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-native 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.

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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 Dell EMC Unity, SC Series, XtremIO, and PowerMax/VMAX systems, as well as Connectrix switches, 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, PowerMax/VMAX and Connectrix.

CloudIQ is designed to deliver these capabilities to customers:

- Centralized Monitoring of Dell EMC Unity, SC Series, XtremIO, PowerMax/VMAX storage systems and Connectrix switches
- 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 systems: Unity, SC Series, XtremIO, PowerMax/VMAX systems and Connectrix switches.

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 via 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 via REST API and utilizes a non-privileged user. A single collector can be used for both VMware and Connectrix.

Secure Remote Services (formerly named ESRS) provides the remote connectivity that enables Dell EMC Unity, XtremIO, PowerMax/VMAX storage systems as well as the CloudIQ Collector (for Connectrix) 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 UniSphere for Dell EMC Unity arrays. It is recommended for smaller Unity customers who do not want to utilize 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 SRS 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 (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 storage 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 for simple monitoring and troubleshooting for an unlimited number of Dell EMC Unity, SC Series, XtremIO, and PowerMax/VMAX storage systems as well as Connectrix switches. CloudIQ is hosted on Dell 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. 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 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

- **Accelerate Time to Value** – Get started in minutes with nothing to install. Manage via the web from anywhere, anytime.
- **Easy to Access and Use** – Benefit from new updates that are automatically provided through CloudIQ.
- **Drive Business Value** – Leverage advanced analytics powered by machine learning to deliver higher uptime, increased performance, and perform effective capacity planning.

CloudIQ Requirements

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

<table>
<thead>
<tr>
<th>Type of Data</th>
<th>Product Models</th>
<th>Min. Code Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dell EMC Unity</td>
<td>All Flash, Hybrid, and/or UnityVSA – Professional Edition</td>
<td>Unity OE 4.1 and later</td>
</tr>
<tr>
<td>SC Series</td>
<td>SC all Flash and SC Hybrid</td>
<td>7.3.1 and later</td>
</tr>
<tr>
<td>PowerMax/VMAX</td>
<td>VMAX 10K, 20K, 40K, 100K, 200K, 400K, 250F, 450F, 850F, 950F PowerMax 2000, 8000</td>
<td>Unisphere 9.0.1.6 Unisphere 9.0.2.10 and later is recommended</td>
</tr>
<tr>
<td>XtremIO</td>
<td>X1 and X2</td>
<td>XMS 6.2.0 and later</td>
</tr>
<tr>
<td>Connectrix B-Series</td>
<td>Connectrix Brocade</td>
<td>FOS 8.2.1a and later</td>
</tr>
<tr>
<td>Connectrix MDS Series</td>
<td>Connectrix Cisco</td>
<td>NX-OS 8.3(2) and later</td>
</tr>
<tr>
<td>VMware</td>
<td>--</td>
<td>ESX 5.5 and higher (some metrics only available at 6.0+)</td>
</tr>
</tbody>
</table>

The following requirements must be fulfilled:

- Remote Support established and configured for CloudIQ Data Access
  - For Secure Remote Services, v3.32 is recommended.
- Valid Dell EMC ProSupport or ProSupport Plus 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, PowerMax/VMAX and Connectrix systems.
**CloudIQ Data Collection**

After the Dell EMC Unity, SC Series, XtremIO and PowerMax/VMAX systems have established connection to CloudIQ, data will be collected for the Dell EMC storage systems. A Dell EMC Unity, XtremIO and PowerMax/VMAX connection is through Secure Remote Services. A Dell SC Series connection is through SupportAssist. Connectrix and VMware data is collected by a local collector and sent 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:

<table>
<thead>
<tr>
<th>Type of Data</th>
<th>Sample Update Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alerts</td>
<td>5 minutes</td>
</tr>
<tr>
<td>Performance</td>
<td>5 minutes</td>
</tr>
<tr>
<td>Capacity¹</td>
<td>1 hour</td>
</tr>
<tr>
<td>Configuration¹</td>
<td>1 hour</td>
</tr>
<tr>
<td>Full Data Collection²</td>
<td>Daily</td>
</tr>
</tbody>
</table>

¹. Connectrix collects at 5 minutes
². Daily “all-in” collection

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, Block and File Storage Objects, Connectrix switches and VMware environments.
- 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 Proactive Health Scores, Capacity Predictions and Performance Anomaly & Impact Detection, as discussed below. From here, the user can easily navigate to the areas of interest or the areas requiring attention.

**Intelligent Analytics – Performance Anomaly & Impact Detection and Capacity Predictions**

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

**Performance Anomaly & Impact Detection**

Using machine learning and analytics, CloudIQ identifies identify performance anomalies (supported on all storage platforms). It compares current performance metrics with historical values to determine when the current metrics deviate outside of historical ranges. This 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 LUN performance impacts (currently for Unity systems) where an increase occurs in LUN latency or queue length while IOPS do not necessarily increase, but instead is being affected by competing resources. CloudIQ also identifies the most likely storage objects causing the resource contention. Additionally, CloudIQ identifies similar performance impacts at the system level. This enables the Storage Admin to narrow the focus of troubleshooting specifically where actual impacts to performance may have occurred.

**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 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). This capability assists users with both 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 Proactive Health mitigates risk are:

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

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

Note: At this time, only the Components category is used for Connectrix switches.
CloudIQ Notification Emails

CloudIQ provides an email triggered by any health issue that contributes to the health score, so immediate action can be taken to resolve any issues before they become a data unavailable 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 unavailable condition exists.

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 unavailable condition 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.

Controlling Asset Visibility

Users have the ability to filter which systems are visible to them in the CloudIQ user interface as well as the mobile app. For example, if an administrator is only interested in monitoring the status of the VMAX and PowerMax arrays in the environment, they can set a filter so that all other systems are excluded from their view. The filtering is set on a user by user basis and can be configured based on site, product type, or down to the individual system level. This feature is accessible under the Sites and Systems tab via Admin > Settings > Your Account menu pick. The following shows a user that has removed the visibility of their XtremIO systems.
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, PowerMax/VMAX and Connectrix 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 as features are added to CloudIQ.

Navigating CloudIQ

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

- **Overview** – Access the overview page that provides high-level summary information as well as some detailed information about the health of the storage environment, allowing the user to quickly identify potential risks.
- **Health** – View the multi-system System Health page showing the proactive health scores across the entire environment. View an aggregated list of all health issues as well as system alerts and available system updates.
- **Inventory** – View the multi-system configuration page showing the system code versions as well as location, site and contract status for all systems in the environment. System, pool and object drill-downs also reside under Inventory, as well as the aggregated listing and detailed views for Hosts.
- **Capacity** – Access the multi-system view for System Capacity showing array level capacity information including the overall efficiencies to support the Dell EMC all flash guarantee. Also access the aggregate and detailed Pools displays as well as the Reclaimable Storage menu.
- **Performance** – Access the multi-system performance page showing array level performance KPIs for all storage systems. Also access the Metrics Browser for more detailed performance analysis.
- **Admin** – Includes the Settings menu used to configure access for User Community (including Trusted Advisors and Partners) and Customer Support access as well as email notification settings. Settings also allow users to set filters on which systems they want to see in both the CloudIQ user interface as well as the mobile app. Admin also includes the Collectors menu where users can download the CloudIQ Collector for VMware and Connectrix collections and see the status of all installed Collectors.
- **Help** – Online CloudIQ documentation which is searchable.

Global Search

The Global Search feature helps users quickly find Systems, Hosts, Pools, LUNs/Volumes, File Systems, Virtual Machines, Storage Groups and Storage Resource Pools. 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.

Online Chat/Feedback

Selecting the exclamation point pull-down allows the user to either open a live chat session with customer support or submit feedback to the CloudIQ product team. When opening a live chat session, the user will need to provide the serial number of the system in question.

What’s New in CloudIQ

CloudIQ is updated frequently to deliver helpful new content to users. New features can be seen by clicking the 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.

Selecting either the user icon or the user email address allows the user to sign out of the UI.
The Overview page provides a consolidated view of the Dell EMC Unity, SC Series, XtremIO, PowerMax/VMAX and Connectrix 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 environment.

The Overview page has the following tiles of information:

- **System Health** – Categorizes all monitored storage systems and Connectrix switches into three ranges of health scores:
  - Poor: 0-73
  - Fair: 74-94
  - Good: 95-100
  - Unknown: list of systems whose health score cannot currently be calculated. This is possibly caused by a connection issue.

Selecting a range’s number 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.
• **Capacity Approaching Full** – Leverages predictive analytics to identify the storage pools (Unity and SC Series) and XtremIO clusters running out of space. The chart is interactive allowing the user to select each storage object to display a trend line of the historical capacities. For Unity storage pools and XtremIO clusters, a forecast capacity chart is also shown. The estimated time range until each pool/cluster will be full is shown as:
  - Full
  - Within a week
  - Within a month
  - Within a quarter

• **Performance Impacts** – Currently supported for Unity systems. Utilizes CloudIQ analytics to identify when there are performance impacts on a system due to a possible resource contention. It will also identify the existence of performance anomalies where the current workload is outside of expected boundaries based on historical workloads. The chart is interactive allowing the user to select each system with a performance impact 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.

• **Connectivity to CloudIQ** – Shows the connectivity status for all systems registered in CloudIQ and the CloudIQ Collector. Systems 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 displays the system(s) and collector(s) corresponding to that connectivity status.

• **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 as well as the type of update. Selecting the “GO TO UPDATES” link opens the System Updates page which shows all available code, firmware and software updates across all systems as well as links to download the update(s).

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

System Health
The System Health page displays the Proactive Health Score for all systems across all products in a consolidated view. There are two tabs, “STORAGE” and “SAN”, that organize the storage systems and switches 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.
The **Card** view, shown above for both Storage and SAN, is the default view for this page. Users can alternatively choose the **List** view, by selecting the List View Icon ( ) in the top right of the window. The list view, shown below for Storage, may be more useful for larger environments 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.

Users also have the ability to export the data from any one of the multi-system views including the information displayed in the Health, Inventory, Performance and Capacity views.

Users can also filter the systems in both the Card View and List View by selecting the **Refine** button and entering in various criteria including System Name, Product Type, Heath Score, Site name and Location. There is also a filter to display only those systems that have an available system code upgrade. 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

The System Health page shows the five categories that are monitored by CloudIQ: **Components ( ), Configuration ( ), Capacity ( ), Performance ( ) and Data Protection ( ).**

<table>
<thead>
<tr>
<th>Health Score</th>
<th>System</th>
<th>Serial Number</th>
<th>Model</th>
<th>Components</th>
<th>Configuration</th>
<th>Capacity</th>
<th>Performance</th>
<th>Data Protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>70</td>
<td>Test_Dev</td>
<td>FCNCH0972C12F3</td>
<td>UnityVSA</td>
<td>✓</td>
<td>✓</td>
<td>-30</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>80</td>
<td>HR_Remote</td>
<td>000204680547</td>
<td>VMAX150F</td>
<td>–</td>
<td>✓</td>
<td>-20</td>
<td>✓</td>
<td>–</td>
</tr>
<tr>
<td>15</td>
<td>Remote DC</td>
<td>92252</td>
<td>SC5020F</td>
<td>✓</td>
<td>✓</td>
<td>-15</td>
<td>-5</td>
<td>✓</td>
</tr>
<tr>
<td>30</td>
<td>Disaster Recovery</td>
<td>FCNCH0972C12F2</td>
<td>UNITY 400</td>
<td>✓</td>
<td>✓</td>
<td>-6</td>
<td>-10</td>
<td>✓</td>
</tr>
<tr>
<td>90</td>
<td>Finance</td>
<td>000197000049</td>
<td>PowerMax_2000</td>
<td>–</td>
<td>✓</td>
<td>-10</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>64</td>
<td>Market Research</td>
<td>FCNCH0972C12F4</td>
<td>UNITY 500F</td>
<td>✓</td>
<td>✓</td>
<td>-6</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>34</td>
<td>ERP Remote</td>
<td>S000174637731</td>
<td>X:2:T</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>100</td>
<td>Production</td>
<td>FCNCH0972C12F1</td>
<td>UNITY 650F</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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</tr>
<tr>
<td>100</td>
<td>Business Analytics</td>
<td>90148</td>
<td>SCT020F</td>
<td>✓</td>
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<td>✓</td>
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<tr>
<td>100</td>
<td>Prod with iCOM</td>
<td>S000174637500</td>
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<tr>
<td>100</td>
<td>ERP Production</td>
<td>S000174637444</td>
<td>X2.R</td>
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<td>✓</td>
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<tr>
<td>100</td>
<td>Software Dev</td>
<td>00019490732</td>
<td>VMAX-15E</td>
<td>–</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

**Note:** PowerMax and VMAX systems do not currently include health issues in the Components or Data Protection categories. CloudIQ will display a “—” for these categories.

**Note:** Connectrix switches currently utilize only Components to obtain the health score.
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 of the five categories. Each of the five categories has 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 for the most impactful issue in the category. This approach is intended to help the user first focus 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 with a dash instead of a number indicates a system that has not yet had a health score calculated (e.g. was just recently added to CloudIQ). Gray coloring with a number indicates a connectivity issue which leads to an uncertain health score, in which case the user should check the system connectivity.

Selecting an individual storage system or switch from either the card view or list view navigates the user to the System Details page located under the Inventory link. These pages are discussed later in this paper. Refer to these sections:

- Storage/Switch System Details – Health Score
- Storage/Switch System Details – Configuration
- Storage/Switch System Details – Capacity
- Storage/Switch System Details – Performance
Health Issues

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

Alerts

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

- **Date** – Date range
- **System** – System Name or ID
- **Product** – Product type
  - SC Series
  - Unity
  - VMAX
  - XtremIO
- **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. 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.

### System Updates

The System Updates page displays a list of all available code, firmware and management software updates across all systems. It includes the system name, update category, update type as well as 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 as well as a link to the release notes for the system update.
The user can filter the results using the Refine button, sort any of the columns and export the list to a CSV file.
Inventory

Systems

The Systems page is the multi-system view showing the configuration information for all systems in the environment. There are again separate tabs for both storage arrays and SAN switches.
The information displayed on this page includes:

- **Version** – Software version installed
- **Last Contact Time** – The last time that CloudIQ received data from the system
- **Location** – Location where the system is installed
- **Site name** – Site ID with which the system is associated
- **Contract Expiration** – Expiration date for the service contract. Valid for Unity, XtremIO and PowerMax and VMAX.

There will also be an indication when a storage system has a code update available. Hovering the mouse over the information icon opens a popup window showing the update version. Clicking the “Learn More” link from within the popup window opens a dialog with summary information and links to the Release Notes and the software download.

### Hosts

The Hosts page shows a list of all hosts or servers attached to storage systems being monitored by CloudIQ. Users can click Refine to filter and specify one or more storage system names to restrict the view to display only those hosts on the selected system(s).

<table>
<thead>
<tr>
<th>Issues</th>
<th>Name</th>
<th>Network Address</th>
<th>Operating System</th>
<th>Initiator Protocol</th>
<th>Initiators</th>
<th>Total Size</th>
<th>System</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>Analytic-Host 1</td>
<td>–</td>
<td>Linux</td>
<td>FC</td>
<td>2</td>
<td>0</td>
<td>Power with IEDM</td>
<td>X1</td>
</tr>
<tr>
<td>✓</td>
<td>Analytic-Host 2</td>
<td>–</td>
<td>Linux</td>
<td>FC</td>
<td>2</td>
<td>0</td>
<td>Power with IEDM</td>
<td>X1</td>
</tr>
<tr>
<td>✓</td>
<td>BA_Apple_Server1</td>
<td>10.0.0.0</td>
<td>Windows Server 2012</td>
<td>FC</td>
<td>2</td>
<td>41.0</td>
<td>Business Analytics</td>
<td>SC7000P</td>
</tr>
<tr>
<td>✓</td>
<td>BA_Apple_Server2</td>
<td>10.0.0.0</td>
<td>Windows Server 2012</td>
<td>FC</td>
<td>2</td>
<td>41.0</td>
<td>Business Analytics</td>
<td>SC7000P</td>
</tr>
<tr>
<td>✓</td>
<td>BA_Apple_Server3</td>
<td>10.0.0.0</td>
<td>Windows Server 2012</td>
<td>FC</td>
<td>2</td>
<td>41.0</td>
<td>Business Analytics</td>
<td>SC7000P</td>
</tr>
<tr>
<td>✓</td>
<td>BA_Apple_Server4</td>
<td>10.0.0.0</td>
<td>Windows Server 2012</td>
<td>FC</td>
<td>2</td>
<td>41.0</td>
<td>Business Analytics</td>
<td>SC7000P</td>
</tr>
<tr>
<td>✓</td>
<td>Backup_001</td>
<td>–</td>
<td>ESXi</td>
<td>FC</td>
<td>2</td>
<td>0</td>
<td>ERP-Production</td>
<td>X2-A</td>
</tr>
<tr>
<td>✓</td>
<td>ERP-Host 1</td>
<td>–</td>
<td>ESXi</td>
<td>FC</td>
<td>2</td>
<td>7.0</td>
<td>ERP-Production</td>
<td>X2-A</td>
</tr>
<tr>
<td>✓</td>
<td>ERP-Host 2</td>
<td>–</td>
<td>ESXi</td>
<td>FC</td>
<td>2</td>
<td>7.0</td>
<td>ERP-Production</td>
<td>X2-A</td>
</tr>
<tr>
<td>✓</td>
<td>ERP-Host 3</td>
<td>–</td>
<td>ESXi</td>
<td>FC</td>
<td>2</td>
<td>7.0</td>
<td>ERP-Production</td>
<td>X2-A</td>
</tr>
<tr>
<td>✓</td>
<td>ERP-Host 4</td>
<td>–</td>
<td>ESXi</td>
<td>FC</td>
<td>2</td>
<td>7.0</td>
<td>ERP-Production</td>
<td>X2-A</td>
</tr>
<tr>
<td>✓</td>
<td>ICM-Host_ESX1</td>
<td>–</td>
<td>ESXi</td>
<td>FC</td>
<td>2</td>
<td>4.5</td>
<td>Power with IEDM</td>
<td>X1</td>
</tr>
<tr>
<td>✓</td>
<td>Local_Esk1</td>
<td>10.0.0.10</td>
<td>VMware ESXi 5.5.0</td>
<td>iSCSI</td>
<td>2</td>
<td>20.0</td>
<td>Market Research</td>
<td>UNITY V100P</td>
</tr>
<tr>
<td>✓</td>
<td>Local_Esk2</td>
<td>10.0.0.10</td>
<td>VMware ESXi 5.5.0</td>
<td>iSCSI</td>
<td>2</td>
<td>19.0</td>
<td>Production</td>
<td>UNITY V100P</td>
</tr>
<tr>
<td>✓</td>
<td>Local_Esk3</td>
<td>10.0.0.10</td>
<td>VMware ESXi 5.5.0</td>
<td>iSCSI</td>
<td>2</td>
<td>19.0</td>
<td>Market Research</td>
<td>UNITY V100P</td>
</tr>
<tr>
<td>✓</td>
<td>Local_Esk3</td>
<td>10.0.0.10</td>
<td>VMware ESXi 5.5.0</td>
<td>iSCSI</td>
<td>2</td>
<td>19.0</td>
<td>Production</td>
<td>UNITY V100P</td>
</tr>
</tbody>
</table>

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
- **Name** – Host name
- **Network Address** – IPv4 or IPv6 IP address (Not reported for hosts attached to XtremIO clusters).
- **Operating System** – Host operating system.
- **Initiator Protocol** – Type of initiator used by the Host (FC, iSCSI).
- **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.
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.

Each host name 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.

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 the 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.

Host Details – Capacity
The Capacity tab for a host provides details for the current capacity from the associated storage system including provisioned and allocated size, and historical capacity trends, of all of the block objects provisioned to that host (LUNs for Unity and Volumes for SC Series).
Host Details – Performance
The Performance tab for a host provides the 24-hour average values of key performance indicators (Latency, IOPS and Bandwidth) 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.
Performance

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 object over the last 24-hour period. (LUNs for Unity, Volumes for SC Series and XtremIO). 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).

The information displayed for SAN 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

For storage systems, 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.

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

The Metrics Browser 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**

<table>
<thead>
<tr>
<th>Metric</th>
<th>System</th>
<th>System Backend</th>
<th>Block</th>
<th>File</th>
<th>Drive</th>
<th>Pool</th>
<th>Pool Backend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandwidth (BPS)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Block Latency</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CPU Utilization</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IO Size</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>IOPS</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>% Read</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Queue Length</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>VVol Latency</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

**SC Series Metrics**

<table>
<thead>
<tr>
<th>Metric</th>
<th>System</th>
<th>System Backend</th>
<th>Volume</th>
<th>Drive</th>
<th>Pool</th>
<th>Pool Backend</th>
<th>FC, SAS, iSCSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandwidth (BPS)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Latency</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>CPU Utilization</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IO Size</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>IOPS</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>% Read</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Queue Length</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

**XtremIO Metrics**

<table>
<thead>
<tr>
<th>Metric</th>
<th>System</th>
<th>Volume</th>
<th>Target</th>
<th>Initiator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandwidth (BPS)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Block Latency</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>IOPS</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>CPU Utilization</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**PowerMax/VMAX Metrics**

<table>
<thead>
<tr>
<th>Metric</th>
<th>System</th>
<th>Storage Group</th>
<th>SRP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandwidth (BPS)</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Latency</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>IOPS</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>IO Size</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>% Read</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Queue Length</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
VMware Metrics

<table>
<thead>
<tr>
<th>Metric</th>
<th>ESXi</th>
<th>Virtual Machine</th>
<th>Datastore</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Memory</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Bandwidth per Datastore</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CPU Readiness</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CPU Usage</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>IOPS per Datastore</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Latency per Datastore</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage Latency</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capacity</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Free Space</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uncommitted</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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 performance metrics from the Metrics list.
4. Select the System(s) being monitored by CloudIQ.
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.
Capacity

System Capacity

The System Capacity page displays the system level storage capacity for storage systems and port capacity for switches across all monitored systems.
The information for 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
- **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 following combined savings ratios:
  - **Thin** – Ratio of thin provisioned objects on the system (Dell EMC Unity, SC Series, VMAX/PowerMax)
  - **Snapshots** – Ratio of snapshots on the system (Dell EMC Unity, SC Series, VMAX/PowerMax),
  - **Thin and Copy** – Ratio of thin provisioned objects (XtremIO volumes, including snapshots).
  - **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.

The information for switches includes:

- **Total Ports** – Total number of ports on the switch, including both Fibre Channel and Ethernet
- **Online** – Number of ports in an online state
- **Offline** – Number of ports in an offline state
- **Error** – Number of ports in an error state
**Pools**

The Pools page provides an aggregated listing of storage pools for Unity and SC Series systems. The **Issues** column will display the number of health issues associated with any pool or storage object or a green check mark for items with no associated issues. The blue text for pool name and system name identifies hyperlinks to the details for the item.

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 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 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.

<table>
<thead>
<tr>
<th>Issues</th>
<th>Name</th>
<th>System</th>
<th>Model</th>
<th>Total Size (TB)</th>
<th>Used (%)</th>
<th>Subscription (%)</th>
<th>Time To Full</th>
<th>Free (TB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>Business Analytics_Pool1</td>
<td>Business Analytics</td>
<td>SC700F</td>
<td>85.2</td>
<td>18.7</td>
<td>65.5</td>
<td>Greater than quarter</td>
<td>69.3</td>
</tr>
<tr>
<td>✓</td>
<td>Disaster Recovery_Pool1</td>
<td>Disaster Recovery</td>
<td>UNITY 400</td>
<td>25.6</td>
<td>64.1</td>
<td>117.2</td>
<td>Unpredictable</td>
<td>9.2</td>
</tr>
<tr>
<td>☑</td>
<td>Disaster Recovery_Pool2</td>
<td>Disaster Recovery</td>
<td>UNITY 400</td>
<td>12.8</td>
<td>65.7</td>
<td>155.3</td>
<td>Within a month</td>
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<td>86.8</td>
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</tr>
</tbody>
</table>
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, Virtual Machines associated to 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 a Learning, Full, or Unpredictable state, only the historical trend graph is displayed. Otherwise, the historical trend with the forecast 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”. The following times are available from the pull down:

- 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)
- 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.
Pool Details – Performance

Similar to the Performance tab for a single system, the **Performance** tab for a pool provides details for the storage pool activity. The top of the page displays 24-hour trend lines and a 24-hour average for Latency (Block or Volume), IOPS, and Bandwidth (LUNs, Volumes, and File Systems) for the top 5 storage objects associated to the pool.

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 (if multiple tiers exist in the pool), Latency (Block for Unity and Volume for SC Series) and Controller Utilization (SC Series). If a performance anomaly is identified, it will be shown as either High or Low. To see more details, the user can select an area on the graph and the activity for the top 5 objects is shown on the left, as shown below in the IOPS and Bandwidth graphs.
Reclaimable Storage

The **Reclaimable Storage** page shows block and file objects that may no longer be in use. This is currently supported for Unity and SC Series systems. It shows the total number of storage objects as well as 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

The **Group By** pull down menu in the top-right of the page allows the user to group the storage objects either by storage system (default) or by the rule types mentioned above.

**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.

**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 **Refine button** allows the user to filter the results based on System or Rule Type.
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.

The Refine button allows the user to filter the results based on storage system.

Selecting any storage system name from any of the multi-system views (or from any other page in CloudIQ) opens the System Details page providing additional health, configuration, capacity and performance details for the selected storage system. The following sections discuss the System Details page in more depth.

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).
Storage System Details

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

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 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.

Note: As noted previously, PowerMax/VMAX systems do not include health issues in the Components or Data Protection categories. A dash is displayed for these categories for PowerMax and VMAX systems.

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 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 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.

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 of the system. The upper portion of this view provides the system attributes such as Serial Number, 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).

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 (for PowerMax/VMAX and XtremIO systems). Clicking the 'Learn More' link will open 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 (SC Series and Unity) / Storage Resource Pools (PowerMax/VMAX)
- Storage Objects (SC Series and Unity) / Volumes (XtremIO) / Storage Groups (PowerMax/VMAX)
- Virtual Machines (All platforms)
- Drives (SC Series and Unity)
- Hosts (Unity and XtremIO) / Servers (SC Series)
- Consistency Groups (XtremIO)
- Service Levels (PowerMax/VMAX)

The Pools tab (Unity and SC Series) or Storage Resource Pools (PowerMax/VMAX), 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 is predicted within a month.
The Storage (Unity and SC Series) or Volumes (XtremIO) 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.

- Unity: LUNs, File Systems, VMware 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 (PowerMax/VMAX) tab shows a listing of storage groups on the storage system along with the total capacity, associated storage resource pool, the associated service level and whether or not it is in 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, ESX Server and ESX Cluster.

The Drives tab (Unity and SC Series) gives the details on the drives for the given storage system and where they are located 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 (Unity, XtremIO, and PowerMax/VMAX) or Servers (SC Series) tab gives the details about the hosts (servers) attached to this storage system. It includes host name, IP Address, operating system, initiator protocol and total accessible storage for each host from the specific storage system.

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

The Service Levels tab (PowerMax/VMAX) lists the configured service level along with the expected response times.

### Storage System Details – Capacity

This tab shows slightly different information depending on the product type. The storage capacity details for SC Series and Unity include:

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

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

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 navigate 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.
Storage System Details – Performance

The top portion of this tab is the Storage 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 as well as the 24-hour average. It is sorted to show:

- Block Latency
- IOPS
- Bandwidth

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

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, but some examples include:

- Block Latency
- IOPS
- Backend IOPS (if multiple storage tiers exist, each tier has a separate chart)
- Bandwidth
- Storage Processor Utilization (Unity) / Controller Utilization (SC Series) / CPU Utilization (XtremlO)
For Unity systems, the Block Latency chart identifies areas of performance impacts. The system charts also identify areas of performance anomalies and configuration changes. Performance impacts are identified by areas of light pink shading. Performance anomalies are identified by areas of red shading. Configuration changes are identified as rectangles along the X-axis of the charts. Selecting the configuration change rectangle opens the Storage Configuration Changes popup window which contains details of the change(s). Selecting any area in the chart displays 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.
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, the Hosts (for Unity and XtremIO systems) and Servers (for SC Series), the Virtual Machines attached to this object and Consistency Groups (for XtremIO) to which this object belongs. The information in the Hosts and Virtual Machines tables 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 objects (Unity and SC Series) provides performance details for the block object activity. The top of the page shows LUN/Volume Workload Changes including performance impacts over the last 24 hours (for Unity systems). This can be changed to display a predefined time range or a custom time range. The user can refine the content by selecting one or more of the following metrics:

- Block Latency
- IOPS
- Bandwidth
- % Read
- IO Size
- Queue Length
- Performance Impact for the Last 24 Hours (Unity systems)

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.

Performance impacts are highlighted in pink as shown below. Clicking on the highlighted region in the chart opens a window in the right hand side of the chart identifying storage objects whose IOPS are strongly correlated with the rise in latency for the impacted LUN. These objects are the most likely candidates causing resource contention and the performance impact.
The bottom of the page displays LUN/Volume performance charts for the following metrics:

- Block Latency
- IOPS
- Bandwidth

As with the system and pool level metrics discussed earlier, CloudIQ identifies performance anomalies for each of these metrics.

Highlighting a section of the Block Latency, IOPS and Throughput charts displays the top five most active virtual machines over that time period in the legend to the left. In this example, MR_VM1 is the most active VM during this performance anomaly.

![Block Latency Chart](image)

![Throughput Chart](image)

![IOPS Chart](image)
Block Object Details – Data Protection

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

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.
File Object Details

File Objects (Unity systems only) 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 various attributes for the file object and any health issues found for the object. The bottom half of the view shows any virtual machines that reside on the file 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 24-hour period (default). This can be changed to one of several pre-defined time ranges or a custom time range. As the user hovers the mouse over the graph, the metrics details will be shown in pop-up boxes. The following metrics are available:

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

- **Aggregated File System Metrics (NFS)**
  - IOPS
  - Latency

The Aggregated File System Metrics (NFS) graph has the ability to breakdown the data by:

- Storage Processor
- Read/Write/Other
- Both
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 from system to system and Snapshots. 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.

![Data Protection Tab](image)

- **Replication:**
  - Session Name: `rsync`
  - Mode: Asynchronous (60 minutes)
  - Local Rate: 395.2 MB/Sec
  - Sync Progress: 80% complete, about 20 minutes remaining
  - Sync Transfer Rate: 395.2 MB/Sec
  - Time of Last Sync: Mon, Oct 17 2016, 5:50:21 PM UTC

- **Snapshots:**
  - Rule 1: Every Tuesday, Wednesday, Thursday, Friday, Saturday, and Sunday at 11:00 PM; retain for 14 days
  - Note: Schedule times are in UTC displayed in 12-hour format

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<th>Modified</th>
<th>Auto Delete</th>
<th>Expiration Time</th>
<th>Access Type</th>
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</thead>
</table>
Storage Group Details (PowerMax/VMAX systems)

Each PowerMax/VMAX system has 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.

![Configuration Tab Example]

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 the Compression ratio.

![Capacity Tab Example]
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 and historic seasonality over the last 24 hours for Latency, IOPS and Bandwidth. These charts also display any performance anomalies in a red shaded area.
Connectrix Switch Details

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

Switch System Details – Health Score

The Health Score tab shows the details for a selected switch driving the health score number. Currently, 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.

Switch System Details – Configuration

The Configuration tab contains various switch attributes at the top half of the screen, including the serial number, model, location, site, firmware and management IP address. The bottom half of the window contains the following tabs: Fabrics, Partitions, Zones, Attached Devices, Components.

Fabrics
• 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.
• 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 being managed by CloudIQ.
• Used % - Percentage of ports in this fabric that are currently in use.

### Partitions

<table>
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<th>Partitions</th>
<th>Fabrics</th>
<th>Zones</th>
<th>Attached Devices</th>
<th>Components</th>
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</thead>
<tbody>
<tr>
<td>Partition ID</td>
<td>Switch Name</td>
<td>Management IP</td>
<td>Number of switches</td>
<td>Total end devices</td>
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<td>1</td>
<td>Stretch Cluster Extension</td>
<td>10.0.12.3</td>
<td>1</td>
<td>4</td>
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</table>

• 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.

### Zones

<table>
<thead>
<tr>
<th>Zones</th>
<th>Fabrics</th>
<th>Partitions</th>
<th>Attached Devices</th>
<th>Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Configuration</td>
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<td>Symbolic Name</td>
<td>Member Name</td>
<td>Alias</td>
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<td>[0]</td>
<td>50:03:09:73:98:03:05:40</td>
<td>VMAX_237_F4_1D_1</td>
</tr>
</tbody>
</table>

• 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 currently 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.
Attached Devices

- **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 currently 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.

Components

- **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.
Switch System Details – Capacity

The capacity tab for a switch provides details about the port usage for the switch. The top left portion of the view shows a breakdown of the ports on the switch broken down by Online, Offline and Error status. The online ports are then broken down by E_Port, F_Port and Unknown status. If the F_Port filter is selected, the right-hand side of the window shows a breakdown by Host Ports, Storage Ports and Unknown. The bottom of the page displays a filtered list of ports based on the filters selected in the top half of the page. By default, the page is filtered to show those ports with a status of Online. The following columns are displayed at the bottom of the page:

- Interface – Location of the port, shown as slot/port number.
- State – Status of the switch port.
- Protocol – Protocol configured for the switch port.
- Switch Port Type – Logical configuration of the switch port.
- Attached Node Type – Describes the device attached to the switch port.
- Attached WWN – Worldwide name of the attached device.

![Production SAN Extension](image-url)
Switch System Details – Performance

The Performance tab displays 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.
VMware Details

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

In addition to seeing Virtual Machines in the Virtual Machines tabs detailed earlier in this document, the user can utilize “search” to find a VM and access the Virtual Machines Details page. Note that the search feature will find the following VM related properties:

- VM name
- vCenter
- ESX Server
- ESX Cluster
- Datacenter

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

Selecting the VM name will direct the user to the Virtual Machine Details page. This page has 3 sections:

- Virtual Machine Summary
- Configuration Changes – Last 24 Hours
- Performance – Last 24 Hours

Virtual Machine Summary:

The figure on the right shows an example of the Virtual Machine Summary information. This section provides various attributes about the virtual machine. It includes capacity information to understand how much storage is allocated and used by the VM as well as vCenter and ESX cluster information to understand where the VM resides.
Configuration Changes – Last 24 Hours:

This figure on the right shows the Configuration Changes section. This section provides a summary of VM related and infrastructure related configuration changes over that last 24 hour time period.

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.

Performance – Last 24 Hours: Provides 24-hour charts for the following three KPIs:

- CPU Readiness (%)
- Active Memory (%)
- Storage Latency (ms)

The performance charts will highlight any performance anomalies during the last 24 hours.

This view also provides Storage Paths details that include:

- Datastore
- Storage (LUN or Filesystem)
- Storage System

The storage device and storage system are hyperlinks allowing the user to quickly navigate to the Storage Object Details page and System Details page, respectively.
Mobile Application

CloudIQ also has a mobile application available for both iOS and Android phones. The primary features of the mobile app are Proactive Health and Push Notifications. It also provides capacity information for pools and XtremIO clusters reaching capacity and alerting details.

The primary screen of the Mobile App summarizes the health scores across the user’s environment, much like with the browser version of CloudIQ.

Users can drill in to 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.
Appendix A – CloudIQ Security

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 EMC standard Secure Software Development Lifecycle. This standard defines the security-focused activities Dell EMC product teams must follow when building and releasing products, to enable Dell EMC products to minimize the risks to our products and customer environments from security vulnerabilities.

CloudIQ Data in Transit to Dell
CloudIQ subscribes to notifications from Dell EMC’s Secure Remote Services (SRS) and Dell Phone Home services when storage system metadata (e.g., system logs, system configuration, system capacity and performance metrics) arrives via those channels. No customer data is sent, only data generated by the customer’s systems. Customers control which systems send information via 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 EMC IT managed infrastructure. In addition, SRS provides for dedicated VPN and multi-factor authentication. Once the data arrives, CloudIQ stores data relating to those systems which have CloudIQ management enabled in its own Dell EMC IT managed infrastructure.

CloudIQ Data at Rest
CloudIQ data is stored on Dell EMC infrastructure which is highly available, fault tolerant, and provides a 4-hour Disaster Recovery SLA. Dell EMC’s Global Security Organization (GSO), led by a Chief Information Security Officer is responsible for security and protection of Dell EMC’s information technology infrastructure. This is accomplished via establishment of governing security policies and procedures, and enforcement of Information Security control. This includes measures such as multi-layered firewalls, intrusion detection systems, industry-leading antivirus and malware protection. The Dell EMC 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 EMC data center. The Information Security Policy ensures that all Dell EMC 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, expect for the members of System Administrator and Database Administrator teams. Database application accounts are managed using standard database password authentication. Dell EMC has implemented an industry best practice Change Management process to ensure that Dell EMC 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 effectively to users.

Accessing CloudIQ Data
CloudIQ access requires that each user has a valid Dell EMC support account. Customers use their existing support account to login to CloudIQ. Authentication is handled by Dell EMC’s Single-Sign-On (SSO) infrastructure. CloudIQ leverages information in the user profile stored in Dell EMC 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 EMC. 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 via 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 EMC Service Center.
Appendix B - Enabling CloudIQ at the System

Dell EMC Unity, XtremIO, and PowerMax/VMAX Systems

The Dell EMC Unity, XtremlO, 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 Dell EMC Unity 4.2 and later, navigate to Settings > Support Configuration > CloudIQ, and then select Send data to CloudIQ.
  - For Dell EMC 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.dell.com:8443 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 Dell EMC Unity, XtremlO, and PowerMax/VMAX 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:

- **Dell EMC Unity** – https://support.emc.com/kb/481102
- **XtremlO** – 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.dell.com. On the CloudIQ.dell.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.

**Connectrix Switches**

Connectrix switches utilize the CloudIQ Collector to collect the data from the switches and send the data back to CloudIQ via 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.emc.com. It is then installed locally in the datacenter.

Once the Collector vApp is deployed, the collector is configured to communicate to the Secure Remote Services Gateway and the Connectrix switches by accessing the collector administration UI via a web browser: https://<collector hostname or IP>.
Communication between the Collector and the switches is done via REST API. The following guidelines can be used to verify and/or 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:

```bash
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:

```bash
mgmtapp --enable rest
```

**Cisco**

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

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

For more information about onboarding Connectrix, see: [https://support.emc.com/kb/534462](https://support.emc.com/kb/534462)

**VMware**

VMware utilizes the CloudIQ Collector to communicate to vCenter and send data back to CloudIQ via 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.emc.com](https://support.emc.com). It is then installed locally in the datacenter. 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 via a web browser: [https://<collector hostname or IP>](https://<collector hostname or IP>).

For more information about onboarding VMware, see: [https://support.emc.com/kb/526579](https://support.emc.com/kb/526579)