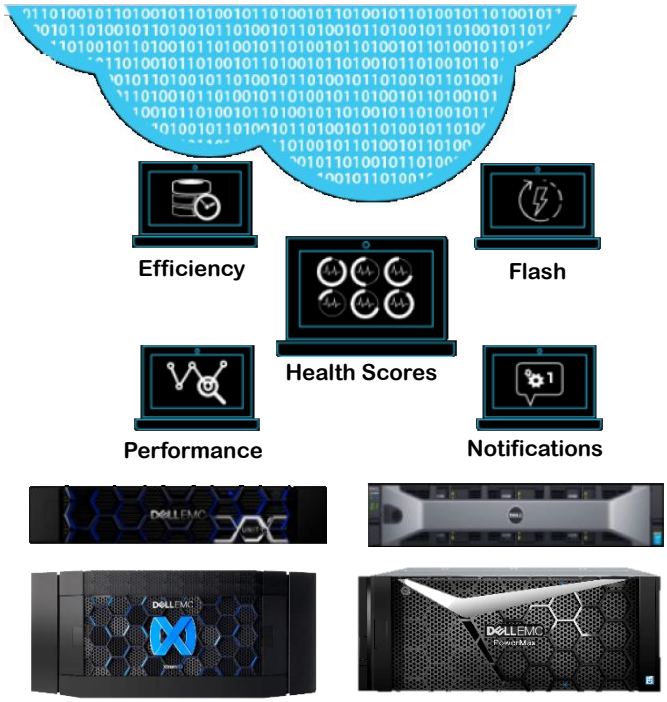
CLOUDIQ DETAILED REVIEW

A Proactive Monitoring and Analytics Application for Dell EMC™ Storage Systems



ABSTRACT

This white paper introduces Dell EMC™ CloudIQ, a free, cloud-based application that lets you easily monitor, analyze, and troubleshoot your Dell EMC Unity, SC Series, XtremIO, and PowerMax/VMAX systems from anywhere and at any time. This paper provides a detailed description of how to use CloudIQ to proactively monitor and troubleshoot Dell EMC storage systems.

October 2018

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EXECUTIVE SUMMARY

With our busy daily lives, it is important to find easier and faster ways to manage storage. With the Dell EMC Unity, SC Series, XtremIO, and PowerMax/VMAX systems, Dell EMC seeks to simplify the user experience in every possible way. One key aspect is in providing a simple way to monitor single or multiple Dell EMC Unity, SC Series, XtremIO, and PowerMax/VMAX systems.

CloudIQ is designed to deliver these capabilities to customers:

- Centralized Monitoring of Dell EMC Unity, SC Series, XtremIO, and PowerMax/VMAX systems
- Proactive Health Score to help users identify potential risks in the environment
- Predictive Analytics enabling capacity trending, capacity predictions, and performance troubleshooting for Dell EMC Unity, SC Series, XtremIO, and PowerMax/VMAX systems

This white paper describes these CloudIQ features that are presented in a consolidated user-friendly interface through any HTML5 browser.

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

Audience

This white paper is intended for Dell EMC customers, partners, and employees who are interested in understanding CloudIQ features and how to monitor the following Dell EMC storage systems: Dell EMC Unity, SC Series, XtremIO, and PowerMax/VMAX systems.

Terminology

Secure Remote Services (formerly named ESRS) provides the remote connectivity that enables Dell EMC Unity, XtremIO, and PowerMax/VMAX systems to connect to CloudIQ and to automatically open Service Requests (SRs) for critical issues that arise. Secure Remote Services allows Dell EMC 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** is embedded in the Dell EMC Unity, XtremIO, and PowerMax/VMAX Element Managers, and is the recommended configuration providing High Availability (HA) failover of Secure Remote Services from the Primary Storage processor (SP) to the backup SP. 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. Centralized Secure Remote Services does not provide an HA feature. Secure Remote Services Centralized communication uses ports 443 and 9443 (HTTPS) and needs unrestricted access to the Global Access Servers (GAS).

SupportAssist (or "Phone Home") provides the remote connectivity that enables Dell EMC SC Series systems to connect to CloudIQ and to send associated data packets for performance, capacity, and health monitoring. Support Assist allows Dell EMC to securely transfer files, such as alerts, performance stats, and capacity/configuration information from the systems.

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

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

CloudIQ

CloudIQ is a cloud-native, Software-as-a-Service (SaaS) offering by Dell EMC that provides a simple monitoring interface for an unlimited number of Dell EMC Unity, SC Series, XtremIO, and PowerMax/VMAX systems. CloudIQ is hosted on Dell EMC infrastructure 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 by using CloudIQ. Each user can only see those systems in CloudIQ which are part of that user's site access as defined in Dell EMC Service Center. Customers register their storage systems with their Site ID (for SC Series systems, a new site ID is created, named after the system ID, for each SC system selected to be viewed in CloudIQ). CloudIQ enables monitoring and troubleshooting for Dell EMC Unity, SC Series, XtremIO, and PowerMax/VMAX systems. CloudIQ will maintain 2 years' worth of historical data for systems that are actively being monitored.

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

The Value of CloudIQ to the Customer

- **Reduce TCO** – Manage from anywhere, increase self-service, and expedite quality resolutions – all at no charge.
- **Expedite Time to Value** – Get started in minutes with nothing to install or license. New features and capabilities are seamlessly and non-disruptively provided through CloudIQ.
- **Drive Business Value** – Deliver higher uptime, increase performance, and perform effective capacity planning.

CloudIQ Requirements

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

	Product Models	Min. Array Code Version	Min. Remote Support Version
Dell EMC Unity	All Flash, Hybrid, and/or UnityVSA – Professional Edition	Unity OE 4.1 and later	Secure Remote Services version 3.30
SC Series	SC all Flash and SC Hybrid	7.3.1 and later	Production version
PowerMax/VMAX	VMAX 10K, 20K, 40K, 100K, 200K, 400K, 250F, 450F, 850F, 950F PowerMax 2000, 8000	Unisphere 9.0.1.6 and later	Secure Remote Services version 3.28.20.06
XtremIO	X1 and X2	6.2.0 and later	Secure Remote Services version 3.20

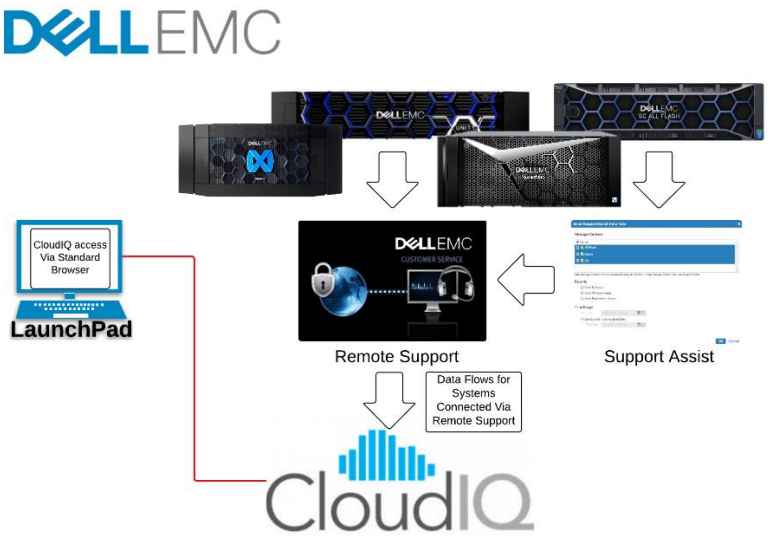
The following requirements must be fulfilled:

- Remote Support established and configured for CloudIQ Data Access
- Valid Dell EMC support contract and account which the user will use to access CloudIQ

When these requirements have been met, users can securely connect the system to CloudIQ and start to monitor their Dell EMC Unity, SC Series, XtremIO, and PowerMax/VMAX systems.

CloudIQ Data Collection

After the Dell EMC Unity, SC Series, PowerMax/VMAX, and XtremIO systems have established connection to CloudIQ, data will be collected for the Dell EMC storage systems. A Dell EMC Unity, PowerMax/VMAX, and XtremIO connection is through secure Remote Support. A Dell SC Series connection is through SupportAssist.



The frequency with which data is updated in CloudIQ varies, based on the type of information. The following table shows the types of data and the frequency with which CloudIQ updates this information:

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

Details about CloudIQ's security measures are available in Appendix A, "CloudIQ Security". Details about initial Remote Support configuration and CloudIQ access are available in Appendix B, "Enabling CloudIQ at the System".

CloudIQ Features

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

- Comprehensive monitoring of performance, capacity, system components, configuration, and data protection. CloudIQ also provides details about Systems, Storage Pools, and Block and File Storage Objects.
- Predictive Analytics that enable intelligent planning and optimization of capacity and performance utilization.
- Comprehensive Proactive Health scores for monitored storage systems. CloudIQ identifies potential issues in the storage environment and offers practical recommendations based on best practices and risk management.

Comprehensive Monitoring

CloudIQ provides a helpful Overview Page that summarizes the key aspects of the storage environment so that the user can quickly see what needs to be addressed. These summaries are especially focused on Anomaly Detection, Capacity Predictions and Proactive Health Score, as discussed below. From here, the user can easily navigate to the areas of interest or the areas requiring attention.

Intelligent Analytics – Anomaly Detection and Capacity Predictions

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

Performance Anomaly Detection

Using machine learning, CloudIQ analyzes historical performance data to determine the range of acceptable normal behavior and indicates when a metric is either above or below the range. These norms are used to compare a system's behavior and performance abnormalities. This provides timely information about the risk level of the storage systems with insights into conditions and anomalies affecting performance.

Capacity Trending and Predictions

CloudIQ provides historical trending and future predictions to provide intelligent insight on how capacity is being used, and what future needs may arise. Since CloudIQ maintains data for a two year period, it effectively means that CloudIQ is tracking information from two years ago up to present day, and also leverages a learning algorithm to predict when Storage Capacity will become full (Storage Pools for Unity and SC, Storage Resource Pools for VMAX, and Clusters for XtremIO). Assisting users both with short-term risk mitigation and longer-term planning.

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 storage 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 upon the five categories shown in the table to the left. Some examples of how the Proactive Health checks mitigate risk are:

Category		Sample Health Checks
	Components	Physical components with issues, faulty cables, fans, etc.
	Configuration	Non-HA Hosts connections
	Performance	CPU at high utilization and Service Processors significantly imbalanced
	Capacity	Pools that are over-subscribed and reaching full capacity
	Data Protection	Recovery Point Objectives not meeting native replication and snapshot policy

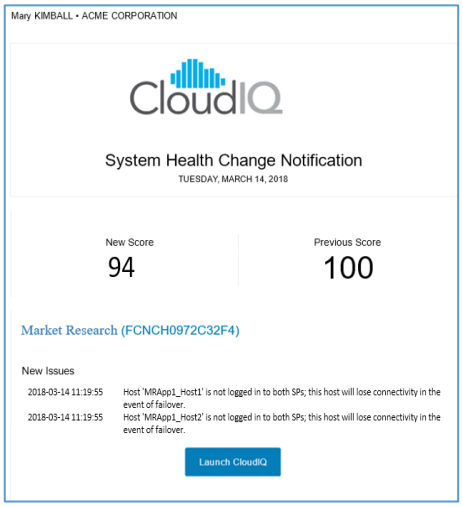
- Verifying redundant paths providing High Availability from the System through the SAN to the Hosts.
- Monitoring the capacity and subscription rate of Storage Pools to understand their trend and predicted time to full, to help the administrator avoid a total stoppage of I/O which could result in application downtime.
- Data Protection policies that are not being fulfilled – such as Recovery Point Objectives that are not being met. Note: At this time, the Component and Data Protection categories do not apply for PowerMax/VMAX systems.

CloudIQ Notification Emails

CloudIQ provides an email triggered by any Health Score change in near real-time, so immediate action can be taken to resolve any issues before they become a data outage condition. These emails will bring attention to the specific systems with issues that have been found. In many cases, the user will be notified about issues that commonly go unnoticed until a complete data outage happens.

In this example email, CloudIQ has identified issues with two hosts connected to a Dell EMC Unity system that are not logged into both SPs of the system. This is a loss of redundant (HA) paths which could result in a data outage should the remaining path also fail. Commonly this condition goes unnoticed as this is not a system failure, but a Host HBA, switch port, or cable failure.

By clicking the “Launch CloudIQ” button, the user can quickly go to CloudIQ, navigate to the system, and view the related details affecting the Health Score.



CloudIQ User Interface

CloudIQ is a cloud-based application, delivered as an HTML5 browser-based user interface which can be reached at https://cloudiq.dellemc.com. When connected to CloudIQ, users can securely view their storage environment.

The illustrations and use cases discussed in this White Paper can be viewed with the online simulator accessible from the following link: https://CloudIQ.dellemc.com/simulator. In the simulator environment, there are Dell EMC Unity, SC Series, XtremIO, and PowerMax/VMAX systems that display various level of operations to show the value of CloudIQ. When viewing the simulator, the dates will be based on the current date the simulator is launched.

As noted above, some features will vary by product type. For specific details per product type, consult **Online Help**, which is updated with each iteration of CloudIQ.

Navigating CloudIQ

The menu tree on the left shows the high-level sections of CloudIQ. Each section will display key attributes with sortable columns for a common and simplified user experience across the CloudIQ GUI.

- **Overview** – Status view of storage environment
- **Systems** – Card or List display of all the systems, viewable by Health Scores, Configuration, Capacity, or Performance
- **Health Center** – List view of each system with the details related to the Health Score

- **Metrics** – Customizable metrics dashboard
- **Pools** – Aggregate listing of Storage Pools for Unity and SC, and Storage Resource Pools for PowerMax/VMAX
- **Hosts** – Aggregate listing of all hosts connected to the systems with connectivity, capacity, and performance information
- **Settings** – The CloudIQ configuration details for your account, User Community, and Customer Support
- **Help** – Online CloudIQ documentation which is searchable

There is also a Global Search feature to help users quickly find Systems, Hosts, Pools, LUNs/Volumes, or File Systems. 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.

What's New in CloudIQ

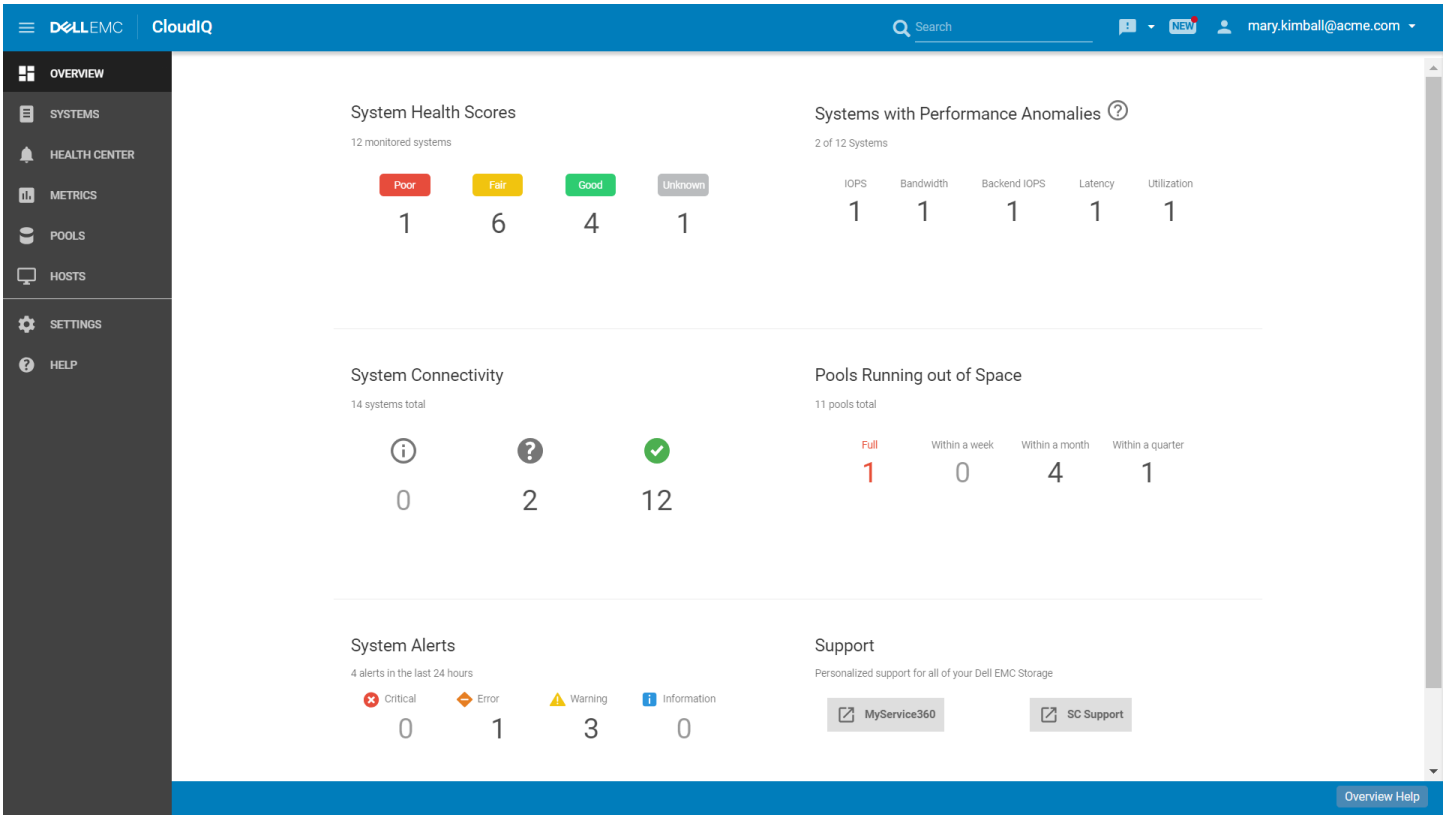
CloudIQ is updated frequently to deliver helpful new content to users. New features can be seen by clicking the NEW icon on the top menu bar.

The "What's New in CloudIQ" window will pop up showing what has changed and what enhancements have been added. Clicking **View All Enhancements** will display a historical list of all the updates. The most recent information will be shown 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.

Some additional key functions are available on the upper right of the menu bar: a button to log out (or click on the user email address), and a dropdown menu to select Online Chat with Customer Service or provide Feedback.

Overview Page

The **Overview** page provides a consolidated view of the Dell EMC Unity, SC Series, XtremIO, and PowerMax/VMAX storage environments. This 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 storage systems.

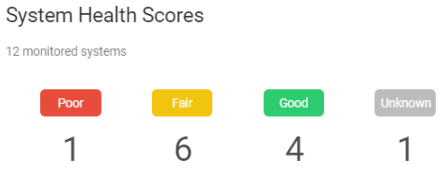


Selecting **Settings** provides information about the user account and systems, and users (Team members, Advisors, and Partners) who have access to this CloudIQ environment and Customer Support information.

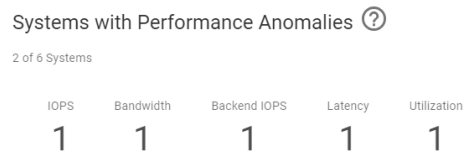
Selecting **Help** provides online help topics with the latest information for CloudIQ.

The **Overview** page has the following tiles of information:

- **System Health Scores** – Summarizes the scores of the monitored systems in the environment. Based on their health score (ranges are Poor 0-73, Fair 74-94, and Good 95-100), each system is represented by the number below the range. Clicking on the number below each range will display a pop-up listing each of the systems in that range with the Health Score and a link to the System details.



- **Systems with Anomalies** – Anomalies are defined as deviations in the system norms for performance, based on a rolling 3 week period. The performance categories monitored are: IOPS, Bandwidth, Backend IOPS, Block Latency, and Utilization. Clicking on the number below each category will show the systems and the direction of the anomaly (High or Low). Selecting a system takes the user to the system's detailed Performance graphs.



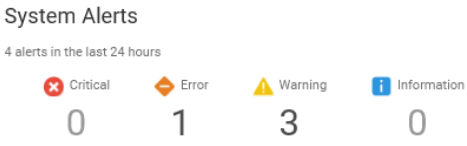
- **System Connectivity** – Shows the total systems monitored in CloudIQ, within three categories:
    - Identified systems not configured ( )
    - Systems with lost connectivity ( )
    - Systems which are successfully connected ( )

  Clicking on the below each category will display the systems corresponding to that connectivity status and details about both the Remote Support and CloudIQ connectivity.

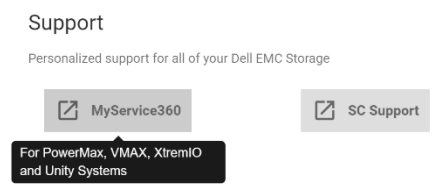
- **Capacity Reaching Full** – Leverages predictive analytics to identify the Storage Pools running out of space (Unity and SC). Selecting the subtitle will navigate the user to the aggregate Pool listing. Hovering over the number under each of the four categories will pop up a list of pools within that time range:

    - Full
    - Within a week (7 days)
    - Within a month (8 – 30 days)
    - Within a quarter (31 – 90 days)
    - Clicking the number will navigate the user to the Pool listing, filtered by that time range.

- **System Alerts** – Summarizes the alerts that were collected by CloudIQ from the monitored storage systems, over the last 24 hours. Selecting the subtitle "x alerts in the past 24 hours" will show a filtered list of alerts, across all severity levels, from the last 24 hours. Selecting the number below each alert severity will further filter the view to display alerts in that severity level only.

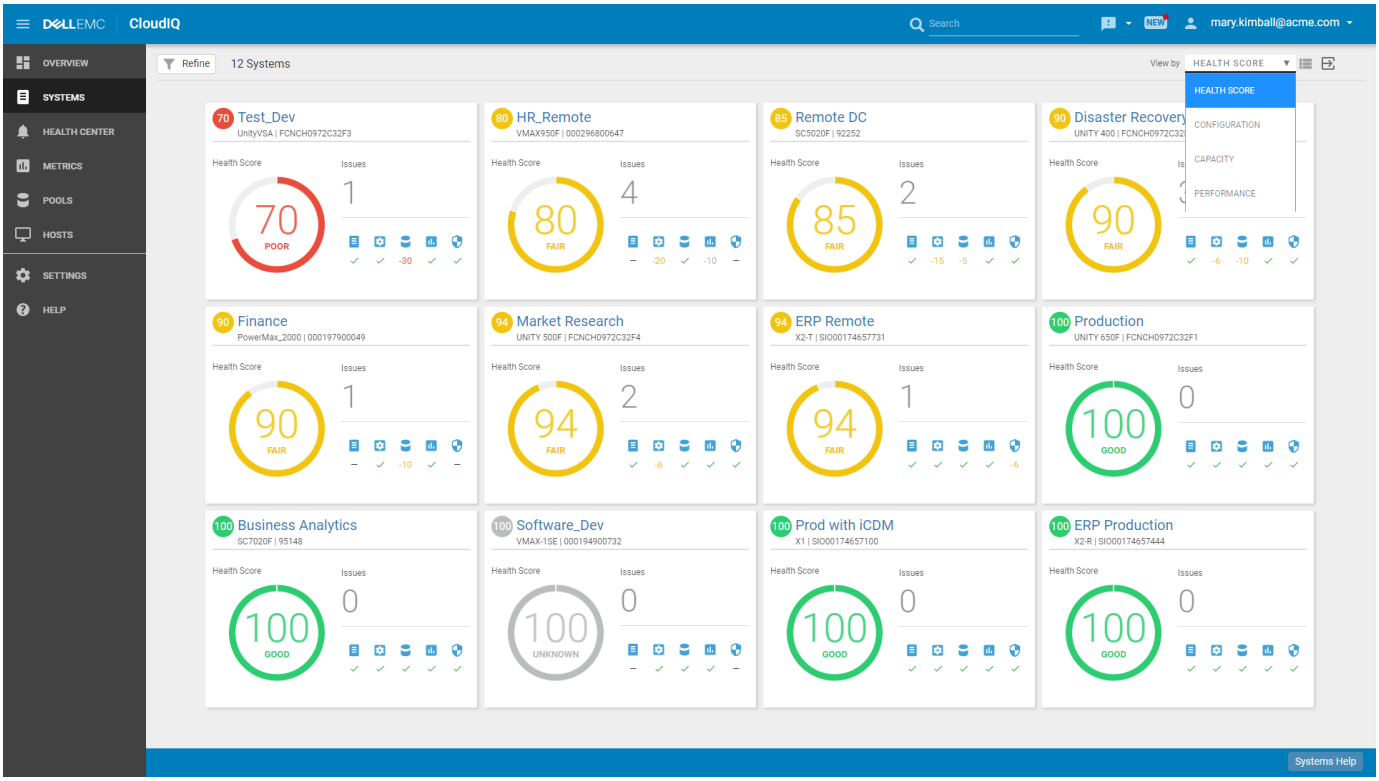


- **Support** - Link to MyService360 for Dell EMC Unity, XtremIO, and PowerMax/VMAX, and SC Support for Dell SC Series for a cloud-based dashboard with service insights for managed systems.

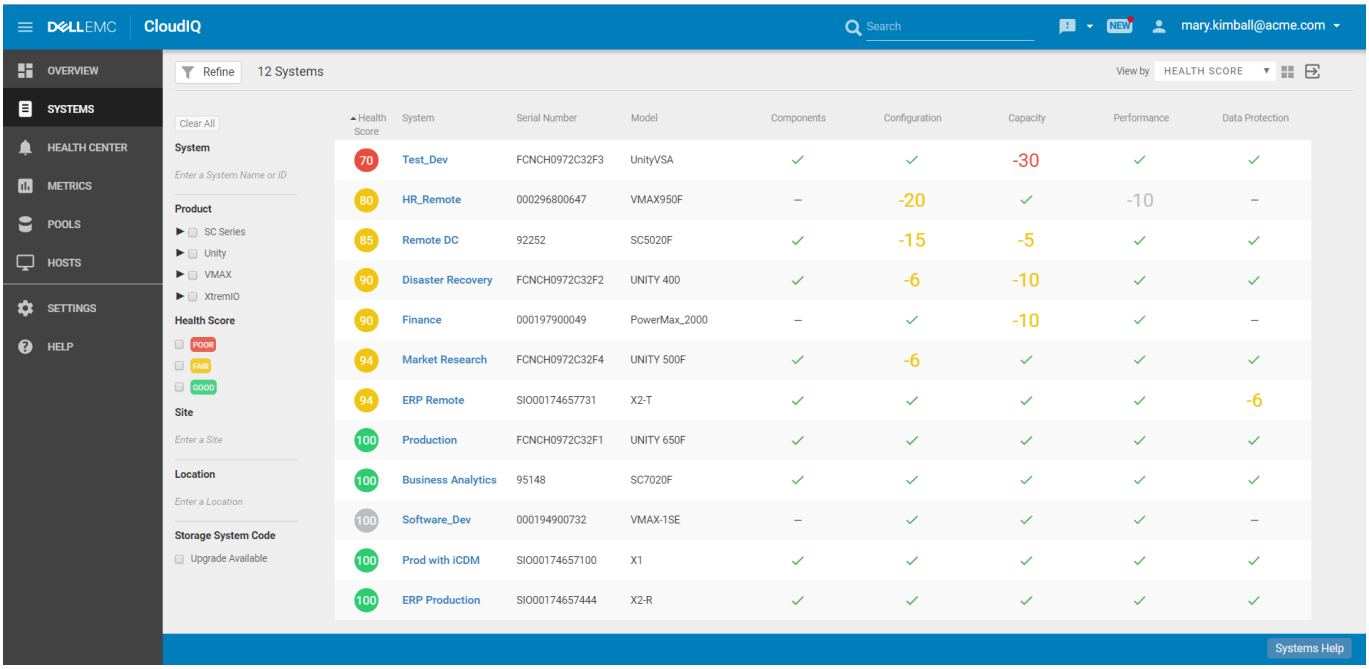


Systems – Summary

The Systems views display all systems across all products in a single view. Users can select from multiple views including **Health Score**, **Configuration**, **Capacity,** and **Performance** using the View by drop-down menu**.**



The **Card** view, shown above, is the default view when reaching this page. Users can alternatively choose the **List** view, by selecting the icon to the right of the **View by** drop-down box. For large environments, the list view may be more useful because it allows the user to sort columns.



Note: If the List view is selected, this will become the new default multi-system view until the user logs out or changes back to the Card view.

The **Export** button is available on each of the pages and will export data across all views to a single csv file.

Users can also **refine** the Systems lists and card views with several filter settings. In the Systems view, after clicking the "Refine" button, users can filter the systems shown based on name or serial number, product family and model, health score, site, and location. The filter settings stay in effect until the user logs out or closes the browser.

Each view provides this information:

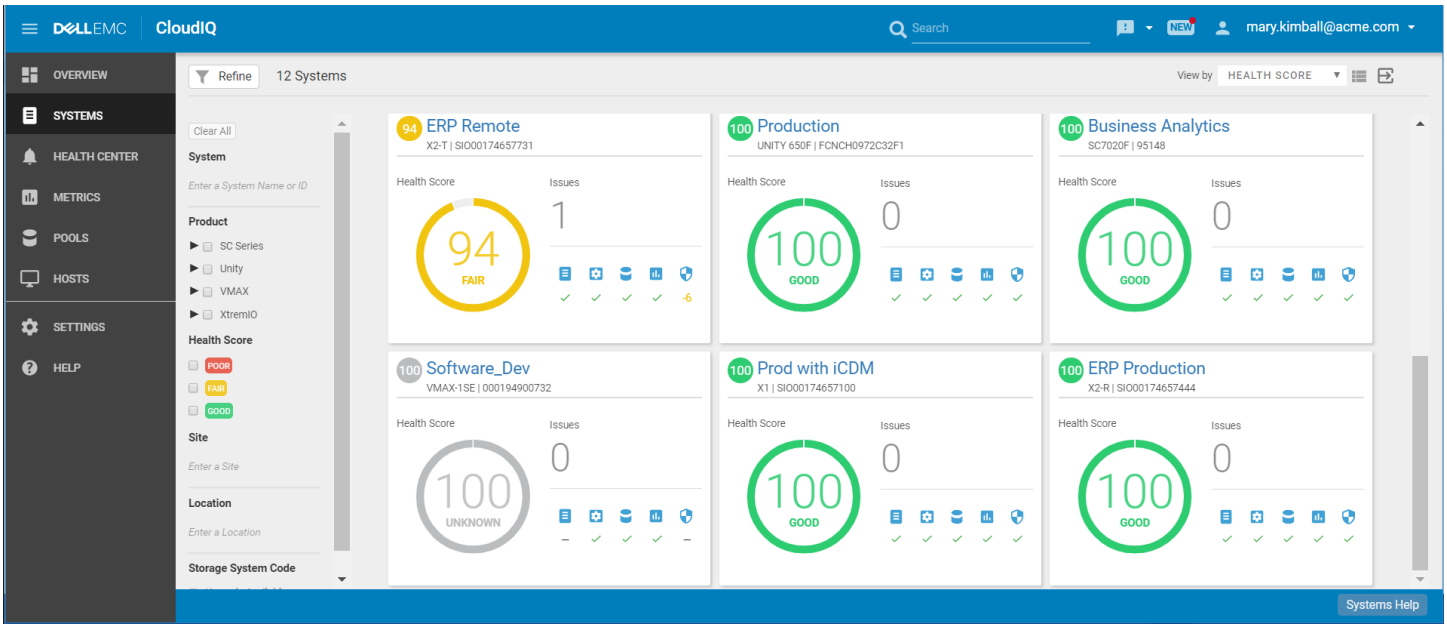
- **Score** – CloudIQ Health Score for system
- **Name** – User-defined name of system
- **Model** – Specific model of system
- **Serial number** – Unique serial number for system

Systems Summary – Health Score View

The default view of the Systems page is Health Score, in the **Card** view, as shown above. This view shows the five categories that are monitored by CloudIQ; **Components** (), **Configuration** (), **Capacity** (), **Performance** () and **Data Protection** () information**.**

Note: PowerMax/VMAX systems do not currently include health checks in the Components or Data Protection categories, and thus "—" will be displayed for these categories for all PowerMax and VMAX systems in CloudIQ.

Each system has a health score (from 100 to 0) which is calculated as 100 minus the issue with the greatest impact of the five categories. The number in the circle represents the most significant issue that needs to be addressed and drives the Health Score. Each of the five categories monitored will have either a green check mark, or a negative number. The green check indicates no issues are present for that category; a negative number represents the number of health points deducted (from 100) for the most impactful issue in the category. This approach is intended to help the user focus first on the most significant issue for the system, so that the user can resolve the issue to improve the health score.



The Health Score range is as follows:

- **Good** = 95– 100 (Green)
- **Fair** = 74– 94 (Yellow)
- **Poor** = 0– 73 (Red)

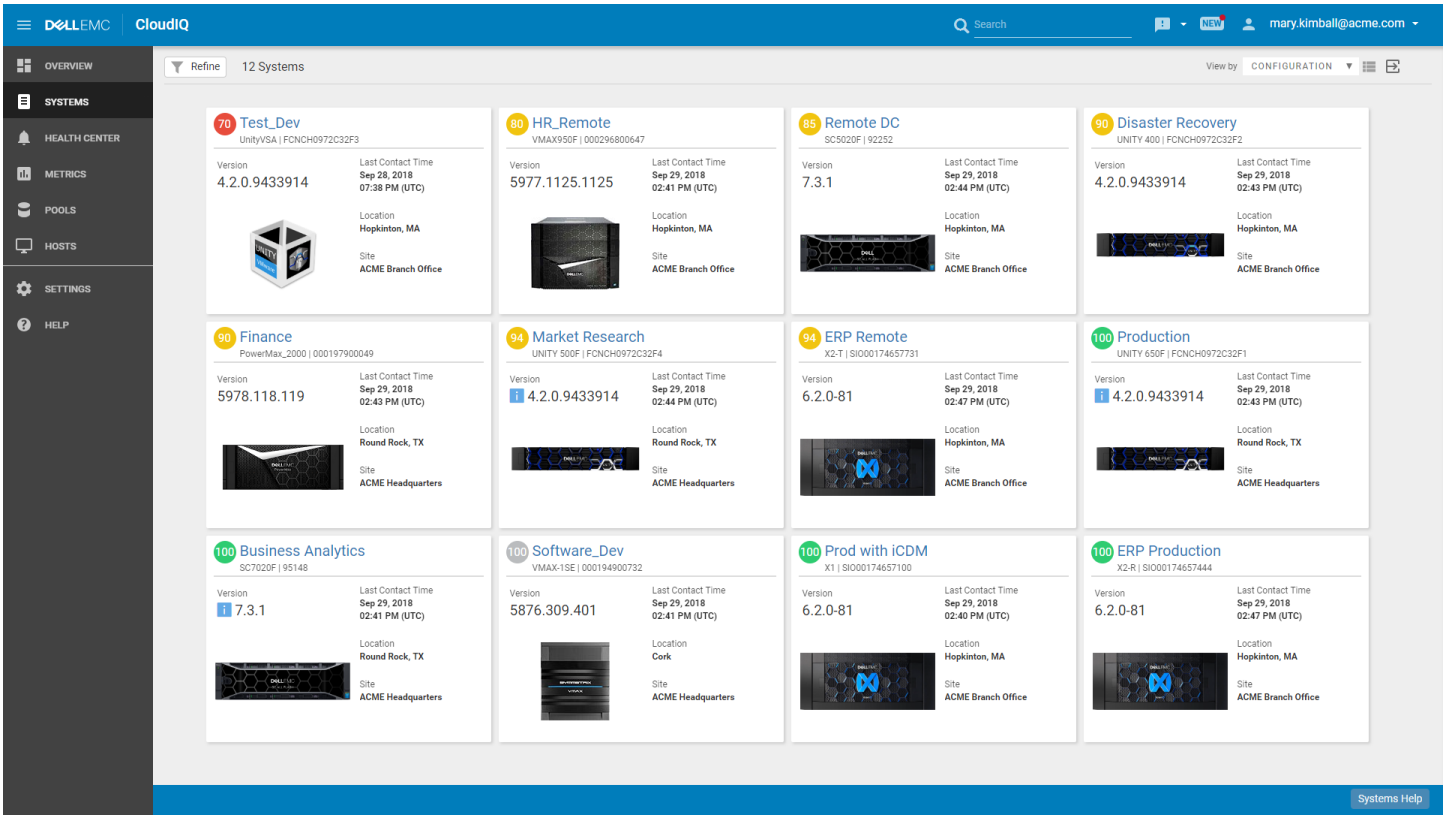
The System Health Score is displayed in the color that corresponds to the range. Gray coloring indicates a system whose health score is stale due to data collection issues. When this occurs, users should check the system connectivity.

Systems Summary – Configuration

This view shows the systems' **Configuration** details. The information provided is:

- **Version** – Software version installed
- **Last Contact Time** – The last time the system data was sent to CloudIQ
- **Location** – Location where the system is installed
- **Site name** – Site with which the system is associated

There will also be an indication when a storage system has a software update available. Clicking the 'Learn More' link will open a dialog with summary information and relevant links to support resources.



Systems Summary – Capacity

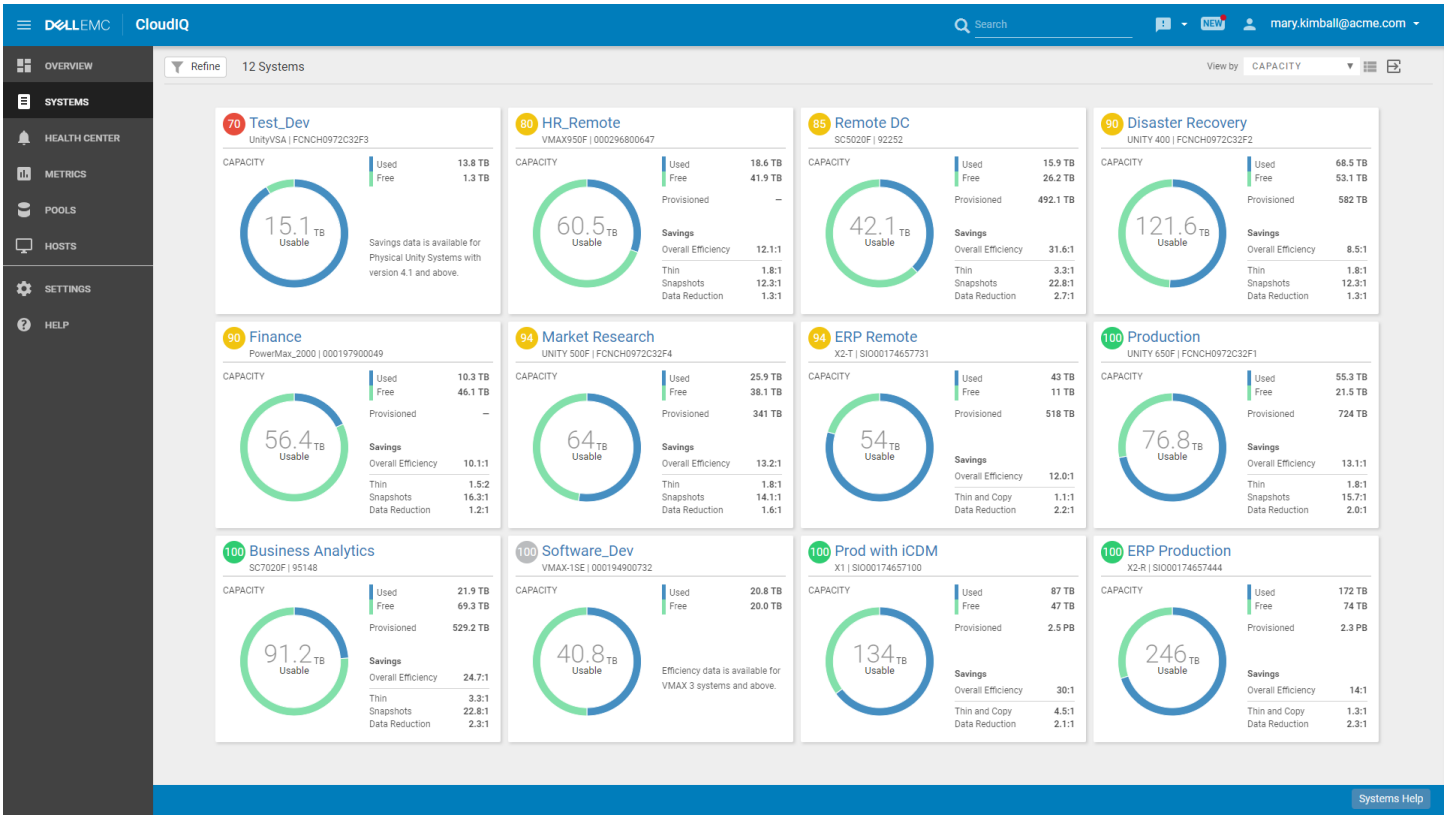
This view shows the systems' **Capacity** details. The information provided is:

- **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
- **Efficiency Savings –** corresponds to the Logical Capacity Guarantee stated for Dell EMC Unity All-Flash systems.
  Overall Efficiency – System-level storage efficiency ratio, based on the combined savings ratios below
  Thin – Ratio of Thin provisioned objects on the system
  Snapshots – Ratio of snapshots on the system
  Data Reduction – Ratio of data that has data reduction applied (using Compression and/or Deduplication)

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

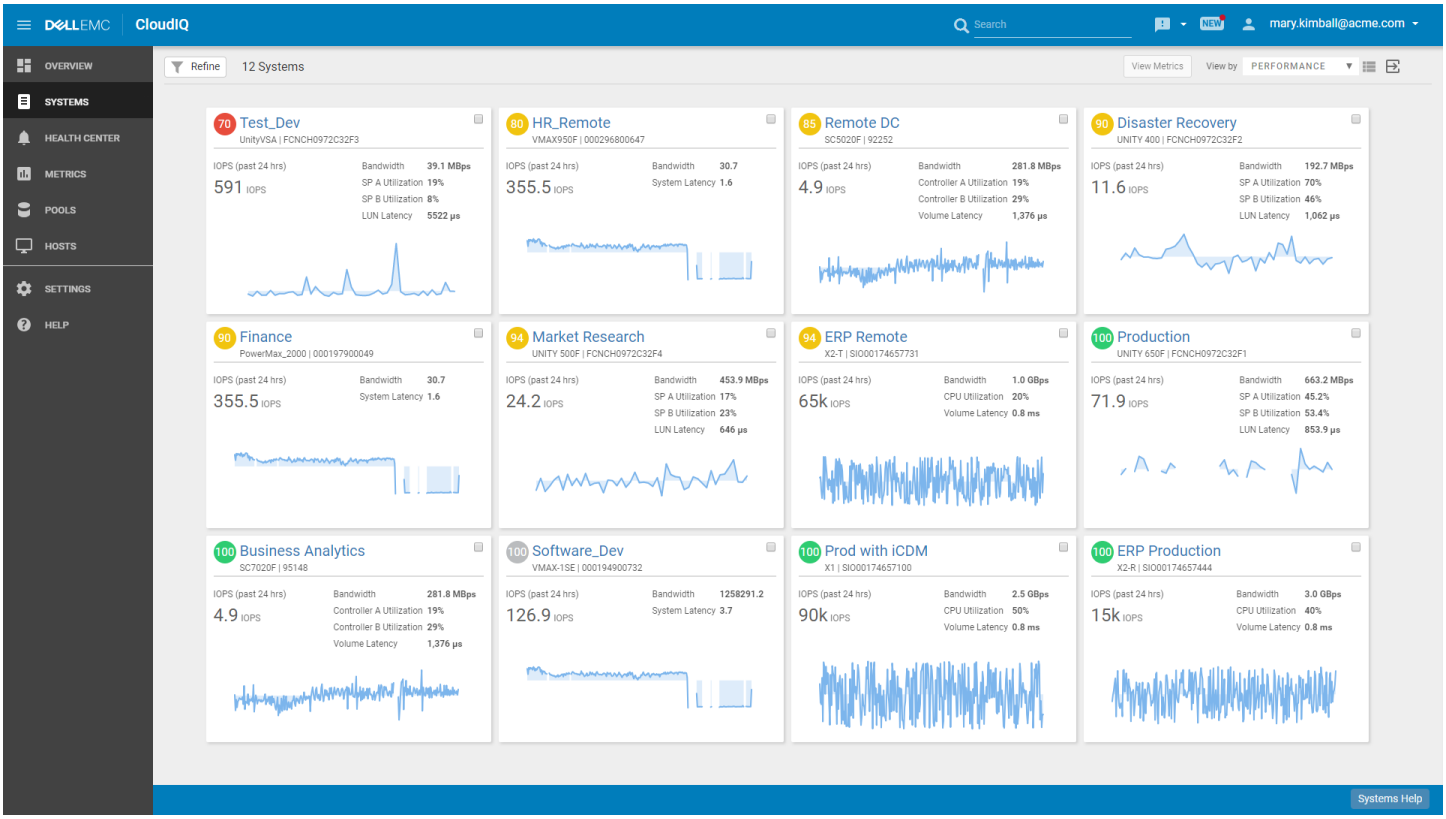
XtremIO systems combine **Thin and Copy** into a single savings value.



Systems Summary – Performance

This view shows the systems' **Performance** details. The information provided is:

- Metric averages over the last 24 hours:
  - **IOPS** –I/O requests per second
  - **Bandwidth** – System bandwidth
  - **Utilization** – SP Utilization for Dell EMC Unity, Controller Utilization for SC Series, XtremIO: average Controller (XEnv) CPU Utilization
  - **Latency** – Time required for a packet to travel from the host to the object. (LUNs for Dell EMC Unity and Volumes for SC Series)
- **Performance Trend graph** – IOPS over the past 24 hours with a data point on every update (varies slightly per product type, as noted above).



CloudIQ offers the additional feature of enabling the user to select multiple systems (up to 10) to compare performance metrics. The user can simply 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 right corner of each card, and in the List view, the checkbox is in the rightmost column. The “Compare Metrics” button only appears on the GUI after you have chosen more than 1 system.

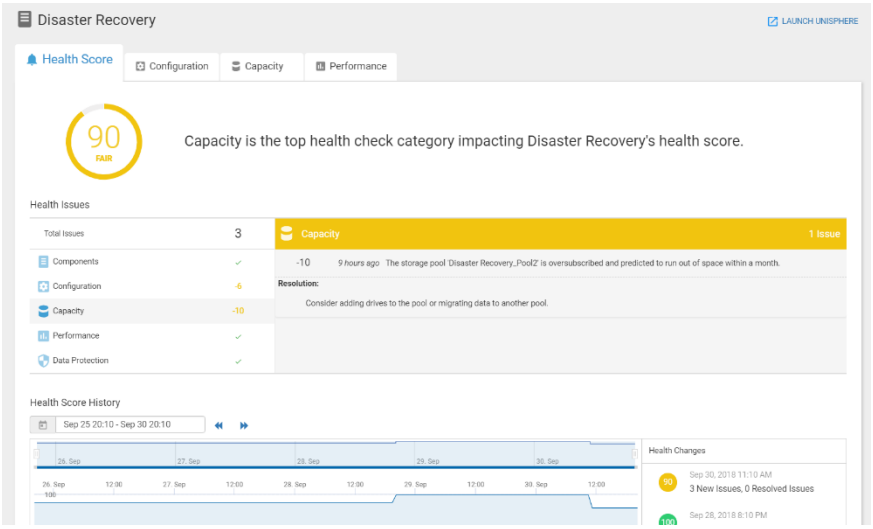
System Details

Within the **System** page of CloudIQ, there are detailed views of any individual system monitored by CloudIQ. Selecting any system from any summary view will show a tab view of that system for Health Score, Configuration, Capacity, and Performance. The content across product types is generally common, but there will be some differences in the layout and the terminology from product to product.

In the upper right is a link to “Launch Unisphere”. Selecting this will open the Unisphere element manager for this system (Web UI for XtremIO).

System Details – Health Score

This tab shows the details for a selected system driving the health score number. In this example there are three issues, two in the Configuration category and one in the Capacity category. Selecting the category and then selecting one of the issues will display a recommended resolution.

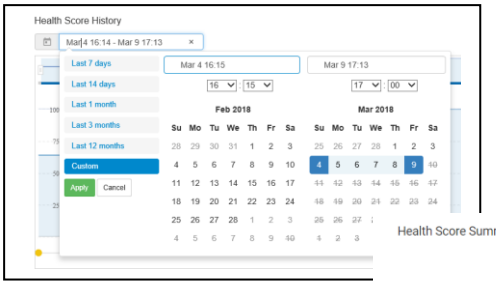


This view also provides any other issues that are found in any of the categories:

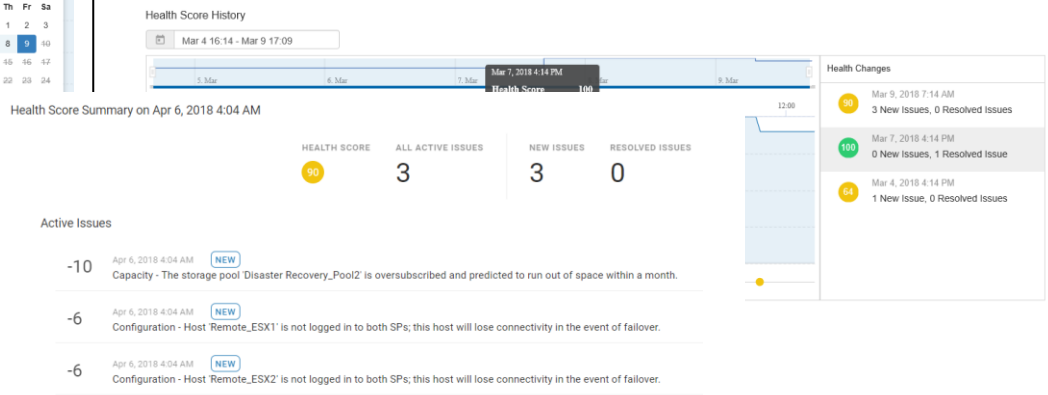
- Components
- Configuration
- Capacity
- Performance
- Data Protection.

Note: As noted above, PowerMax/VMAX systems do not currently include health checks in the Components or Data Protection categories, and thus “—“ will be displayed for these categories for all PowerMax and VMAX systems in CloudIQ.

Scrolling down in this view shows a historical time line and calendar options. This graph displays the historical trend of the health score and details of any issue(s) over the displayed range of time.



Selecting any of the issues listed to the right of graph will mark the change on the time-line and a summary of the active issues will be displayed. Viewing across a longer-term time range can be helpful in identifying recurring issues in the environment.



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. Selecting any line item will give the remediation.

System Details – Configuration

This tab shows the details for a selected system indicating the physical and logical components of the system.

- Pools
- Storage
- Drives
- Hosts (Unity) or Servers (SC)

The upper portion of this view provides the system attributes such as Serial Number, Model, Site and Location information, Code Version, and IP address. Some attributes vary by system type (such as Uptime and Hotfixes which are specific to Unity).

As noted in the discussion about Multi-System views of configuration, there will also be an indication when a storage system has a software update available. In this single system view, there will also be an indication if the Management Software has an update available, for supported products (PowerMax/VMAX and XtremIO). Clicking the 'Learn More' link will open a dialog with summary information and relevant links to support resources.

The **Pools** tab, for applicable systems (Storage Resource Pools for PowerMax/VMAX), shows various information about the configured storage pools including Total Size, Used %, Subscription %, Time To Full, and Free. This sort of information helps in understanding the pools at risk where subscription rate is greater than the total free storage and the Time to Full is predicted within a month.

The **Storage** (Unity and SC Series), **Volumes** (XtremIO), or **Storage Groups** (PowerMax/VMAX) tab shows all the storage objects in the system:

- Unity: LUNs, File Systems, VMware VMFS, and VMware NFS
- SC Series: Volumes
- PowerMax/VMAX: Storage Groups
- XtremIO: Volumes

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

The **Drives** tab, for applicable systems, gives the details on the drives for the given storage system and where they are located in the system.

The **Hosts** (Unity, XtremIO, and PowerMax/VMAX) or Servers (SC Series) tab gives the details about the hosts (servers) attached to this storage system.

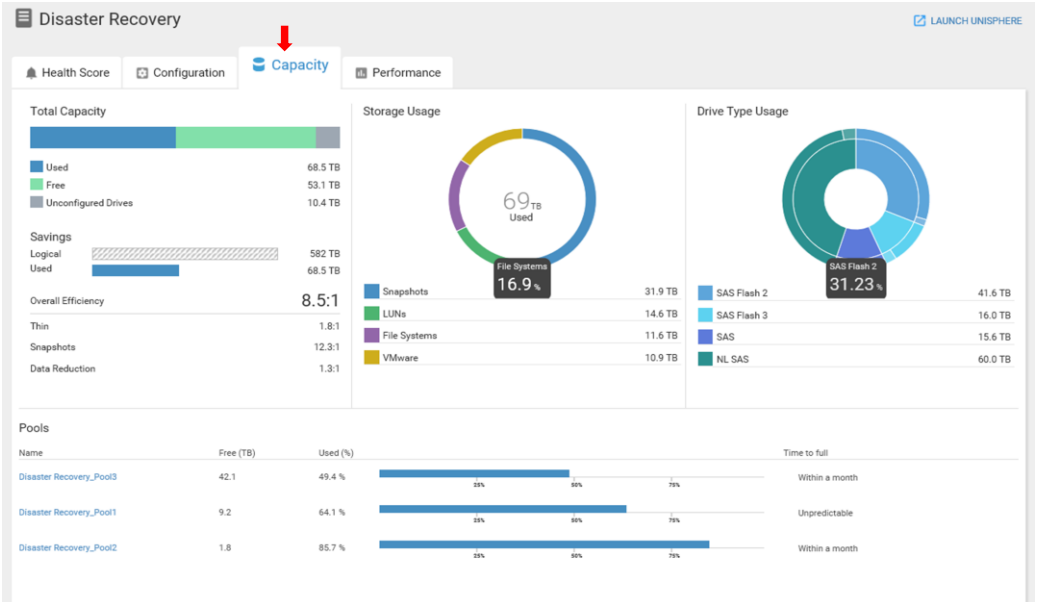
Additional tabs vary by product type:

- XtremIO: Consistency Groups
- PowerMax/VMAX: Service Levels

System Details – Capacity

This tab shows the storage capacity details for a selected system.

- Total Capacity
- Storage Usage
- Drive Type Usage
- Pools



The **Total Capacity** is a breakdown of the raw storage: Used, Free, and Unconfigured Drives (Unity only).

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

Storage Usage shows the consumed capacity of these categories of storage objects: Block (LUNs for Dell EMC Unity and Volumes for other products), File (NAS for Dell EMC Unity only), VMware (VMDK and VMFS), and Snapshots.

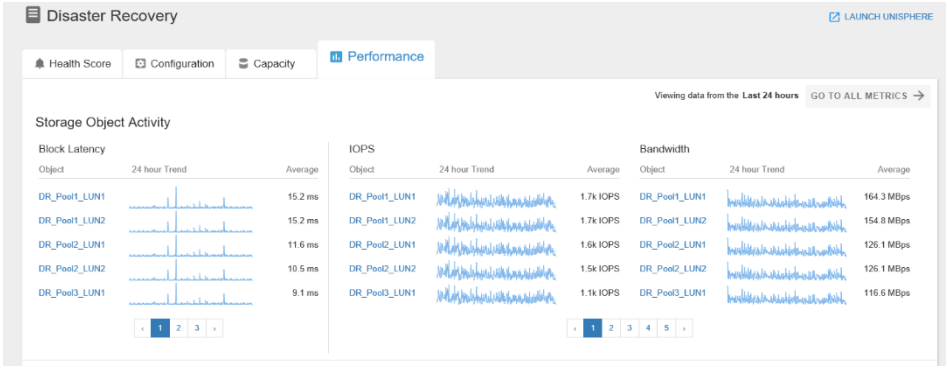
Drive Type Usage shows the drive types installed in the system, with configured and unconfigured capacity. Hovering over the rings will show the details related to that configuration.

Pools 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 will redirect the user to the Pool Details page.

System Details – Performance

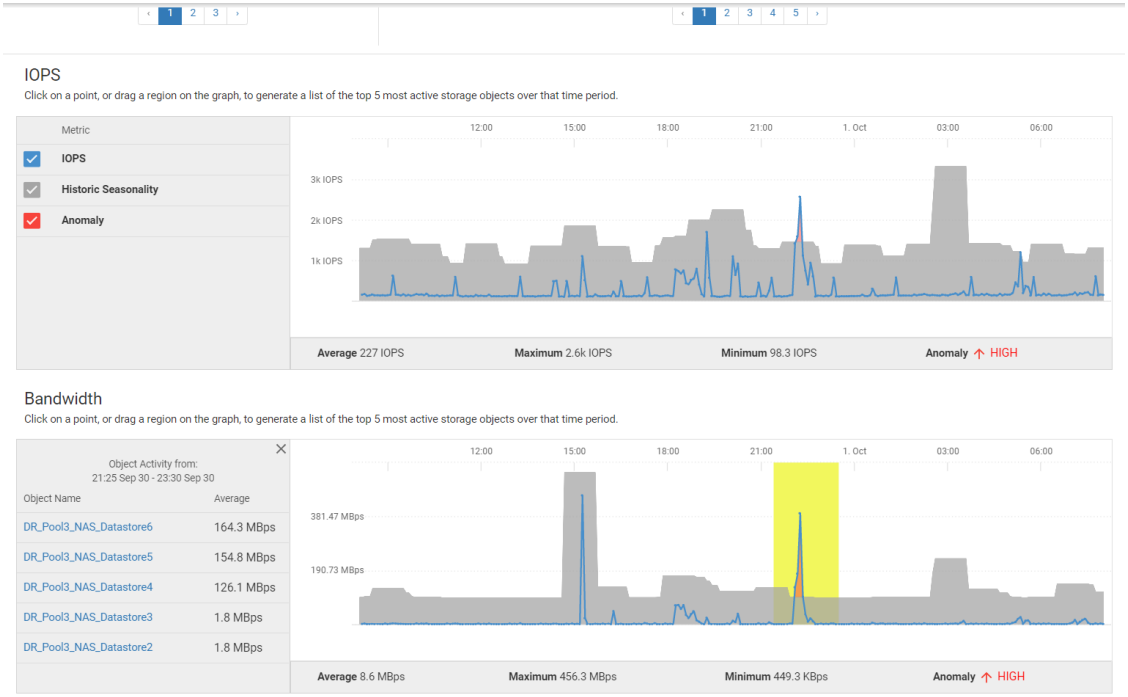
This tab shows a selected system's performance details for all its objects.

- Block Latency
- IOPS
- Bandwidth



Storage Object Activity displays Block Latency, IOPS, and Bandwidth over a 24-hour period. The data is sorted from high to low in order to quickly provide visibility to objects using the most resources. Below this object activity listing is a series of graphs for each of the system performance metrics over the last 24 hours.

Each performance graph shows a 24-hour timeline with an overlay of historic seasonality. On systems that support the Anomaly Detection feature, any anomalies detected will be displayed – for example, as seen with the red shading in the IOPS and Bandwidth graphs below. Selecting any point on any of the graphs will display the top five most active storage objects (LUNs for Unity, Volumes for SC and XtremIO, and Storage Groups for PowerMax/VMAX) over that time period, in the legend to the left.



For additional performance metrics, the user can click the **GO TO ALL METRICS** button in the Storage Object Activity upper right corner to access the **Metrics** page. The **Metrics** section provides more information about performance charts and how to create customized performance dashboards.

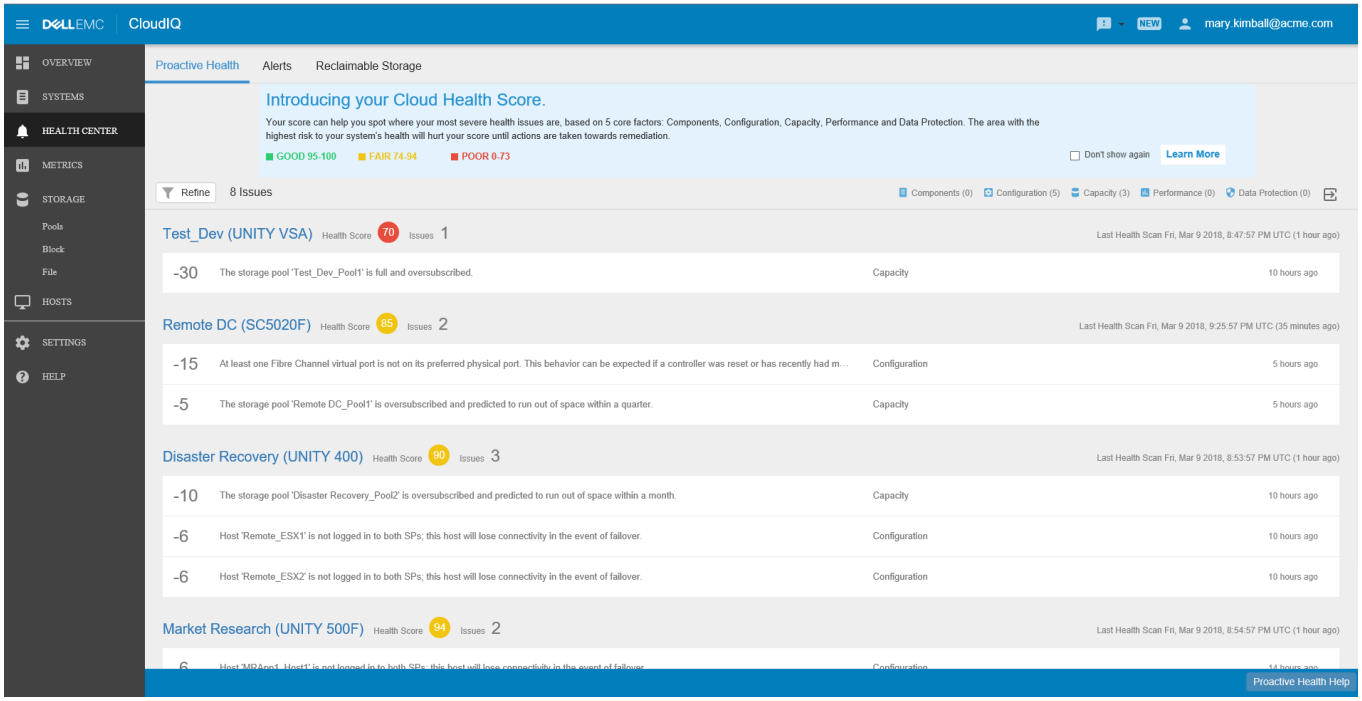
Health Center

The Health Center has three main sections:

- **Proactive Health**
- **Alerts**
- **Reclaimable Storage**

Health Center – Proactive Health

The **Proactive Health** section displays a comprehensive view of all the current health issues across all the monitored systems in the environment. The user can click the Refine button to change the view to a single system or multiple systems, in order to focus on issues for a particular system. When the user types the name of the system, the Proactive Health section will display the particular system and its associated issues.



Selecting an individual system navigates the user to the details discussed in the Systems section above. Refer back to these sections:

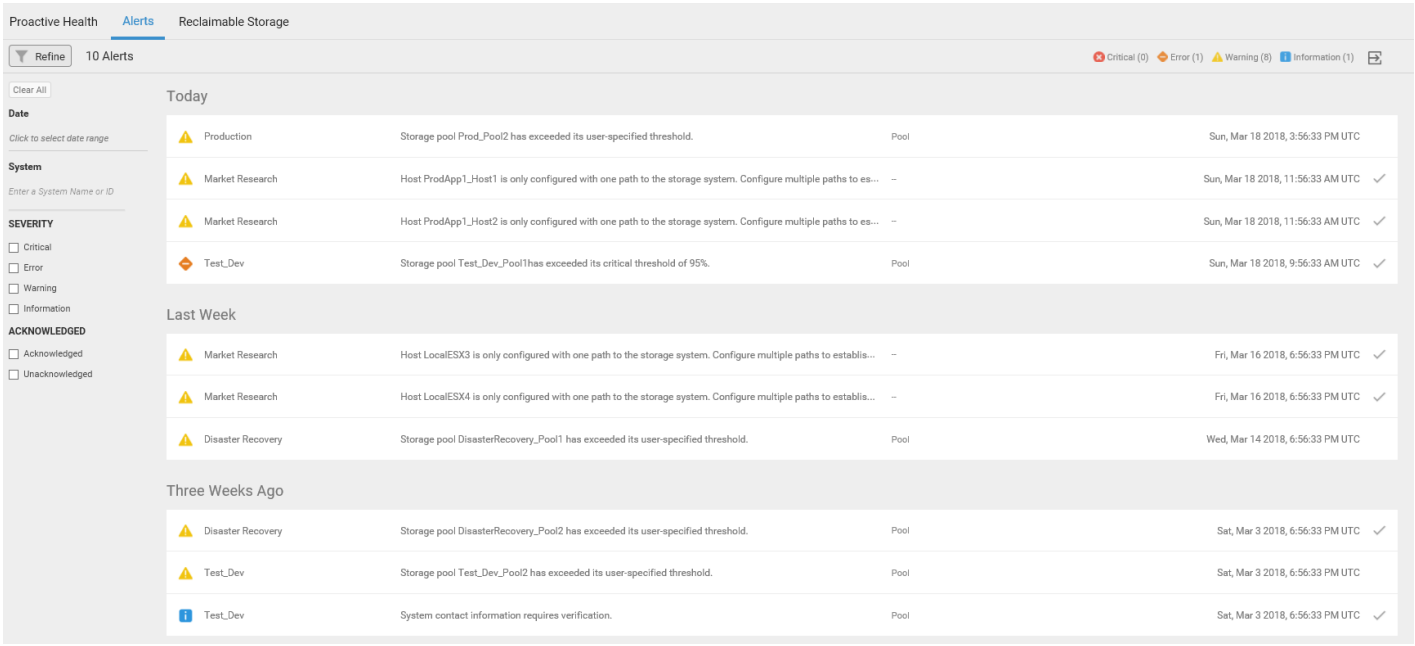
- System – Health Score
- System – Configuration
- System – Capacity
- System – Performance

Health Center – Alerts

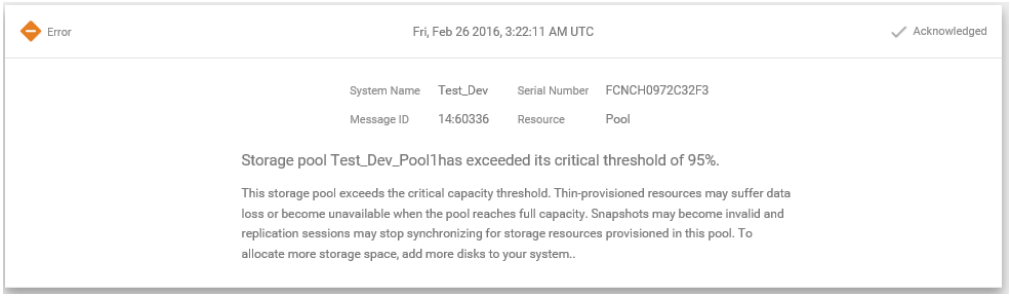
The **Alerts** listing displays all the alerts that are associated with the monitored systems. Users have several options for viewing the alerts.

- **Date** – Date range
- **System** – System Name or Site ID
- **Severity**
    - **Critical** – Event that has significant impact on the system and needs to remedied immediately
    - **Error** – Event that has minor impact on the system and needs to 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 array
    - **Unacknowledged** – Event that has not been acknowledged on the array

Note: Alerts shown in CloudIQ come from the array and can only be acknowledged and unacknowledged on the array.



The alerts are grouped in current and weekly sections. When an alert has been acknowledged, a checkmark appears at the right end of the alert line. More details pertaining to an alert can be seen by selecting the alert.



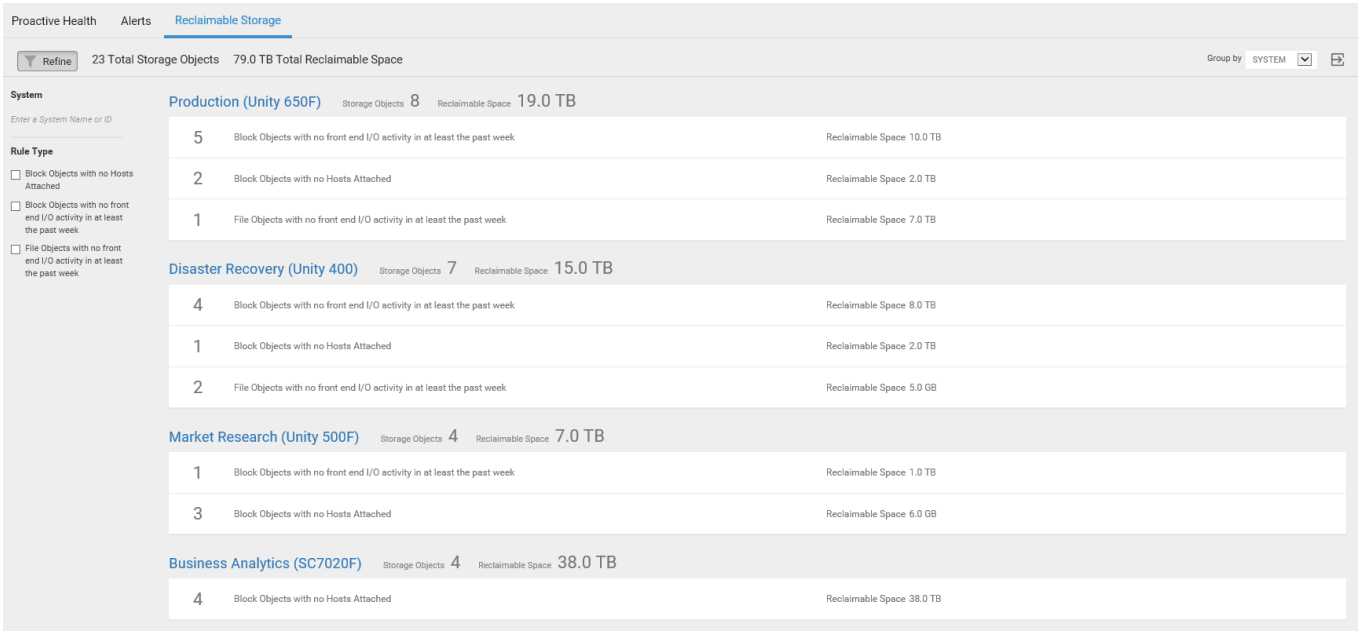
Health Center – Reclaimable Storage

The **Reclaimable Storage** view shows the objects and capacity of storage that may no longer be in use. This can be viewed two ways: for a System and for a Rule Type. Users can use the drop-down menu to change the display to show the three rules that are used for Reclaimable Storage, which are:

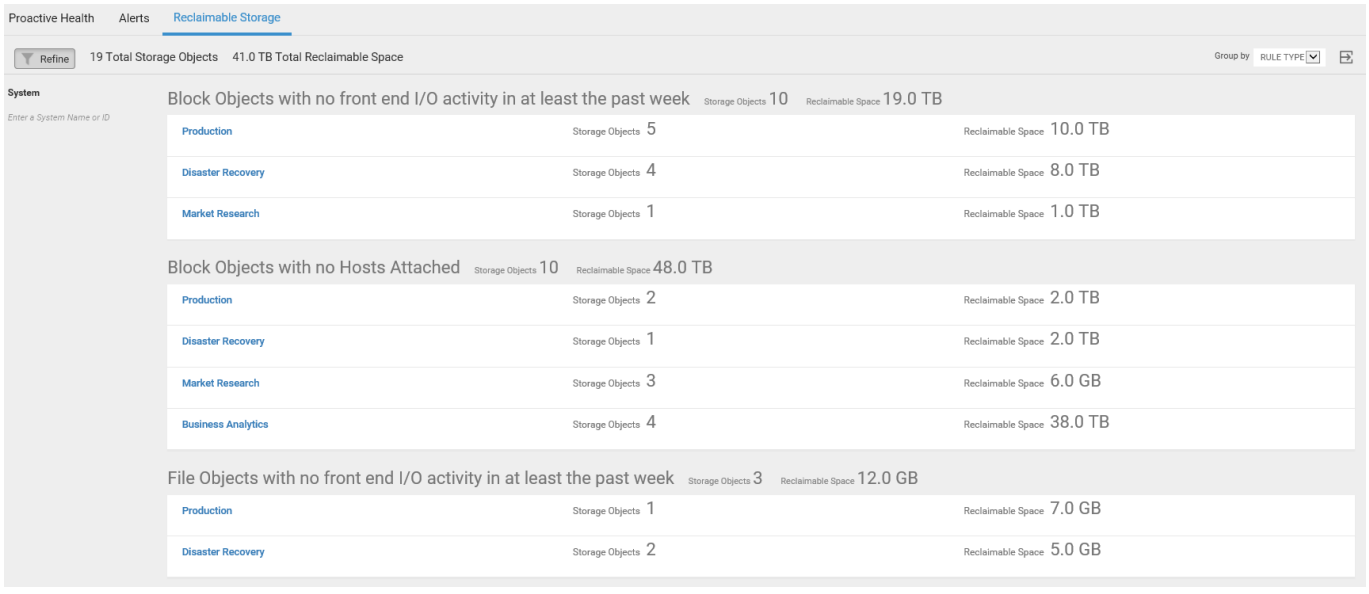
- Block Objects with no front end I/O activity
- File Objects with no front end I/O activity
- Block Objects with no Hosts attached

Note: The Reclaimable Storage report will intelligently filter out objects that are array-based replicas, since those replicas are neither attached to hosts nor do they have front-end I/O.

View by System (Default) shows reclaimable storage for each system with the number of objects and reclaimable storage. A more detailed view of each can be seen by selecting the line item to expand to display the associated details.



View by Rule shows reclaimable storage for each rule with the number of objects and reclaimable storage displayed.



Metrics

The **Metrics** section allows the user to create custom performance dashboards. Different performance metrics are available based upon the selected System type and Category, as shown in the tables below.

Dell EMC Unity Metrics

Metric	System	System Backend	Block	File	Drive	Pool	Pool Backend
Bandwidth (BPS)	X	X	X	X	X	X	X
Block Latency	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	

SC Series Metrics

Metric	System	System Backend	Volume	Drive	Pool	Pool Backend	FC, SAS, iSCSI
Bandwidth (BPS)	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	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

XtremIO Metrics

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

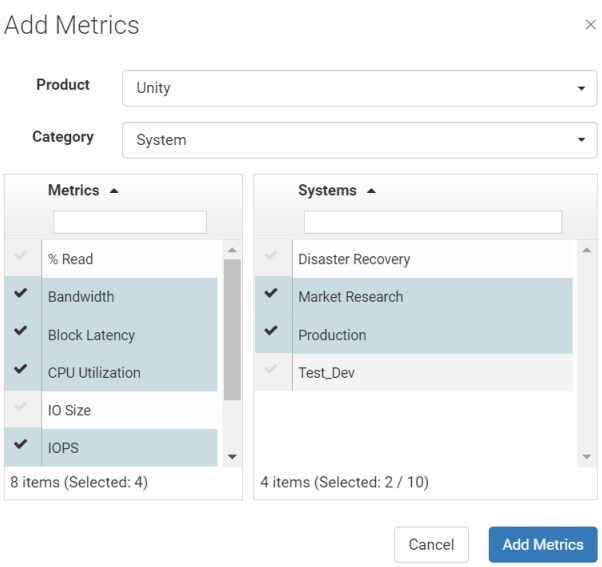
PowerMax/VMAX Metrics

Metric	System	Storage Group	SRP
Bandwidth (BPS)	X	X	X
Latency	X	X	X
IOPS	X	X	X
IO Size		X	X
% Read		X	X
Queue Length		X	X

Metric Dashboard Wizard

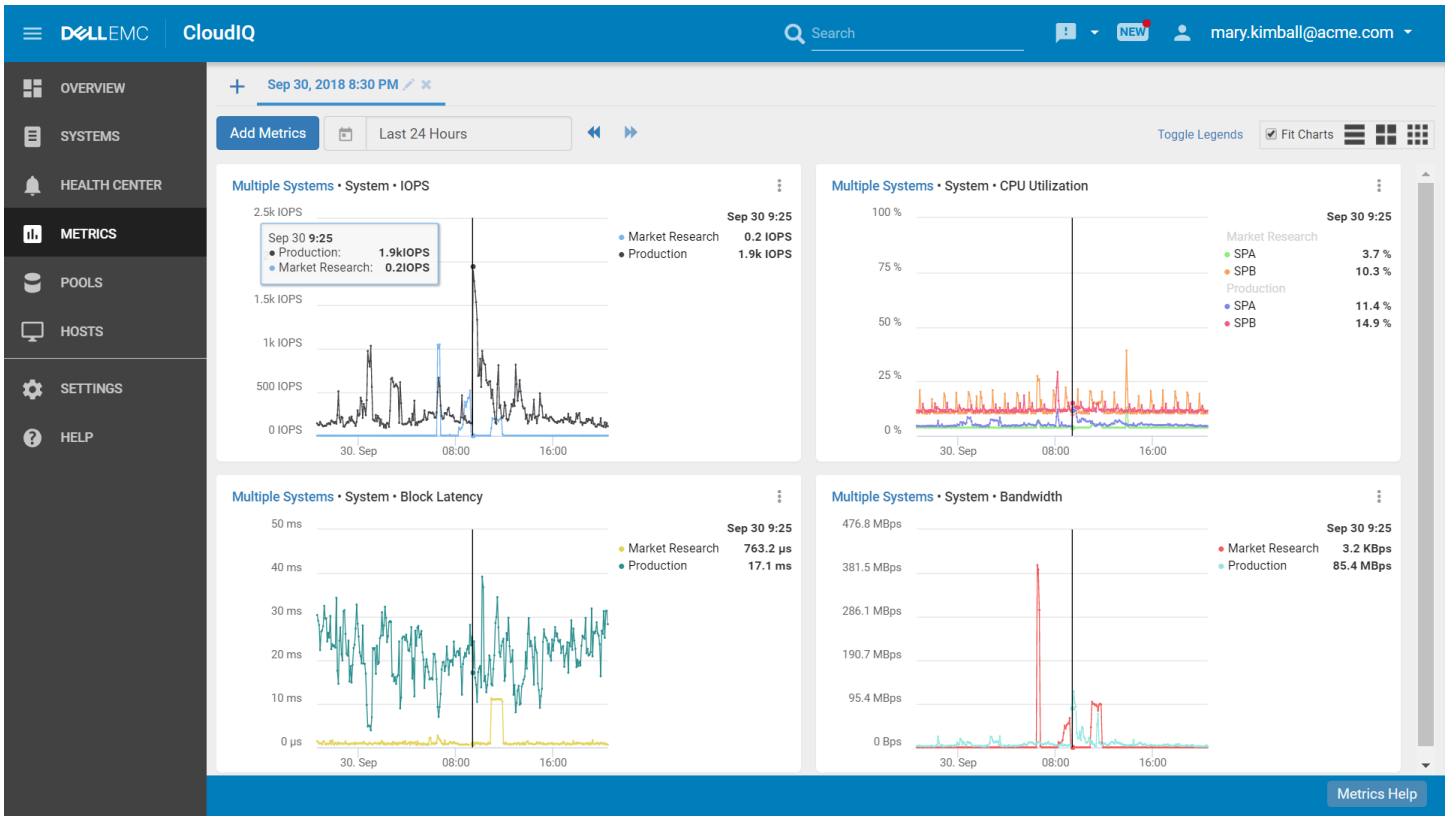
Users can click **Add Metrics** to open a wizard where a new dashboard can be created. Then users can select from each of the wizard sections the data to view in the new dashboard.

1. Select the Product.
2. Select the Category.
3. Select the System(s) being monitored by CloudIQ.
4. Select the performance metrics from the Metrics list.
5. Select Add Metrics.



The new dashboard will show the performance graphs for each selected metric with one or more entities selected. Scrolling across the timeline graph displays a vertical line on each graph for quick analysis of performance at any given time. These charts can be viewed as a grid pattern (shown) or one graph per line. The timeline can be selected from a pre-defined value ranging from Last Hour to Last 7 Days or the user can enter a custom date range.

Hovering across the performance graph displays a vertical line on all the graphs for the same point in time. The legend to the right of the graph displays the performance measurement related to the graph.



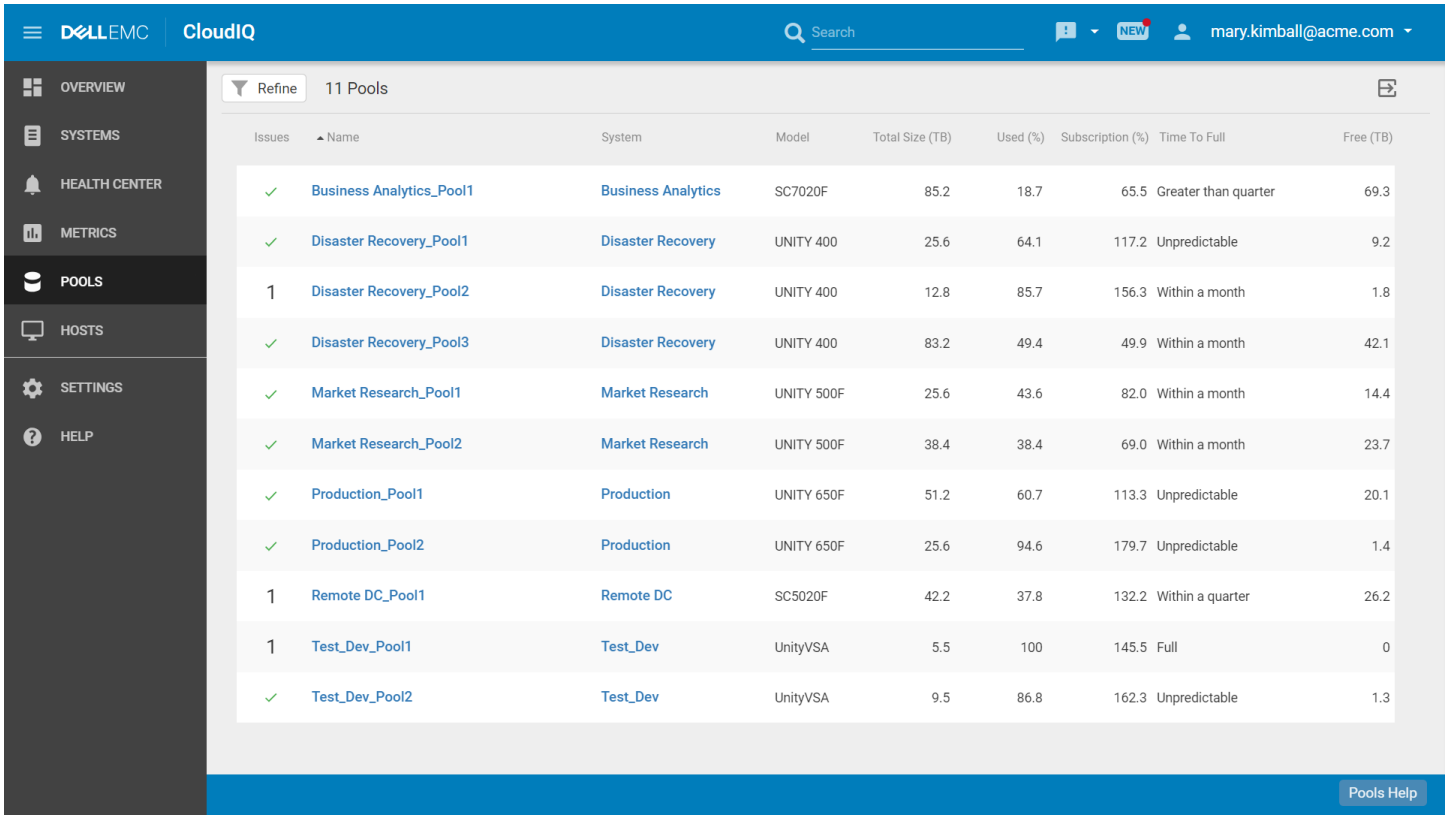
Note:	VVol data is not included in object-level (LUN, file system, and drive) metrics because VVol object data is not collected.
Note:	Block Latency timing shown is an auto-adjusted field for milliseconds (ms) and microseconds (µs) when appropriate.

Storage Pools

The Storage Pools view provides an aggregated listing for easy comparison of data. The **Issues** column will display the number of health issues associated with any pool or storage object, and a green check mark for items with no associated issues. The blue text identifies hyperlinks to the details for the item.

Storage Pools Listing (Unity and SC)

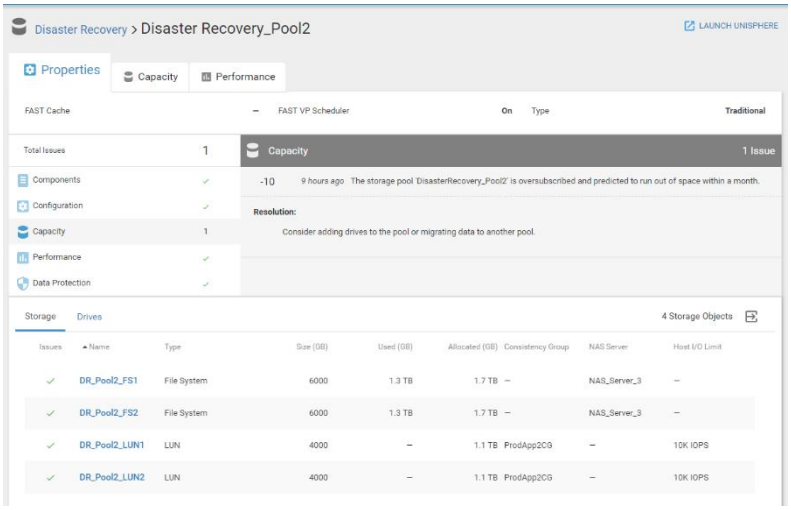
This listing shows all the Pools across the entire environment of all systems monitored by CloudIQ. The Pools listing represents the raw storage on the system that has been prepared to be provisioned as either Block storage or File storage (Unity only). This listing provides the Pool Total Size, Used and Subscription percentages, and Free 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 upon the storage size measured over time. 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.



Pool Details – Properties

The **Properties** tab for a Pool provides Pool attributes and any Health issues associated with the Pool. Expanding the issue will provide a suggested resolution. Also included in this view is a list of **Storage Objects** using this pool and the **Drives** assigned to this pool, each of which can be exported to a CSV file.

In the upper right is a link to “Launch Unisphere”. Selecting this will open the Unisphere element manager for the system hosting this Pool.



Pool Details – Capacity

The **Capacity** tab for a Pool provides details for the Pool capacity, showing total Used and Free storage as well as subscription. There is a Storage usage ring showing how the Used storage is configured.

On supported systems, the bottom graph displays the historical pool capacity data and the Predicted Date to Full date. The graph specifies pool space as Actual Free, Actual Used, Forecast Free, and Forecast Used. The Confidence Range represents the confidence level in predicting the date to full; the wider the range, the lower the confidence level. If the pool is in either a Learning, Full, or Unpredictable state, the Historical Trend graph is displayed. Otherwise, the Historical Trend with Forecast graph is displayed.

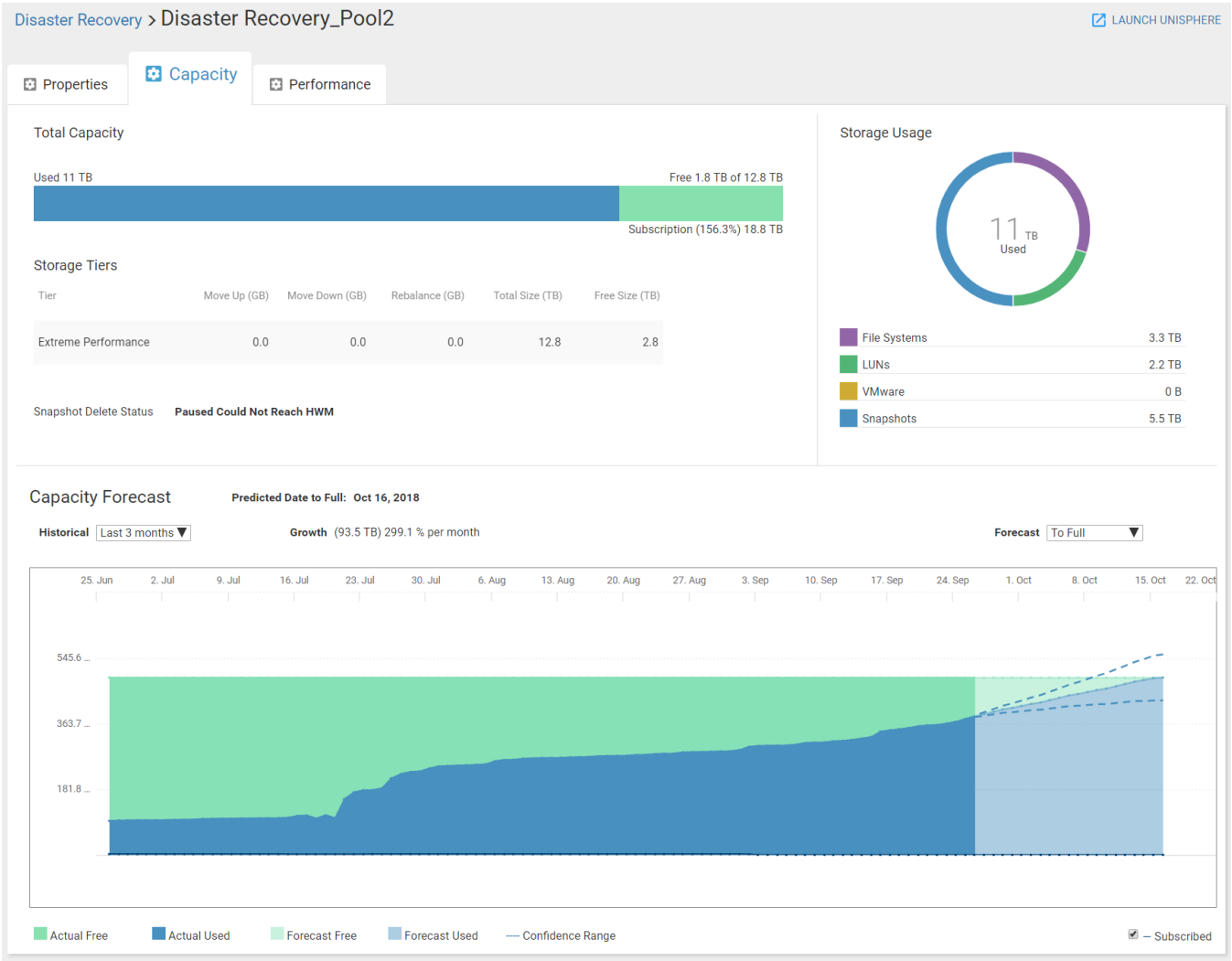
The following Historical date ranges are available:

- Last 3 months (default)
- Last 6 months
- Last 1 year
- Last 2 years

And the following Forecast date ranges are available:

- None (Historical data only will be shown)
- Next 3 months
- Next 6 months
- To Full (default)

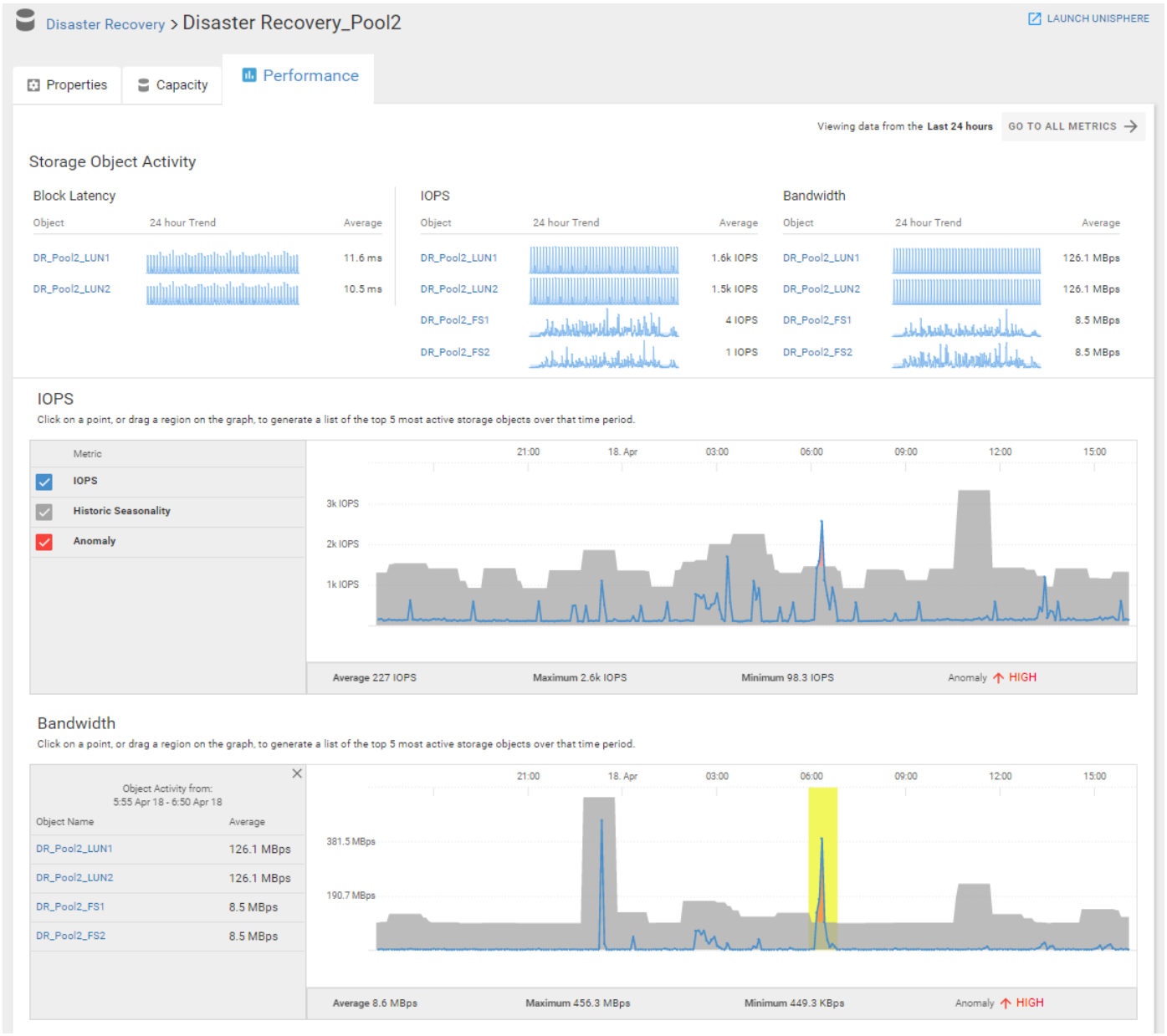
The **Subscribed** checkbox enables to view or hide the pool subscription data on the graph.



Pool Details – Performance

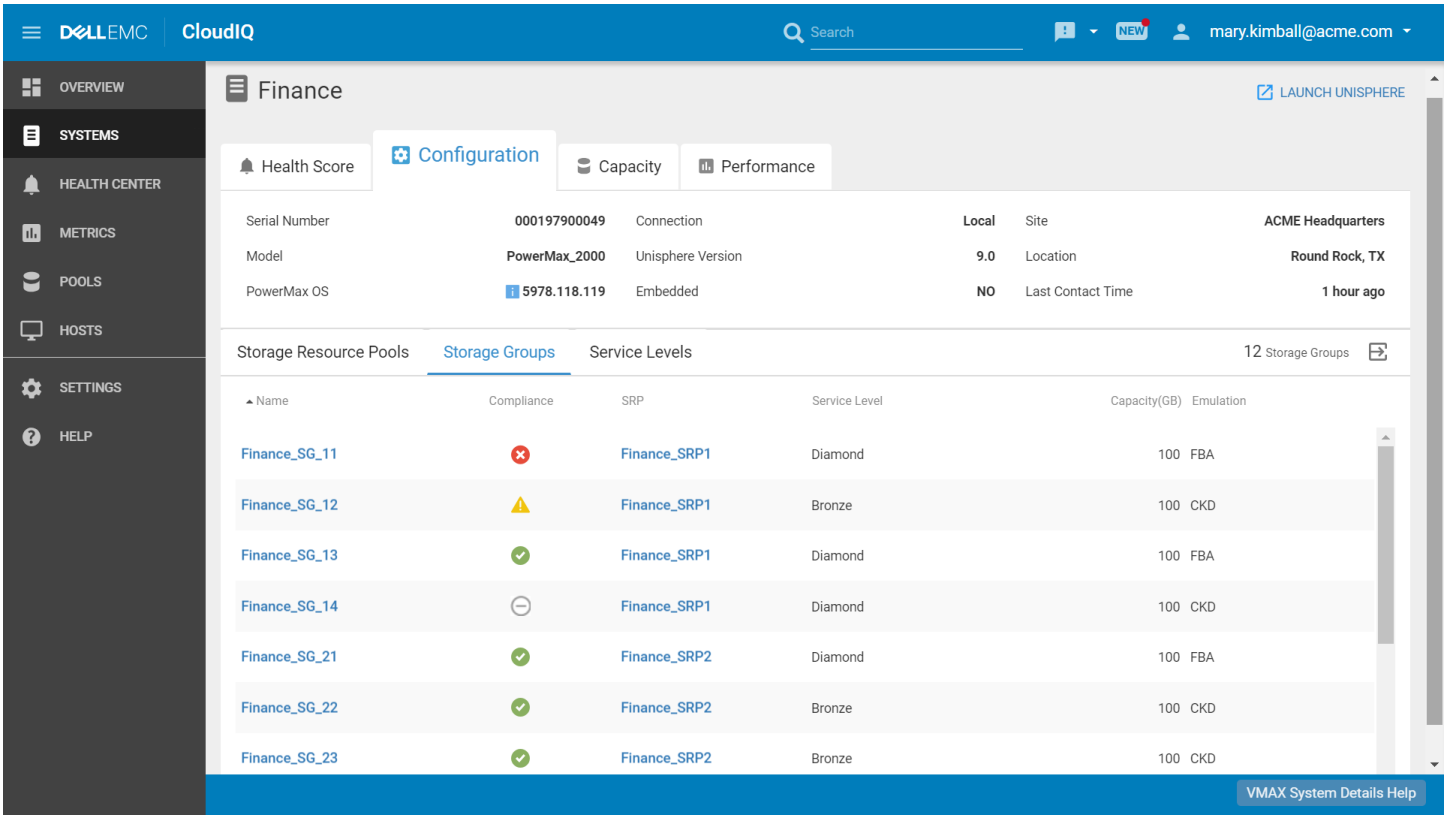
Similar to the Performance tab for a single system, the **Performance** tab for a Pool provides details for the Pool Storage Object Activity. A 24-hour trend graph is shown below for Block latency (LUNs and Volumes), IOPS, and Bandwidth (LUNs, Volumes, and File Systems).

Also similar to the Performance tab for a single system, scrolling down this view provides the user with detailed performance graphs for IOPS, Bandwidth, Backend IOPS, and Latency (Block for Dell EMC Unity systems and Volume for SC Series). If an Anomaly is found, this will be shown as either High or Low. To see more details, the user can select an area on the graph and the Object activity for this period will be shown on the left, as seen in the Bandwidth graph.


Disaster Recovery > Disaster Recovery_Pool2
LAUNCH UNISPHERE
Properties
Capacity
Performance
Viewing data from the Last 24 hours
GO TO ALL METRICS
Storage Object Activity
Block Latency
Object
24 hour Trend
Average
DR_Pool2_LUN1
11.6 ms
DR_Pool2_LUN2
10.5 ms
IOPS
Object
24 hour Trend
Average
DR_Pool2_LUN1
1.6k IOPS
DR_Pool2_LUN2
1.5k IOPS
DR_Pool2_FS1
4 IOPS
DR_Pool2_FS2
1 IOPS
Bandwidth
Object
24 hour Trend
Average
DR_Pool2_LUN1
126.1 MBps
DR_Pool2_LUN2
126.1 MBps
DR_Pool2_FS1
8.5 MBps
DR_Pool2_FS2
8.5 MBps
IOPS
Click on a point, or drag a region on the graph, to generate a list of the top 5 most active storage objects over that time period.
Metric
IOPS
Historic Seasonality
Anomaly
21:00
18. Apr
03:00
06:00
09:00
12:00
15:00
3k IOPS
2k IOPS
1k IOPS
Average 227 IOPS
Maximum 2.6k IOPS
Minimum 98.3 IOPS
Anomaly HIGH
Bandwidth
Click on a point, or drag a region on the graph, to generate a list of the top 5 most active storage objects over that time period.
Object Activity from:
5:55 Apr 18 - 6:50 Apr 18
Object Name
Average
DR_Pool2_LUN1
126.1 MBps
DR_Pool2_LUN2
126.1 MBps
DR_Pool2_FS1
8.5 MBps
DR_Pool2_FS2
8.5 MBps
21:00
18. Apr
03:00
06:00
09:00
12:00
15:00
381.5 MBps
190.7 MBps
Average 8.6 MBps
Maximum 456.3 MBps
Minimum 449.3 KBps
Anomaly HIGH

Storage Groups (PowerMax/VMAX systems)

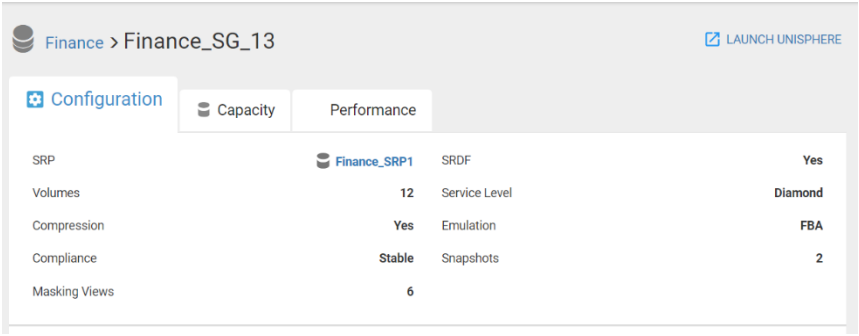
Each PowerMax/VMAX system will have a listing of the Storage Groups with key information about which Storage Resource Pool they are assigned to, and also the assigned Service Level and whether the Storage Group is in compliance. The Storage Group name is hyperlinked to enable easy navigation to the details pages for a given Storage Group.



Storage Group Details – Configuration

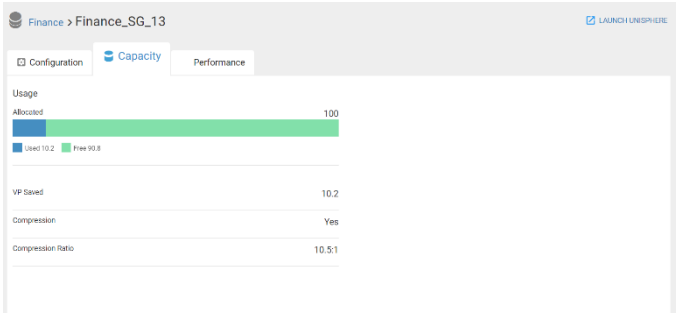
The **Configuration** tab for a Storage Group displays the attributes of the Storage Group.

In the upper right is a link to “Launch Unisphere”. Selecting this will open the Unisphere element manager for the system hosting this Storage Group.



Storage Group Details – Capacity

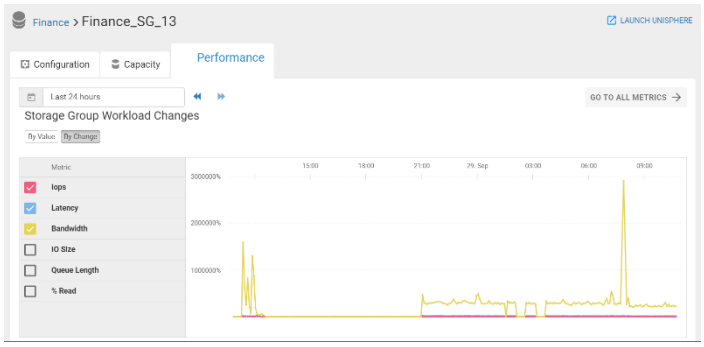
The **Capacity** tab for a Storage Group provides details for the Storage Group capacity, showing Used and Free Allocation. Additionally, Storage Efficiency information is provided, including VP Savings and also the Compression ratio.



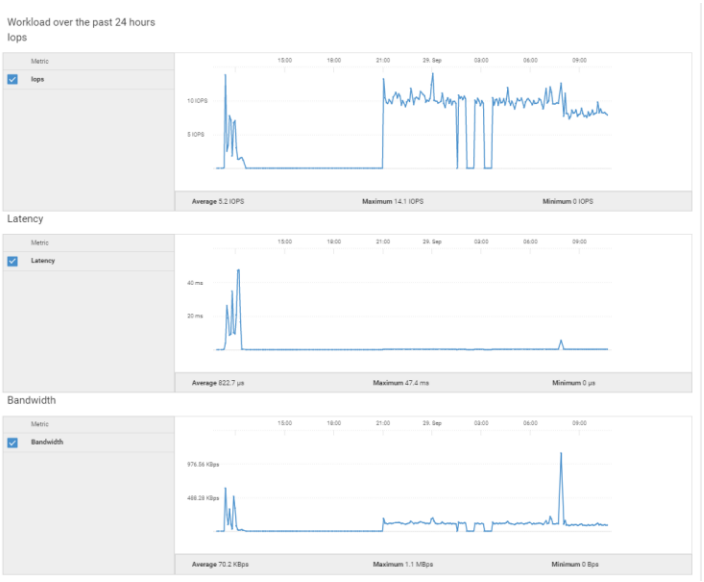
Storage Group Details – Performance

The **Performance** tab for a Storage Group provides performance details for the Storage Group over a 24-hour period. This can be changed to show a predefined time range or a custom data range.

By default the Workload Changes graph displays values as a percentage of change. Clicking the **By Value** button displays the values for each of the performance metrics. Additional metrics can be added by selecting the corresponding checkbox. Users can zoom in on a range in any graph by selecting the starting point and dragging to the right. Clicking **Reset Zoom** returns the user to the default view.



Users can scroll down to see each the actual Workload activity over the last 24 hours. The performance metrics displayed IOPS, Latency and Bandwidth. Performance trend information updates whenever the current page is loaded.



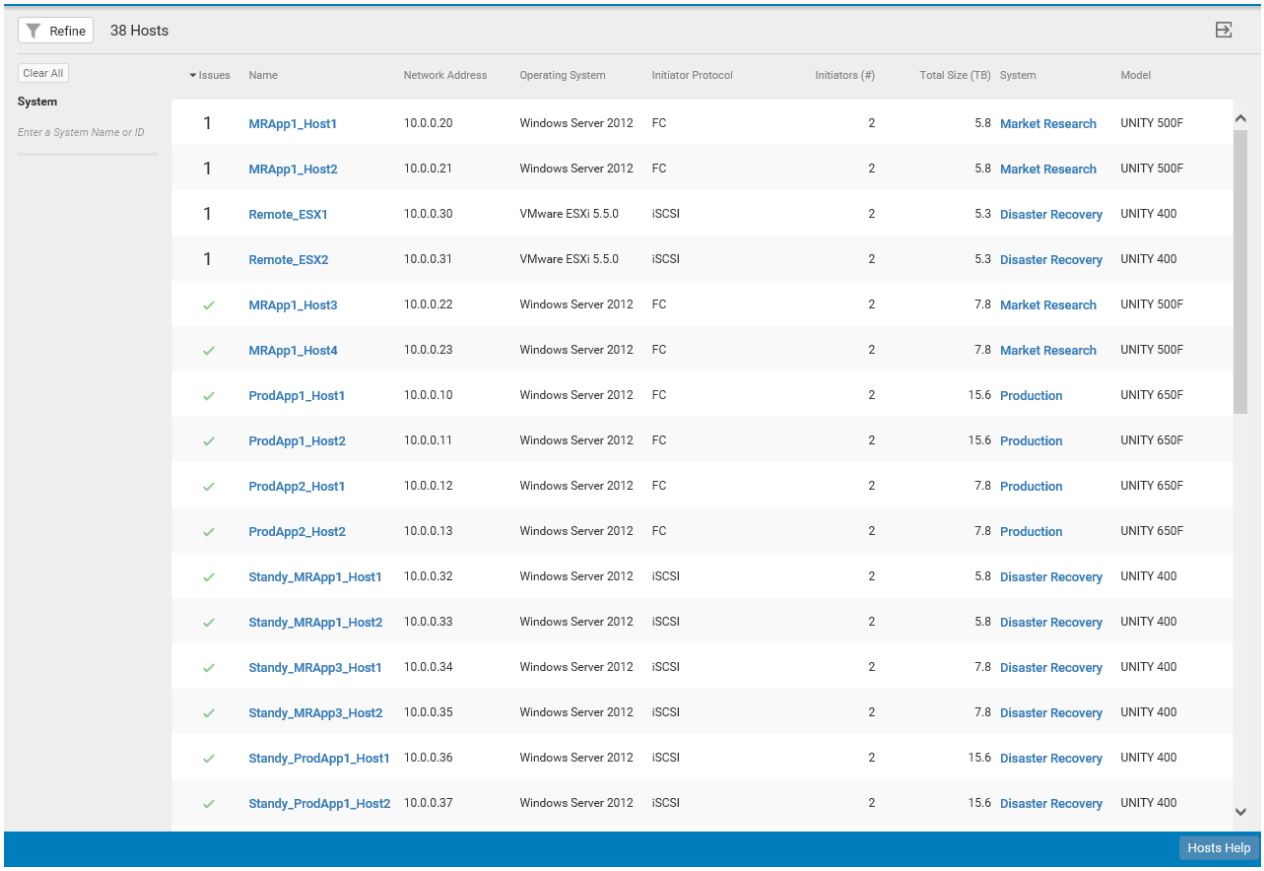
Hosts

The **Hosts** listing shows all the hosts (ESX, Linux, or Windows) which are attached to storage systems being monitored by CloudIQ. Users can click **Refine** to filter and specify one or more system names to view the hosts for the selected system(s).

The Hosts listing shows:

- **Issues** – Health of the host: green checkmark (OK) or the number issues reported issues by CloudIQ
- **Name** – Host name
- **Network Address** – IPv4 or IPv6 IP address
- **Operating System** – Host operating system version
- **Initiator Protocol** – Type of initiator used by the Host (FC, iSCSI)
- **Initiators (#)** – Number of initiators connected between the host and the monitored system(s)
- **Total Size** – Total size of the object provisioned to the host from the system
- **System –** System connected to the host
- **Model –** Model of the system

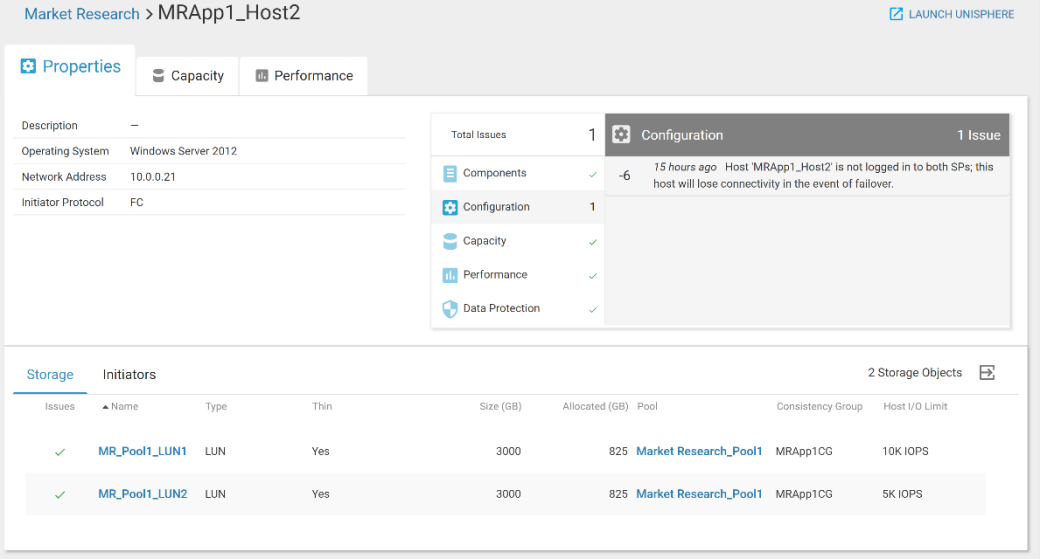
As with other listings, the user can sort the list by clicking any of the column headings, and export data by selecting the Export icon.



Issues	Name	Network Address	Operating System	Initiator Protocol	Initiators (#)	Total Size (TB)	System	Model
1	MRApp1_Host1	10.0.0.20	Windows Server 2012	FC	2	5.8	Market Research	UNITY 500F
1	MRApp1_Host2	10.0.0.21	Windows Server 2012	FC	2	5.8	Market Research	UNITY 500F
1	Remote_ESX1	10.0.0.30	VMware ESXi 5.5.0	iSCSI	2	5.3	Disaster Recovery	UNITY 400
1	Remote_ESX2	10.0.0.31	VMware ESXi 5.5.0	iSCSI	2	5.3	Disaster Recovery	UNITY 400
✓	MRApp1_Host3	10.0.0.22	Windows Server 2012	FC	2	7.8	Market Research	UNITY 500F
✓	MRApp1_Host4	10.0.0.23	Windows Server 2012	FC	2	7.8	Market Research	UNITY 500F
✓	ProdApp1_Host1	10.0.0.10	Windows Server 2012	FC	2	15.6	Production	UNITY 650F
✓	ProdApp1_Host2	10.0.0.11	Windows Server 2012	FC	2	15.6	Production	UNITY 650F
✓	ProdApp2_Host1	10.0.0.12	Windows Server 2012	FC	2	7.8	Production	UNITY 650F
✓	ProdApp2_Host2	10.0.0.13	Windows Server 2012	FC	2	7.8	Production	UNITY 650F
✓	Standy_MRApp1_Host1	10.0.0.32	Windows Server 2012	iSCSI	2	5.8	Disaster Recovery	UNITY 400
✓	Standy_MRApp1_Host2	10.0.0.33	Windows Server 2012	iSCSI	2	5.8	Disaster Recovery	UNITY 400
✓	Standy_MRApp3_Host1	10.0.0.34	Windows Server 2012	iSCSI	2	7.8	Disaster Recovery	UNITY 400
✓	Standy_MRApp3_Host2	10.0.0.35	Windows Server 2012	iSCSI	2	7.8	Disaster Recovery	UNITY 400
✓	Standy_ProdApp1_Host1	10.0.0.36	Windows Server 2012	iSCSI	2	15.6	Disaster Recovery	UNITY 400
✓	Standy_ProdApp1_Host2	10.0.0.37	Windows Server 2012	iSCSI	2	15.6	Disaster Recovery	UNITY 400

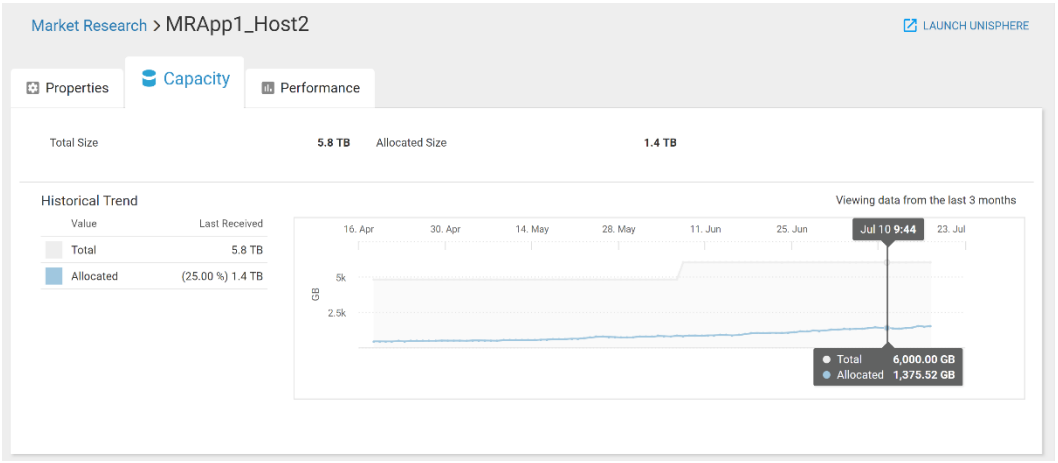
Host Details – Properties

The **Properties** tab for a Host provides details of the host type, IP Address, and how it is connected. Any Health issues are displayed with the suggested resolution. Details about the Storage object being used by 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.



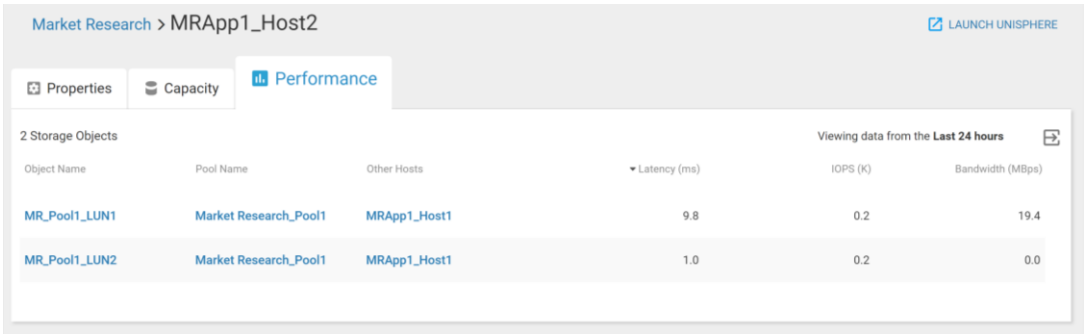
Host Details – Capacity

The **Capacity** tab for a Host provides details for the current capacity and historical trending.



Host Details – Performance

The **Performance** tab for a Host provides the 24 hour average values of key performance indicators of all block objects provisioned to a specific host. It also displays the names of other hosts to which the block objects are also provisioned.

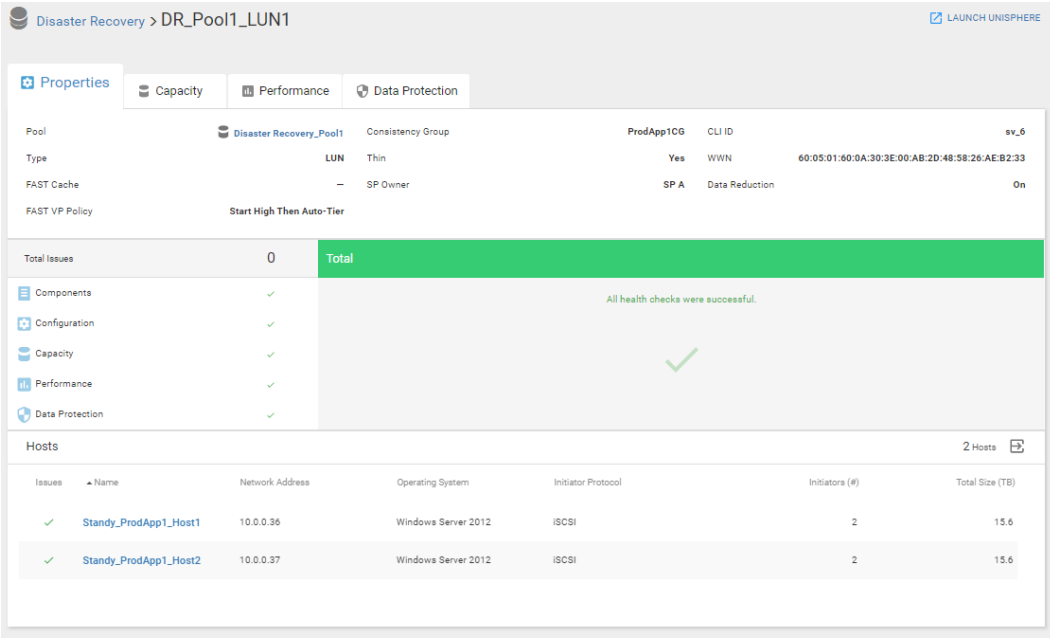


Block Object Details

Block Objects are included in the Storage listing for individual Systems and Pools. Block objects can also be found using Global search.

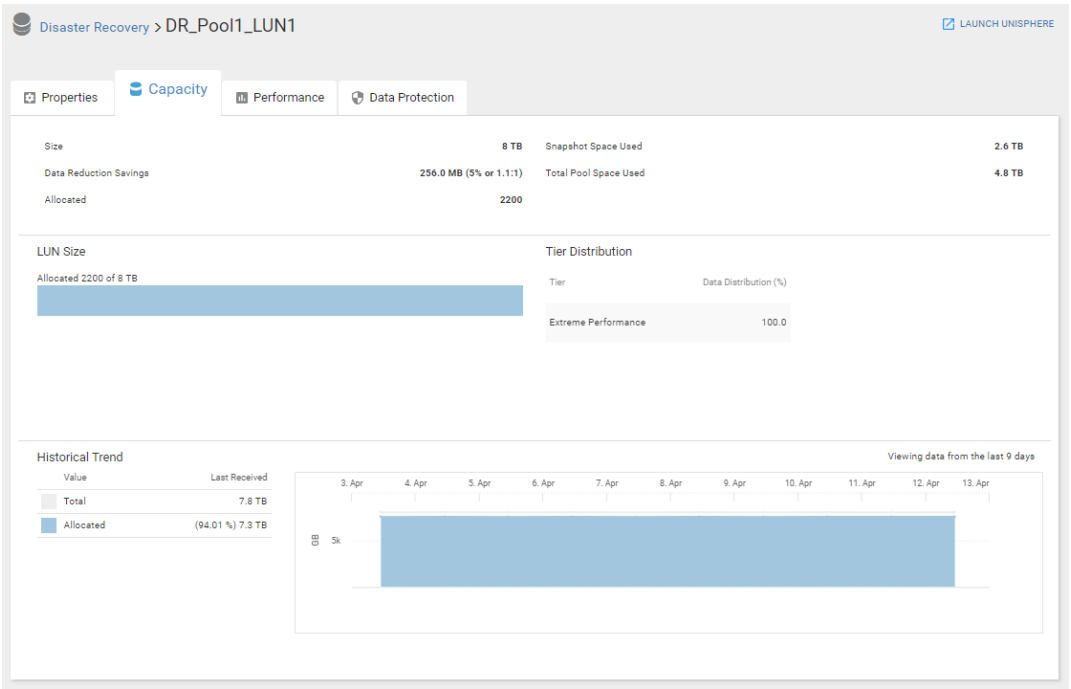
Block Object Details – Properties

The **Properties** tab for a Block object displays attributes for the Block object, any Health issues associated with this object, and the Hosts (for Dell EMC Unity systems) and Servers (for SC Series) that are attached to this object. The information in the Hosts table can be exported to a CSV file.



Block Object Details – Capacity

The **Capacity** tab for a Block object 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.



Block Object Details – Performance

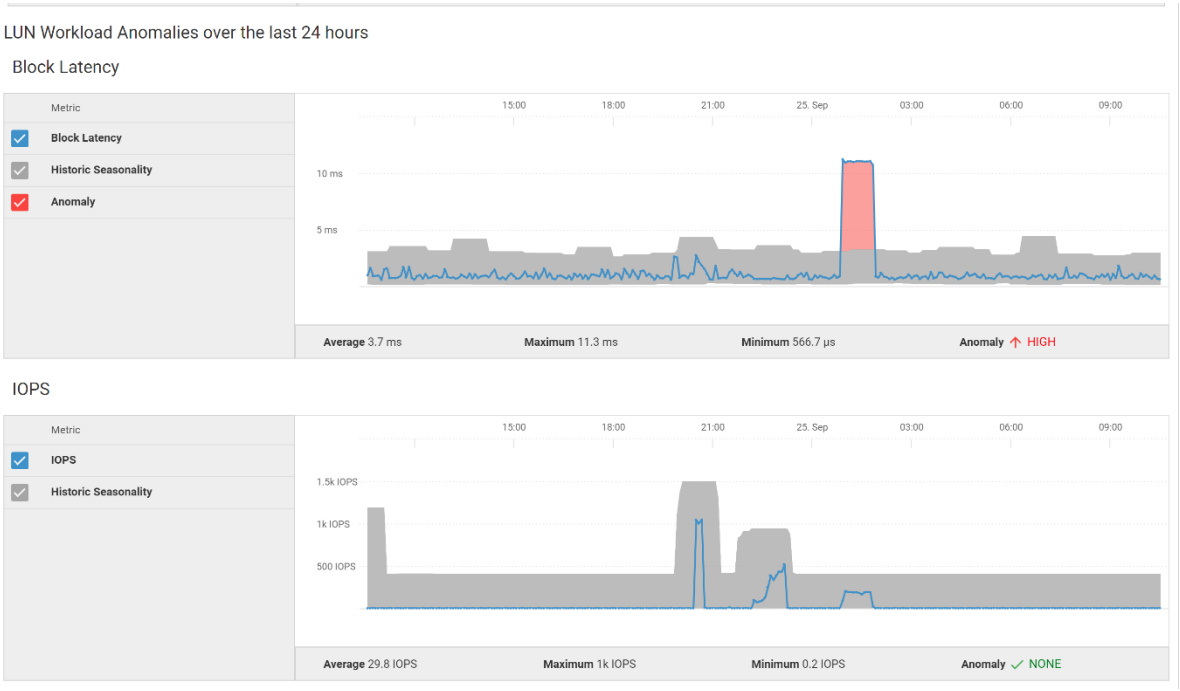
The **Performance** tab for a Block object provides performance details for the Block Storage Object Activity over a 24-hour period. This can be changed to show a predefined time range or a custom data range. The performance graphs available are Workload Changes, Workload Anomalies for Block latency, IOPS, and Bandwidth.

By default the Workload Changes graph displays values as a percentage of change. Clicking the **By Value** button displays all the performance metrics. Additional metrics can be added by selecting the corresponding checkbox. Users can zoom in on a range in any graph by selecting the starting point and dragging to the right. Clicking **Reset zoom** returns the user to the default view. Performance trend information updates whenever the current page is loaded.

Users can also see if there was a **performance impact** in the last 24 hours, where the region with the performance impact will be highlighted in pink as shown below. Clicking on the region will provide more information about why that time range has been identified and the potential causes to investigate.

As discussed previously for System and Pool Performance, CloudIQ also identifies Performance Anomalies at the block object level. For block objects, the anomaly detection applies for the following three metrics:

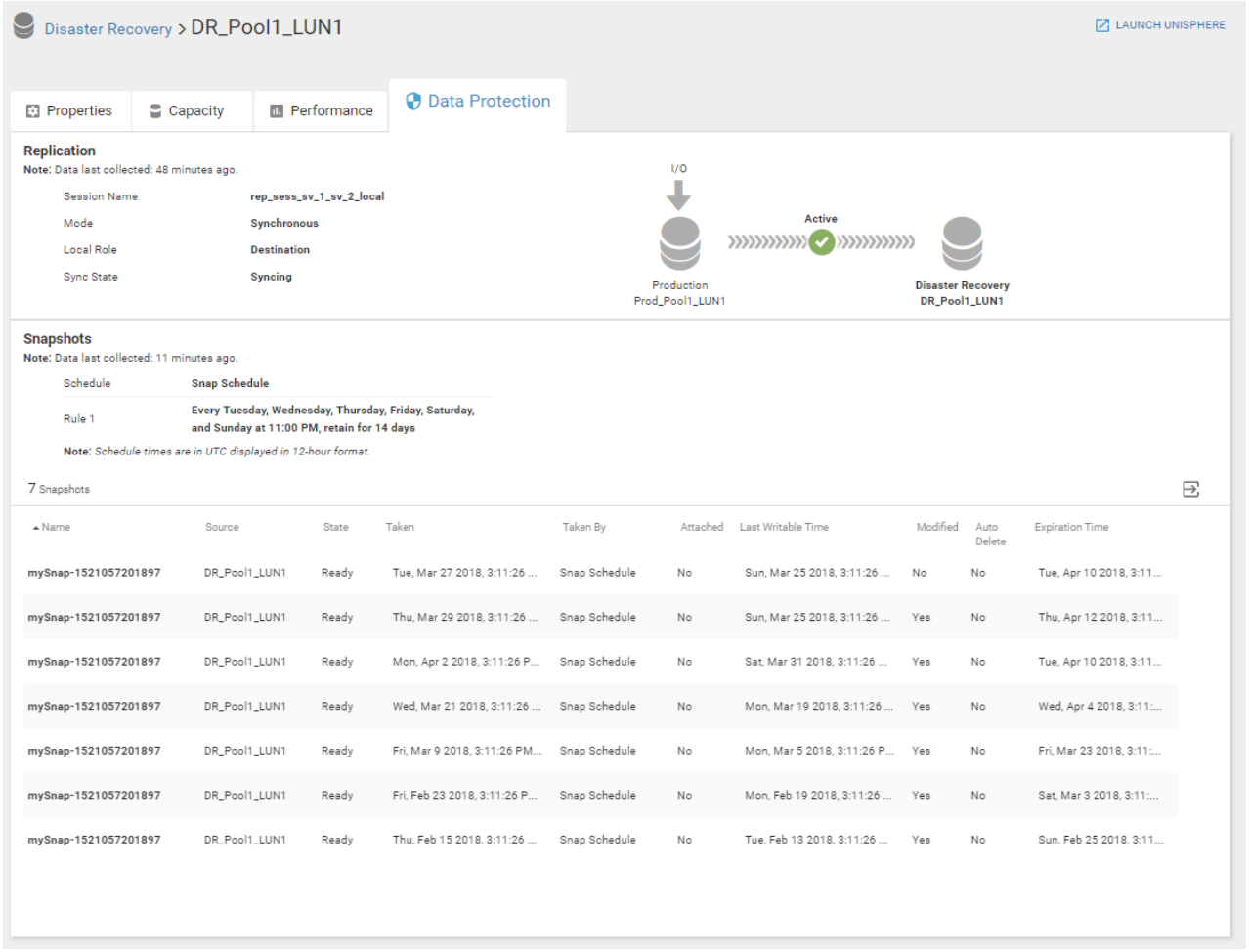
- Block Latency (Block objects only)
- IOPS
- Bandwidth



Block Object Details – Data Protection

The **Data Protection** tab for a Block object displays how data protection has been configured for an Object. There are two levels of Data Protection available: Replication from system to system and Snapshots.

The **Replication** details show the replication details and status of the replication session status. The **Snapshots** detail shows how data is backed up within the system using a Snapshot. A custom Snapshot rule can be defined which determines when the snapshot is taken and how long the data is retained. The Snapshot list can be exported to a CSV file.

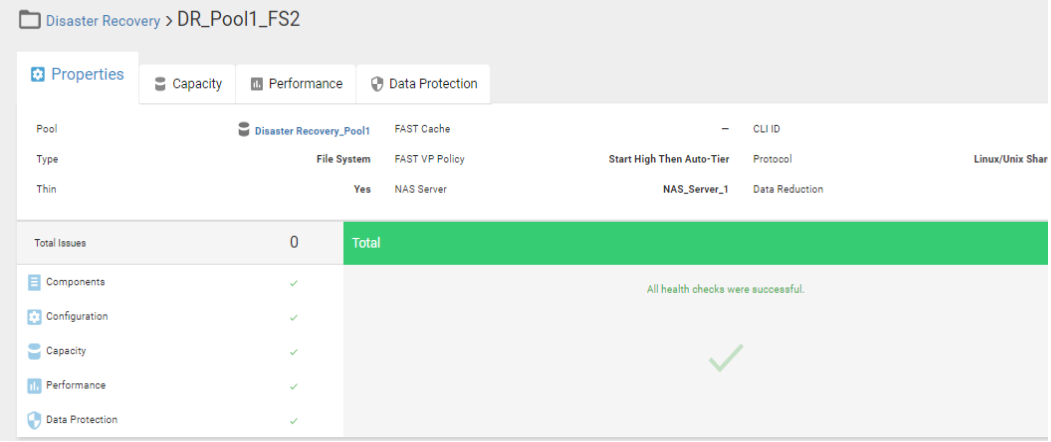


File Object Details

File Objects are included in the Storage listing for individual Systems and Pools. File objects can also be found using Global search.

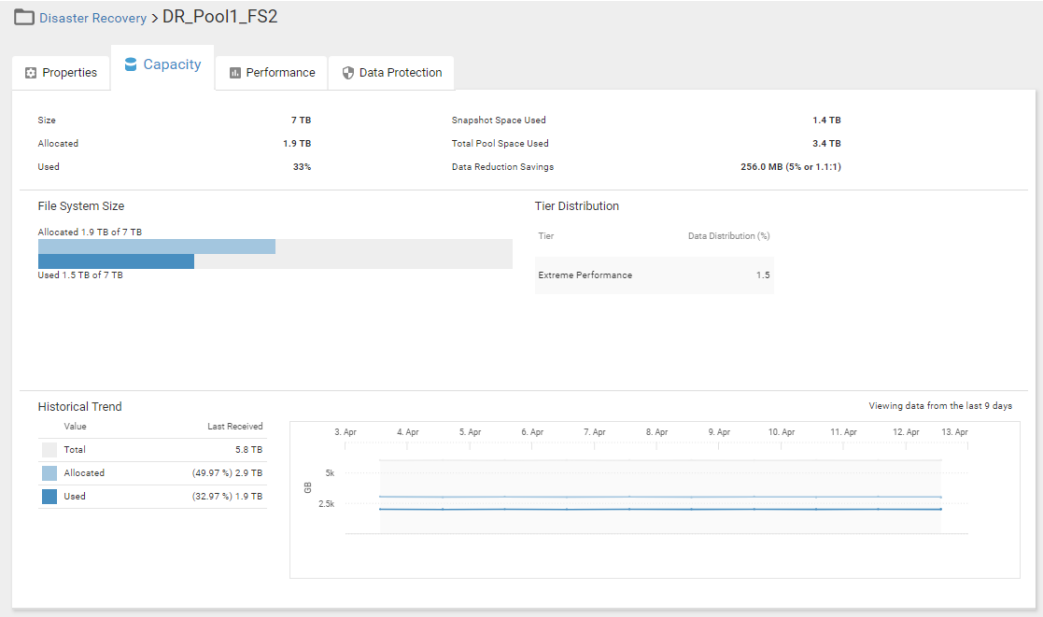
File Object Details – Properties

The **Properties** tab displays attributes for the File object and any Health issues found for the object.



File Object Details – Capacity

The **Capacity** tab for a File object provides details for how the File capacity is being used, including Data Reduction savings and capacity utilization by Snapshots. The File used percentage is based upon the actual data written to the file system. The Historical Trend shows the capacity changes since the object was created. Hovering across the trend line displays the specific capacity values for that selected point in time.



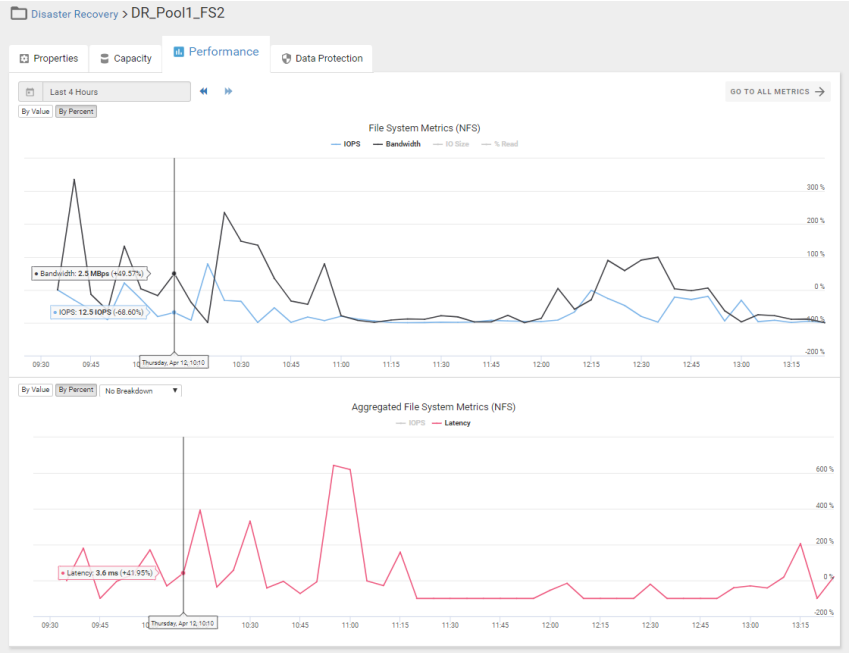
File Object Details – Performance

The **Performance** tab for a File object provides two performance graphs with aggregated metrics for a 4-hour period (default). This can be changed to show from Last Hour to last 7 Days or a custom data range. As you hover across the graph, the metrics details will be shown in pop-up boxes.

- File System Metrics (NFS)
- IOPS

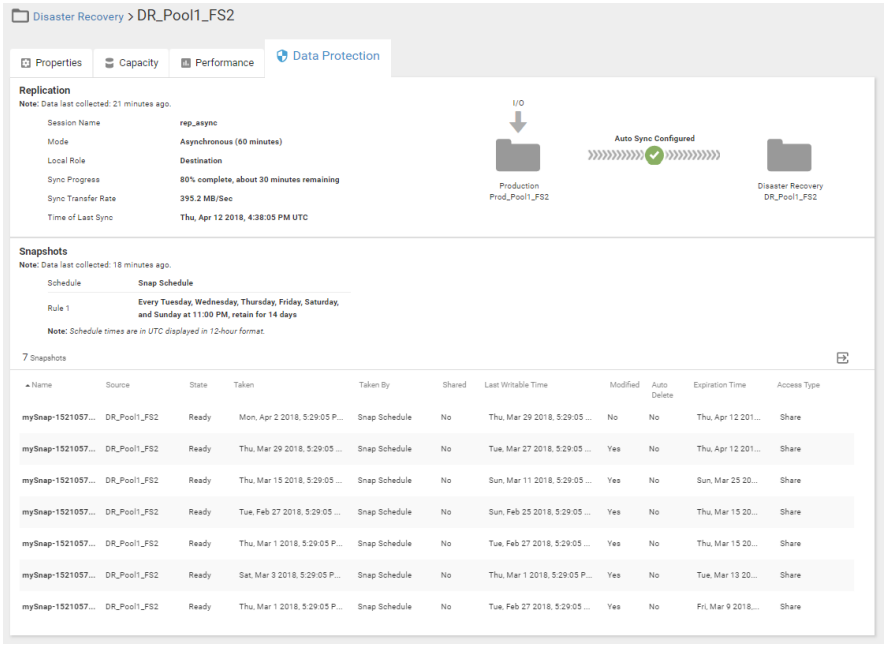
- Bandwidth
- IO Size
- % Read
- Aggregated File System Metrics (NFS)
- IOPS
- Latency

The Aggregated File System Metrics (NFS) graph has additional breakdown information available to show both Storage Processor Read, Write, and other.



File Object Details – Data Protection

The **Data Protection** tab for a File object displays how data protection has been configured for an Object. There are two levels of Data Protection available: Replication from system to system and Snapshots. The **Replication** details show the replication details and status of the replication session status. The **Snapshots** detail shows how data is backed up with the system using a Snapshot. A custom Snapshot rule can be defined which determines when the snapshot is taken and how long the data is retained. The Snapshot list can be exported to a CSV file.



Appendix A – CloudIQ Security

CloudIQ's Security Measures are as follows:

CloudIQ uses Dell EMC Secure Remote Services to collect data from Dell EMC Unity, and Dell SupportAssist to collect data from SC Series systems, namely: system alerts, system logs, system configuration, and system capacity and performance metrics. Secure Remote Services provides sophisticated point-to-point encryption over a dedicated VPN, multi-factor authentication, customer-controlled access policies, and RSA digital certificates to ensure that all customers' telemetry data is securely transported to Dell EMC. SupportAssist provides a similarly secure connection to likewise ensure secure transmission of customers' telemetry data. CloudIQ stores data received from Dell EMC Unity and SC Series systems in a secure Dell EMC IT managed infrastructure.

CloudIQ access requires that each user has a valid Dell EMC support account. Each user can only see those systems in CloudIQ which are part of that user's site access as per configuration of such user in Dell EMC Service Center.

Customers use their existing support account with Dell EMC to login to CloudIQ. CloudIQ leverages the information in user profile related to company and site mapping for access control. The user profile is created when the user registers for an account with Dell EMC and the account is associated with a valid company profile. The company admin has full control over associating products with sites and giving other users (partner or authorized contact) access to particular site or product.

CloudIQ provides each customer an independent secure portal, and ensures that customers will only be able to see their own systems via CloudIQ. CloudIQ access requires that each user has a valid Dell EMC support account. Each user can only see those systems in CloudIQ which are part of that user's site access as per configuration in Dell EMC Service Center.

CloudIQ uses a leading application security provider to perform continuous vulnerability scans as well as annual penetration testing of the application. The underlying environment is included in regular infrastructure vulnerability scans, and any required remediation is handled through an ongoing vulnerability remediation program. CloudIQ will soon begin the process of obtaining a Service Organization Control (SOC2) report to provide assurance regarding security controls.

CloudIQ will maintain 2 years' worth of historical data for systems that are actively monitored by CloudIQ. For any system that is no longer monitored by CloudIQ, configuration, capacity, and performance data for that system is removed from all CloudIQ Data Stores.

CloudIQ is hosted on Dell EMC infrastructure which is Highly Available, Fault Tolerant, and guarantees a 4-hour Disaster Recovery SLA. Because it is web-based, CloudIQ is accessible anytime, anywhere.

Appendix B - Enabling CloudIQ at the System

Dell EMC Unity, XtremIO, and PowerMax/VMAX Systems

The Dell EMC Unity, XremIO, and PowerMax/VMAX systems leverage Secure Remote Services for CloudIQ data collection. This must be enabled and configured successfully on each individual Dell EMC 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 Unity 4.2 and later, navigate to **Settings** > **Support Configuration** > **CloudIQ**, and then select Send data to CloudIQ.
  - For Unity 4.1, navigate 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, navigate to **Settings** > **Management** > **CloudIQ**, ensure the checkmark to **Send data to CloudIQ** is checked**,** and then click **Apply**

After this action, the system will appear in CloudIQ after one hour. The user can then simply proceed to **CloudIQ.dellemc.com** by clicking the link on the displayed page, or the user can proceed to CloudIQ.emc.com from the main Unisphere page. On the CloudIQ.emc.com page, users can log in with their valid service accounts to view their SC and Unity systems in CloudIQ.

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.emc.com.

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

- Unity – https://support.emc.com/kb/481102
- XtremIO – https://support.emc.com/kb/524858
- PowerMax/VMAX – https://support.emc.com/kb/526005

Dell EMC SC Series

The Dell SC Series CloudIQ solution leverages Dell EMC's SupportAssist (Phone Home) 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 follow **Monitoring > SupportAssist > Turn On SupportAssist.**

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

After this action, the system will appear in CloudIQ after 4 hours. The user can then simply proceed to CloudIQ.dellemc.com. On the CloudIQ.dellemc.com page, users can log in with their valid service accounts to view their SC and Unity systems in CloudIQ.

For more information about onboarding the Dell SC Series arrays, see: https://support.emc.com/kb/520264**.**