Dell EMC Unity: Performance Metrics

Abstract

This document explains the performance metrics features for Dell EMC Unity systems including viewing performance information, creating charts, and downloading performance archive files.

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Executive summary

Data is a crucial part of the day-to-day operations of an organization. Data access, data availability, system performance, and capacity are always top concerns of storage administrators. Advanced data services like thin provisioning, replication, and snapshots provide important benefits but also add complexity to storage environments. Addressing this complexity requires a wide range of understandable and differentiating performance metrics to diagnose and troubleshoot issues or accomplish routine maintenance operations.

Dell EMC™ Unity storage systems address these concerns by providing capacity and performance metrics through simple-to-use management interfaces including Dell EMC Unisphere™, the Unisphere CLI (UEMCLI), and the built-in RESTful API. This expansive set of information enables storage administrators to easily analyze system performance on demand while monitoring capacity details, ensuring users are always able to access their critical data.

This white paper discusses the performance metrics available on Dell EMC Unity storage systems and describes how to view and gather performance metrics data from the storage system. The paper also describes different functionality related to performance metrics and provides guidelines for using these features. This paper does not address off-array monitoring options. For more information, see the Unisphere Online Help, Unisphere CLI documentation, and Dell EMC Unity REST API documentation.

Audience

This white paper is intended for Dell EMC customers, partners, and employees considering using capacity and performance metrics for Dell EMC Unity storage systems. It is assumed that the reader is at least an IT generalist who has experience as a system or network administrator.

Terminology

Bandwidth: Maximum amount of data that can be transmitted through a data channel per unit of time. Commonly expressed in megabytes per second (MB/s).

CIFS: Common Internet File System. See Server Message Block (SMB).

Fibre Channel (FC): A high-speed networking technology that is used to transport Small Computer Systems Interface (SCSI) commands over a Fibre Channel fabric.

Internet SCSI (iSCSI): A protocol that provides a mechanism for accessing raw block-level data storage over network connections. The iSCSI protocol is based on the network-standard client/server model with iSCSI initiators (hosts) acting as storage clients and iSCSI targets acting as storage interfaces. Once a connection is established between an iSCSI host and the iSCSI interface, the host requests storage resources and services from the interface.

IOPS: Input/output operations per second.

NAS server: A file storage server that uses SMB or NFS protocols to catalog, organize, and transfer files within designated file system shares. A NAS Server must be created before creating file-level storage resources such as SMB or NFS file systems, or VMware® NFS datastores.

Network File System (NFS): An access protocol that enables users to access files and folders from Linux/UNIX hosts located on a network.

Pool: A collection of drives configured with a particular storage profile. The storage profile defines the type of drives used to provide storage and the type of RAID configured on the drives. The storage pool's configuration defines the number of drives and quantity of storage associated with the pool.

REST API: An application programming interface that utilizes familiar HTTP operations like GET, POST, and DELETE. REST architecture includes certain constraints that ensure that different implementations of REST conform to the same guiding principles, thereby allowing developers the ease of application development when working with different REST API deployments.

Server Message Block (SMB): A file sharing protocol that allows users to share files systems over the Internet and intranets. This is typically used in Windows environments. Also known as Common Internet File System (CIFS), Microsoft's implementation of SMB.

Storage processor: A hardware component that performs Dell EMC Unity storage operations such as creating, managing, and monitoring storage resources.

Unisphere: The web-based user interface for managing Dell EMC Unity storage systems.

Unisphere CLI (UEMCLI): The command-line interface for managing Dell EMC Unity storage systems.

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1 Performance metrics

Dell EMC Unity storage systems provide the ability to view performance metrics from the system level to the individual drives. The performance metrics are located in the Unisphere Performance page. Performance data can be used to diagnose and troubleshoot issues within a storage environment.

1.1 Performance metrics database

Performance metrics data is located in a database stored on the first four system drives. This performance database space is fixed at 16 GB in size and is automatically reserved on every storage system. The fixed size allows the system to retain historical metrics for a fixed duration of time, although not indefinitely (see section 1.2).

The target for total consumed space for storing metrics is 70% of the available 16 GB reserved system space for metrics. If there is a lack of space, the system decreases the retention period for the oldest metrics while attempting to retain at least 24 hours' worth of data for all collected metrics.

1.2 Performance metrics aging policy

Performance metrics data is consolidated and averaged depending on the age of the data so that the metrics database can hold older data for longer periods. For example, data that is greater than 3 days old is consolidated from 1 minute intervals to 5 minute intervals for a longer sampling interval. The same concept is applied at 14 days and 28 days, respectively. Table 1 shows the full list of metric retention periods and associated sampling intervals.

Table 1   Sampling intervals and retention periods

Sampling interval	Retention period
1 minute	3 days
5 minutes	14 days
1 hour	28 days
4 hours	90 days

1.3 Unisphere performance metrics page

On Dell EMC Unity systems, there are several ways to view metrics data that have been collected by the system. This includes viewing metrics from the Unisphere Performance Page, from the Unisphere CLI, and from the Dell EMC Unity RESTful API.

1.3.1 Overview

As shown in Figure 1, to open the Performance Page in Unisphere, click **Performance** in the left-hand navigation menu under the **SYSTEM** category. This page shown in Figure 2 allows viewing and modifying the metrics charts shown on that dashboard as well as adding additional dashboards to adjust the views to specific needs. The charts themselves are interactive, allowing modifying the time view range or hovering over the charts to see individual metric points and comparing with other charts on the page for troubleshooting purposes. Leveraging these capabilities enables quickly locating any high-level performance issues as well as drilling down further for more details by utilizing various breakdown categories and filter

options on each chart. The filter options chosen on one chart do not affect any other charts on the dashboard. By default, the Historical Charts dashboard page is populated with performance charts which show the system's CPU Utilization, File System Bandwidth, LUN IOPS, LUN Bandwidth, and File System IOPS. This page displays data collected within a preset or customized time range.

Dell EMC Unity OE version 4.1 added the Real-time Charts dashboard. When viewing metrics in the real-time dashboards, new data points are automatically added every 5 seconds. The Real-time Charts dashboards display data collected during the current session, over a maximum time range of 15 minutes. The session ends when navigating away from the current tab and restarts when navigating back to the tab. A dashboard can display up to four real-time metrics charts at a time.

For a full list of available metrics in the Unisphere GUI including descriptions, see appendix A.
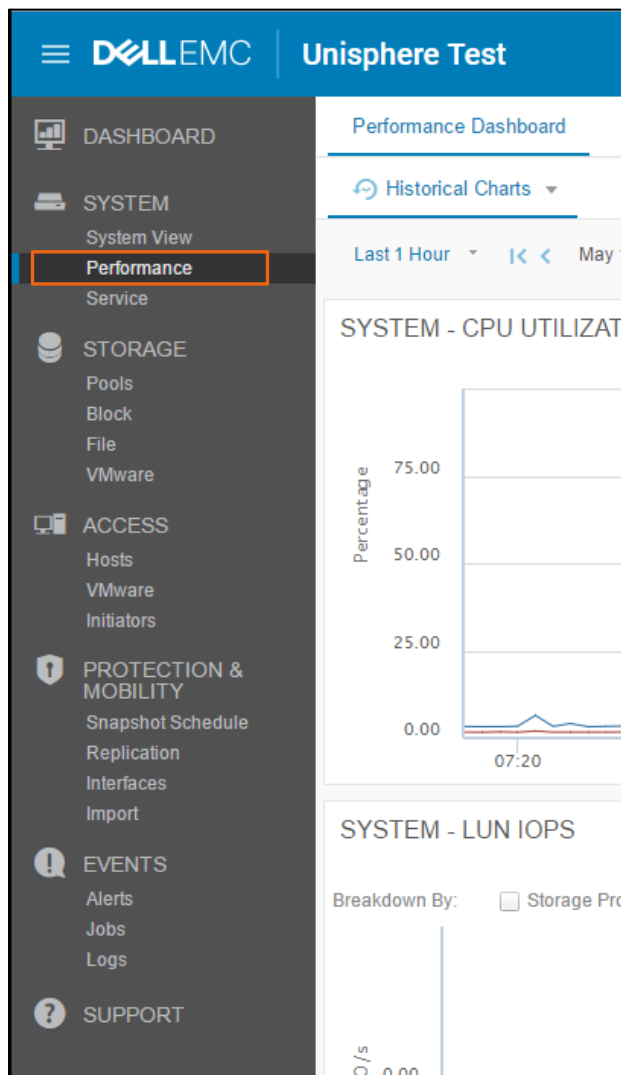

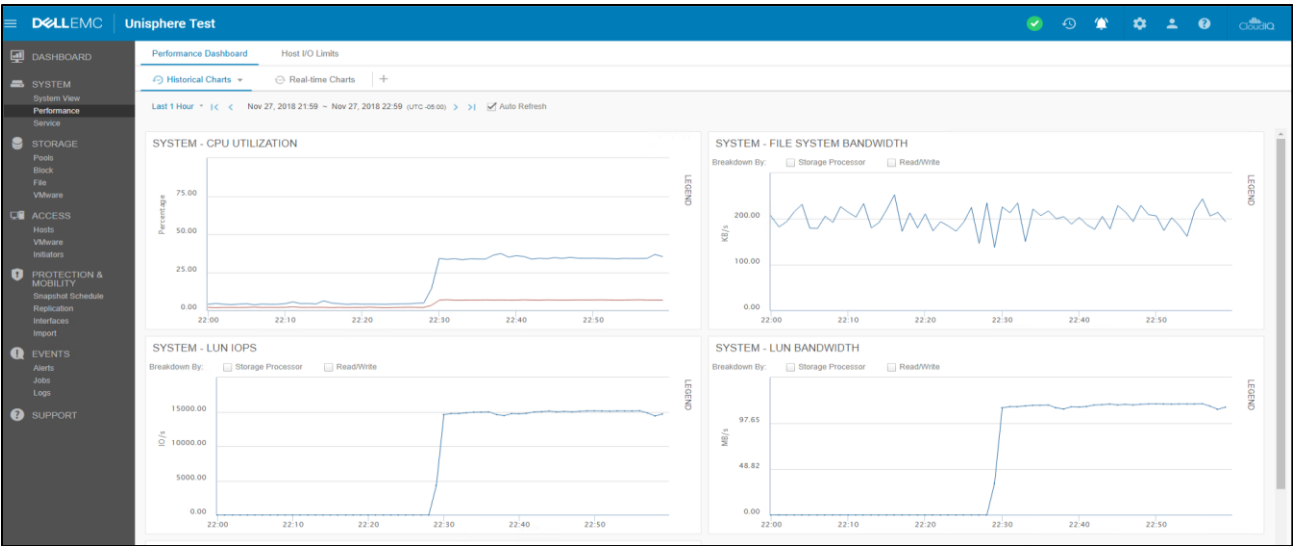Figure 1   Performance page (navigation menu)

Figure 2   Performance page in Unisphere

1.3.2   Add charts

While in the **Performance** page, to add a chart to a dashboard, select the dashboard's name and click **Add Charts**. The available charts that can be added to the dashboard are shown. The Add Historical/Real-Time Charts menu (Figure 3), separates charts into categories like system-level or resource-level, allowing for easy searches of related metrics.
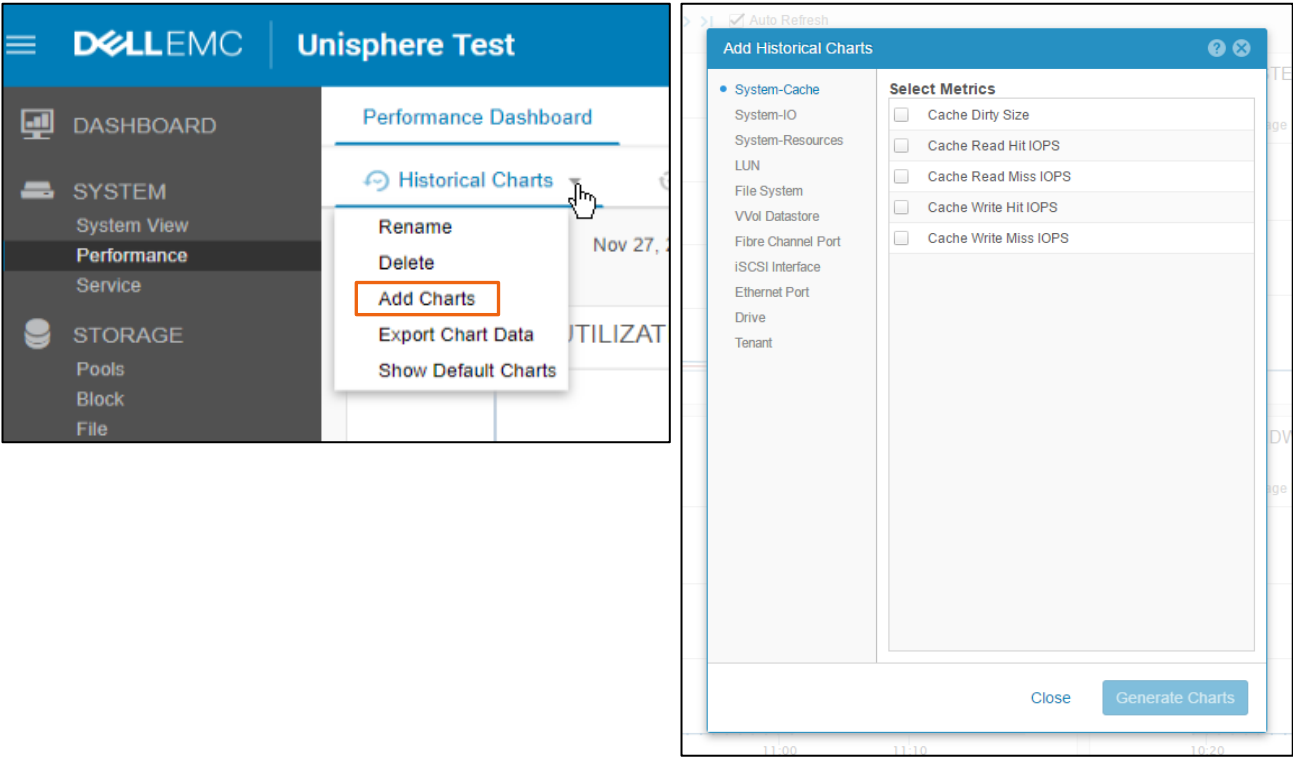

Figure 3   Dashboard actions and Add Charts menu

1.3.3   Viewing metrics

When viewing metrics on the Performance page of Unisphere, hover the mouse over individual charts to see specific graphed metric values along with associated timestamps. Hovering over one chart automatically shows metric values in all other visible charts on the page for the same timestamp as seen in Figure 4. This allows for fast comparison between metric charts when conducting troubleshooting steps.
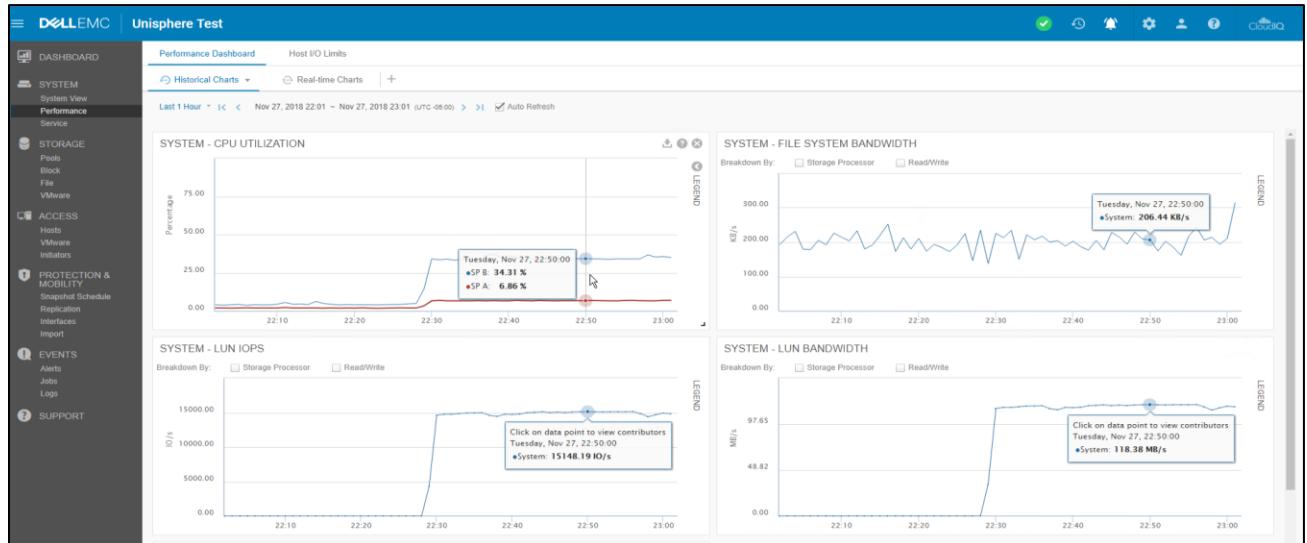

Figure 4   Metric charts (hover)

For more customized viewing, move charts to different parts of the dashboard. Hover the cursor over the top part of a chart (the cursor changes to a movement cursor as shown in Figure 5), drag to move the chart to a new location on the page.
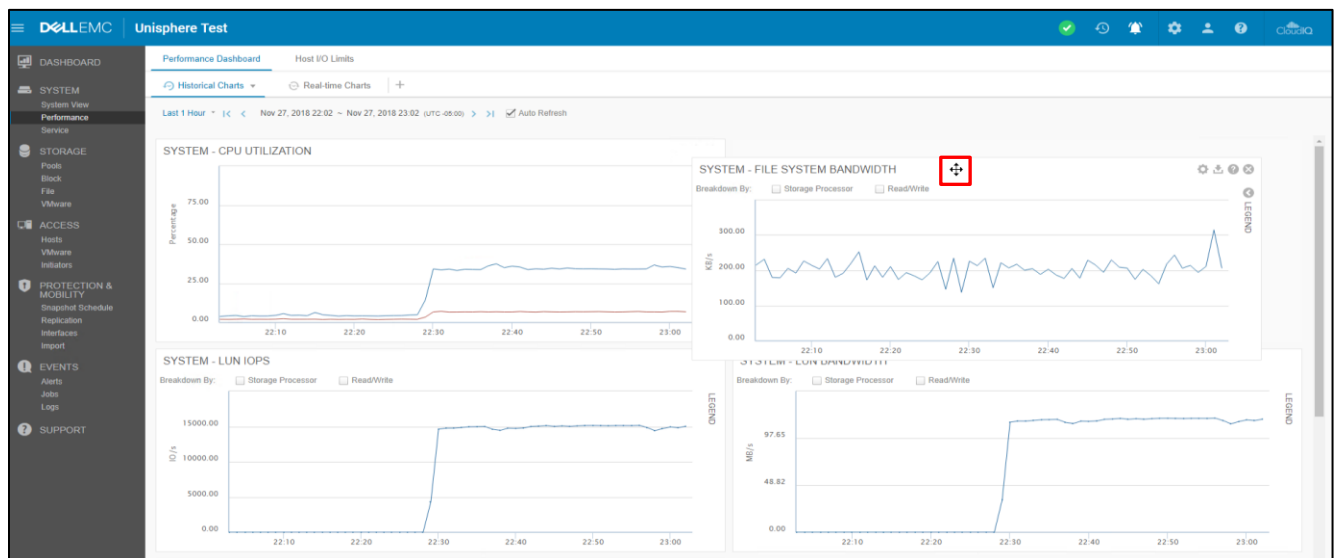

Figure 5   Relocating metric charts (cursor highlighted)

The Performance page also supports expanding metric charts for easier viewing. Hover over a chart and drag the bottom-right corner of the chart to the right of the page (see Figure 6). The chart must be on the left side of the page to be expanded to the right.
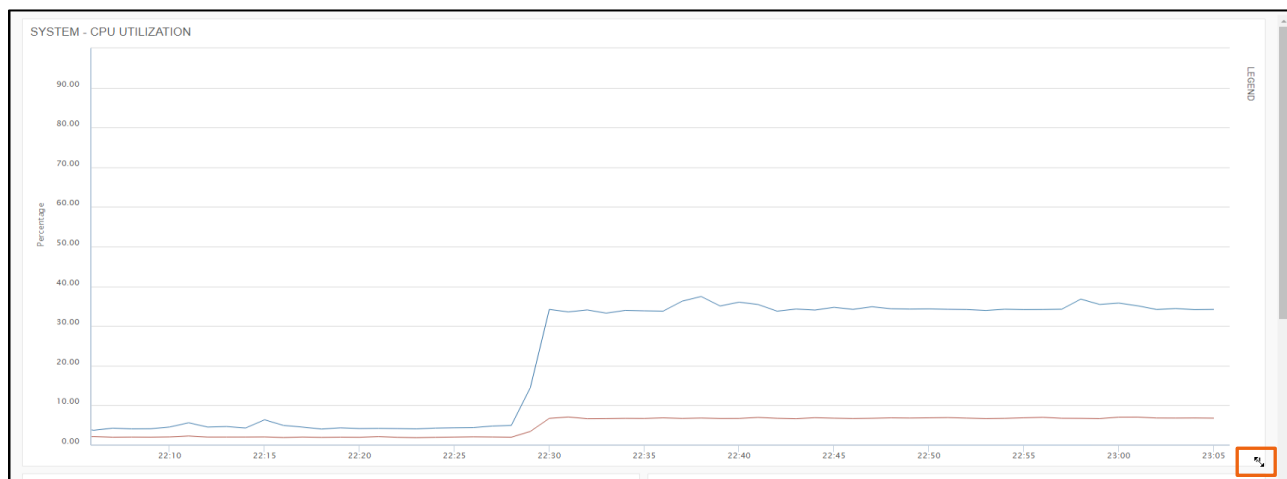

Figure 6   Expanding charts (chart expansion corner highlighted)

1.3.4   Viewing range and charts refresh

To change the viewing time range of the metric charts displayed on the dashboard, use either the default time ranges (shown in Table 2) or use a custom time range as shown in Figure 7. The different time ranges correlate to specific sampling intervals, as shown in Table 2.

Table 2   Time ranges and associated sampling intervals

Time range setting	Sampling interval
Last 1 Hour	1 minute
Last 4 Hours	1 minute
Last 12 Hours	5 minutes
Last 24 Hours	5 minutes
Last 7 Days	1 hour
Last 30 Days	4 hours
Last 90 Days	4 hours
Custom	Varies based on the length of the range. If the range is more than one week, the sampling interval is 4 hours.

The center of Figure 7 shows how the date and times for the start and end points of the viewing window correlate to the metric points shown in the charts. To view the latest metrics, select the **Auto Refresh** checkbox to the right of the time window. To change the viewing window itself, use the arrows to adjust the time or zoom into a specific range as shown in Figure 8.
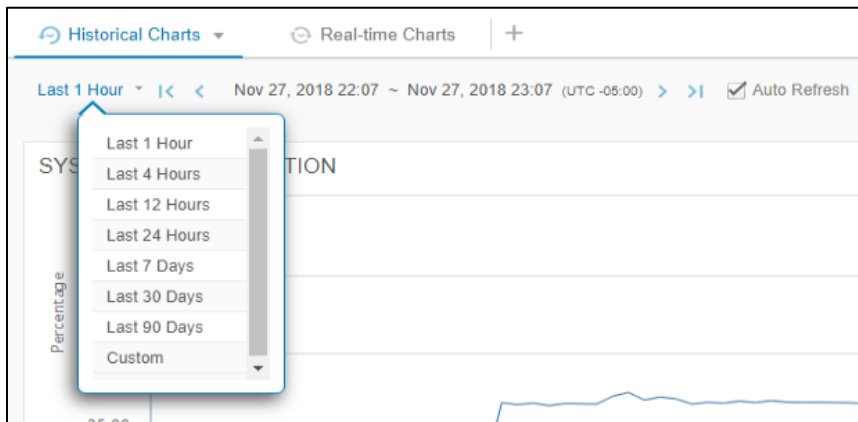

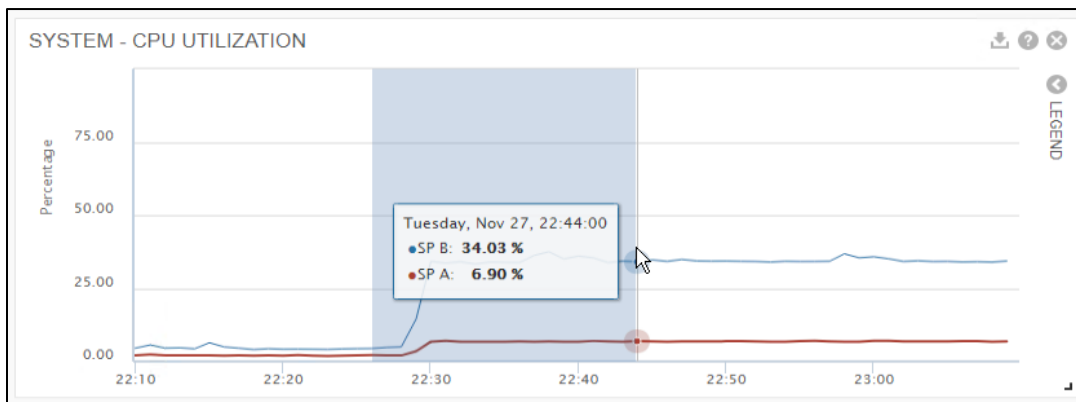Figure 7   Navigator bar, default time ranges, and Auto Refresh

Figure 8   Zooming the chart view

1.3.5   Breakdown categories and filter options

At the top of each metric chart there are different checkbox buttons (breakdown categories). When selected, the chart updates according to the breakdown category with separate lines designating each component of the breakdown. For example, Figure 9 shows the LUN IOPS metric chart with the **Storage Processor** breakdown category selected allowing for SP A, SP B, and average metrics to be graphed on separate lines. Click the **LEGEND** in each chart to see the labels for each graphed line.
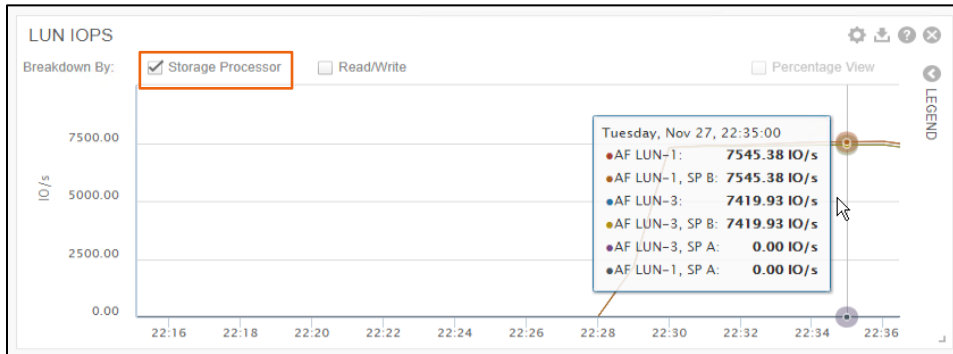

Figure 9   LUN IOPS metric chart (breakdown)

To hide certain lines from being graphed, add a filter by clicking the check box next to the line labels in the legend, as seen in Figure 10. This helps isolate metrics for further investigation.
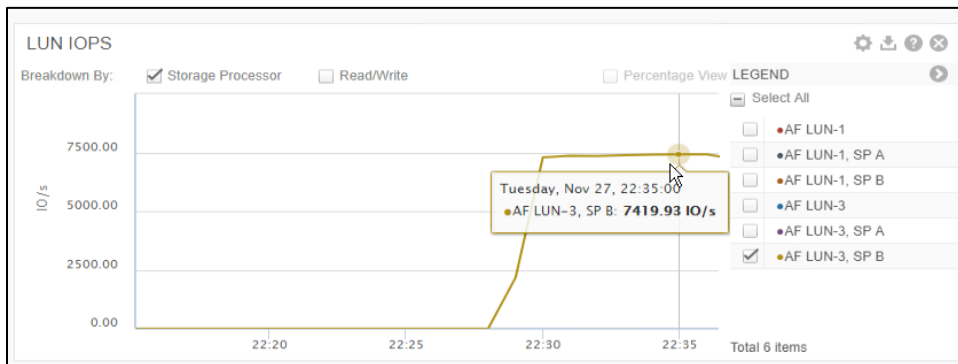

Figure 10   LUN IOPS metric chart (filtered)

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With the Unity OE 4.5 release, for object-level line charts such as those for LUNS, file systems, drives, and so forth, select **Percentage View** to view data points as percentage values instead of absolute values.
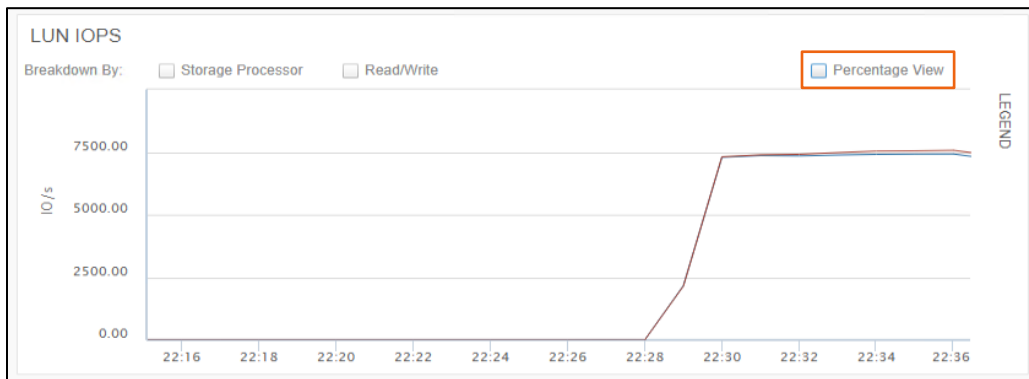

Figure 11   Percentage View option

The Percentage View breakdown shows each resource's contribution as a percentage of the total. This option is only available in Unisphere and is available for both historical and real-time charts. It is deselected by default and only available when all other breakdown options are deselected.
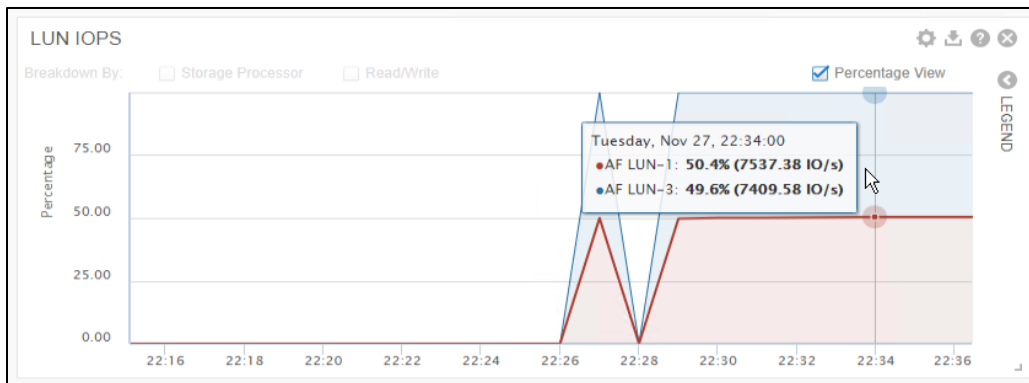

Figure 12   Percentage view example

1.3.6 Click data point to view contributors

To view more details, click a data point tooltip in a chart that has the message **Click on a data point to view contributors**. Click the data point with this message to open the **Top 20 Contributors** tooltip shown in Figure 13. In the tooltip, use the **Choose Group** drop-down menu to view the line chart for the option selected. The options listed in the drop-down menu vary depending on the **Breakdown By** field chosen. To compare the metrics, select the resources and click the **Generate Chart** button, which generates a chart with the metrics for the resources selected.
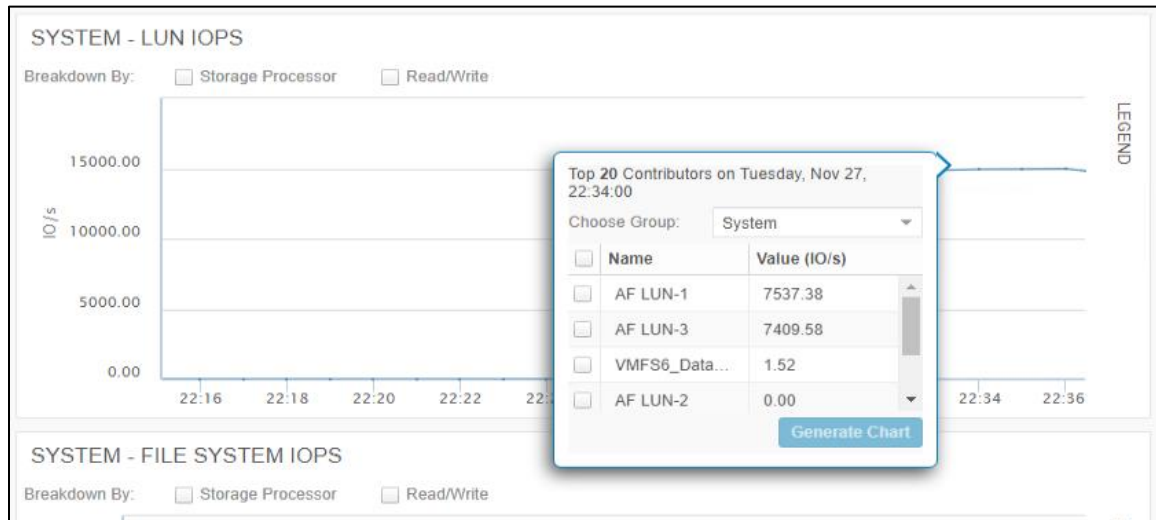
Figure 13   Top 20 contributors for a data point

1.3.7 Export option

To export metrics data into a comma separated value (CSV) format, hover over a metric chart and click the **Export** button as shown in Figure 14. This action downloads the metrics into a CSV file with data of the current view shown in the graph including any applied breakdown categories and filter options. Make sure to adjust the chart to show the desired information before clicking the **Export** button.

Figure 14   Export metrics button

With Dell EMC Unity OE version 4.2, the Historical Charts dashboards allow exporting data of all the displayed charts to a single CSV file. In the **Performance** page, to export all the data, select the dashboard's name and click **Export Chart Data,** as shown in Figure 15.

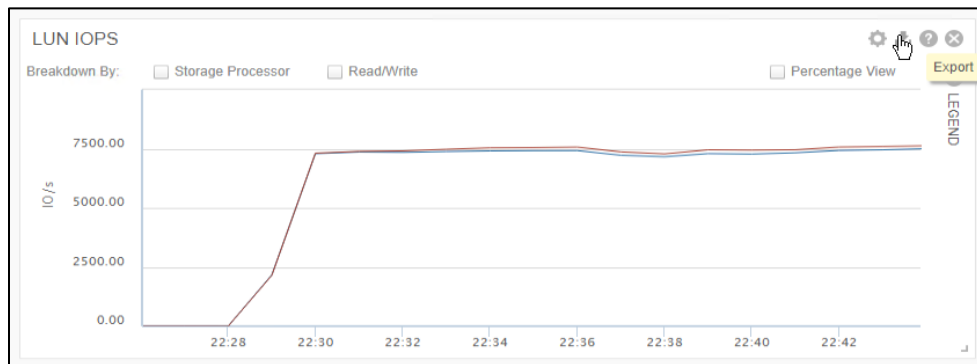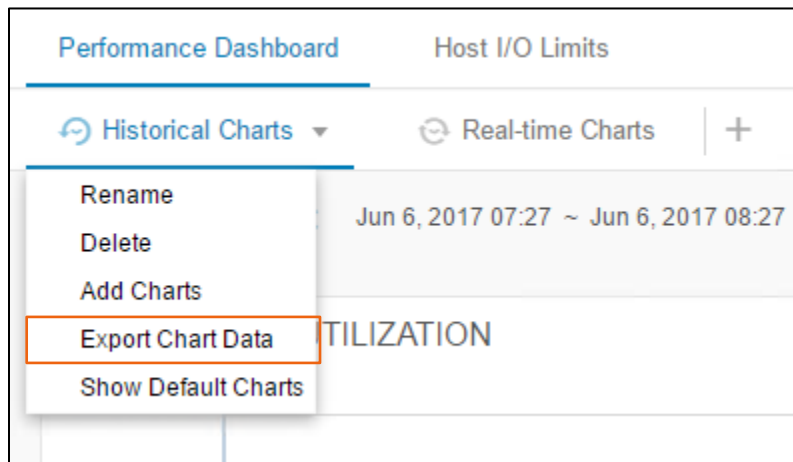Figure 15   Export chart data

1.4   Download performance archive files

Dell EMC Unity OE version 4.2 introduced an option to download performance archive files from Unisphere, UEMCLI, and REST API. Performance archive files are similar to performance historical metrics, except the archive collects raw data at a predefined interval (10 seconds), and the data are not averaged into larger intervals. The system generates a performance archive file for every hour and assures there are performance archives for at least the last 48 hours. Download and send performance archive files to Dell EMC Support to troubleshoot performance issues.

To download a performance archive file from Unisphere, navigate to the **Downloads** page shown in Figure 16. Individual archive files or all files within a specific time range are downloadable. The **Select specific archive files** option shown in Figure 17 allows selecting individual archive files from the list. With the **Select files within a specific time range** option (Figure 18), click the calendar icon to select a custom date and time range.

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To obtain a record of performance for an extended period of time, is recommended to download the performance archive files from the system for the desired period. For example, if one weeks' worth of data is needed, download the performance archive files for each day of the week.
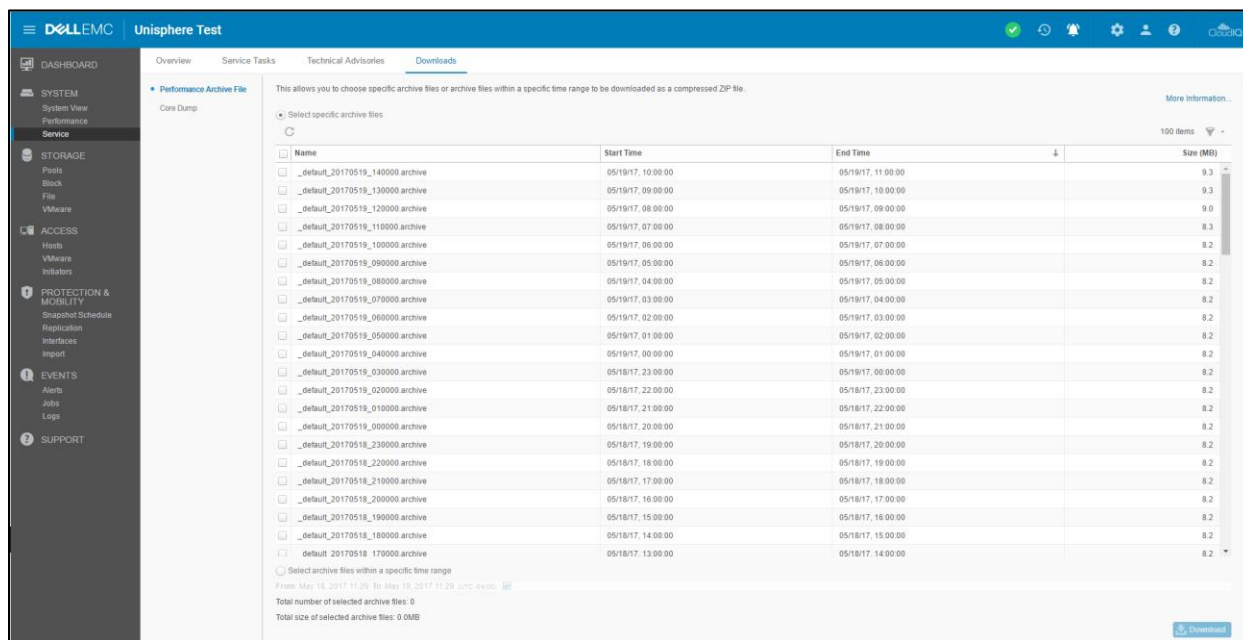

Figure 16   Service > Downloads > Performance Archive File page

The Size column for a Performance Archive File table gives the size of the archive file in the system. When clicking the **Download** button, the file(s) is (are) compressed into a zip file of smaller size.
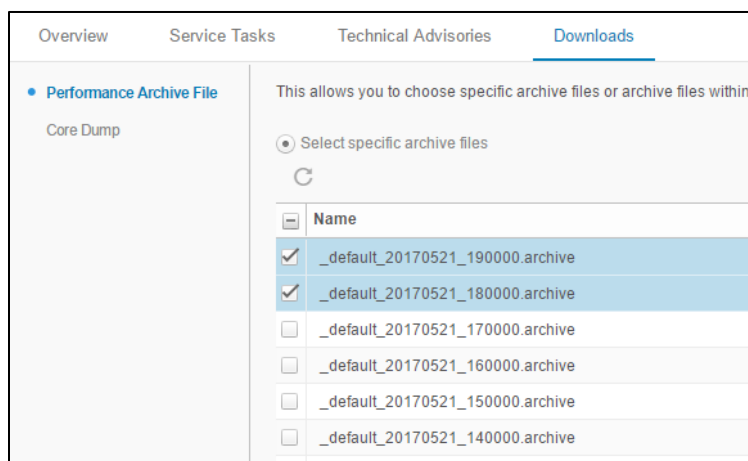

Figure 17   Selecting specific archive files

The **Total number of selected archive files** field states the number of files that are selected or are within the time range selected. The **Total size of selected archive files** give the size of the file(s) selected. Both fields update accordingly by selection.
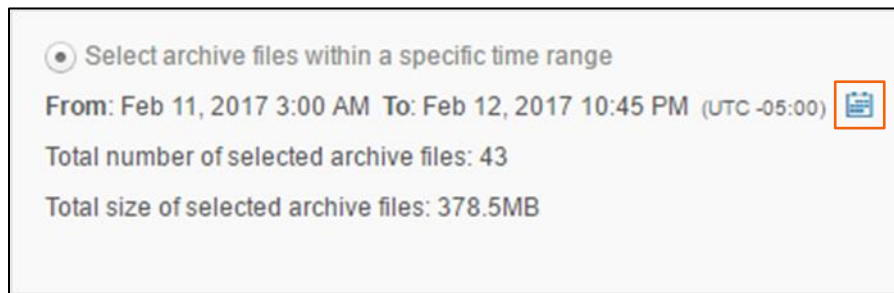

Figure 18   Selecting archive files within a specific time range

1.5 Unisphere CLI performance metrics

Unisphere CLI allows running commands to a Dell EMC Unity system through a command prompt on a several host types including Microsoft® Windows® and Unix/Linux® hosts. The Unisphere CLI is intended to be used by advanced users who would like to use command prompts to script complex or routine tasks. The same actions performed in the Unisphere GUI can also be completed through the Unisphere CLI. In terms of performance metrics, use the Unisphere CLI to enable or disable the metrics collection service, view available metrics paths, and view historical or real-time metric values. The metrics collection service is enabled by default.

For more information on using Unisphere CLI and its related syntax, see the *Dell EMC Unity Family Unisphere CLI User Guide* on Dell EMC Support.

1.5.1 Performance metrics service

Using the Unisphere CLI, enable or disable the metrics collection service on the Dell EMC Unity system by using the **/metrics/service** CLI command path. When viewing the current status of the metrics collection service, the system displays the current metrics data aging retention policy values as shown in Figure 19. Even if the metrics collection service is disabled, the 16 GB of reserved metrics space is still reserved by the system.
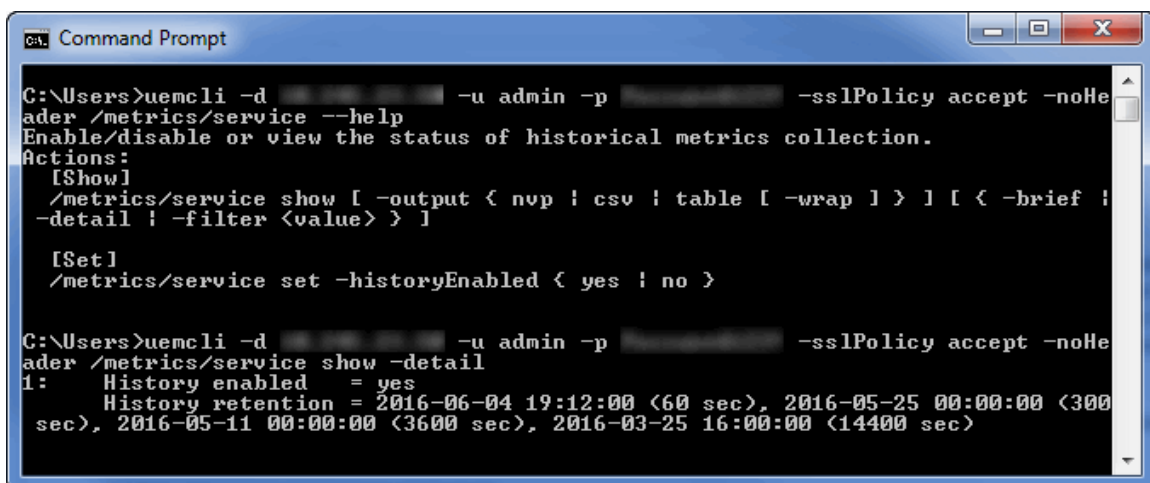

Figure 19   Unisphere CLI metrics service command

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1.5.2   Available performance metrics

The Unisphere CLI allows using the **/metrics/metric** command path to see all available metrics paths (both historical and real-time). A metrics path must be specified when viewing metrics using Unisphere CLI. An example of the output running the **/metrics/metric** command is shown in Figure 20.

Figure 20   Unisphere CLI available metrics paths command

1.5.3   Historical performance metrics

Unisphere CLI allows viewing historical performance metrics of the Dell EMC Unity system in predefined intervals. To view all available historical metrics paths, use the same **/metrics/metric** command path as previous, but with the added **–availability historical** option as shown in Figure 21.

Figure 21   Unisphere CLI available historical metrics available paths command

To use a specific historical metrics path to view corresponding metric values, use the **/metrics/value/hist** command path in the Unisphere CLI. This command requires specifying the time interval of the data to be viewed by using the **–interval** option. The predefined interval values are 60 (1 minute), 300 (5 minutes), 3600

(1 hour), and 14400 seconds (4 hours). To specify the start and end times of the desired metrics time period, add the **–from** and **–to** options (see an example in Figure 22).

Figure 22   Unisphere CLI Historical Metrics

1.5.4   Real-time performance metrics

All available metrics in the **/metrics/metric** path command can be used to view real-time metrics on Dell EMC Unity systems. Real-time metrics can be viewed using the **/metrics/value/rt** command and using the **–path** option to specify a specific metric path to view metric values for. This also requires specifying the interval using the **–interval** option and providing an acceptable value (5 to 300 seconds). See Figure 23 for an example.

Figure 23   Unisphere CLI real-time metrics

1.6 REST API performance metrics

The REST API can be used to collect performance metrics from Dell EMC Unity systems. To view all available performance metrics, run the **GET /api/types/metric/instances** REST API command. An example of the command being run is shown in Figure 24. Additional information can be added to the query to find out if a metric path is available for historical or real-time metrics by adding **isHistoricalAvailable** or **isRealTimeAvailable** as additional fields to display.
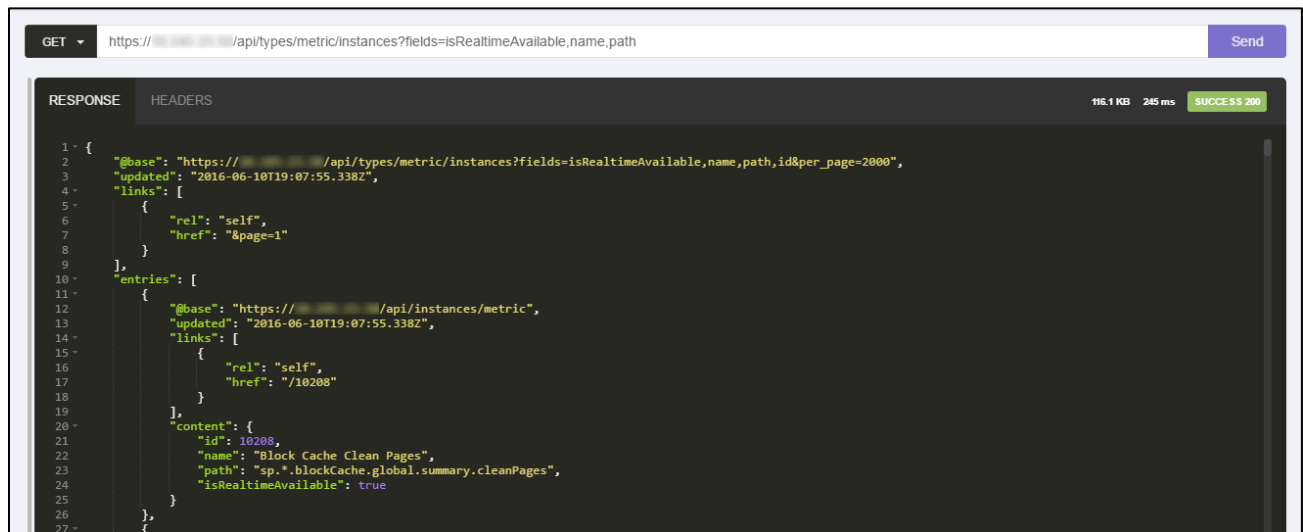
Figure 24   Available Metrics Paths through REST API

Once a specific path is found, use the name of the path to query metrics from REST API by using the **GET /api/types/metricValue/instances** for historical metrics or the **POST /api/types/metricRealTimeQuery/instances** command for real-time metrics. An example of a historical metric query is shown in Figure 25 with the metric path of **sp.*.cpu.summary.utilization.**
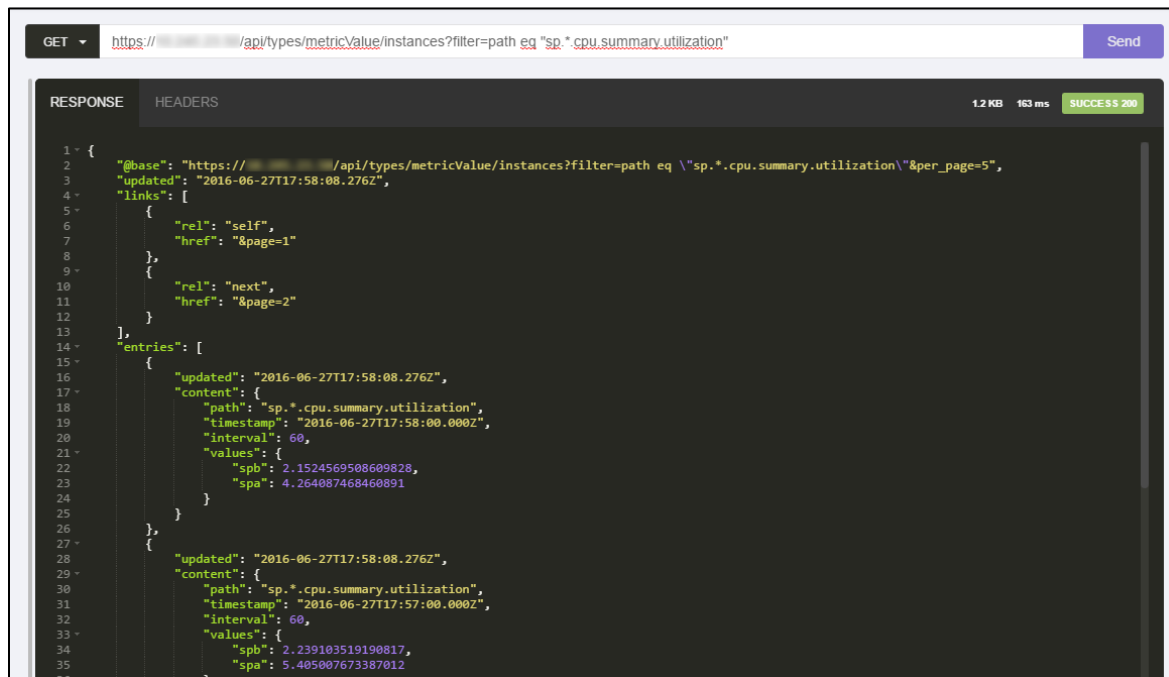
Figure 25   Historical metrics query

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For real-time metrics, a query first needs to be initiated as seen in Figure 26 with the path **sp.*.cpu.summary.busyTicks**. The system replies with a query ID which can be used to gather results with the **GET /api/types/metricQueryResult/instances?queryId EQ <#>** command path as seen in Figure 27.
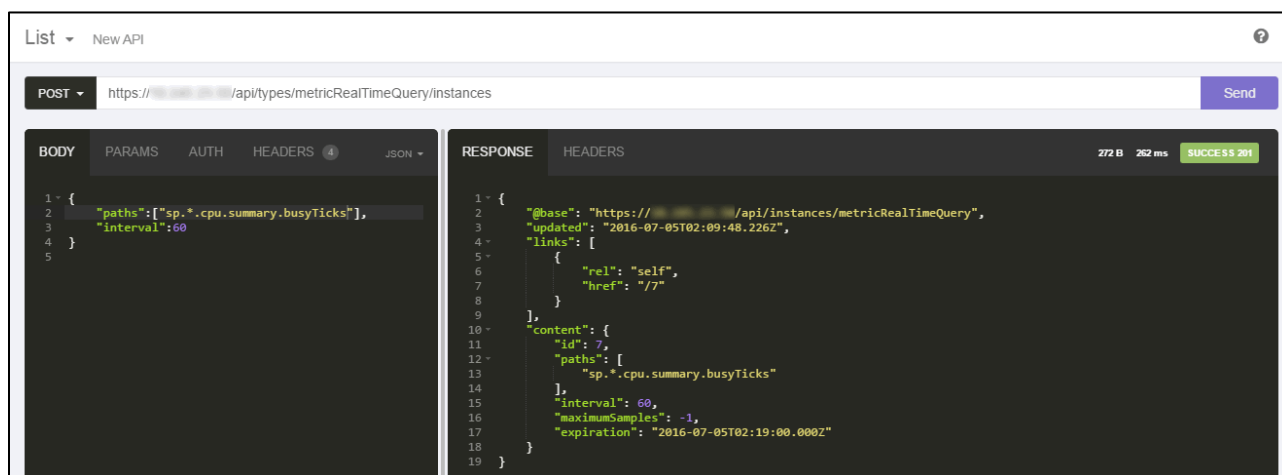
Figure 26   Real-time metrics query
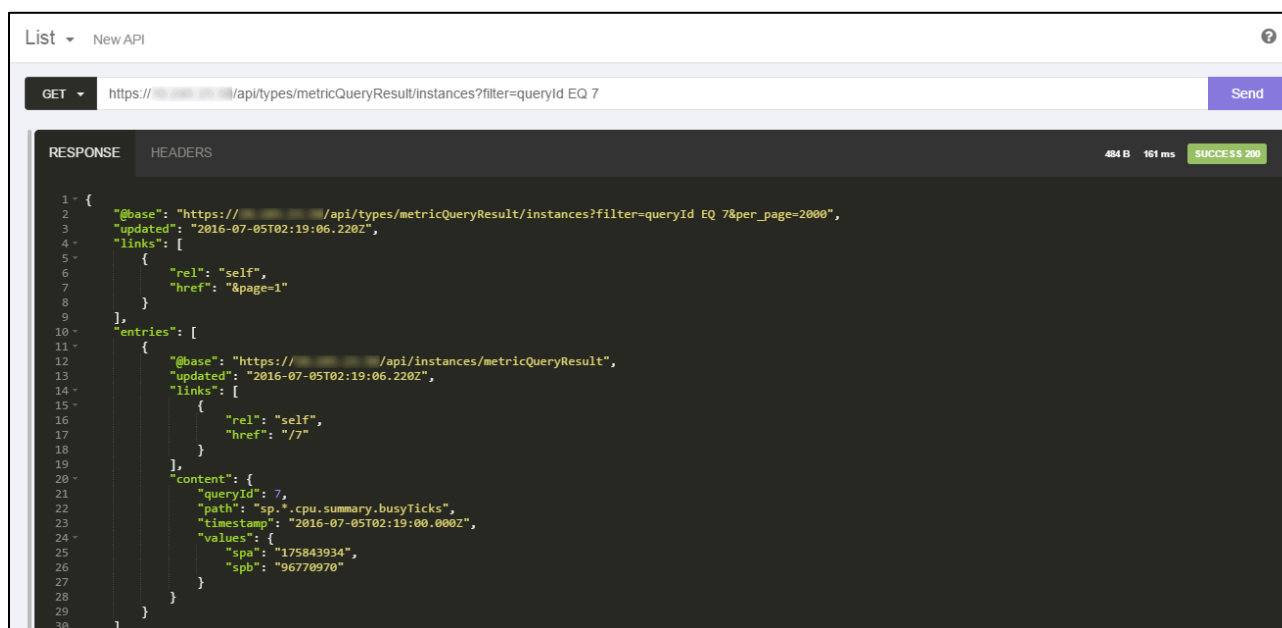
Figure 27   Metric query result (real-time metrics)

For additional information on using REST API and associated syntax, see the *Dell EMC Unity Family Unisphere Management REST API Reference Guide* and the *Dell EMC Unity Family Unisphere Management REST API Programmer's Guide* on Dell EMC Support.

2 Troubleshooting techniques

2.1 Performance categories

When viewing historical metrics on Dell EMC Unity systems, there are several performance metrics available that are separated into several high-level performance categories. Table 3 explains the meaning of each category to clarify which charts to view when troubleshooting system(s).

Table 3   Performance categories (Unisphere GUI)

Performance category	Description
System-Cache	Provides a high-level view of the cache friendliness of the workload.
System-IO	Provides a system-level aggregation of front-end (client-to-system) activity.
System-Resources	Provides a system-level aggregation of hardware activity (CPU, drives, ports).
LUN	Provides a detailed breakdown of client block activity on a per-LUN basis.
File System	Provides a detailed breakdown of client file activity on a per-FS basis.
vVol Datastore	Provides a detailed breakdown of VMware vSphere® Virtual Volumes™ (vVols) datastore activity on a per-vVol basis.
Fibre Channel Port	Provides a detailed breakdown of client block activity on a per-port basis (for FC).
iSCSI Interface	Provides a detailed breakdown of client block activity on a per-port basis (for iSCSI).
Ethernet Port	Provides a detailed breakdown of client block/file activity on a per-port basis.
Drive	Provides a detailed breakdown of drive activity on a per-drive basis.
Tenant	Provides a detailed breakdown of tenant activity on a per-tenant basis.

2.2 Triage general workflow

Use the available performance metrics on Dell EMC Unity systems to complete performance troubleshooting on the system, determining potential bottlenecks or issues within the storage environment. When conducting performance troubleshooting, it is useful to know which metrics charts provide the necessary information to help drill down to the root cause of the issue. For a broad example, assume that an application running on a Dell EMC Unity storage system is reported to be experiencing slow response times, and client, server, and network issues have been determined to not be the cause of the issue. In this case, initiate performance troubleshooting in the storage environment to resolve the slow response times.

The following is a general workflow for performance troubleshooting on Dell EMC Unity systems.

1. Starting at a system level, investigate aggregated system statistics.

   a. Look at System-IO metric charts and find where the bulk of client workload is originating, such as the LUN or FS (SMB, NFS).
   b. Look at System-Resources metric charts and determine if hardware usage aligns with incoming client workload, and also see if CPU Utilization may be an issue.

2. Drill-down to potential hardware bottlenecks.

   a. If affected workload is from a LUN (through FC), go to the Fibre Channel Port metric charts to see if the load is distributed evenly among configured ports or if any ports are too heavily utilized.
   b. If affected workload is from a LUN (through iSCSI), go to the iSCSI Interface metric charts to see if the load is distributed evenly among configured ports or if any ports are too heavily utilized.
   c. If affected workload is from a file system, go to the Ethernet Port metric charts to see if the load is distributed evenly among configured ports or if any ports are too heavily utilized.

3. If load on ports is determined not be the issue, investigate physical drives.

   a. Track the busiest system resources (LUN, FS, datastore) back to the physical drives which comprise the corresponding storage pool.

      i. Go to Drive metric charts and select the appropriate drives to see if they are causing the bottleneck. The drives can be sorted by Pool as shown in the following screen.
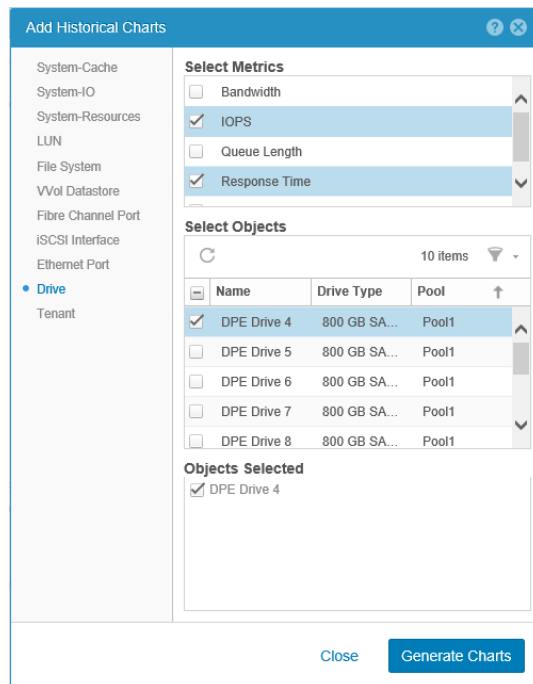
The above steps are complemented by using the *Dell EMC Unity Best Practices Guide* when configuring system settings and system resources, including recommendations on system utilization and workloads. The guide also includes recommended maximum limits for hardware resources. Find the *Dell EMC Unity: Best Practices Guide* on Dell EMC Support.

3 Conclusion

By leveraging performance metrics functionality on Dell EMC Unity systems, administrators have the ability to view, monitor, and analyze metrics data with the Unisphere graphical interface, the Unisphere CLI, or the REST API. Administrators with different backgrounds and knowledge can gather information from Dell EMC Unity storage systems in the method that is most familiar to them. Whether users are diagnosing current issues or planning for future initiatives, the available metrics functionality provides administrators the ability to make well-informed decisions for their storage environments.

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A   Unisphere performance metrics

The following tables outline the various performance metrics available in Unisphere. The tables are organized by breakdown category, and include each performance metric and a brief description. For more information on each performance metric, refer to Unisphere Online Help on the Dell EMC Unity system or on Dell EMC Support.

A.1   Historical performance metrics

Table 4   System-cache performance metrics

Metric Name	Description	Additional breakdown categories
Cache Dirty Size	Total amount of data in the write cache, in MB, that has not yet been flushed out to drives.	Storage Processor
Cache Read Hit IOPS1	Total number of read I/O requests, in I/O per second that do not demand a new allocation of cache memory.	Storage Processor
Cache Read Miss IOPS1	Total number of read I/O requests, in I/O per second, passing through, that is, not served by cache.	Storage Processor
Cache Write Hit IOPS1	Total number of write I/O requests, in I/O per second that do not demand a new allocation of cache memory.	Storage Processor
Cache Write Miss IOPS1	Total number of write I/O requests, in I/O per second, passing through, that is, not served by cache.	Storage Processor
FAST Cache Dirty Ratio	Ratio of dirty pages to total pages in the FAST Cache, expressed as a percent.	Storage Processor

[1] If FAST Cache is configured, this metric includes I/O requests passing through the FAST Cache.

Table 5   System-IO performance metrics

Metric name	Description	Additional breakdown categories
CIFS Bandwidth	Total amount of CIFS (SMB) I/O requests, in KB/s, across all ports in the storage system.	Storage Processor Read/Write
CIFS I/O Size	Average size of CIFS (SMB) I/O requests, in KB, across all ports in the storage system. Calculated as a weighted average, which gives more weight to the SP with the highest number of CIFS I/O requests.	Storage Processor Read/Write
CIFS IOPS	Total number of CIFS (SMB) I/O requests, in I/O per second, across all ports in the storage system.	Storage Processor Read/Write

Metric name	Description	Additional breakdown categories
CIFS Response Time	Average time spent completing CIFS I/O requests, in microseconds, across all file systems in the storage system. Calculated as a weighted average, which gives more weight to the file systems with the highest number of I/O requests.	Storage Processor Read/Write
Client File System Bandwidth	Total amount of file system client I/O requests, in KB/s, across all file systems in the storage system.	Storage Processor Read/Write
Client File System I/O Size	Average size of file system client I/O requests, in KB, across all file systems in the storage system.	Storage Processor Read/Write
Client File System IOPS	Total number of file system client I/O requests, in I/O per second, across all file systems in the storage system.	Storage Processor Read/Write
Client File System Response Time	Average time spent completing file system client I/O requests, in microseconds, across file systems in the storage system.	Storage Processor Read/Write
File System Bandwidth	Total amount of file system I/O requests, in KB/s, across all file systems in the storage system.	Storage Processor Read/Write
File System I/O Size	Average size of file system I/O requests, in KB, across all file systems in the storage system. Calculated as a weighted average, which gives more weight to the file systems with the highest number of I/O requests.	Storage Processor Read/Write
File System IOPS	Total number of file system I/O requests, in I/O per second, across all file systems in the storage system.	Storage Processor Read/Write
LUN Bandwidth	Total amount of LUN I/O requests, in KB/s, across all LUNs in the storage system.	Storage Processor Read/Write
LUN I/O Size	Average size of LUN I/O requests, in KB, across all LUNs in the storage system. Calculated as a weighted average, which gives more weight to the LUNs with the highest number of I/O requests.	Storage Processor Read/Write
LUN IOPS	Total amount of LUN I/O requests, in I/O per second, across all LUNs in the storage system.	Storage Processor Read/Write
LUN Queue Length	Average number of LUN I/O requests in the system queue, in counts per second, across all LUNs in the storage system. Calculated as a weighted average, which gives more weight to the LUNs with the highest number of I/O requests.	Storage Processor Read/Write

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Metric name	Description	Additional breakdown categories
LUN Response Time	Average time spent completing LUN I/O requests, in microseconds, across all LUNs in the storage system. Calculated as a weighted average, which gives more weight to the LUNs with the highest number of I/O requests.	Storage Processor
NFS Bandwidth	Total amount of NFS I/O requests, in KB/s, across all ports in the storage system.	Storage Processor Read/Write
NFS I/O Size	Average size of NFS I/O requests, in KB, across all ports in the storage system. Calculated as a weighted average, which gives more weight to the SP with the highest number of NFS I/O requests.	Storage Processor Read/Write
NFS IOPS	Total number of NFS I/O requests, in I/O per second, across all ports in the storage system.	Storage Processor Read/Write
NFS Response Time	Average time spent completing NFS I/O requests, in microseconds, across all file systems in the storage system. Calculated as a weighted average, which gives more weight to the LUNs with the highest number of I/O requests.	Storage Processor Read/Write
vVol Datastore Bandwidth	Total amount of vVol I/O requests, in KB/s, across all vVols in the storage system.	Storage Processor Read/Write
vVol Datastore IOPS	Total number of vVol I/O requests, in I/O per second, across all vVols in the storage system.	Storage Processor Read/Write
vVol Datastore Response Time	Average time spent completing vVol I/O requests, in microseconds, across all vVols in the storage system. Calculated as a weighted average, which gives more weight to the vVols with the highest number of I/O requests.	Storage Processor

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Table 6   System resources performance metrics

Metric name	Description	Additional breakdown categories
CPU Utilization	Total amount of processing cycles, as a percentage, across all cores in the storage system SPs.	Storage Processor
Drive Bandwidth	Total amount of drive I/O requests, in KB/s, across all drives in the storage system used in provisioned storage.	Storage Processor Read/Write
Drive IOPS	Total number of drive I/O requests, in I/O per second, across all drives in the storage system used in provisioned storage.	Storage Processor Read/Write
Ethernet Bandwidth	Total amount of Ethernet I/O requests, in KB/s, across all non-management Ethernet ports in the storage system.	Storage Processor Read/Write
Ethernet Packets	Total amount of Ethernet I/O requests, in I/O per second, across all non-management Ethernet ports in the storage system.	Storage Processor Read/Write
Fibre Channel Bandwidth	Total amount of Fibre Channel I/O requests, in KB/s, across all ports in the storage system.	Storage Processor Read/Write
Fibre Channel IOPS	Total number of Fibre Channel I/O requests, in I/O per second, across all ports in the storage system.	Storage Processor Read/Write
iSCSI Bandwidth	Total amount of iSCSI I/O requests, in KB/s, across all ports in the storage system.	Storage Processor Read/Write
iSCSI IOPS	Total number of iSCSI I/O requests, in I/O per second, across all ports in the storage system.	Storage Processor Read/Write

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Table 7   LUN performance metrics

Metric name	Description	Additional breakdown categories
Bandwidth	Total amount of LUN I/O requests, in KB/s, for the selected LUN or LUNs.	Storage Processor Read/Write
I/O Size	Average size of LUN I/O requests, in KB/s, for the selected LUN or LUNs.	Storage Processor Read/Write
IOPS	Total amount of LUN I/O requests, in I/O per second, for the selected LUN or LUNs.	Storage Processor Read/Write
Queue Length	Average number of LUN I/O requests in the system queue, in counts per second, for the selected LUN or LUNs.	Storage Processor Read/Write
Response Time	Average time spent completing LUN I/O requests, in microseconds, for the selected LUNs in the storage system. Calculated as a weighted average, which gives more weight to the LUNs with the highest number of I/O requests.	Storage Processor

Table 8   File system performance metrics

Metric name	Description	Additional breakdown categories
Bandwidth	Total amount of file system I/O requests, in KB/s, for the selected file system or file systems.	Storage Processor Read/Write
Client Bandwidth	Total amount of file system client I/O requests, in KB/s, for the selected file systems.	Read/Write
Client I/O Size	Average size of file system client I/O requests, in KB, for the selected file systems.	Read/Write
Client IOPS	Total number of file system client I/O requests, in I/O per second, for the selected file systems.	Read/Write
Client Response Time	Average time spent completing file system client I/O requests, in microseconds, for the selected file systems.	Read/Write
I/O Size	Average size of file system I/O requests, in KB, for the selected file systems or file systems. Calculated as a weighted average, which gives more weight to the file systems with the highest number of I/O requests.	Storage Processor Read/Write
IOPS	Total number of file system I/O requests, in I/O per second, for the selected file system or file systems.	Storage Processor Read/Write

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Table 9   vVol datastore performance metrics

Metric name	Description	Additional breakdown categories
Bandwidth	Total amount of vVol I/O requests, in KB/s, for the selected vVols.	Storage Processor Read/Write
IOPS	Total amount of vVol I/O requests, in I/O per second, for the selected vVols.	Storage Processor Read/Write
Response Time	Average time spent completing vVol I/O requests, in microseconds, for the selected vVols in the storage system. Calculated as a weighted average, which gives more weight to the vVols with the highest number of I/O requests.	Storage Processor

Table 10   Fibre Channel port performance metrics

Metric name	Description	Additional breakdown categories
Bandwidth	Total amount of Fibre Channel I/O requests, in KB/s, for the selected Storage Processors and associated Fibre Channel ports.	Read/Write
Replication Bandwidth	Total number of Fibre Channel I/O replication requests, in KB/s per second, for the selected Storage Processors and associated Fibre Channel ports.	Read/Write
IOPS	Total number of Fibre Channel I/O requests, in I/O per second, for the selected Storage Processors and associated Fibre Channel ports.	Read/Write
Replication IOPS	Total number of Fibre Channel I/O replication requests, in I/O per second, for the selected Storage Processors and associated Fibre Channel ports.	Read/Write
Total Link Errors	Total number of link errors, in I/O per second, for the selected Storage Processors and associated Fibre Channel (FC) ports.	

Table 11   iSCSI interface performance metrics

Metric name	Description	Additional breakdown categories
Bandwidth	Total amount of iSCSI I/O requests, in KB/s, for the selected iSCSI interfaces.	Read/Write
IOPS	Total number of iSCSI I/O requests, in I/O per second, for the selected iSCSI interfaces.	Read/Write

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Table 12   Ethernet port performance metrics

Metric name	Description	Additional breakdown categories
Bandwidth	Total amount of Ethernet I/O requests, in KB/s, for the selected Storage Processors and associated Ethernet ports.	Read/Write
Packets	Total amount of Ethernet I/O requests, in I/O per second, for the selected Storage Processors and associated Ethernet ports.	Read/Write

Table 13   Drive performance metrics

Metric name	Description	Additional breakdown categories
Bandwidth	Total amount of drive I/O requests, in KB/s, for the selected drives used in provisioned storage.	Storage Processor Read/Write
IOPS	Total number of drive I/O requests, in I/O per second, for the selected drives used in provisioned storage.	Storage Processor Read/Write
Queue Length	Average number of drive I/O requests in the system queue, in counts per second, for the selected drives used in provisioned storage. Calculated as a weighted average, which gives more weight to the drives with the highest number of I/O requests.	Storage Processor
Response Time	Average time spent completing drive I/O requests, in microseconds, for the selected drives used in provisioned storage, including time spent in the queue. Calculated as a weighted average, which gives more weight to the drives with the highest number of I/O requests.	Storage Processor
Service Time	Average time spent completing drive I/O requests, in microseconds, for the selected drives used in provisioned storage, not including time spent in the queue. Calculated as a weighted average, which gives more weight to the drives with the highest number of I/O requests.	Storage Processor

Table 14   Tenant performance metrics

Metric name	Description	Additional breakdown categories
Bandwidth	Total amount of I/O requests, in KB/s, for the selected tenant.	Read/Write

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A.2 Real-time performance metrics

Table 15   System-cache performance metrics

Metric name	Description
Cache Dirty Size	Amount of data in the write cache, in MB, that has not yet been flushed out to disks.
Cache Read Hit IOPS	Read I/O served by Cache.
Cache Read Miss IOPS	Read I/O not served by Cache.
Cache Write Hit IOPS	Write I/O served by Cache, in I/O per second, that does not demand a new allocation of cache memory.
Cache Write Miss IOPS	Write I/O served by Cache, in I/O per second, that demands a new allocation of cache memory.

Table 16   System-resources performance metrics

Metric name	Description
CPU Utilization	Total amount of processing cycles, as a percentage, across all cores in the storage system SPs.

Table 17   System-I/O performance metrics

Metric name	Description
CIFS Bandwidth Read, Write, or Total	Amount of SMB read, write, or total I/O requests, in KB/s, for all LUNs in the storage system.
CIFS I/O Size Read, Write, or Total	Average size of SMB read or write I/O requests, in microseconds, for all LUNs in the storage system.
CIFS IOPS Read Write or Total	Number of SMB read, write, or total I/O requests, in I/O per second, for the selected LUNs.
CIFS Response Time Read or Write	Average time spent completing CIFS (SMB) read or write I/O requests, in microseconds, for all file systems in the storage system.
CIFS Response Time (Total)	Average time spent completing all CIFS (SMB) I/O requests, in microseconds, for all file systems in the storage system.
NFS Response Time Read or Write	Average time spent completing NFS read or write I/O requests, in microseconds, for all file systems in the storage system.
NFS Response Time (Total)	Average time spent completing all NFS I/O requests, in microseconds, for all file systems in the storage system.

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Table 18   LUN performance metrics

Metric name	Description
Bandwidth Read, Write, or Total	Amount of LUN read, write, or total I/O requests, in KB/s, for the selected LUNs.
I/O Size Read or Write	Average size of LUN read or write I/O requests, in KB, across all LUNs in the storage system. Calculated as a weighted average, which gives more weight to the LUNs with the highest number of I/O requests.
IOPS Read, Write, or Total	Number of LUN read, write, or total I/O requests, in I/O per second, for the selected LUNs.
Queue Length	Average number of LUN I/O requests in the system queue, in counts per second, for the selected LUNs.
Response Time	Average time spent completing LUN I/O requests, in microseconds, for the selected LUNs in the storage system. Calculated as a weighted average, which gives more weight to the LUNs with the highest number of I/O requests.

Table 19   File system performance metrics

Metric name	Description
Bandwidth Read or Write	Amount of file system read or write I/O requests, in KB/s, for the selected file systems.
I/O Size Read or Write	Average size of file system read or write I/O requests, in KB, across all file systems in the storage system. Calculated as a weighted average, which gives more weight to the file systems with the highest number of I/O requests.
IOPS Read or Write	Number of file system read or write I/O requests, in I/O per second, for the selected file systems.

Table 20   Fibre Channel port performance metrics

Metric name	Description
Bandwidth Read or Write	Amount of Fibre Channel read or write I/O requests, in KB/s, for the selected Storage Processors and associated Fibre Channel ports.
Requests/Second Read or Write	Number of Fibre Channel read or write I/O requests, in I/O per second, for the selected Storage Processors and associated Fibre Channel ports.

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Table 21   iSCSI interface performance metrics

Metric name	Description
Bandwidth Read or Write	Amount of iSCSI read or write I/O requests, in KB/s, for the selected iSCSI interfaces.
Requests/Second Read or Write	Number of iSCSI read or write I/O requests, in I/O per second, for the selected iSCSI interfaces.

Table 22   Ethernet port performance metrics

Metric name	Description
Bandwidth Read or Write	Amount of iSCSI read or write I/O requests, in KB/s, for the selected iSCSI interfaces.
Packets Read or Write	Number of Ethernet read or write packets per second, for the selected Storage Processors and associated Ethernet ports.

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Table 23   Drive performance metrics

Metric name	Description
Bandwidth Read or Write	Amount of drive read or write I/O requests, in KB/s, for the selected drives used in provisioned storage.
IOPS Read, Write, or Total	Number of drive read, write, or total I/O requests, in I/O per second, for the selected drives used in provisioned storage.
Queue Length	Average number of drive I/O requests in the system queue, in counts per second, for the selected drives used in provisioned storage. Calculated as a weighted average, which gives more weight to the drives with the highest number of I/O requests.
Response Time	Average time spent completing drive I/O requests, in microseconds, for the selected drives used in provisioned storage, including time spent in the queue. Calculated as a weighted average, which gives more weight to the drives with the highest number of I/O requests.
Service Time	Average time spent completing drive I/O requests, in microseconds, for the selected drives used in provisioned storage, not including time spent in the queue. Calculated as a weighted average, which gives more weight to the drives with the highest number of I/O requests.

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Table 24   Tenant performance metrics

Metric name	Description
Bandwidth Read or Write	Amount of read or write I/O requests, in KB/s, for the selected tenants in the storage system.

B   Technical support and resources

Dell.com/support is focused on meeting customer needs with proven services and support.

Storage technical documents and videos provide expertise that helps to ensure customer success on Dell EMC storage platforms.

B.1   Related resources

- CLI Guide
- Unisphere Command Line Interface User Guide
- REST API Guides
- Unisphere Management REST API Programmer's Guide
- Unisphere Management REST API Reference Guide
- Best Practices Guide
- Dell EMC Unity: Best Practices Guide
- Additional Documentation
- Dell EMC Online Support
- Dell EMC Unity Info Hub (http://bit.ly/unityinfohub)