi Server		Datastore		Virtual Machine	
	Perf	Cap	Perf	Cap	Perf	Cap	Perf	Cap
VMware	✓		✓		✓	✓	✓	✓

D Report Browser PowerEdge Metrics

Available PowerEdge metrics vary based on model, license, and firmware. See the CloudIQ section of the [OpenManage Portfolio Software Licensing Guide](#) for additional details.

Drives	
NVMe	Storage Disk
Available Spare Threshold (%)	Command Timeout (Count for last hour)
Composite Temp (C, Max over last 15 min)	CRC Errors (Count for last hour)
Critical Warnings	Drive Life Remaining
Percentage Used (Max over last 1 hour)	Drive Temperature (C, Avg over last hour)
	Erase Failures (Count for last hour)
	Exception Mode Status (Count for last hour)
	Media Writes (Count for last hour)
	Power On Hours
	Program Fail (Count for last hour)
	Read Error Rate (Count for last hour)
	Reallocated Block (Count for last hour)
	Uncorrectable Error (Count for last hour)
	Uncorrectable LBA (Count for last hour)
	Volatile Memory Backup Source Failures (Count for last hour)

FC Port
Invalid CRCs (Count for last 5 min)
Link Failures (Count for last 5 min)
Received Bytes (Total over last 5 min)
Transmitted Bytes (Total over last 5 min)

Network Port
Discarded Packets (Count for last 5 min)
Excessive Collision Packets (Count for last 5 min)
FCoE Packets Received (Count for last 5 min)
FCoE Packets Transmitted (Count for last 5 min)
FCoE/FIP Link Failures (Count for last 5 min)

FCS Error Packets Received (Count for last 5 min)
Jabber Packets (Count for last 5 min)
Multiple Collision Packets (Count for last 5 min)
RDMA Bytes Transmitted (Total over last 1 min)
RDMA Packets Received (Count for last 5 min)
RDMA Packets Transmitted (Count for last 5 min)
Received Bytes (Total over last 5 min)
Transmitted Bytes (Total over last 5 min)

Processor (CPU/GPU)
CPU Temperature (°C, Avg. over last 5 min)
GPU: Board Temperature (°C, Avg. over last 15 min)
GPU: DBE Retired Pages (Count for last 15 min)
GPU: Power Consumption (W, Avg. over last 15 min)
GPU: Primary Temperature (°C, Avg. over last 15 min)
GPU: SBE Retired Pages (Count for last 15 min)
GPU: Secondary Temperature (°C, Avg. over last 15 min)

Server System
CPU Usage (% , Avg. over last 5 min)
Inlet Temperature (°C, Avg. over last 15 min)
Memory Usage (% , Avg. over last 5 min)
Peak Inlet Temperature (°C, Max. over last 15 min)
Power Consumption (W, Avg. over last 15 min)
Power Consumption (W, Max. over last 15 min)
Power Consumption (W, Min. over last 15 min)
System Board IO Usage (% , Avg. over last 5 min)
System Net Airflow (CFM, Avg. over last 15 min)
System Usage (% , Avg. over last 5 min)
Total CPU Power (W, Total over last 15 min)
Total Memory Power(W, Total over last 15 min)