EMC® VNXe® Series

Version 3.1

Monitoring System Performance

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EMC²

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CHAPTER 1

About performance metrics

About performance metrics

You can analyze system performance by viewing and interacting with charts that display historical performance data. These charts enable you to:

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

- Analyze data at both the aggregate and detail levels:

- Line charts initially display aggregated performance metrics information, 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 viewing breakdown categories in heat maps and applying a filter to the displayed data.

- Use preset or customized time ranges to view data collected within a specified time period.

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

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

About line charts

A line chart initially displays aggregated information for one performance metric, such as Total LUN Bandwidth. The line chart shows the metric's value along the y-axis against the user-specified 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.

Line charts provide metrics for the following resources:

- The storage system, including the cache, FAST Cache (physical deployments only), and CPU

- LUNs

- CIFS file systems

- NFS file systems

- File systems

- Fibre channel (physical deployments only)

- iSCSI

- Disks

- Network ports

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

Table 1 Calculations used for aggregating data

Calculation	Description
Sum	Total of the measurements for each target object instance. For example, the Total LUN Bandwidth metric adds together the amount of I/O traffic handled by each LUN.

Table 1 Calculations used for aggregating data (continued)

Calculation	Description
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 Average CPU Utilization metric, which is calculated as a percentage: `[(Percentage of processing cycles used by SP1) + (Percentage of processing cycles used by SP2) / 2]`

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 metric for object 2, and so forth.
	
	For example, the storage system uses the following formula to calculate the Average 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 Pages 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.

Line charts 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
15 Minutes	5 seconds
3 Hours	1 minute
1 Day	5 minutes
1 Week	1 hour
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 Total Cache Throughput/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. If there is less than five minutes' worth of metric data, but more than one minute's worth of metric data, the system displays the data using one minute intervals. If there is 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.

About heat maps

Once you open a line chart, you can select the category by which you want to break down the summary data. The system displays detailed data for the selected category in a heat map. For example, the Total LUN Bandwidth metric has a breakdown category called LUN, which breaks the data down by individual LUN.

Category items in a heat map are sorted by their contribution level to the metric, with the highest contributor shown first and the lowest contributor shown last. To determine contribution levels, the system first aggregates the individual items in a category across the selected category and time range. Then, the system compares the results. Heat maps show up to five contributors at a time. You can page through the heat map to view data for the other contributors.

The colors on a heat map show the intensity of a breakdown category's contribution to the associated metric over time:

- Dark blue areas have a high contribution.

- Areas with gradients of blue have intermediate levels of contribution.

- White areas have little to no contribution.

- Gray areas have no data available.

A heat map aligns with its associated line chart so that the color intensity in the heat map matches a line chart segment and time range. This alignment helps you determine if one item is contributing to the aggregated value more than another item. It also helps you analyze how an item's activity increased or decreased over a particular time range.

About filters

One way to view detailed performance data is to filter the metric data by one or more breakdown category items. Filtering enables you to zero in on a subset of data according to criteria that can span multiple categories. For example, the Total LUN Bandwidth metric enables you to filter by SP, storage resource type, storage resource, storage pool, provisioning type, individual LUN, and read or write traffic. You can select one item from within each breakdown category and can use any combination of categories to create a filter.

When you apply a filter to a line chart, the system redraws the chart to show only those metric values that reflect the filter criteria. It also applies the filter to the heat maps associated with the filtered line chart, including the displayed heat map, if any.

Note

If you select the breakdown category for a displayed heat map as a filter category, the system will close the displayed heat map.

Performance metrics aging policy

The system governs the aging of collected 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 8 G).

- Metrics data retention is based on the sampling interval:

Table 3 Sampling intervals

Sampling interval	Retention period
5 seconds	18 hours
1 minute	7 days
5 minutes	4 weeks
1 hour	4 weeks
4 hours	16 weeks

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 hours worth of data for all collected metrics. The system chooses the smallest sampling interval that can satisfy this goal without violating the first goal.

Available performance metrics

The following performance metrics are available for this system. For more information about a particular metric, including its breakdown and filter categories, click on the associated link in the Metric column.

Note

The stat path listed in the individual metrics topics is the path that identifies the metric's location in the stats namespace. It is used in the CLI.

Table 4 Performance metrics available

Resource	Metric	Description
Cache	FAST Cache Dirty Pages (physical deployments only) on page 32	Ratio of dirty pages to total pages in the FAST Cache, expressed as a percent.
	Total Cache Dirty Size (physical deployments only) on page 32	Amount of data in the write cache, in MB, that has not yet been flushed out to disks.
	Total Cache Throughput/ IOPS on page 32	Total number of I/O requests, in I/O per second, passing through the cache.

Table 4 Performance metrics available (continued)

Resource	Metric	Description
CIFS	Average CIFS I/O Size on page 33	Average size of CIFS I/O requests, in KB, across all ports in the storage system.
	Total CIFS Bandwidth on page 33	Total amount of CIFS I/O requests, in KB/s, across all ports in the storage system.
	Total CIFS Throughput/ IOPS on page 33	Total number of CIFS I/O requests, in I/O per second, across all ports in the storage system.
CPU	Average CPU Utilization on page 34	Total amount of processing cycles, as a percentage, across all cores in the storage system SPs.
Disk	Average Disk Queue Length (physical deployments only) on page 34	Average number of disk I/O requests in the system queue, in counts per second, across all disks used in provisioned storage.
	Average Disk Response Time (physical deployments only) on page 34	Average time spent completing disk I/O requests, in microseconds, across all disks used in provisioned storage, including time spent in the queue.
	Average Disk Service Time (physical deployments only) on page 35	Average time spent completing disk I/O requests, in microseconds, across all disks used in provisioned storage, not including time spent in the queue.
	Total Disk Bandwidth (physical deployments only) on page 36	Total amount of disk I/O requests, in KB/s, across all disks used in provisioned storage.
	Total Disk Throughput/IOPS (physical deployments only) on page 36	Total number of disk I/O requests, in I/O per second, across all disks used in provisioned storage.
FC	Total Fibre Channel Bandwidth (physical deployments only) on page 37	Total amount of Fibre Channel I/O requests, in KB/s, across all ports in the storage system.
	Total Fibre Channel Requests/Second (physical deployments only) on page 37	Total number of Fibre Channel I/O requests across all ports in the storage system.
File System	Average File System I/O Size on page 37	Average size of file system I/O requests, in KB, across all file systems in the storage system.
	Total File System Bandwidth on page 38	Total amount of file system I/O requests, in KB/s, across all file systems in the storage system.
	Total File System Throughput/IOPS on page 38	Total number of file system I/O requests, in I/O per second, across all file systems in the storage system.
iSCSI	Total iSCSI Bandwidth on page 38	Total amount of iSCSI I/O requests, in KB/s, across all ports in the storage system.
	Total iSCSI Requests/ Second on page 39	Total number of iSCSI I/O requests across all ports in the storage system.

Table 4 Performance metrics available (continued)

Resource	Metric	Description
LUN	Average LUN I/O Size on page 39	Average size of LUN I/O requests, in KB, across all LUNs in the storage system.
	Average LUN Queue Length on page 40	Average number of LUN I/O requests in the system queue, in counts per second, across all LUNs in the storage system.
	Total LUN Bandwidth on page 40	Total amount of LUN I/O requests, in KB/s, across all LUNs in the storage system.
	Total LUN Throughput/ IOPS on page 41	Total number of LUN I/O requests, in I/O per second, across all LUNs in the storage system.
Network Port	Total Network Bandwidth on page 41	Total aggregate bandwidth of all network activity across all non-management Ethernet ports in the storage system.
	Total Network Throughput/ IOPS on page 42	Total aggregate packet rate of all network activity across all non-management Ethernet ports in the storage system.
NFS	Average NFS I/O Size on page 42	Total amount of NFS I/O requests, in KB/s, across all ports in the storage system.
	Total NFS Bandwidth on page 43	Total amount of NFS I/O requests, in KB/s, across all ports in the storage system.
	Total NFS Throughput/ IOPS on page 43	Total number of NFS I/O requests, in I/O per second, across all ports in the storage system.

CHAPTER 2

Monitor system performance using Unisphere

View aggregated metrics data using line charts

To view and analyze aggregated performance metrics, you can use a line chart. A line chart initially displays aggregated information for one performance metric, such as Total LUN Bandwidth. It can help you identify trends in the performance metrics data.
To display a line chart:

Procedure

1. Click **System** › **System Performance**.

2. Select the metrics for which you want to display line charts. You can display a maximum of five line charts on each dashboard.

   Note

   To display more than five line charts, click **+** to create an additional dashboard view. There is no limit on the number of dashboard views you can create. To quickly review the list of selected performance metrics, you can collapse each displayed line chart by clicking on the down arrow located at the top left of the line chart.

3. Optionally, change the time range of the metrics to be displayed. Click on one of the preset time range values or customize a time and date range by clicking on **Custom** and selecting a start and end date.

4. Optionally, shift the time range of the metrics to be displayed back or forward by clicking one of these symbols above the line chart:

   • ‹ shifts the time range start date and time back by the selected time range.

   • |‹ shifts the time range start date and time back to the oldest collected data point.

   • › shifts the time range end date and time forward by the selected time range.

   • ›| shifts the time range end date and time forward to the newest collected data point.

   Note

   To ensure accurate results, both the client and server need to be synched to an accurate time server.

   To drill down into the data displayed in the line chart, you can:

   • Display a heat map that identifies the top contributors to the line chart within the selected time range.

   • Apply filters to focus on a subset of the data.

View detailed metrics data using a heat map

To view and analyze performance metrics in detail, you can display a heat map. A heat map identifies the top contributors to a system's performance within the selected category and time range. You can use the alignment between the line chart and heat map to determine if one contributor is contributing to the aggregated total more than another contributor. You can also use the alignment between the line chart and heat map to analyze how a contributor's activity increased or decreased over a particular time period.
To display a heat map:

Procedure

1. Click **System** › **System Performance**.

2. Select the metric for which you want to display detailed data.

3. Click on the category by which you want to break down the aggregated data displayed in the line chart. The breakdown categories are located below the line chart.

Note

The performance metric view expands to display a heat map of the selected category. The heat map initially displays the top five contributors to the selected category. It aligns with the line chart so that the color intensity in the heat map matches a line chart segment and time frame.

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4. To view the next five contributors to the selected category, click the right arrow below the heat map.

View detailed metrics data using a filter

To view and analyze performance metrics in detail, you can apply a filter to focus on a subset of data. For example, suppose that analysis of the Total LUN Bandwidth line chart and the Read/Write heat map shows a correlation between writes and a spike in LUN bandwidth. To see if this issue was caused by a particular LUN, you can filter the line chart by the suspected LUN and read/write contributions.
To create a filter:

Procedure

1. Click **System** › **System Performance**.

2. On the line chart for which you want to display detailed data, click **Manage Filter**.

3. In the **Filter** dialog, select a category by which to filter the metric data. The categories are the same as the breakdown categories available to display in a heat map.

4. Select one contributor to the filter category, and click **OK**.

   The **Filter** dialog appears again, listing the selected filter category and contributor.

5. Optionally, click **Add Another** (if enabled) to select another filter category and contributor. You cannot select a filter category or contributor that has already been selected.

6. Repeat Step 5 for each additional contributor you want to display.

7. Click **OK**.

   The system applies the filter to the displayed line chart data. The applied filter is listed above the line chart. If there was an open heat map for the metric, it closes when the filter is applied.

Remove a filter

To remove a filter:

Procedure

1. In the **Filtered** field above the line chart, click the filter.

2. In the **Filter** dialog, click **Remove All**.

3. Click **OK**.

Export performance metrics data

You can export performance metrics data to a .csv file and use the data for reporting purposes. The export process works as follows:

- Enables you to select the metric data behind one or more open line charts.
- If you select a breakdown category for the metric, the system exports the data for all contributors to the selected breakdown category.
- If the line chart data is filtered, the system exports the filtered values.

To export performance metrics data:

Procedure

1. Click **System** › **System Performance**.

2. Select the metrics for which you want to export data. You can select up to five metrics.

3. Optionally, select a breakdown category for each open line chart, or apply a filter to the line chart data.

4. Click the Export icon above the open line charts.

   The **Export** wizard appears. It displays a list of selected metrics with their associated breakdown categories, if any.

5. Clear the checkboxes for the metrics you do not want to export, and click **Next**.

   The Export wizard lists the metrics to be exported.

6. Click **Download**.

   The **Select location for download dialog** appears.

7. Navigate to the location where you want to save the export file, and click **Save**.

   The default export file name is `tab-name_date-time.csv`, where:

   - `tab-name` is the metric name
   - `date-time` is the date/time when the export occurred

Enable the collection of historical performance metrics

The collection of historical performance metrics is enabled by default. If the historical metrics collection is disabled, you can re-enable it by following this procedure:

Procedure

1. Click **System** › **System Performance**.

2. Click the **Disabled** link in the **Metric Collection Status** field near the top right of the window.

3. Select the **Enable metrics collection** checkbox to enable it, and click **OK**.

Disable the collection of historical performance metrics

To disable the collection of historical performance metrics:

Procedure

1. Click **System › System Performance**.

2. Click the **Enabled** link in the **Metrics Collection Status** field near the top right corner of the window.

3. Clear the **Enable metrics collection** checkbox, and click **OK**.

CHAPTER 3

Monitor system performance using the CLI

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 5 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 (5 sec) • 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) 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 (5 sec), 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: • Yes • No Default value is Yes. **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
```

```
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 6 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. • 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.

Qualifier	Description
	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: • Historical • Real-time Omitting this switch displays all metrics.

Example

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

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 7 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 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 { 5 | 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.
`-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

Qualifier	Description
	• `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.

Example
The following command displays historical metrics for the system:

```
uemcli -d 10.0.0.1 -u Local/joe -p MyPassword456! /metrics/value/hist
-path sp.*.fs.filesystem.*.file.*.readBytes show -from "2012-07-08
12:17:30" -to "2012-07-08 12:19:30" -count 10 -interval 60
```

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

Timestamp           | SP   | File System | File   | Read Bytes
--------------------+------+-------------+--------+-----------
2012-07-08 12:17:30 |  spa|         fs1|     f11|       4000
                    |  spa|         fs1|     f12|       5000
                    |  spa|         fs2|     f21|       6000
                    |  spb|         fs1|     f11|       7000
                    |  spb|         fs1|     f12|       8000
                    |  spb|         fs2|     f21|       9000
                    |  spb|         fs2|     f23|       9000
```

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.

Qualifier Combination	Output
`-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`".

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 8 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 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.

Qualifier	Description
	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.

Example

The following command displays real-time metrics for the system:

**uemcli -d 10.0.0.1 -u Local/joe -p MyPassword456! uemcli /metrics/
value/rt -path sp.*.cifs.client.*.readCalls show -interval 10 -output
nvp**

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

1:  Timestamp = 2012-07-08 12:17:30
    SP        = spa
```

```
       Client    = c1
       CIFS Read = 100

2:     Timestamp = 2012-07-08 12:17:30
       SP        = spb
       Client    = c1
       CIFS Read = 100


3:     Timestamp = 2012-07-08 12:18:40
       SP        = spa
       Client    = c1
       CIFS Read = 100

4:     Timestamp = 2012-07-08 12:18:40
       SP        = spa
       Client    = c2
       CIFS Read = 100

5:     Timestamp = 2012-07-08 12:18:40
       SP        = spb
       Client    = c1
       CIFS Read = 100

6:     Timestamp = 2012-07-08 12:19:50
       SP        = spa
       Client    = c1
       CIFS Read = 100

7:     Timestamp = 2012-07-08 12:19:50
       SP        = spb
       Client    = c1
       CIFS Read = 100
```

The set action command

The set action command modifies, or changes, an object type or object based on the specified path and object qualifier. If the object identified by the object qualifier does not exist, an error message appears.

Format

<object path> set *<object qualifier>* [*<action qualifiers>*]

Example

The following example uses the set action command to change the password for a user account. The path /user/account specifies that the object type is a user account. The –id object qualifier identifies local_user as the user account to change:

```
uemcli -d 10.0.0.1 -u Local/joe -p MyPassword456! /user/account –id
local_user set –passwd NewPassword456! –oldpasswd OldPassword456!

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

ID = local_user
Operation completed successfully.
```

CHAPTER 4

Reference

FAST Cache Dirty Pages (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.

Total Cache Dirty Size (physical deployments only)

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.

Underpinning stat paths

- sp.*.blockCache.global.summary.dirtyBytes

Total Cache Throughput/IOPS

Total number of I/O requests, in I/O per second, passing through the cache. 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 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.
Hit/Miss	Whether or not the I/O was fulfilled.

Underpinning stat paths

- sp.*.blockCache.global.summary.readHits
- sp.*.blockCache.global.summary.readMisses
- sp.*.blockCache.global.summary.writeHits
- sp.*.blockCache.global.summary.writeMisses

Average CIFS I/O Size

Average size of CIFS 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.

Underpinning stat paths

- sp.*.cifs.global.basic.readAvgSize
- sp.*.cifs.global.basic.writeAvgSize
- sp.*.cifs.global.basic.reads
- sp.*.cifs.global.basic.writes

Total CIFS Bandwidth

Total amount of CIFS 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.

Underpinning stat paths

- sp.*.cifs.global.basic.readBytes
- sp.*.cifs.global.basic.writeBytes

Total CIFS Throughput/IOPS

Total number of CIFS 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.

Underpinning stat paths

- sp.*.cifs.global.basic.reads
- sp.*.cifs.global.basic.writes

Average 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.

Underpinning stat path
sp.*.cpu.summary.utilization

Average Disk Queue Length (physical deployments only)

Average number of disk I/O requests in the system queue, in counts per second, across all disks used in provisioned storage. Calculated as a weighted average, which gives more weight to the disks 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...
Disk	Target disks for the network traffic.
Storage Processor	SPs that processed the network traffic.
Tier	Storage tiers against which this metric was tracked.
Enclosure	Disk array enclosures against which this metric was tracked.
Storage Pool	Storage pools against which this metric was tracked, including the FAST Cache.
RAID type	RAID types against which this metric was tracked.
Bus	Buses for transporting the network traffic.

Underpinning stat paths

- sp.*.physical.disk.*.averageQueueLength
- sp.*.physical.disk.*.totalCalls

Average Disk Response Time (physical deployments only)

Average time spent completing disk I/O requests, in microseconds, across all disks used in provisioned storage, including time spent in the queue. Calculated as a weighted average, which gives more weight to the disks with the highest number of I/O requests.

The assumptions the system makes when calculating the average disk 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...
Disk	Target disks for the network traffic.
Storage Processor	SPs that processed the network traffic.
Tier	Storage tiers against which this metric was tracked.
Enclosure	Disk array enclosures against which this metric was tracked.
Storage Pool	Storage pools against which this metric was tracked, including the FAST Cache.
RAID type	RAID types against which this metric was tracked.
Bus	Buses for transporting the network traffic.

Underpinning stat paths

- sp.*.physical.disk.*.responseTime
- sp.*.physical.disk.*.totalCalls

Average Disk Service Time (physical deployments only)

Average time spent completing disk I/O requests, in microseconds, across all disks used in provisioned storage, not including time spent in the queue. Calculated as a weighted average, which gives more weight to the disks 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...
Disk	Target disks for the network traffic.
Storage Processor	SPs that processed the network traffic.
Tier	Storage tiers against which this metric was tracked.
Enclosure	Disk array enclosures against which this metric was tracked.
Storage Pool	Storage pools against which this metric was tracked, including the FAST Cache.
RAID type	RAID types against which this metric was tracked.
Bus	Buses for transporting the network traffic.

Underpinning stat paths

- sp.*.physical.disk.*.serviceTime
- sp.*.physical.disk.*.totalCalls

Total Disk Bandwidth (physical deployments only)

Total amount of disk I/O requests, in KB/s, across all disks 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...
Disk	Target disks for the network traffic.
Storage Processor	SPs that processed the network traffic.
Tier	Storage tiers against which this metric was tracked.
Enclosure	Disk array enclosures against which this metric was tracked.
Storage Pool	Storage pools against which this metric was tracked, including the FAST Cache.
RAID type	RAID types against which this metric was tracked.
Bus	Buses for transporting the network traffic.

Underpinning stat paths

- sp.*.physical.disk.*.readBytes
- sp.*.physical.disk.*.writeBytes

Total Disk Throughput/IOPS (physical deployments only)

Total number of disk I/O requests, in I/O per second, across all disks 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...
Disk	Target disks for the network traffic.
Storage Processor	SPs that processed the network traffic.
Tier	Storage tiers against which this metric was tracked.
Enclosure	Disk array enclosures against which this metric was tracked.
Storage Pool	Storage pools against which this metric was tracked, including the FAST Cache.
RAID type	RAID types against which this metric was tracked.
Bus	Buses for transporting the network traffic.

Underpinning stat paths

- sp.*.physical.disk.*.reads
- sp.*.physical.disk.*.writes

Total 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...
Port	Target hardware ports for the network traffic.
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

Underpinning stat paths

- sp.*.fibreChannel.FEPort.*.readBytes
- sp.*.fibreChannel.FEPort.*.writeBytes

Total Fibre Channel Requests/Second (physical deployments only)

Total number of Fibre Channel I/O requests 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...
Port	Target hardware ports for the network traffic.
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

Underpinning stat paths

- sp.*.fibreChannel.FEPort.*.reads
- sp.*.fibreChannel.FEPort.*.writes

Average 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.

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.

Underpinning stat paths

- sp.*.storage.filesystem.*.readSizeAvg
- sp.*.storage.filesystem.*.writeSizeAvg
- sp.*.storage.filesystem.*.reads
- sp.*.storage.filesystem.*.writes

Total File System Bandwidth

Total amount of file system 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.

Underpinning stat paths

- sp.*.storage.filesystem.*.readBytes
- sp.*.storage.filesystem.*.writeBytes

Total File System Throughput/IOPS

Total number of file system 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.

Underpinning stat paths

- sp.*. storage.filesystem.*.reads
- sp.*. storage.filesystem.*.writes

Total 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...
Port	Target hardware ports for the network traffic.
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

Underpinning stat paths

- sp.*.iscsi.FEPort.*.readBytes
- sp.*.iscsi.FEPort.*.writeBytes

Total iSCSI Requests/Second

Total number of iSCSI I/O requests 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...
Port	Target hardware ports for the network traffic.
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

Underpinning stat paths

- sp.*.iSCSI.FEPort.*.reads
- sp.*.iSCSI.FEPort.*.writes

Average 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.

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...
LUN	Target LUNs for the network traffic.
Storage Processor	SPs that processed the network traffic.
Provisioning Type	Types of provisioning used for the accessed storage.
Storage Pool	Storage pools against which this metric was tracked, including the FAST Cache.
Storage Resource	Storage resources that generated the network traffic.

This category...	Groups or filters data by the...
Storage Resource Type	Types of storage resources that generated the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

Underpinning stat paths

- sp.*.storage.lun.*.avgReadSize
- sp.*.storage.lun.*.avgWriteSize
- sp.*.storage.lun.*.reads
- sp.*.storage.lun.*.writes

Average 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.

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...
LUN	Target LUNs for the network traffic.
Storage Processor	SPs that processed the network traffic.
Provisioning Type	Types of provisioning used for the accessed storage.
Storage Pool	Storage pools against which this metric was tracked, including the FAST Cache.
Storage Resource	Storage resources that generated the network traffic.
Storage Resource Type	Types of storage resources that generated the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

Underpinning stat paths

- sp.*.storage.lun.*.queueLength
- sp.*.storage.lun.*.totalCalls

Total LUN Bandwidth

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...
LUN	Target LUNs for the network traffic.
Storage Processor	SPs that processed the network traffic.

This category...	Groups or filters data by the...
Provisioning Type	Types of provisioning used for the accessed storage.
Storage Pool	Storage pools against which this metric was tracked, including the FAST Cache.
Storage Resource	Storage resources that generated the network traffic.
Storage Resource Type	Types of storage resources that generated the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

Underpinning stat paths

- sp.*.storage.lun.*.readBytes
- sp.*.storage.lun.*.writeBytes

Total LUN Throughput/IOPS

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...
LUN	Target LUNs for the network traffic.
Storage Processor	SPs that processed the network traffic.
Provisioning Type	Types of provisioning used for the accessed storage.
Storage Pool	Storage pools against which this metric was tracked, including the FAST Cache.
Storage Resource	Storage resources that generated the network traffic.
Storage Resource Type	Types of storage resources that generated the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

Underpinning stat paths

- sp.*.storage.lun.*.reads
- sp.*.storage.lun.*.writes

Total Network Bandwidth

Total aggregate bandwidth of all network activity 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...
Port	Target hardware ports for the network traffic.
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

Underpinning stat paths

- sp.*.net.device.*.bytesOut
- sp.*.net.device.*.bytesIn

Total Network Throughput/IOPS

Total aggregate packet rate of all network activity 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...
Port	Target hardware ports for the network traffic.
Storage Processor	SPs that processed the network traffic.
Read/Write	Traffic types: read I/O and write I/O.

Underpinning stat paths

- sp.*.net.device.*.pktsOut
- sp.*.net.device.*.pktsIn

Average 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.

Underpinning stat paths

- sp.*. nfs.basic.readAvgSize
- sp.*. nfs.basic.writeAvgSize
- sp.*.nfs.basic.reads
- sp.*.nfs.basic.writes

Total 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.

Underpinning stat paths

- sp.*.nfs.basic.readBytes
- sp.*.nfs.basic.writeBytes

Total NFS Throughput/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.

Underpinning stat paths

- sp.*.nfs.basic.reads
- sp.*.nfs.basic.writes

Reference