Dell EMC Unity™ Family

Version 4.5

Monitoring System Performance

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REV 04

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Additional resources

As part of an improvement effort, revisions of the software and hardware are periodically released. Therefore, some functions described in this document might not be supported by all versions of the software or hardware currently in use. The product release notes provide the most up-to-date information on product features. Contact your technical support professional if a product does not function properly or does not function as described in this document.

Where to get help

Support, product, and licensing information can be obtained as follows:

Product information

For product and feature documentation or release notes, go to Unity Technical Documentation at: www.emc.com/en-us/documentation/unity-family.htm.

Troubleshooting

For information about products, software updates, licensing, and service, go to Online Support (registration required) at: https://Support.EMC.com. After logging in, locate the appropriate **Support by Product** page.

Technical support

For technical support and service requests, go to Online Support at: https://Support.EMC.com. After logging in, locate **Create a service request**. To open a service request, you must have a valid support agreement. Contact your Sales Representative for details about obtaining a valid support agreement or to answer any questions about your account.

Special notice conventions used in this document

⚠ DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

⚠WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE

Addresses practices not related to personal injury.

Note

Presents information that is important, but not hazard-related.

Additional resources

CHAPTER 1

About performance metrics

This chapter addresses the following topics:

Historical and real-time performance metrics

Storage system metrics gather information about system performance and storage usage, and collect that information for user review. Analyzing the system metrics can help predict the future growth of the system.

Historical and real-time metrics values are available in predefined intervals.

You can manage both historical and real-time performance metrics using the Unisphere System Performance page and the CLI.

Aging policy for historical performance metrics

The system governs the aging of collected historical metrics data according to the following goals:

- The total consumed space for storing metrics should not exceed 70% of the available metrics space (which is 16 G).

- Metrics data retention is based on the sampling interval:

Table 1 Sampling intervals

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

If the metrics retention policy is violated due to lack of space, the system decreases the retention period for the oldest metrics, while attempting to retain at least 24 hour's worth of data for all collected metrics. The system chooses the smallest sampling interval that can satisfy this goal without violating the first goal.

CHAPTER 2

Monitor system performance using the Unisphere GUI

This chapter addresses the following topics:

Working with performance metrics in the Unisphere GUI

You can analyze system performance in Unisphere by viewing and interacting with line charts that display historical and real-time performance metrics. Metrics collection on the storage system is enabled by default.

Note

The system automatically allocates space for storing collected metrics, whether or not metrics collection is enabled.

Historical metrics

Historical metrics display data collected within a preset or customized time range. With historical metrics charts, you can:

- Compare changes in performance across multiple metrics, such as network traffic, bandwidth, and throughput.

- Analyze data at both the aggregate and detail levels:

  - Aggregated performance metrics information is initially displayed in line charts, enabling you to quickly determine whether there are any high-level performance issues.

  - Once you open a line chart, you can drill down to the detailed data by applying breakdown categories to the displayed data.

- Export the data of selected metrics to a .csv file. The exported values reflect the metric's filtered state.

Line charts for historical metrics typically display 150 - 300 samples. Within a line chart, different time ranges correlate to specific sampling intervals, as shown in the following table:

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.

If you select a preset time range for a metric (such as 1 Week), but the amount of available data is less than the associated display interval for that preset, the system tries to display the data using the next smallest available interval. This behavior can also occur when you page back and forth through time.

For example, suppose you select the Cache Read Hit IOPS metric and the 1 Week preset. The system tries to display the metric data in one hour intervals. If there is:

- Less than one hour's worth of metric data, but more than five minutes' worth of metric data, the system displays the data using five minute intervals.

- Less than one minute's worth of metric data, the system defaults to the most granular sample size possible, while keeping the legibility of the graph intact.

Real-time metrics

Real-time metrics display data collected during the current session, over a maximum time range of 15 minutes. The session ends when you navigate away from the current tab and restarts when you navigate back to the tab. You can display up to four real-time metrics charts at a time on a dashboard.

With real-time metrics charts, you can:

- Compare changes in performance across multiple metrics, such as network traffic, bandwidth, and throughput.

- Analyze data at the aggregated level using line charts, to quickly determine whether there are any performance issues.

The sampling interval for real-time metrics is every 5 seconds.

About line charts

A line chart initially displays aggregated information for one performance metric, such as LUN Bandwidth. The line chart shows the metric's value along the y-axis against the time range on the x-axis. When you hover over a data point on a line chart, a tool tip displays the time, date, and measurement associated with that data point.

System line charts display all information across all like resources in the storage system. For example, the System-IO File System Bandwidth metric displays the total amount of file system I/O requests, in KB/s, across all file systems in the storage system. Resource line charts display all information for the selected resource objects. For example, the File System Bandwidth metric displays the total amount of file system I/O requests, in KB/s, for the selected file systems.

Depending on the metric, each line chart aggregates data using one of the following calculations:

Table 3 Calculations used for aggregating data

Calculation	Description
Sum	Total of the measurements for each target object instance. For example, the LUN Bandwidth metric adds together the amount of I/O traffic handled by each LUN.
Average	Sum of a set of numerical measurements divided by the number of measurements in the set. For example, the system uses the following formula to calculate the CPU Utilization metric, which is calculated as a percentage: ```[(Percentage of processing cycles used by SP1) + (Percentage of processing cycles used by SP2) / 2]```

Table 3 Calculations used for aggregating data (continued)

Calculation	Description

Weighted average	Average that gives more weight to the objects with the highest contribution to the metric. The storage system uses the following formula to calculate a weighted average:
	
	`[(m1 * w1) + (m2 * w2) + (m3 * w3) / (w1 + w2 + w3)]`
	
	where:
	
	• `m1` is the metric for object 1, `m2` is the metric for object 2, and so forth.
	
	• `w1` is the weight for object 1, `w2` is the weight for object 2, and so forth.
	
	For example, the storage system uses the following formula to calculate the LUN IO Size metric:
	
	`[((LUN1 I/O size) * (Number of LUN1 I/Os)) + ((LUN2 I/O size * (Number of LUN2 I/Os)) + ((LUN3 I/O size) * (Number of LUN3 I/Os))/ (Number of LUN1 I/Os) + (Number of LUN2 I/Os) + (Number of LUN3 I/Os)]`
	
	In this example, the LUNs with the highest number of I/Os have the highest weighting.

Ratio	Relative size of two values. For example, the FAST Cache Dirty Ratio metric measures the ratio of dirty pages to total pages in the FAST Cache.

For information about the calculation used by a particular metric, see the help topic for that metric.

View historical performance metrics

Procedure

1. Under **System**, select **Performance**.

2. Select the historical metrics dashboard for the system for which you created a performance metrics display.

3. For each system dashboard, you can define the time range of the values displayed for all the metric line charts on that dashboard. The default time range is **Last 1 hour**. Alternatively, select one of the other time range values.

   The time range selections are enabled only if Unisphere has data spanning that time range.

4. For a custom time range, select **Custom** and choose the start and end dates and times of the charts displayed. Click **OK**.

5. To drill down into the data displayed in the line chart, you can breakdown the data displayed into individual lines that show the categories and contributors that provide data to the performance metric. Choose among the breakdown categories available for a particular metric.

   Each contributor displays as a different color line in the chart and is identified in the legend. You can quickly remove and add each contributor by clicking on its name in the legend. Use the breakdown display to determine if one contributor

is adding to the aggregated total more than another contributor as well as analyze how a contributor's activity increases or decreases at a particular time.

6. Hover over a data point in the chart to display the date, time, and measurement associated with that data point. Gaps in metric data collection are displayed as gaps in the line chart.

7. For object-level line charts, such as those for LUNS, file systems, drives, and so forth, you can select **Percentage View** to view the data points as percentage values instead of absolute values.

View real-time performance metrics

Procedure

1. Under **System**, select **Performance**.

2. Select the real-time metrics dashboard for the system for which you created a performance metrics display.

3. Hover over a data point in the chart to display the date, time, and measurement associated with that data point. Gaps in metric data collection are displayed as gaps in the line chart.

4. For object-level line charts, such as those for LUNS, file systems, drives, and so forth, you can select **Percentage View** to view the data points as percentage values instead of absolute values.

Add performance metrics charts

Use **Add Charts** to select the performance metric charts to be displayed on each dashboard tab.

Procedure

1. Under **System**, select **Performance**.

2. To display charts for historical metrics, select **Historical Charts** > **Add Charts**.

3. To display real-time metrics, select **Real-time Charts** > **Add Charts**.

4. Select the resource type for which you want to display metrics.

5. From the list of available metrics for that resource type, select the metrics you want to display. If applicable, select the objects for which you want to display metrics.

6. Select **Generate Charts** to save your selections, and then select **Close**.

7. Optionally, repeat these steps to select other resource types or metrics.

Results

There is no limit to the number of historical metric charts you can display on each dashboard tab, but you can only display up to four real-time metric charts. Newly added charts display at the top of the display; you can drag and drop charts to different positions.

Available historical performance metrics

The following historical performance metrics are available in the Unisphere GUI. For more information about a particular metric, including its breakdown categories, select the link in the Metric column.

Resource category	Metric
System - Cache	Cache Dirty Size
	Cache Read Hit IOPS
	Cache Read Miss IOPS
	Cache Write Hit IOPS
	Cache Write Miss IOPS
	FAST Cache Dirty Ratio
System - IO	CIFS Bandwidth
	CIFS I/O Size
	CIFS IOPS
	File System Bandwidth
	File System I/O Size
	File System IOPS
	LUN Bandwidth
	LUN I/O Size
	LUN IOPS
	LUN Queue Length
	LUN Response Time
	NFS Bandwidth
	NFS I/O Size
	NFS IOPS
	VVOL Datastore Bandwidth
	VVOL Datastore IOPs
	VVol Datastore Response Time
System - Resources	CPU Utilization
	Drive Bandwidth
	Drive IOPS
	Ethernet Bandwidth
	Ethernet Packets
	Fibre Channel Bandwidth
	Fibre Channel Requests/Second
	iSCSI Bandwidth
	iSCSI Requests/Second
LUN	Bandwidth
	I/O Size

Resource category	Metric
	IOPS
	Queue Length
	Response Time
File System	Bandwidth
	I/O Size
	IOPS
VVol Datastore	Bandwidth
	IOPs
	Response Time
Fibre Channel Port	Bandwidth
	Requests/Second
iSCSI Interface	Bandwidth
	Requests/Second
Ethernet Port	Bandwidth
	Packets
Drive	Bandwidth
	IOPS
	Queue Length
	Response Time
	Service Time
Tenant	Bandwidth

Available real-time performance metrics

The following real-time performance metrics are available in the Unisphere GUI.

Resource category	Metric	Description
System - Resources	CPU Utilization	Total amount of processing cycles, as a percentage, across all cores in the storage system SPs.
LUN	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.

Resource category	Metric	Description
	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.
File System	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.
Fibre Channel Port	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.
iSCSI Interface	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.
Ethernet Port	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.
Drive	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

Resource category	Metric	Description
		weight to the drives with the highest number of I/O requests.
		Note
		The assumptions the system makes when calculating the average drive response time may not hold true for bursty traffic.
	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.

CHAPTER 3

Monitor system performance using the CLI

This chapter addresses the following topics:

Working with performance metrics in the Unisphere CLI

You can use the Unisphere CLI to enable/disable the metrics collection service, view available metrics paths, and view historical and real-time metrics values.

Note

The metrics collection service is enabled by default in the CLI.

To view metric values in the CLI, you must specify a metrics path. The following table summarizes the CLI commands used to display paths for the available metrics:

Command	Description
`/metrics/metric show`	Displays all available metrics paths.
`/metrics/metric -availability historical show`	Displays the paths for all available historical metrics.
`/metrics/metric -availability real-time show`	Displays the paths for all available real-time metrics.

For information about using the CLI to enable or disable metrics settings and to display specific metrics, see the following sections.

Manage metrics service

Storage system metrics gather information about system performance and storage usage, and collect that information for user review. Analyzing the system metrics can help predict the future growth of the system.

Historical and real-time metrics values are available in predefined intervals. High frequency (short interval) metric values are not kept as long as low frequency (long interval) metrics.

The following table lists the metrics service attributes:

Table 4 Metrics service attributes

Attribute	Description
`History enabled`	Indicates whether historical metrics collection is enabled. Value is one of the following: • `yes` • `no` Default value is `yes`.
`History retention`	Identifies the timestamp of the earliest available value for each frequency interval. The formats are: • `YYYY-MM-DD HH:MM:SS` (60 sec) • `YYYY-MM-DD HH:MM:SS` (300 sec) • `YYYY-MM-DD HH:MM:SS` (3600 sec) • `YYYY-MM-DD HH:MM:SS` (14400 sec)

Table 4 Metrics service attributes (continued)

Attribute	Description
	If the data for a certain interval is not available, the system displays not available instead of a timestamp.
	Note By default, the timestamps are UTC time. If you specify a timezone offset with -gmtoff, the timestamps adjust accordingly.

View metrics service settings

View the current metrics service settings.

Note

Use the show action command to change the output format.

Format
```
/metrics/service show
```

Example
The following command displays the metrics service settings for the system:

uemcli -d 10.0.0.1 -u Local/joe -p MyPassword456! /metrics/service show

```
Storage system address: 10.0.0.1
Storage system port: 443
HTTPS connection


1:  History enabled  = yes
    History retention= 2012-9-20 12:00:00 (60 sec), 2012-9-14
12:00:00 (300 sec), not available (3600 sec), not available (14400
sec)
```

Configure metrics service

Enable historical metrics collection.

Format
```
/metrics/service set -historyEnabled { yes | no }
```

Note

Only administrators are allowed to run this command.

Action qualifiers

Qualifier	Description
-historyEnabled	Indicates whether historical metrics collection is enabled or disabled. Value is one of the following:

Qualifier	Description
	• yes • no <hr>**Note** The system prompts for confirmation if you specify no.

Example

The following command enables metrics collection:

uemcli -d 10.0.0.1 -u Local/joe -p MyPassword456! /metrics/service set -historyEnabled yes

```
Storage system address: 10.0.0.1
Storage system port: 443
HTTPS connection


Operation completed successfully.
```

Manage metrics settings

Storage system metrics gather information about system performance and storage usage, and collect that information for user review. Analyzing the system metrics can help predict the future growth of the system.

The following table lists the metrics attributes:

Table 5 Metrics attributes

Attribute	Description
Path	Unique ID for the metric.
	Note Metrics are usually associated with objects. This association is reflected by a * character in the metric path, such as **sp.*.net.device.*.bytes**, which is associated with two objects, SP and network device. The metrics commands will accept a metric path with the * replaced by an object, and return only the result for the specified object. The system generates an error if the specified object is not valid.
Description	Description of the metric.
Type	Metric type. Valid values are: • rate — A counter difference relative to a unit of time.

Table 5 Metrics attributes (continued)

Attribute	Description
	• `counter` — A monotonically increasing, unsigned quantity. • `fact` — Represents point-in-time information. Fact values should be expected to go up and down. • `64 bits counter` — A counter of 64 bits. • `text` — Literal.
Unit	Unit measure for the metric.
Availability	Availability of the metric. Value is one of the following: • `historical` — The metric is included in historical metrics collection. • `real-time` — The metric supports real-time subscription. • `historical, real-time` — The metric supports both historical and real-time collection. This attribute does not apply to family, set, and compound metrics.

View metrics settings

View information about supported metrics.

Note

Use the show action command to change the output format.

Format

```
/metrics/metric [-path <value>] [-availability { historical |
real-time } ] show
```

Object qualifier

Qualifier	Description
-path	Specify a comma-separated list of metric paths. **Note** When typing metric paths, replace . with \., , with \, and \ with \\ in the object names. Omitting this switch specifies all available metrics.
-availability	Specify a type of metric to display. Value is one of the following:

Qualifier	Description
	• `historical` • `real-time` Omitting this switch displays all metrics.

Example 1

The following command displays all available metric service settings for the system:

`uemcli -d 10.0.0.1 -u Local/joe -p MyPassword456! /metrics/metric show`

```
Storage system address: 10.0.0.1
Storage system port: 443
HTTPS connection

1:   Path        = sp.*.cifs.global.basic.readsRate

2:   Path        = sp.*.cifs.global.basic.totalCallsRate

3:   Path        = sp.*.cifs.global.basic.writeAvgSize
```

Example 2

The following command displays all available metric service settings for the system with additional details:

`uemcli -d 10.0.0.1 -u Local/joe -p MyPassword456! /metrics/metric show -detail`

```
Storage system address: 10.0.0.1
Storage system port: 443
HTTPS connection

1:    Path        = sp.*.blockCache.global.summary.cleanPages
      Description = Number of Clean Pages on SP, based on a
logical
                                  64 KB page size
      Type        = fact
      Unit        = Count
      Availability = real-time

2:    Path        = sp.*.blockCache.global.summary.dirtyBytes
      Description = Amount of Dirty Data (MB) on SP
      Type        = fact
      Unit        = MB
      Availability = historical, real-time

3:    Path        = sp.*.blockCache.global.summary.dirtyPages
      Description = Number of Dirty Pages on SP, based on a
logical
                      64 KB page size
      Type        = fact
      Unit        = Count
      Availability = real-time
```

Example 3

The following command displays all available real-time metric service settings for the system:

```
uemcli -d 10.0.0.1 -u Local/joe -p MyPassword456! /metrics/metric -
availability real-time show
```

```
Storage system address: 10.0.0.1
Storage system port: 443
HTTPS connection

439:  Path = sp.*.storage.pool.*.sizeTotal

440:  Path = sp.*.storage.pool.*.sizeUsed

441:  Path = sp.*.storage.pool.*.sizeUsedBlocks

442:  Path = sp.*.storage.pool.*.snapshotSizeSubscribed

443:  Path = sp.*.storage.pool.*.snapshotSizeUsed

444:  Path = sp.*.storage.summary.readBlocksRate

445:  Path = sp.*.storage.summary.readBytesRate

446:  Path = sp.*.storage.summary.readsRate

447:  Path = sp.*.storage.summary.totalBytesRate
```

Example 4
The following command displays the metrics service settings for the metrics with the specified paths:

```
uemcli -d 10.0.0.1 -u Local/joe -p MyPassword456! /metrics/metric -
path
sp.*.storage.lun.*.avgReadSize,sp.*.storage.filesystem.*.writesRate,sp
.*.cifs.smb2.basic.readsRate show -detail
```

```
Storage system address: 10.0.0.1
Storage system port: 443
HTTPS connection

1:  Path        = sp.*.storage.lun.*.avgReadSize
    Description = Average read size on this LUN
    Type        = fact
    Unit        = KB
    Availability = historical, real-time

2:  Path        = sp.*.storage.filesystem.*.writesRate
    Description = Rate of sp.*.storage.filesystem.*.writes
    Type        = rate
    Unit        = Requests/s
    Availability = historical, real-time

3:  Path        = sp.*.cifs.smb2.basic.readsRate
    Description = Rate of sp.*.cifs.smb2.basic.reads
    Type        = rate
    Unit        = Ops/s
    Availability = real-time
```

Manage historical metrics values

Storage system metrics gather information about system performance and storage usage, and collect that information for user review. Analyzing the system metrics can help predict the future growth of the system.

Historical metric values are available in predefined intervals. High frequency (short interval) metric values are not kept as long as low frequency (long interval) metrics.

The following table lists the historical metrics attributes:

Table 6 Historical metrics attributes

Attribute	Description
Timestamp	Time when the metric value was collected. The format is: YYYY-MM-DD HH:MM:SS, where: • YYYY — Year • MM — Month • DD — Day • HH — Hour • MM — Minute • SS — Second
Dynamic attributes	Identifies the object name or metric value.

View historical metrics settings

View historical metrics settings. The default output appears in a tabular format.

Note

Use the show action command to change the output format.

Format
```
/metrics/value/hist -path <value> show -interval { 60 | 300 |
3600 | 14400 }[ -from <value> ] [ -to <value>] [ -count
<value> ][ -flat ][ -summary ]
```

Object qualifier

Qualifier	Description
-path	Specify a comma-separated list of metric paths. **Note** When typing metric paths, replace . with \., , with \, and \ with \\ in the object names.
-interval	Specify an interval for the metric values. Default interval is seconds.

Qualifier	Description
-from	Specify the start of the query period. The format is: YYYY-MM-DD HH:MM:SS or YYYY-MM-DDTHH:MM:SS, where: • YYYY — Year • MM — Month • DD — Day • T — Time delimiter • HH — Hour • MM — Minute • SS — Second **Note** Ensure that the value is a time in the past. You can choose to specify just the date (in the YYYY-MM-DD format) or the time (in the HH:MM:SS format). If you do not specify the time, the system automatically uses 00:00:00. If you choose to not specify the date, the current system date is used.
-to	Specify the end of the query period. The format is: YYYY-MM-DD HH:MM:SS or YYYY-MM-DDTHH:MM:SS, where: • YYYY — Year • MM — Month • DD — Day • T — Time delimiter • HH — Hour • MM — Minute • SS — Second **Note** Ensure that the value is a time in the past. You can choose to specify just the date (in the YYYY-MM-DD format) or the time (in the HH:MM:SS format). If you do not specify the time, the system automatically uses 00:00:00. If you choose to not specify the date, the current system date is used.
-count	Specify the number of samples to display. A sample is a set of metric values related to a single timestamp. Valid values are numbers greater than or equal to one.
-flat	Displays the member values for grouped metrics.
-summary	Displays the maximum, minimum, and average value for each metric.

Note

The `-from` and `-to` qualifiers take precedence over the `-count` qualifier. In the example below, only 7 samples exist between the from and to dates. Although the value for the `-count` qualifier is set to 10, only 7 values appear. If the `-from` and `-to` qualifiers are not specified, the output will include 10 samples.

Examples of output with different combinations of the -from, -to, and -count qualifiers

The following table illustrates the output that appears with combinations of the `-from`, `-to`, and `-count` qualifiers. It assumes that the current time is 2012-09-21 12:30:00.

Qualifier Combination	Output
`-from <future date/ time>`	**Example**: `-from` "2012-09-21 12:31:00" **Result**: This results in an error because the time for the `-from` qualifier is specified in the future.
`-from <current date/ time or date/time in the past>` `-to <future date/ time>`	**Example**: `-from` "2012-09-01 00:00:00" `-to` "2012-09-21 12:31:00" **Result**: This results in an error because the time for the `-to` qualifier is specified in the future.
`-from <date/time in the past> -count <value>`	**Example**: `-from` "2012-09-20 01:02:00" `-count` 100 **Result**: The result includes 100 samples from "2012-09-20 01:02:00". If there are less than 100 samples available, the result lists all samples from the specified time to the current time.

`-from <date/time in the past>`
`-to <current date/ time or date/time in the past>`
 	
`-count <value>`
	Example: `-from` "2012-09-20 01:02:00" `-to` "20-09-20 12:00:00" `-count` 100
	Result: The result includes 100 samples within the specified time period. If there are less than 100 samples available, the result lists all samples within the time period.

`-to <current date/ time or date/time in the past>` `-count <value>`	**Example**: `-to` "20-09-20 12:00:00" `-count` 100 **Result**: The result includes the latest 100 samples before the specified time. If there are less than 100 samples available, the result lists all samples.
`-count <value>`	**Example**: `-count` 100 **Result**: The result includes the latest 100 samples, or if there are less than 100 samples available, the result lists all samples.
`-to <current date/ time or date/time in the past>`	**Example**: `-to` "20-09-20 12:00:00" **Result**: The result includes all samples from the timestamp of the earliest sample to the specified time.
`-from`, `-to`, and `-count` are not specified.	**Result**: The result includes the latest 100 samples, or if there are less than 100 samples available, the result lists all samples. This is equivalent to "`-count` 100".

Example 1

The following command displays the specified individual metric SPA LUN sv_1 every 60 seconds during the query period:

```
uemcli -d 10.0.0.1 -u Local/joe -p MyPassword456! /metrics/value/hist
-path sp.spa.storage.lun.sv_1.readsRate show -interval 60 -from
"2014-06-24 02:12:00" -to "2014-06-24 02:1 4 :00"
```

```
Storage system address: 10.0.0.1
Storage system port: 443
HTTPS connection

Timestamp              |SP         |LUN               |Read
                       |           |                  |Counts/s
-----------------------+-----------+------------------+--------
2014-06-24 02:12:00 |spa         |sv_1              |   4.001
2014-06-24 02:13:00 |spa         |sv_1              |   2.400
2014-06-24 02:14:00 |spa         |sv_1              |   9.602
```

Example 2

The following command displays the specified metric, associated with a single object type, SPs, every 60 seconds during the query period:

```
uemcli -d 10.0.0.1 -u Local/joe -p MyPassword456! /metrics/value/hist
-path sp.*.cpu.summary.utilization show -interval 60 -from "2014-06-24
02:57:00" -to "2014-06-24 02:59:10"
```

```
Storage system address: 10.0.0.1
Storage system port: 443
HTTPS connection

Timestamp              |SP         |summary
                       |           |CPU
                       |           |Util %
-----------------------+-----------+-------
2014-06-24 02:57:00 |spa         |  12.62
                       |spb         |  32.46
2014-06-24 02:58:00 |spa         |  13.06
                       |spb         |  19.75
2014-06-24 02:59:00 |spa         |  13.44
                       |spb         |  32.47
```

Example 3

The following command displays the specified metric, associated with two object types, SPs and LUNs, every 60 seconds during the query period:

```
uemcli -d 10.0.0.1 -u Local/joe -p MyPassword456! /metrics/value/hist
-path sp.*.storage.lun.*.readsRate show -interval 60 -from "2014-06-24
02:59:00" -to "2014-06-24 03:01:00"
```

```
Storage system address: 10.0.0.1
Storage system port: 443
HTTPS connection

Timestamp              |SP         |LUN               |Read
                       |           |                  |Counts/s
-----------------------+-----------+------------------+--------
2014-06-24 02:59:00 |spa         |sv_1              |   0.050
                       |spa         |sv_2              |       0
```

```
                               |spb        |sv_1                |         0
                               |spb        |sv_2                |     0.033
          2014-06-24 03:00:00  |spa        |sv_1                |     0.467
                               |spa        |sv_2                |         0
                               |spb        |sv_1                |         0
                               |spb        |sv_2                |     0.117
          2014-06-24 03:01:00  |spa        |sv_1                |     0.833
                               |spa        |sv_2                |         0
                               |spb        |sv_1                |         0
                               |spb        |sv_2                |     0.467
```

Example 4

The following command displays the specified metric, associated with three object types, SPs, pools, and LUNs, every 60 seconds during the query period:

uemcli -d 10.0.0.1 -u Local/joe -p MyPassword456! /metrics/value/hist -path sp.*.storage.pool.*.lun.*.dataSizeAllocated show -interval 60 - from "2014-06-24 03:04:00" -to "2014-06-24 03:06:00"

```
Storage system address: 10.0.0.1
Storage system port: 443
HTTPS connection

Timestamp           |SP  |Pool Statistics |LUN    |Data Size
Allocated Bytes
-------------------+----+---------------+------
+------------------------
2014-06-24 03:04:00 |spa |pool_1          |sv_1   |6442450944
                    |spa |pool_1          |sv_2   |8589934592
                    |spb |pool_1          |sv_1   |6442450944
                    |spb |pool_1          |sv_2   |8589934592
2014-06-24 03:05:00 |spa |pool_1          |sv_1   |6442450944
                    |spa |pool_1          |sv_2   |8589934592
                    |spb |pool_1          |sv_1   |6442450944
                    |spb |pool_1          |sv_2   |8589934592
2014-06-24 03:06:00 |spa |pool_1          |sv_1   |6442450944
                    |spa |pool_1          |sv_2   |8589934592
                    |spb |pool_1          |sv_1   |6442450944
                    |spb |pool_1          |sv_2   |8589934592
```

Example 5

The following command displays metrics, associated with two object types, SPs and LUNs, and an individual metric associated with SPA, every 60 seconds during the query period:

uemcli -d 10.0.0.1 -u Local/joe -p MyPassword456! /metrics/value/hist -path sp.*.storage.lun.*.readsRate, sp.*.storage.lun.*.writesRate, sp. spa.cpu.summary.utilization show -interval 60 -from "2014-06-24 03:04:00" -to "2014-06-24 03:06:00"

```
Storage system address: 10.0.0.1
Storage system port: 443
HTTPS connection

Timestamp           |SP       |LUN      |Read      |Write     |SP     |
summary
                    |         |         |Counts/s |Counts/s |       |CPU
                    |         |         |         |         |       |
Util %
```

```
--------------------+-------+--------+------+--------+----------
+-------
2014-06-24 03:10:00 |spa     |sv_1    |       0|        0|spa    |
12.63
                    |spa     |sv_2    |   1.050|    9.066|       |
                    |spb     |sv_1    |   0.067|    9.350|       |
                    |spb     |sv_2    |   0.100|    14.95|       |
2014-06-24 03:11:00 |spa     |sv_1    |       0|        0|spa    |
12.56
                    |spa     |sv_2    |   0.700|    26.62|       |
                    |spb     |sv_1    |   0.167|    12.28|       |
                    |spb     |sv_2    |   2.883|    25.65|       |
2014-06-24 03:12:00 |spa     |sv_1    |   0.667|    19.53|spa    |
12.12
                    |spa     |sv_2    |   0.333|    26.87|       |
                    |spb     |sv_1    |   7.066|    3.700|       |
                    |spb     |sv_2    |   7.066|    3.383|       |
```

Example 6

The following command displays the member values for specified metrics every 60 seconds during the query period:

```
uemcli -d 10.0.0.1 -u Local/joe -p MyPassword456! /metrics/value/hist
-path sp.*.cpu.summary.utilization show -interval 60 -from "2014-06-24
03:14:00" -to "2014-06-24 03:16:00" -flat
```

```
Storage system address: 10.0.0.1
Storage system port: 443
HTTPS connection

Timestamp           |spa     |spb
                    |summary |summary
                    |CPU     |CPU
                    |Util %  |Util %
--------------------+-------+-------
2014-06-24 03:14:00 |  15.06|  26.78
2014-06-24 03:15:00 |  15.82|  29.39
2014-06-24 03:16:00 |  15.94|  23.59
```

Example 7

The following command displays the maximum, minimum, and average value for each metric every 60 seconds during the query period:

```
uemcli -d 10.0.0.1 -u Local/joe -p MyPassword456! /metrics/value/hist
-path sp.*.cpu.summary.utilization show -interval 60 -from "2014-06-24
03:19:00" -to "2014-06-24 03:21:00" -summary
```

```
Storage system address: 10.0.0.1
Storage system port: 443
HTTPS connection

Timestamp           |SP        |summary
                    |          |CPU
                    |          |Util %
--------------------+----------+-------
2014-06-24 03:19:00 |spa       |  17.72
                    |spb       |  43.52
2014-06-24 03:20:00 |spa       |  15.35
                    |spb       |  37.82
```

```
2014-06-24 03:21:00 |spa          |  15.08
                    |spb          |  36.32

Summary             |SP           |summary
                    |             |CPU
                    |             |Util %
--------------------+----------+-------
Minimum             |spa          |  15.08
                    |spb          |  36.32
Average             |spa          |  16.05
                    |spb          |  39.22
Maximum             |spa          |  17.72
                    |spb          |  43.52
```

Manage real-time metrics values

Storage system metrics gather information about system performance and storage usage, and collect that information for user review. Analyzing the system metrics can help predict the future growth of the system.

The following table lists the real-time metrics attributes.

Table 7 Real-time metrics attributes

Attribute	Description
Timestamp	Time when the metric value was collected. The format is: YYYY-MM-DD HH:MM:SS, where: • YYYY — Year • MM — Month • DD — Day • HH — Hour • MM — Minute • SS — Second
Dynamic attributes	Identifies the object name or metric value.

View real-time metrics settings

View real-time metrics settings. The default output appears in a tabular format.

Note

Use the show action command to change the output format.

Format
```
/metrics/value/rt -path <value> show -interval <value> [ -to
<value>] [ -count <value> ][ -flat ][ -summary ]
```

Object qualifier

Qualifier	Description
-path	Specify a comma-separated list of metric paths.
	Note
	When typing metric paths, replace . with \., , with \, and \ with \\ in the object names.

Action qualifier

Qualifier	Description
-interval	Specify an interval for the metric values. Default interval is seconds.
-to	Specify the end of the query period. The format is: YYYY-MM-DD HH:MM:SS or YYYY-MM-DDTHH:MM:SS, where:
	• YYYY — Year
	• MM — Month
	• DD — Day
	• T — Time delimiter
	• HH — Hour
	• MM — Minute
	• SS — Second
	Note
	Ensure that the value is a time in the past. You can choose to specify just the date (in the YYYY-MM-DD format) or the time (in the HH:MM:SS format). If you do not specify the time, the system automatically uses 00:00:00. If you choose to not specify the date, the current system date is used.
-count	Specify the number of samples to display. A sample is a set of metric values related to a single timestamp. Valid values are numbers greater than or equal to one.
-flat	Displays the member values for grouped metrics.
-summary	Displays the maximum, minimum, and average value for each metric.

Note

Objects can come and go at any time, mostly due to object creation and deletion. In flat format, every time a new object is included, the title in tabular or CSV format or the attributes in NVP format is adjusted accordingly and reprinted as necessary on screen. If an object is no longer valid but it already has a column in tabular or CSV format, the column is kept only if its value becomes blank. Otherwise the object is not displayed anymore.

Example 1

The following command displays the specified real-time metric every 10 seconds:

```
uemcli -d 10.0.0.1 -u Local/joe -p MyPassword456! uemcli /metrics/
value/rt -path sp.*.storage.lun.*.readsRate show -interval 10
```

```
Storage system address: 10.0.0.1
Storage system port: 443
HTTPS connection

Timestamp           |SP        |LUN              |Read
                    |          |                 |Counts/s
--------------------+----------+-----------------+--------
2014-06-24 03:26:10 |spb       |sv_1             |   0.225
2014-06-24 03:26:20 |spb       |sv_1             |   0.200
                    |spb       |sv_2             |   0.100
2014-06-24 03:26:30 |spb       |sv_2             |   0.200
```

Example 2

The following command displays the member values for the specified grouped real-time metric every 10 seconds in comma-separated values (CSV) format:

```
uemcli -d 10.0.0.1 -u Local/joe -p MyPassword456! uemcli /metrics/
value/rt -path sp.*.storage.lun.*.readsRate show -interval 10 -flat -
output csv
```

```
Storage system address: 10.0.0.1
Storage system port: 443
HTTPS connection

Timestamp,spb sv_1 Read Counts/s
2014-06-24 03:26:10,0.225
Timestamp,spb sv_1 Read Counts/s,spb sv_2 Read Counts/s
2014-06-24 03:26:20,0.200,0.100
2014-06-24 03:26:30,,0.200
```

Example 3

The following command displays the specified real-time metric every 10 seconds name-value pair (NVP) format:

```
uemcli -d 10.0.0.1 -u Local/joe -p MyPassword456! uemcli /metrics/
value/rt -path sp.*.storage.lun.*.readsRate show -interval 10 -output
nvp
```

```
Storage system address: 10.0.0.1
Storage system port: 443
HTTPS connection

1: Timestamp = 2014-06-24 03:26:10
   SP        = spb
   Client    = sv_1
   CIFS Read = 0.225

2: Timestamp = 2014-06-24 03:26:20
   SP        = spb
   Client    = sv_1
   CIFS Read = 0.200

3: Timestamp = 2014-06-24 03:26:20
   SP        = spb
   Client    = sv_2
```

```
   CIFS Read = 0.100

4: Timestamp = 2014-06-24 03:26:30
   SP        = spb
   Client    = sv_2
   CIFS Read = 0.200
```

CHAPTER 4

Reference

This chapter addresses the following topics:

Historical metrics available in Unisphere

This chapter describes the historical metrics that can you can view in Unisphere. For information about the real-time metrics you can view in Unisphere, see Available real-time performance metrics on page 15.

Cache Dirty Size (physical deployments only)

Total amount of data in the write cache, in MB, that has not yet been flushed out to disks.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following category:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.

Cache Read Hit IOPS

Total number of read I/O requests, in I/O per second, that do not demand a new allocation of cache memory.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following category:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.

Cache Read Miss IOPS

Total number of read I/O requests, in I/O per second, passing through, that is, not served by cache.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following category:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.

Cache Write Hit IOPS

Total number of write I/O requests, in I/O per second, that do not demand a new allocation of cache memory. If the FAST Cache is configured, this metric includes I/O requests passing through the FAST Cache.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following category:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.

Cache Write Miss IOPS

Total number of write I/O requests, in I/O per second, that demand a new allocation of cache memory. If the FAST Cache is configured, this metric includes I/O requests passing through the FAST Cache.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following category:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.

FAST Cache Dirty Ratio (physical deployments only)

Ratio of dirty pages to total pages in the FAST Cache, expressed as a percent.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following category:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.

System - CIFS Bandwidth

Total amount of CIFS (SMB) I/O requests, in KB/s, across all ports in the storage system.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

System - 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.

Breakdown and filter categories
The aggregated data can be broken down by or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

System - CIFS IOPS

Total number of CIFS (SMB) I/O requests, in I/O per second, across all ports in the storage system.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

System - 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.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

System - NFS Bandwidth

Total amount of NFS I/O requests, in KB/s, across all ports in the storage system.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

System - NFS IOPS

Total number of NFS I/O requests, in I/O per second, across all ports in the storage system.

Breakdown and filter categories

The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

System - 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.

Breakdown and filter categories

The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

System - 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.

Breakdown and filter categories

The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

System - File System Bandwidth

Total amount of internal I/O requests, in KB/s, across all file systems in the storage system.

Breakdown and filter categories

The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

File System Bandwidth

Total amount of internal I/O requests, in KB/s, for the selected file systems.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following category:

This category...	Groups or filters data by the...
Read/Write	Traffic types: read I/O and write I/O.

System - File System I/O Size

Average size of internal I/O requests, in KB, across all file systems in the storage system.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

File System I/O Size

Average size of internal I/O requests, in KB, for the selected file systems.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following category:

This category...	Groups or filters data by the...
Read/Write	Traffic types: read I/O and write I/O.

System - File System IOPS

Total number of internal I/O requests, in I/O per second, across all file systems in the storage system.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

File System IOPS

Total number of internal I/O requests, in I/O per second, for the selected file systems.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following category:

This category...	Groups or filters data by the...
Read/Write	Traffic types: read I/O and write I/O.

LUN Bandwidth (System)

Total amount of LUN I/O requests, in KB/s, across all LUNs in the storage system.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

LUN Bandwidth

Total amount of LUN I/O requests, in KB/s, for the selected LUN or LUNs.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

LUN I/O Size (System)

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.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

LUN I/O Size

Average size of LUN I/O requests, in KB/s, for the selected LUNs.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

LUN IOPS (System)

Total amount of LUN I/O requests, in I/O per second, across all LUNs in the storage system.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

LUN IOPS

Total amount of LUN I/O requests, in I/O per second, for the selected LUNs.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

LUN Queue Length (System)

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.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

LUN Queue Length

Average number of LUN I/O requests in the system queue, in counts per second, for the selected LUNs.

Breakdown and filter categories

The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

LUN Response Time (System)

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.

Breakdown and filter categories

The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.

LUN 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.

Breakdown and filter categories

The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.

VVol Datastore Bandwidth (System)

Total amount of VVol I/O requests, in KB/s, across all VVols in the storage system.

Breakdown and filter categories

The aggregated data can be broken down or filtered by the following category:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

VVol Datastore Bandwidth

Total amount of VVol I/O requests, in KB/s, for the selected VVols.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following category:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

VVol Datastore IOPS (System)

Total number of VVol I/O requests, in I/O per second, across all VVols in the storage system.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

VVol Datastore IOPS

Total amount of VVol I/O requests, in I/O per second, for the selected VVols.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

VVol Datastore Response Time (System)

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.

Breakdown and filter category
The aggregated data can be broken down or filtered by the following category:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.

VVol Datastore 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.

Breakdown and filter category
The aggregated data can be broken down or filtered by the following category:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.

CPU Utilization

Total amount of processing cycles, as a percentage, across all cores in the storage system SPs.

Breakdown and filter categories
The aggregated data can be broken down by or filtered by the following category:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.

Fibre Channel Bandwidth (physical deployments only)

Total amount of Fibre Channel I/O requests, in KB/s, across all ports in the storage system.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

Fibre Channel Requests/Second (physical deployments only)

Total number of Fibre Channel I/O requests, in I/O per second, across all ports in the storage system.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.

This category...	Groups or filters data by the...
Read/Write	Traffic types: read I/O and write I/O.

Fibre Channel Port Bandwidth (physical deployments only)

Total amount of Fibre Channel I/O requests, in KB/s, for the selected Storage Processors and associated Fibre Channel ports.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Read/Write	Traffic types: read I/O and write I/O.

Fibre Channel Port Replication Bandwidth (physical deployments only)

Total number of Fibre Channel I/O replication requests, in KB/s per second, for the selected Storage Processors and associated Fibre Channel ports.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following category:

This category...	Groups or filters data by the...
Read/Write	Traffic types: read I/O and write I/O.

Fibre Channel Port IOPS (physical deployments only)

Total number of Fibre Channel I/O requests, in I/O per second, for the selected Storage Processors and associated Fibre Channel ports.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Read/Write	Traffic types: read I/O and write I/O.

Fibre Channel Port Replication Requests/Second (physical deployments only)

Total number of Fibre Channel I/O requests serving replication traffic, in I/O per second, for the selected Storage Processors and associated Fibre Channel ports.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following category:

This category...	Groups or filters data by the...
Read/Write	Traffic types: read I/O and write I/O.

Fibre Channel Port Total Link Errors (physical deployments only)

Total number of link errors, in I/O per second, for the selected Storage Processors and associated Fibre Channel (FC) ports.

iSCSI Bandwidth

Total amount of iSCSI I/O requests, in KB/s, across all ports in the storage system.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

iSCSI Requests/Second

Total number of iSCSI I/O requests, in I/O per second, across all ports in the storage system.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

iSCSI Interface Bandwidth

Total amount of iSCSI I/O requests, in KB/s, for the selected iSCSI interfaces.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Read/Write	Traffic types: read I/O and write I/O.

iSCSI Interface IOPS

Total number of iSCSI I/O requests, in I/O per second, for the selected iSCSI interfaces.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Read/Write	Traffic types: read I/O and write I/O.

Ethernet Bandwidth

Total amount of Ethernet I/O requests, in KB/s, across all non-management Ethernet ports in the storage system.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

Ethernet Packets

Total amount of Ethernet I/O requests, in I/O per second, across all non-management Ethernet ports in the storage system.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

Ethernet Port Bandwidth

Total amount of Ethernet I/O requests, in KB/s, for the selected Storage Processors and associated Ethernet ports.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Read/Write	Traffic types: read I/O and write I/O.

Ethernet Port Packets

Number of Ethernet packets per second, for the selected Storage Processors and associated Ethernet ports.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Read/Write	Traffic types: read I/O and write I/O.

Drive Bandwidth (physical deployments only)

Total amount of drive I/O requests, in KB/s, for the selected drives used in provisioned storage.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

Drive IOPS (physical deployments only)

Total number of drive I/O requests, in I/O per second, for the selected drives used in provisioned storage.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

Drive Queue Length (physical deployments only)

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.

Breakdown and filter categories
The aggregated data can be broken down by or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.

Drive Response Time (physical deployments only)

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.

Note

The assumptions the system makes when calculating the average drive response time may not hold true for bursty traffic.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.

Drive Service Time (physical deployments only)

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.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.

Tenant Bandwidth

Total amount of I/O requests, in KB/s, for the selected tenant.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following category:

This category...	Groups or filters data by the...
Read/Write	Traffic types: read I/O and write I/O.

System - Drive Bandwidth

Total amount of drive I/O requests, in KB/s, across all drives in the storage system used in provisioned storage.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

System - 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.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

File System Client Bandwidth

Total amount of file system client I/O requests, in KB/s, for the selected file systems.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following category:

This category...	Groups or filters data by the...
Read/Write	Traffic types: read I/O and write I/O.

File System Client IOPS

Total number of file system client I/O requests, in I/O per second, for the selected file systems.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following category:

This category...	Groups or filters data by the...
Read/Write	Traffic types: read I/O and write I/O.

File System Client I/O Size

Average size of file system client I/O requests, in KB, for the selected file systems.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following category:

This category...	Groups or filters data by the...
Read/Write	Traffic types: read I/O and write I/O.

File System Client Response Time

Average time spent completing file system client I/O requests, in microseconds, for the selected file systems.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following category:

This category...	Groups or filters data by the...
Read/Write	Traffic types: read I/O and write I/O.

System - Client File System Bandwidth

Total amount of file system client I/O requests, in KB/s, across all file systems in the storage system.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

System - 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.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

System - 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.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.

This category...	Groups or filters data by the...
Read/Write	Traffic types: read I/O and write I/O.

System - Client File System Response Time

Average time spent completing file system client I/O requests, in microseconds, across file systems in the storage system.

Breakdown and filter categories
The aggregated data can be broken down or filtered by the following categories:

This category...	Groups or filters data by the...
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.