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CHAPTER 1

Introduction

This chapter contains the following topics.

- **Overview** ........................................................................................................... 10
- **References** ....................................................................................................... 10
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Overview

VMware® vCenter Operations Manager is a software product that collects performance and capacity data from monitored software and hardware resources. It provides users with real-time information about potential problems in the enterprise.

vCenter Operations Manager presents data and analysis in several ways:

- Through alerts that warn of potential or occurring problems.
- In configurable dashboards and predefined pages that show commonly needed information.
- In predefined reports.

EMC® Storage Analytics links vCenter Operations Manager with an EMC Adapter. The adapter is bundled with a connector that enables vCenter Operations Manager to collect performance metrics. The adapter is installed with the vCenter Operations Manager user interface.

The connector types are shown in Figure 1 on page 10.

EMC Storage Analytics leverages the power of existing vCenter features to aggregate data from multiple sources and process the data with proprietary analytic algorithms.

References

This topic provides a list of vCenter Operations Manager documentation.

VMware vCenter Operations Manager documentation includes:

- vCenter Operations Manager vApp Deployment and Configuration Guide Explains installation, deployment, and management of vCenter Operations Manager.
- vCenter Operations Manager Getting Started Guide. Explains basic features and use of vCenter Operations Manager.
Terminology

This topic contains a list of commonly used terms.

**adapter**
A vCenter Operations Manager component that collects performance metrics from an external source like a vCenter or storage system. Third-party adapters such as the EMC Adapter are installed on the vCenter Operations Manager server to enable creation of adapter instances within vCenter Operations Manager.

**adapter instance**
A specific external source of performance metrics, such as a specific storage system. An adapter instance resource is an instance of an adapter that has a one-to-one relationship with an external source of data, such as a VNX storage system.

**dashboard**
A tab on the home page of the vCenter Operations Manager GUI. vCenter Operations Manager ships with default dashboards. Dashboards are also fully customizable by the end user.

**health rating**
An overview of the current state of any resource, from an individual operation to an entire enterprise. vCenter Operations Manager checks internal metrics for the resource and uses its proprietary analytics formulas to calculate an overall health score on a scale of 0 to 100.

**metric**
A category of data collected for a resource. For example, the number of read operations per second is one of the metrics collected for each LUN resource.

**resource**
Any entity in your environment for which vCenter Operations Manager can collect data. For example, LUN 27 is a resource.

**resource kind**
A general type of a resource, such as LUN or DISK. The resource kind dictates the type of metrics collected.
CHAPTER 2

Installation and licensing

This chapter contains the following topics.

- Installation overview .......................................................... 14
- Installation requirements ...................................................... 15
- Installing vCenter Operations Manager for EMC Storage ........... 17
- Installing the EMC adapter and dashboards ............................. 17
- Adapter instances ................................................................. 18
Installation overview

EMC Storage Analytics v1.5 consists of two installation packages. The two packages are:

- vCenter Operations Manager for EMC Storage
- EMC Adapter

vCenter Operations Manager for EMC Storage is a storage only version of vCenter Operations Manager 5.7 (build 1073531) developed specifically for EMC storage customers. Installation instructions are in the \textit{vApp Deployment and Configuration Guide} at \url{http://www.vmware.com/support/pubs/vcops-pubs.html}.

Licensing depends on the version of the vCenter Operations Manager:

- VMware issues the license for full vCenter Operations Manager versions.
- EMC issues the license for vCenter Operations Manager for EMC Storage.

\underline{Note}

The EMC license for vCenter Operations Manager for EMC Storage Analytics 5.6 will not work with vCenter Operations Manager for EMC Storage Analytics 5.7.

A 90-day trial license is available with EMC Storage Analytics v1.5 for all supported products. The 90-day trial license provides the same features as a permanent license, but after 90 days of usage, the adapter stops collecting data. You can add a permanent license at any time.

The EMC Adapter collects metrics from VNX resources. It supports vCenter Operations Manager for EMC Storage and the full VMware vCenter Operations Manager. EMC Adapter version 1.5 supports vCenter Operations Manager versions 5.0.3, 5.6, and 5.7.

The adapter installation includes:

- Installing the adapter and dashboards.
- Configuring the adapter instances with licensing.

\textbf{Installing the EMC adapter and dashboards on page 17} provides installation instructions. The adapter is licensed when \textit{Adding EMC adapter instances for your storage system on page 21} or \textit{Editing EMC adapter Instances for your storage system on page 24}.

\textit{Table 1 on page 14} lists the installation and upgrade options for different vCenter Operations Manager and the EMC Adapter combinations. To perform an installation or upgrade, refer to the instructions for the task that matches your objective.

\textbf{Table 1 Installation and Upgrade options}

<table>
<thead>
<tr>
<th>Task</th>
<th>Instructions</th>
</tr>
</thead>
</table>
| Install VMware vCenter Operations Manager 5.7 with the EMC Adapter version 1.5. | \begin{itemize}
  \item \textit{vApp Deployment and Configuration Guide} at \url{http://www.vmware.com/support/pubs/vcops-pubs.html}
  \item Installing the EMC adapter and dashboards on page 17
  \item Adding EMC adapter instances for your storage system on page 21
\end{itemize} |
| Upgrade EMC Adapter version 1.0 to EMC Adapter version 1.5 on a | \begin{itemize}
  \item Installing the EMC adapter and dashboards on page 17
\end{itemize} |
### Table 1 Installation and Upgrade options (continued)

<table>
<thead>
<tr>
<th>Task</th>
<th>Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>system running VMware vCenter Operations Manager 5.0.3 or later.</td>
<td>Editoring EMC adapter instances for your storage system on page 24</td>
</tr>
</tbody>
</table>
| Install the EMC Adapter version 1.5 on a system running VMware vCenter Operations Manager 5.7. | Installing the EMC adapter and dashboards on page 17  
Adding EMC adapter instances for your storage system on page 21 |
| Install the vCenter Operations Manager for EMC Storage and the EMC Adapter version 1.5. | Installing vCenter Operations Manager for EMC Storage on page 17  
Installing the EMC adapter and dashboards on page 17  
Adding EMC adapter instances for your storage system on page 21 |

### Installation requirements

Before installing the EMC Adapter, verify that hardware and software component compatibility requirements are satisfied.

**EMC Adapter requirements**

**Supported vCenter Operations Manager version**
- vCenter Operations Manager 5.7
- vCenter Operations Manager for EMC Storage

**Note**

Previous vCenter Operations Manager versions (5.0.3 and 5.6) are supported with EMC Adapter v1.5, but vCenter Operations Manager 5.7 is recommended. To access all the dashboards in the new Dashboard XChange community, you need vCenter Operations Manager 5.7 with EMC Adapter version 1.5.

Deploy the vApp for vCenter Operations Manager before installing the EMC Adapter. Check the vApp Deployment and Configuration Guide at [http://www.vmware.com/support/pubs/vcops-pubs.html](http://www.vmware.com/support/pubs/vcops-pubs.html) for system requirements pertaining to your version of vCenter Operations Manager. The deployment instructions for vCenter Operations Manager 5.7 apply to vCenter Operations Manager for EMC Storage.

**Supported VNX series (1st generation)**
- VNX5100
- VNX5300
- VNX5500
- VNX5700
- VNX7500
- VG2
- VG8
Supported CX series
- CX4-120
- CX4-240
- CX4-480
- CX4-960

Supported NS series
- NS120
- NS480
- NS960

Supported web browser
- Internet Explorer 8 or 9.
- Firefox 10.0 or later.
- Google Chrome version 19 or later.

VNX Block systems
The EMC Adapter uses naviseccli to collect metrics from VNX Block systems. It is bundled into the EMC Adapter install file and is automatically installed along with the adapter. Storage processors require an IP addresses that are reachable from the vCenter Operations Manager server. Bidirectional traffic for this connection flows through port 443 (HTTPS).

VNX File systems
CLI commands issued on the Control Station direct the EMC Adapter to collect metrics from VNX File systems. The Control Station requires an IP address that is reachable from the vCenter Operations Manager server. Bidirectional ethernet traffic flows through port 22 using Secure Shell (SSH).

Minimum OE requirements
- VNX R31 Block 05.31.000.5.502 and higher
- VNX R31 File: 7.0.35.3 and higher
- VNX R32 Block: 05.32.000.5.006 and higher
- VNX R32 File: 7.1.47.5 and higher
- CX4 04.30.000.5.004 and higher
- NS 6.0.40-0 and higher
- VG2/VG8 7.0.54-1 and higher

DNS configuration
To use the EMC Adapter, the vCenter Operations Manager vApp requires network connectivity to the VNX storage systems to be monitored. DNS must be correctly configured on the vCenter Operations Manager server to enable hostname resolution by the EMC Adapter.

Time zone and synchronization settings
Ensure time synchronization for all ESA resources by using Network Time Protocol (NTP). Also set correct time zones for ESA resources and related systems.
Installing vCenter Operations Manager for EMC Storage

If no vApp for vCenter Operations Manager is deployed, install the vCenter Operations Manager for EMC Storage.

Before you begin

Pre-requisites:
- Obtain the OVA installation package for vCenter Operations Manager 5.7 from VMware or vCenter Operations Manager for Storage from EMC.
- Obtain a vCenter Operations Manager for EMC Storage license key.

To deploy the vApp for vCenter Operations Manager, refer to the vApp Deployment and Configuration Guide.

Procedure
1. Review the System Requirements.
2. Follow instructions in Installing vCenter Operations Manager.
   When assigning the vCenter Operations Manager license, type the vCenter Operations Manager for EMC Storage license from the EMC Storage Analytics Software Key Card.
3. Conclude the installation with Verifying the vCenter Operations Manager Installation.

Installing the EMC adapter and dashboards

Before you begin

Pre-requisites:
Obtain the PAK file for the EMC Adapter.

Note
If using Internet Explorer, the installation file downloads as a ZIP file but functions the same way as the PAK file.

To install the adapter and dashboards:

Procedure
1. Save the PAK file in a temporary folder.
2. Start the vCenter Operations Manager administrative user interface in your web browser and log in as administrator.
   For example, http://<vCOPs_ip_address>/admin
3. On the Update tab, click Browse to locate the adapter PAK file.
4. Click Update.
   The status of the update process appears in the bottom pane.

Note
Installation of the PAK file can take several minutes or longer depending on the amount of metric data that already exists in the vCenter Operations database. The vCenter Operations Manager will restart services following installation of the PAK file.
### Adapter instances

The vCenter Operations Manager requires an Adapter Instance for each resource to be monitored. The instance specifies the type of adapter to use and the information needed to identify and access the resource.

With EMC Storage Analytics, the vCenter Operations Manager uses EMC Adapter Instances to identify and access the resources, such as:

- Adapter Instance for vCenter
- Adapter Instance for the VNX File
- Adapter Instance for the VNX Block

The adapter instance for vCenter is a prerequisite for other adapter instances. If this adapter is not configured, other adapter instances will function normally but will not display visible connections between the VMware objects and the array objects.

---

**Note**

After adapter instances are created, the vCenter Operations Manager Collector requires several minutes to collect statistics, depending on the size of the storage array configuration. Large configurations can take up to 20 minutes to collect metrics and resources and update dashboards.

### Adding an EMC Adapter Instance for vCenter

For users to traverse health trees from the virtual environment into the storage environment, EMC Storage Analytics requires you to install an EMC adapter instance for vCenter. All storage system adapter instances require the EMC adapter instance for vCenter, which you must add first.

To add an EMC Adapter Instance for vCenter:

**Procedure**

1. Start the vCenter Operations Manager custom user interface and log in as administrator.

   For example in a web browser, type: `http://<vCOPs_ip_address>/vcops-custom`

2. Select **Environment > Configuration > Adapter Instances**.

3. Click the **Add New Adapter Instance** icon.

   The **Add Adapter Instance** screen appears.

4. Set the following:

<table>
<thead>
<tr>
<th>Collector</th>
<th>vCenter Operations Standard Server</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adapter Kind</td>
<td>EMC Adapter</td>
</tr>
<tr>
<td>Adapter Instance Name</td>
<td>Any descriptive name. For example, <em>My vCenter</em>.</td>
</tr>
<tr>
<td>Management IP</td>
<td>IP address of the vCenter Server</td>
</tr>
<tr>
<td>Array ID (optional)</td>
<td>This field must be blank for VMWare vSphere connection type.</td>
</tr>
<tr>
<td>Connection Type</td>
<td>VMware vSphere</td>
</tr>
<tr>
<td>License (optional)</td>
<td>Blank. Not applicable for EMC Adapter Instance for vCenter.</td>
</tr>
</tbody>
</table>
Log Level

Configure log levels for each adapter instance. The four levels for logging information are ERROR, WARN, INFO, and DEBUG.

**ERROR**
The ERROR level logs only error conditions. The ERROR level provides the smallest amount of logging information.

**WARN**
The WARN level logs information when an operation completes successfully but there are issues with the operation.

**INFO**
The INFO level logs information about workflow. It describes how an operation occurs.

**DEBUG**
The DEBUG level logs all details related to an operation. This level is the highest level of logging. If logging is set to DEBUG, all other levels of logging information are displayed in the log file.

| Credential | Select any previously defined credentials for this storage system, otherwise click Add. |

The **Add Credential** screen appears with the **Adapter Kind** set to **EMC Adapter**.

5. Set the following:

<table>
<thead>
<tr>
<th>Credential kind</th>
<th><strong>vCenter Credentials</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Instance name</td>
<td>Any descriptive name. For example, <strong>My VMware Credentials</strong>.</td>
</tr>
<tr>
<td>Username</td>
<td>Username that EMC Storage Analytics uses to connect to the VMware vCenter system. If a domain user is used, the format for the username is DOMAIN\USERNAME.</td>
</tr>
<tr>
<td>Password</td>
<td>Password for the EMC Storage Analytics username on the VMware vCenter system.</td>
</tr>
</tbody>
</table>
6. Click **OK**.

The **Add Adapter Instance** screen reappears.

7. To test the adapter instance, click **Test**

If the connection is correctly configured, a confirmation box appears.

8. Click **OK**.

The new adapter instance polls for data every 5 minutes by default. At every interval, the adapter instance will collect information about the VMware vSphere datastore and virtual machines with Raw Device Mapping (RDM). Consumers of the registered VMware service can access the mapping information.

To edit the polling interval, select **Environment** > **Environment Overview** > **Resource Kinds** > **EMC Adapter Instance** > **All Attributes**. Select the EMC Adapter Instance and click the **Edit Resource** icon.
Adding EMC adapter instances for your storage system

Before you begin

Pre-requisites:

- Install the EMC adapter for vCenter
- Obtain the adapter license key for your storage system

Each storage system requires an adapter instance. All storage system adapter instances require the EMC adapter instance for vCenter. Add the EMC adapter instance for vCenter first. Then add the adapter instances for each storage system. Adapter instances are licensed per array. A Unified array can use the same license for File and Block.

Procedure

1. Start the vCenter Operations Manager custom user interface and log in as administrator.
   
   For example in a web browser, type: `http://<vCOPs_ip_address>/vcops-custom`

2. Select Environment > Configuration > Adapter Instances.

   The Manage Adapter Instances screen appears.

3. Click the Add New Adapter Instance icon.

   The Add Adapter Instance screen appears.
4. Set the following:

<table>
<thead>
<tr>
<th>Collector</th>
<th>vCenter Operations Standard Server</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adapter Kind</td>
<td>EMC Adapter</td>
</tr>
<tr>
<td>Adapter Instance Name</td>
<td>Any descriptive name. For example, My VNX Block Storage System or the array ID.</td>
</tr>
<tr>
<td>Management IP</td>
<td>For VNX File, use the IP of the primary Control Station.</td>
</tr>
</tbody>
</table>

**Note**

VNX VG2 and VG8 gateways are considered VNX File instances.

For VNX Block, use the IP address of one Storage Processor in a single array. Do not add an adapter instance for each SP.

<table>
<thead>
<tr>
<th>Array ID (optional)</th>
<th>Not applicable to VNX File and VNX Block connection types.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection Type</td>
<td>VNX File or VNX Block.</td>
</tr>
</tbody>
</table>

**Note**

For NS and CX4 systems, use VNX File or VNX Block connection type, depending on the system. For VNX gateways, use VNX File.

<table>
<thead>
<tr>
<th>License (optional)</th>
<th>License key required for the array. Verify that the license is for the array you want to monitor.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Log Level</td>
<td>Configure log levels for each adapter instance. The four levels for logging information are ERROR, WARN, INFO, and DEBUG.</td>
</tr>
</tbody>
</table>

**ERROR**

The ERROR level logs only error conditions. The ERROR level provides the smallest amount of logging information.

**WARN**

The WARN level logs information when an operation completes successfully but there are issues with the operation.

**INFO**

The INFO level logs information about workflow. It describes how an operation occurs.

**DEBUG**

The DEBUG level logs all details related to an operation. This level is the highest level of logging. If logging is set to DEBUG, all other levels of logging information are displayed in the log file.

| Credential     | Select any previously defined credentials for this storage system, otherwise, click Add. |

The Add Credential screen appears with the Adapter Kind set to EMC Adapter.
5. Set the following:

<table>
<thead>
<tr>
<th>Adapter kind</th>
<th>EMC Adapter. Retain the setting.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Credential kind</td>
<td>Default VNX Block Credentials or Default VNX File Credentials</td>
</tr>
<tr>
<td>Instance name</td>
<td>Any descriptive name. For example, Default VNX Credentials.</td>
</tr>
<tr>
<td>Username</td>
<td>Username that EMC Storage Analytics uses to connect to the storage system. For VNX File, use the credentials of the Control Station. For VNX Block, use the credentials of the Storage Processors.</td>
</tr>
<tr>
<td>Password</td>
<td>Password for the EMC Storage Analytics username on the storage system.</td>
</tr>
</tbody>
</table>

6. Click **OK**.

The **Add Adapter Instance** screen reappears.

7. Click **Test** to validate the values you entered.

   If the adapter instance is correctly configured, a confirmation box appears.

   **Note**

   Testing an adapter instance validates the values you entered. Failure to do this step causes the adapter instance to change to the red (warning) state if you enter invalid values and do not validate them.

8. To finish adding the adapter instance, click **OK**.
Editing EMC adapter Instances for your storage system

Before you begin

Pre-requisites:

- Install the EMC Adapter
- Configure the EMC Adapter Instance for your storage system
- Obtain an adapter license key for your storage system

The EMC Adapter Instances for storage systems require licenses. Adapter instances are licensed per storage array. A Unified array can use the same license for File and Block.

Procedure

1. Start the vCenter Operations Manager custom user interface and log in as administrator.
   
   For example in a web browser, type: http://<vCOPs_ip_address>/vcops-custom

2. Select Environment > Configuration > Adapter Instances.
   
   The Manage Adapter Instances screen appears.

3. Select the row of an EMC adapter instance (Adapter Kind is EMC Adapter), and click the Edit Selected Adapter Instance icon.

   ![](image)

   The Edit Adapter Instance screen appears.
4. Add the license from the EMC Storage Analytics Software Key Card. The EMC Adapter Instances license key is issued for the storage system. Verify that the Management IP is for the same array model specified on the key card.

5. To test the configuration, click Test.
   
   If the adapter instance is correctly configured, a confirmation box appears.

6. To finish editing the adapter instance, click OK.
Installation and licensing
CHAPTER 3

EMC Storage Analytics Dashboards

This chapter contains the following topics.

- Topology mapping .......................................................... 28
- EMC dashboards ............................................................ 30
Topology mapping

Topology mapping is viewed and traversed graphically using vCenter Operations Manager health trees. The dashboards developed for EMC Storage Analytics utilize topology mapping to display resources and metrics.

EMC Storage Analytics establishes mappings between:
- Storage system components
- Storage system objects and vCenter objects

Topology mapping enables health scores and alerts from storage system components, such as storage processors and disks, to appear on affected vCenter objects, such as LUNs, datastores, and VMs. Topology mapping between storage system objects and vCenter objects uses a vCenter adapter instance.
VNX Block topology

EMC Storage Analytics implements the following topology for VNX Block.

Figure 2  VNX Block topology
VNX File topology

EMC Storage Analytics implements the following topology for VNX File.

**Figure 3  VNX File topology**

EMC dashboards

Use dashboards to view metrics.

EMC Storage Analytics includes these EMC dashboards:

- EMC Storage Topology
- EMC Storage Metrics
- EMC VNX Overview

You can use the standard vCenter Operations Manager dashboard customization features to create additional dashboards that are based on your site requirements.
EMC Storage Topology dashboard

The EMC Storage Topology dashboard provides an entry point for viewing resources and relationships between storage and virtual infrastructure objects.

Click the EMC Storage Topology tab. Details for every object in every widget are available by selecting the object and clicking the Resource Detail icon at the top of each widget circled in red in Figure 4 on page 31.

Figure 4  EMC Storage Topology dashboard

The EMC Storage Topology dashboard contains the following widgets:

**Storage System Selector**

This Resource widget filters the EMC Adapter Instances that are found in each storage system. To populate the Storage Topology and Health widget, select an instance name.

**Storage Topology and Health**

This Health Tree widget provides a navigable visualization of resources and virtual infrastructure resources. Single-click to select resources, or double-click to change the navigation focus. To populate the Parent Resources and Child Resources widgets, select a resource in this widget.

**Parent resources**

This widget lists the parent resources of the resource selected in the Storage Topology and Health widget.
**Child resources**
This widget lists the child resources of the resource selected in the Storage Topology and Health widget.

**EMC Storage Metrics dashboard**

The EMC Storage Metrics dashboard displays resource and metrics for storage systems and allows the user to view graphs of resource metrics.

**Figure 5** EMC Storage Metrics dashboard

The EMC Storage Metrics dashboard contains the following widgets:

**Storage System Selector**
This Resource widget filters the EMC Adapter Instances that are found in each storage system. To populate the Resource Selector widget, select an instance name.

**Resource Selector**
This Health Tree widget lists each resource associated with the adapter instance selected in the Storage System Selector. The search feature of this widget allows users to locate specific objects. To populate the Storage System Selector widget, select a resource.

**Metric Selector**
This widget lists all the metrics that are collected for the resource selected in the Resource Selector widget. Double-click a metric to create a graph of the metric in the Metric Graph widget.
**Metric Graph**

This widget graphs the metrics selected in the **Metric Selector** widget. Display multiple metrics simultaneously in a single graph or in multiple graphs.

**EMC VNX Overview dashboard**

This collection of heat maps provides a single view of the performance and capacity for all VNX resources with configured adapter instances. Heat maps on this dashboard group the contents by adapter instance.

**Figure 6** EMC VNX Overview dashboard

The EMC VNX Overview dashboard displays the following heat maps:

**CPU performance**

This displays the CPU Utilization, such as % busy, of each Storage Processor and Data Mover on each configured adapter instance. The color of the heat map entries shows % busy:
- Green indicates 0% busy.
- Red indicates 100% busy.

**FAST cache performance**

This has two modes: Read Hit Ratio and Write Hit Ratio. To select the mode, use the Configuration menu. The Read/Write Cache Hit Ratio (%) is the number of FAST Cache read or write hits divided by the total number of read or write I/Os across all RG LUNs and Pools configured to use FAST Cache. The color of the heat map entries shows hit ratios:
- Green indicates a high FAST Cache hit ratio.
- Red indicates a low FAST Cache hit ratio. A low value on an idle array is acceptable.
Grey indicates that there is no FAST Cache present on the VNX systems identified by the adapter instances and a **Heat Map not configured** message appears with the heat map.

**Pool capacity**
This has four modes: RAID Group Available Capacity, Storage Pool Capacity Utilization, Storage Pool Available Capacity, and File Pool Available Capacity. In Capacity Utilization mode, the color of the heat map entries shows the value of the % full metric for all non-RAID Group storage pools:
- Green indicates 0% full.
- Red indicates 100% full.

In Available Capacity mode, the color of the heap map entries shows the value of the Available Capacity (GB) metric:
- Green indicates the largest available capacity on any storage pool for any of the configured adapter instances.
- Red indicates 0 GB available.

**LUN and file system performance**
This has several modes.
In LUN Utilization mode, the color of the heat map entries show the %busy metric for all LUNs grouped by adapter instance:
- Green indicates 0% busy.
- Red indicates 100% busy.

In RAID Group LUN Latency mode, the color of the heat map entries shows the value of the Latency (ms) metric:
- Green indicates 0 ms latency.
- Red indicates 20 ms or greater latency and is configurable.

Latency values appear for RAID Group LUNs. Pool LUNS appear in white with no latency values reported.

In LUN Read IOPs mode, the color of the heat map entries shows the relative number of read IO operations per second serviced by the LUN. The color ranges from light green to dark green. Dark green indicates the highest number of read IO operations per second serviced by any LUN listed in the heat map.

In LUN Write IOPS mode, the color of the heat map entries shows the relative number of write IO operations per second serviced by the LUN. The color ranges from light green to dark green. Dark green indicates the highest number of write IO operations per second serviced by any LUN listed in the heat map.

In File System Read IOPs mode, the color of the heat map shows the relative number of read IO operations per second serviced by the file system. The color ranges from light green to dark green. Dark green indicates the highest number of read IO operations per second serviced by any file system listed in the heat map.

In File System Write IOPS mode, the color of the heat map entries shows the relative number of write IO operations per second serviced by the file system. The color ranges from light green to dark green. Dark green indicates the highest number of write IO operations per second serviced by any file system listed in the heat map.
Dashboard XChange

The Dashboard XChange is a user community page for users to exchange EMC Storage Analytics custom dashboards.

EMC Storage Analytics provides a set of default dashboards that provide you with a variety of functional views into your storage environment. EMC Storage Analytics also enables you to create custom dashboards that allow you to visualize collected data according to your own requirements. The Dashboard XChange is an extension of that feature that enables you to:

- Export custom dashboards to the Dashboard XChange to benefit a wider EMC Storage Analytics community
- Import custom dashboards from the Dashboard XChange to add value to your own environment

The Dashboard XChange, hosted on the EMC Community Network, will also host dashboards designed by EMC to showcase widget functions that may satisfy a particular use-case in your environment. You can import these dashboards into your existing environment to enhance the functionality offered by EMC Storage Analytics. You can also edit imported dashboards to meet the specific requirements of your own storage environment.

The Dashboard XChange, shown in Figure 7 on page 35, provides the following resources to assist you in creating custom dashboards:

- How-to video that shows how to create custom dashboards
- Best practices guide that provides detailed guidelines for dashboard creation
- Slide show that demonstrates how to import dashboards from or export them to the Dashboard XChange

Figure 7  Dashboard XChange

The EMC Storage Analytics Dashboard XChange is available at https://community.emc.com/community/connect/esa.
CHAPTER 4

Resource Kinds and Metrics

This chapter contains the following topics.

- Resource Kinds ................................................................. 38
- VNX Block metrics .......................................................... 38
- VNX File metrics ........................................................... 44
Resource Kinds

Metrics collected in the vCenter Operations Manager are grouped by Resource Kind. VNX Block and VNX File have different Resource Kinds.

**Resource Kinds for VNX Block**

EMC Storage Analytics includes the following Resource Kinds for VNX Block:
- Adapter Instance (Array)
- Storage Processor
- FAST Cache
- LUN
- RAID Group
- Storage Pool
- Tier
- Disk

**Resource Kinds for VNX File**

EMC Storage Analytics includes the following Resource Kinds for VNX File:
- Adapter Instance (Array)
- Virtual Data Mover
- Data Mover
- dVol
- NFS Export
- File Pool
- File System

VNX Block metrics

EMC Storage Analytics includes the following metrics for VNX Block with one table for each Resource Kind.

**Table 2 VNX Block metrics for Array**

<table>
<thead>
<tr>
<th>Metric</th>
<th>Additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elapsed collect time</td>
<td></td>
</tr>
<tr>
<td>New metrics in each collect call</td>
<td>Number of new metrics per collection.</td>
</tr>
<tr>
<td>New resources in each collect call</td>
<td>Number of new resources per collection.</td>
</tr>
<tr>
<td>Number of down resources</td>
<td>Number of down resources for this adapter instance.</td>
</tr>
<tr>
<td>Number of metrics collected</td>
<td>Number of metrics collected by this adapter instance.</td>
</tr>
<tr>
<td>Number of resources collected</td>
<td>Number of resources collected by this adapter instance.</td>
</tr>
</tbody>
</table>
### Table 3 VNX Block metrics for Storage Processor

<table>
<thead>
<tr>
<th>Metric</th>
<th>Additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Writes (IO/s)</td>
<td>The number of writes per second at the time when the SP is polled, that is passed through the SP per second. Smaller requests usually result in a higher write throughput than larger requests.</td>
</tr>
<tr>
<td>Writes (MB/s)</td>
<td>The average write request size in Mbytes that passes through the SP per second. Larger requests usually result in higher bandwidth than smaller requests.</td>
</tr>
<tr>
<td>Reads (IO/s)</td>
<td>The average number of host read requests that is passed through the SP per second. Smaller requests usually result in a higher read throughput than larger requests.</td>
</tr>
<tr>
<td>Reads (MB/s)</td>
<td>The average amount of host read data in Mbytes that is passed through the SP per second. Larger requests usually result in a higher bandwidth than smaller requests.</td>
</tr>
<tr>
<td>Busy (%)</td>
<td>The percentage of time during which the SP is serving requests. When the SP becomes the bottleneck, the utilization will be at or close to 100%. And increase in workload will have no further impact on the SP throughput, but the I/O response time will start increasing more aggressively.</td>
</tr>
<tr>
<td>Write Cache Flashes (MB/s)</td>
<td>The average amount of data in Mbytes that was written from the write cache to the disks per second. The value is a measure of back-end activity.</td>
</tr>
<tr>
<td>Dirty Cache Pages (%)</td>
<td>Percentage of write cache pages owned by this SP containing data that has not yet been flushed out to the disks. This metric shows the level of the write cache at the last polling time and is not an average over the last polling interval.</td>
</tr>
<tr>
<td>Read Cache Size (MB)</td>
<td>The size of the read cache in Mbytes.</td>
</tr>
<tr>
<td>Read Cache State</td>
<td>The enabled or disabled state of the read cache.</td>
</tr>
<tr>
<td>Write Cache Size (MB)</td>
<td>The size of the write cache in Mbytes.</td>
</tr>
<tr>
<td>Write Cache State</td>
<td>The enabled or disabled state of the write cache.</td>
</tr>
<tr>
<td>Read Cache Hit Ratio (%)</td>
<td>The ratio of read requests that the SP Cache satisfied without requiring any disk access versus the total number of read requests.</td>
</tr>
<tr>
<td>Write Cache Hit Ratio (%)</td>
<td>The ratio of write requests that the SP Cache satisfied without requiring any disk access versus the total number of write requests.</td>
</tr>
</tbody>
</table>

### Table 4 VNX Block metrics for FAST Cache

<table>
<thead>
<tr>
<th>Metric</th>
<th>Additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current operation</td>
<td>Creating or Destroying.</td>
</tr>
<tr>
<td>Current operation status</td>
<td>If there is a current FAST Cache operation in progress such as destroying or creating, this displays the percentage complete.</td>
</tr>
</tbody>
</table>
Table 4 VNX Block metrics for FAST Cache (continued)

<table>
<thead>
<tr>
<th>Metric</th>
<th>Additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode</td>
<td>Read or write.</td>
</tr>
<tr>
<td>RAID Type</td>
<td>The RAID Type of FAST Cache.</td>
</tr>
<tr>
<td>Size (GB)</td>
<td>The capacity of FAST Cache.</td>
</tr>
<tr>
<td>SP A Dirty (%)</td>
<td>Percentage of write cache pages owned by SP A that contain data that has not yet been flushed out to the FAST Cache.</td>
</tr>
<tr>
<td>SP A Flushed (MB)</td>
<td>The average amount of data in Mbytes that was written from the write cache to the FAST Cache.</td>
</tr>
<tr>
<td>SP B Dirty (%)</td>
<td>Percentage of write cache pages owned by SP B that contain data that has not yet been flushed out to the FAST Cache.</td>
</tr>
<tr>
<td>SP B Flushed (MB)</td>
<td>The average amount of data in Mbytes that was written from the write cache to the FAST Cache.</td>
</tr>
<tr>
<td>Read Cache Hits Ratio (%)</td>
<td>The ratio of read requests that the FAST Cache satisfied without requiring any disk access versus the total number of read requests. The higher the ratio the better the read performance.</td>
</tr>
<tr>
<td>Read Cache Hits (Hits/s)</td>
<td>Average number of read requests per second that were satisfied by the FAST Cache without requiring any disk access. Read requests that are not FAST Cache hits are read misses.</td>
</tr>
<tr>
<td>Read Cache Misses (Misses/s)</td>
<td>Average number of read requests per second that required one or multiple disk accesses.</td>
</tr>
<tr>
<td>Write Cache Hits Ratio (%)</td>
<td>The ratio of write requests that the FAST Cache satisfied without requiring any disk access versus the total number of write requests. The higher the ratio the better the write performance.</td>
</tr>
<tr>
<td>Write Cache Hits (Hits/s)</td>
<td>Average number of write requests per second that were satisfied by the FAST Cache without requiring any disk access. Write requests that are not FAST Cache hits are write misses.</td>
</tr>
<tr>
<td>Write Cache Misses (Misses/s)</td>
<td>Average number of write requests per second that required one or multiple disk accesses.</td>
</tr>
<tr>
<td>Current Operation Complete (%)</td>
<td>If there is a current FAST Cache operation in progress such as destroying or creating, this displays the percentage complete.</td>
</tr>
</tbody>
</table>

Table 5 VNX Block metrics for Pool LUN

<table>
<thead>
<tr>
<th>Metric</th>
<th>Additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance Tier Distribution (%)</td>
<td>The distribution (%) of the Performance Tier.</td>
</tr>
<tr>
<td>Extreme Performance Tier Distribution (%)</td>
<td>The distribution (%) of the Extreme Performance Tier.</td>
</tr>
<tr>
<td>Capacity Tier Distribution (%)</td>
<td>The distribution (%) of the Capacity Tier.</td>
</tr>
<tr>
<td>Tiering Policy</td>
<td>The tiering policy of this Pool LUN.</td>
</tr>
</tbody>
</table>
### Table 5: VNX Block metrics for Pool LUN (continued)

<table>
<thead>
<tr>
<th>Metric</th>
<th>Additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Tier</td>
<td>The initial tier that was used for initial placement of the new LUN.</td>
</tr>
<tr>
<td>Consumed capacity (GB)</td>
<td>The amount of space consumed in the pool by the LUN plus overhead.</td>
</tr>
<tr>
<td>User capacity (GB)</td>
<td>The amount of space consumed in the pool by the LUN.</td>
</tr>
<tr>
<td>Busy (%)</td>
<td>The fraction of an observation period during which a LUN has any outstanding requests. When the LUN becomes the bottleneck, the utilization is at or near 100%. However, since the I/Os can be serviced by multiple disks, an increase in workload may still result in a higher throughput.</td>
</tr>
<tr>
<td>Queue depth</td>
<td>The length of the LUN queue.</td>
</tr>
<tr>
<td>Reads (I/O/s)</td>
<td>The average number of host read requests that is passed through the LUN per second. Smaller requests usually result in a higher read throughput than larger requests.</td>
</tr>
<tr>
<td>Reads (MB/s)</td>
<td>The average amount of host read data in Mbytes that is passed through the LUN per second. Larger requests usually result in a higher bandwidth than smaller requests.</td>
</tr>
<tr>
<td>Writes (I/O/s)</td>
<td>The average number of host write requests that is passed through the LUN per second. Smaller requests usually result in a higher write throughput than larger requests.</td>
</tr>
<tr>
<td>Writes (MB/s)</td>
<td>The average amount of host write data in Mbytes that is passed through the LUN per second. Larger requests usually result in a higher bandwidth than smaller requests.</td>
</tr>
<tr>
<td>Explicit trespasses</td>
<td>Number of trespasses since the last poll. Default polling cycle is 5 minutes. Occurs as a result of an external command from a user or the failover software. When an SP receives this command, LUN ownership is transferred to that SP.</td>
</tr>
<tr>
<td>Implicit trespasses</td>
<td>Number of trespasses since the last poll. Default polling cycle is 5 minutes. Occurs as a result of software controls within the storage system. An implicit trespass occurs when the amount of I/O transferred across the non-optimal path exceeds the optimal path I/O by a specified threshold.</td>
</tr>
</tbody>
</table>

### Table 6: VNX Block metrics for RAID Group LUN

<table>
<thead>
<tr>
<th>Metric</th>
<th>Additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Latency (ms)</td>
<td>The average time in milliseconds, that it takes for one request to pass through the LUN, including any waiting time. The higher the queue length for a LUN, the more requests are waiting in its queue, thus increasing the average latency of a single request. For a given workload, queue length and response time are directly proportional.</td>
</tr>
<tr>
<td>Read Latency (ms)</td>
<td>The average time in milliseconds, that it takes for one read request to pass through the LUN, including any waiting time.</td>
</tr>
</tbody>
</table>
### Table 6 VNX Block metrics for RAID Group LUN (continued)

<table>
<thead>
<tr>
<th>Metric</th>
<th>Additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write Latency (ms)</td>
<td>The average time in milliseconds, that it takes for one write request to pass through the LUN, including any waiting time.</td>
</tr>
<tr>
<td>Read Cache State</td>
<td>The enabled or disabled state of the read cache.</td>
</tr>
<tr>
<td>Write Cache State</td>
<td>The enabled or disabled state of the write cache.</td>
</tr>
<tr>
<td>Reads (IO/s)</td>
<td>The average number of host read requests that is passed through the LUN per second.</td>
</tr>
<tr>
<td>Reads (MB/s)</td>
<td>The average amount of host read data in Mbytes that is passed through the LUN per second.</td>
</tr>
<tr>
<td>Writes (IO/s)</td>
<td>The average number of host write requests that is passed through the LUN per second.</td>
</tr>
<tr>
<td>Writes (MB/s)</td>
<td>The average amount of host write data in Mbytes that is passed through the LUN per second.</td>
</tr>
<tr>
<td>User Capacity (GB)</td>
<td>The amount of space consumed in the RAID Group by the LUN.</td>
</tr>
</tbody>
</table>

### Table 7 VNX Block metrics for RAID Group

<table>
<thead>
<tr>
<th>Metric</th>
<th>Additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full (%)</td>
<td>Percentage of total capacity that is consumed.</td>
</tr>
<tr>
<td>User Capacity (GB)</td>
<td>The amount of space available in the RAID Group.</td>
</tr>
<tr>
<td>Raw Capacity (GB)</td>
<td>The total amount of space available in the RAID Group prior to RAID protection.</td>
</tr>
<tr>
<td>Logical Capacity (GB)</td>
<td>The amount of usable space in the RAID Group.</td>
</tr>
<tr>
<td>Available Capacity (GB)</td>
<td>The remaining free capacity of this RAID Group.</td>
</tr>
<tr>
<td>Free Continuous Group of Unbound Segments (GB)</td>
<td>Size in GB of the largest continuous span of free space in the RAID Group. LUNs must fit into a contiguous span of free space.</td>
</tr>
<tr>
<td>Disk Count</td>
<td>Number of disks in this RAID Group.</td>
</tr>
<tr>
<td>LUN Count</td>
<td>Number of LUNs in this RAID Group.</td>
</tr>
<tr>
<td>Maximum Number of Disks</td>
<td>Maximum number of disks allowed for this RAID Group.</td>
</tr>
<tr>
<td>Maximum Number of LUNs</td>
<td>Maximum number of LUNs allowed for this RAID Group.</td>
</tr>
<tr>
<td>Defragmented (%)</td>
<td>When a defragment operation in progress, this displays the percentage complete.</td>
</tr>
<tr>
<td>Expanded (%)</td>
<td>Percentage of the completed expansion process.</td>
</tr>
</tbody>
</table>
### Table 8 VNX Block metrics for Storage Pool

<table>
<thead>
<tr>
<th>Metric</th>
<th>Additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Available Capacity (GB)</td>
<td>Capacity available for use in this Storage Pool.</td>
</tr>
<tr>
<td>Consumed Capacity (GB)</td>
<td>Capacity used in this Storage Pool.</td>
</tr>
<tr>
<td>Disk type</td>
<td>Type of disks in this Storage Pool.</td>
</tr>
<tr>
<td>Current operation</td>
<td>Displays the current operation in the pool.</td>
</tr>
<tr>
<td>Current operation complete (%)</td>
<td>If there is a thin pool operation in progress such as a re-balance, this displays the percentage complete.</td>
</tr>
<tr>
<td>Current operation state</td>
<td>Displays the current operation state.</td>
</tr>
<tr>
<td>Current operation status</td>
<td>Displays additional descriptive information for the current state of the thin pool.</td>
</tr>
<tr>
<td>FAST Cache (Enabled/Disabled)</td>
<td>The enabled or disabled state of the FAST Cache for this Storage Pool.</td>
</tr>
<tr>
<td>Full (%)</td>
<td>Percentage of total capacity that is consumed.</td>
</tr>
<tr>
<td>Subscribed (%)</td>
<td>Percentage of total capacity that is subscribed.</td>
</tr>
<tr>
<td>Threshold (%)</td>
<td>Threshold as percentage of total capacity.</td>
</tr>
<tr>
<td>Oversubscribed (GB)</td>
<td>How much the Storage Pool is oversubscribed.</td>
</tr>
<tr>
<td>Disk Count</td>
<td>Number of disks consumed by this Storage Pool.</td>
</tr>
<tr>
<td>LUN Count</td>
<td>Number of LUNs hosted by this Storage Pool.</td>
</tr>
<tr>
<td>Auto-Tiering</td>
<td>Shows if auto-tiering is scheduled.</td>
</tr>
<tr>
<td>Relocation Status</td>
<td>Relocation is active or inactive.</td>
</tr>
<tr>
<td>Relocation Type</td>
<td>Scheduled or manual relocation.</td>
</tr>
<tr>
<td>Schedule Duration Remaining</td>
<td>If using scheduled relocation, this displays the remaining time for the relocation.</td>
</tr>
<tr>
<td>Auto-Tiering State</td>
<td>The enabled or disabled state of auto-tiering.</td>
</tr>
<tr>
<td>Data Movement Completed (GB)</td>
<td>Amount of data that has been moved up or down.</td>
</tr>
<tr>
<td>Data to Move Up (GB)</td>
<td>Amount of data that is going to be moved up.</td>
</tr>
<tr>
<td>Data to Move Down (GB)</td>
<td>Amount of data that is going to be moved down.</td>
</tr>
<tr>
<td>Estimated Time to Complete</td>
<td>Estimated time to complete the data relocation.</td>
</tr>
</tbody>
</table>

### Table 9 VNX Block metrics for Tier

<table>
<thead>
<tr>
<th>Metric</th>
<th>Additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAID Type</td>
<td>Type of RAID applied to the tier.</td>
</tr>
<tr>
<td>Disk Count</td>
<td>Number of disks in the tier.</td>
</tr>
<tr>
<td>Higher Tier (GB)</td>
<td>Amount of data targeted for higher tiers.</td>
</tr>
<tr>
<td>Lower Tier (GB)</td>
<td>Amount of data targeted for lower tiers.</td>
</tr>
</tbody>
</table>
Table 9 VNX Block metrics for Tier (continued)

<table>
<thead>
<tr>
<th>Metric</th>
<th>Additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Available Capacity (GB)</td>
<td>Capacity still available for use.</td>
</tr>
<tr>
<td>Consumed Capacity (GB)</td>
<td>Used capacity.</td>
</tr>
<tr>
<td>User Capacity (GB)</td>
<td>Free capacity for users.</td>
</tr>
<tr>
<td>Subscribed (%)</td>
<td>Percentage of tier that is subscribed.</td>
</tr>
</tbody>
</table>

Table 10 VNX Block metrics for Disk

<table>
<thead>
<tr>
<th>Metric</th>
<th>Additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity (GB)</td>
<td>Total capacity of the disk.</td>
</tr>
<tr>
<td>LUN Count</td>
<td>Total number of LUNs that the disk is serving.</td>
</tr>
<tr>
<td>State</td>
<td>Current state of the disk.</td>
</tr>
<tr>
<td>Hard Read Errors</td>
<td>Number of hard read errors.</td>
</tr>
<tr>
<td>Hard Write Errors</td>
<td>Number of hard write errors.</td>
</tr>
<tr>
<td>Reads (IO/s)</td>
<td>The average number of read requests from the disk per second.</td>
</tr>
<tr>
<td>Reads (MB/s)</td>
<td>The average amount of data read from the disk in Mbytes per second.</td>
</tr>
<tr>
<td>Writes (IO/s)</td>
<td>The average number of write requests to the disk per second.</td>
</tr>
<tr>
<td>Writes (MB/s)</td>
<td>The average amount of data written to the disk in Mbytes per second.</td>
</tr>
</tbody>
</table>

VNX File metrics

EMC Storage Analytics includes the following metrics for VNX File with one table for each Resource Kind.

Table 11 VNX File metrics for Array

<table>
<thead>
<tr>
<th>Metric</th>
<th>Additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elapsed collect time</td>
<td></td>
</tr>
<tr>
<td>New metrics in each collect call</td>
<td>Number of new metrics per collection.</td>
</tr>
<tr>
<td>New resources in each collect call</td>
<td>Number of new resources per collection.</td>
</tr>
<tr>
<td>Number of down resources</td>
<td>Number of down resources for this adapter instance.</td>
</tr>
<tr>
<td>Number of metrics collected</td>
<td>Number of metrics collected by this adapter instance.</td>
</tr>
<tr>
<td>Number of resources collected</td>
<td>Number of resources collected by this adapter instance.</td>
</tr>
</tbody>
</table>
### Table 12 VNX File metrics for Data Mover

<table>
<thead>
<tr>
<th>Metric</th>
<th>Additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Data Mover type.</td>
</tr>
<tr>
<td>Busy (%)</td>
<td>CPU utilization percentage during this interval.</td>
</tr>
<tr>
<td>DNLC Hit Ratio (%)</td>
<td>Directory Name Lookup Cache (DNLC) hit ratio percentage used for pathname resolution logic.</td>
</tr>
<tr>
<td>Open File Cache Hit Ratio (%)</td>
<td>Open File Cache Hit ratio percentage.</td>
</tr>
<tr>
<td>Buffer Cache Hit Ratio (%)</td>
<td>Buffer Cache Hit ratio percentage.</td>
</tr>
<tr>
<td>Reads (MB/s)</td>
<td>Storage in Mbytes received from all server-storage interfaces.</td>
</tr>
<tr>
<td>Writes (MB/s)</td>
<td>Storage in Mbytes sent to all server-storage interfaces.</td>
</tr>
<tr>
<td>Total Bandwidth (MB/s)</td>
<td>The total bandwidth for the Data Mover.</td>
</tr>
<tr>
<td>NFS Reads (IO/s)</td>
<td>NFS read operations per second.</td>
</tr>
<tr>
<td>NFS Writes (IO/s)</td>
<td>NFS write operations per second.</td>
</tr>
<tr>
<td>NFS Reads (MB/s)</td>
<td>NFS read data response in Mbytes per second.</td>
</tr>
<tr>
<td>NFS Writes (MB/s)</td>
<td>NFS write data response in Mbytes per second.</td>
</tr>
<tr>
<td>NFS Average Read Size (Bytes)</td>
<td>Average size of data read.</td>
</tr>
<tr>
<td>NFS Average Write Size (Bytes)</td>
<td>Average size of data written.</td>
</tr>
<tr>
<td>Network In Bandwidth (MB/s)</td>
<td>Network in bandwidth. Megabytes received per second.</td>
</tr>
<tr>
<td>Network Out Bandwidth (MB/s)</td>
<td>Network out bandwidth. Megabytes sent per second.</td>
</tr>
</tbody>
</table>

### Table 13 VNX File metrics for dVol

<table>
<thead>
<tr>
<th>Metric</th>
<th>Additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity (GB)</td>
<td>Total capacity of the disk volume.</td>
</tr>
<tr>
<td>Average Completion Time (µSec/call)</td>
<td>Average time for completion of an I/O.</td>
</tr>
<tr>
<td>Average Service Time (µSec/call)</td>
<td>Average service time for successful completion of I/O without retries and queuing delays.</td>
</tr>
<tr>
<td>IO Retries (Retries/s)</td>
<td>Number of I/O retries per second.</td>
</tr>
<tr>
<td>Queue depth</td>
<td>Length of disk queue</td>
</tr>
<tr>
<td>Reads (IO/s)</td>
<td>Number of read operations on the disk per second.</td>
</tr>
<tr>
<td>Reads (MB/s)</td>
<td>Mbytes read from the disk per second.</td>
</tr>
<tr>
<td>Total Operations (IO/s)</td>
<td>Number of I/O operations on the disk volume per second.</td>
</tr>
<tr>
<td>Total Bandwidth (MB/s)</td>
<td>Total bandwidth of the disk volume.</td>
</tr>
<tr>
<td>Utilization (%)</td>
<td>Percentage time that disk has been utilized.</td>
</tr>
<tr>
<td>Writes (IO/s)</td>
<td>Number of write operations on the disk per second.</td>
</tr>
<tr>
<td>Writes (MB/s)</td>
<td>Mbytes written to the disk per second.</td>
</tr>
</tbody>
</table>
### Table 14 VNX File metrics for File Pool

<table>
<thead>
<tr>
<th>Metric</th>
<th>Additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity (GB)</td>
<td>Total capacity of the file pool.</td>
</tr>
<tr>
<td>Consumed Capacity (GB)</td>
<td>Consumed capacity of the file pool.</td>
</tr>
<tr>
<td>Available Capacity (GB)</td>
<td>Capacity still available for use.</td>
</tr>
</tbody>
</table>

### Table 15 VNX File metrics for File System

<table>
<thead>
<tr>
<th>Metric</th>
<th>Additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity (GB)</td>
<td>Total space available for storage of user data (does not include metadata).</td>
</tr>
<tr>
<td>Consumed Capacity (GB)</td>
<td>Consumed capacity of the File System.</td>
</tr>
<tr>
<td>Available Capacity (GB)</td>
<td>Capacity still available for use.</td>
</tr>
<tr>
<td>Thin Provisioning</td>
<td>True indicates that the file system is enabled for virtual provisioning, an option that can only be used with automatic file system extension. Combining automatic file system extension with virtual provisioning allows growth of the file system gradually and as needed. When virtual provisioning is enabled, NFS and CIFS clients receive reports for either the virtual maximum file system size or real file system size, which ever is larger.</td>
</tr>
<tr>
<td>Maximum Capacity</td>
<td>If automatic extension is enabled, the file system will automatically extend to this maximum size when the high water mark is reached. The default value for the high water mark is 90 percent.</td>
</tr>
<tr>
<td>Read Requests (Requests/s)</td>
<td>Read operations per second in the interval.</td>
</tr>
<tr>
<td>Write Requests (Requests/s)</td>
<td>Write operations per second in the interval.</td>
</tr>
<tr>
<td>Reads (MB/s)</td>
<td>Read data response in Mbytes per second.</td>
</tr>
<tr>
<td>Writes (MB/s)</td>
<td>Write data response in Mbytes per second.</td>
</tr>
<tr>
<td>Average Read Size (Bytes)</td>
<td>Average size of data read.</td>
</tr>
<tr>
<td>Average Write Size (Bytes)</td>
<td>Average size of data written.</td>
</tr>
<tr>
<td>Reads (IO/s)</td>
<td>The average read operations per second.</td>
</tr>
<tr>
<td>Writes (IO/s)</td>
<td>The average write operations per second.</td>
</tr>
<tr>
<td>Read IO ratio (%)</td>
<td>Percentage of total IOs that are read IOs.</td>
</tr>
<tr>
<td>Write IO ratio (%)</td>
<td>Percentage of total IOs that are write IOs.</td>
</tr>
</tbody>
</table>
This chapter contains the following topics.

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- Error handling and event logging .................................................. 48
- Editing the Collection Interval for a resource ................................. 51
- Frequently Asked Questions .............................................. 52
Installation logs

This topic lists the log files to which errors in the EMC Storage Analytics installation are written.

Errors in the EMC Storage Analytics installation are written to log files in the following directory on the UI VM of the vCenter Operations Manager:

/var/log/emc

Log files in this directory follow the naming convention:
install-2012-12-11-10:54:19.log.

Use a text editor to view the installation log files.

Error handling and event logging

Errors in the EMC Storage Analytics operation are written to log files on the Analytics VM of the vCenter Operations Manager.

Error logs are available in the /data/vcops/log directory. This directory contains the vC Ops logs.

Adapter logs (including adapters other than the EMC adapter) are in /data/vcops/log/adapters.

Logs for each EMC adapter instance are in folders under /data/vcops/log/adapters/EmcAdapter. For example, if you have five EMC adapter instances, a directory appears for each of them.

Log files in this directory follow this naming convention: VNX_File-131.log.9.

The log filename begins with the name of the EMC adapter instance (for example, VNX_Block or EmcAdapter). Filenames beginning with EmcAdapter are common to all connectors. The number that follows the EMC adapter instance name is the adapter instance ID, which corresponds to a VMware internal ID. The last number in the filename indicates the roll-over increment; the lowest number represents the most recent log. Each roll-over is 10 MB, and ten roll-overs are possible.

View logs relating to EMC Storage Analytics operation in the vCenter Operations Manager GUI. Create and download a support bundle used for troubleshooting.

Viewing error logs

EMC Storage Analytics enables you to view error log files for each adapter instance.

Procedure

1. Start the vCenter Operations Manager custom user interface and log in as administrator.
   
   For example in a web browser, type: http://<vCOPs_ip_address>/vcops-custom

2. Select Admin ➤ Support. Select the Logs tab.

3. Expand the vCenter Operations Collector. Select vCenter Operations Collector ➤ adapters ➤ EmcAdapter. Log files appear under the EmcAdapter folder and are separated for each adapter instance. Double-click a log entry in the log tree.

   Entries appear in the Log Content window.
Troubleshooting

Viewing error logs
Creating and downloading a support bundle

Procedure
1. On the Logs tab, for Support bundle, click the Create Support Bundle icon.

The bundle encapsulates all necessary logs.
2. Select the bundle name and click the download bundle icon.

Editing the Collection Interval for a resource

From the vCenter Operations Manager UI, you can edit the Collection Interval for a resource.

The interval time is 5 minutes by default. Changing this time will affect the frequency of collection times for the VNX Block and File metrics, but the EMC Adapter will only
recognize the change if the resource is the EMC Adapter Instance. This is normal vCenter Operations Manager behavior.

Instructions on configuring Resource Management settings are provided in the vCenter Operations Manager online help.

Frequently Asked Questions

How does a trial license work?
A 90-day trial license is provided for each platform that EMC Storage Analytics supports (for example, NS960). The 90-day trial license provides the same features as a permanent license, but after 90 days, the adapter stops collecting data. You can add a permanent license at any time during or after the trial period.

How do health scores work?
Health scores measure how normal a resource is acting and grades it on a scale of 0-100. A health score of 100 indicates normal behavior while a lower health score indicates that the resource is acting abnormally. The resource may not be in an unhealthy state but there is an abnormality. Health scores are calculated by a proprietary algorithm which account for several factors including thresholds and historical statistics. vCenter Operations Manager may take up to 30 days to gather enough information to determine what is considered normal in your environment. Until then, you may not see any changes in your health scores.

How many arrays can I add?
It is difficult to arrive the exact number of arrays you can add because the scale limits depend on the number of monitored objects and the metrics applied to them. When you deploy vC Ops 5.7 and ESA 1.5 in full profile mode, it can support up to 15,000 objects and up to 5 million metrics. Examples of objects are File Systems, NFS Exports, LUNs, Storage Pools, and Disks. For more details, refer to vCenter Operations Manager 5.7 Release Notes at http://www.vmware.com/support/vcops/doc/vcops-57-vapp-release-notes.html

Which arrays does EMC Storage Analytics support?
It supports first-generation VNX platforms (VNX5100, VNX5300, VNX5500, VNX5700, and VNX7500) and VNX VG2 and VG8 gateways. CX4 support covers CX4-120, CX4-240, CX4-480, and CX4-960. Supported NS series includes NS120, NS240, and NS960.

I deleted a resource. Why does it still appear in the vCenter Operations Manager?
vCenter Operations Manager will not delete any resources automatically because it retains historical statistics and topology information that may be important to the user. To remove the resource, delete it on the Environment Overview page.

What does the blue question mark in the health score indicate?
The blue question mark indicates that vCenter Operations Manager was unable to poll that resource. It will retry during the next polling interval.

What does it mean when a resource has a health score of 0?
This indicates that the resource is either down or not available.

Will EMC Storage Analytics continue to collect VNX statistics if the primary SP or CS goes down?
Storage Analytics will continue to collect statistics through the secondary Storage Processor if the primary Storage Processor goes down. EMC Storage Analytics will automatically collect metrics from the secondary Control Station in the event of a Control Station failover. Note that the credentials on the secondary Control Station must match the credentials on the primary Control Station.

Does the Unisphere Analyzer for VNX need to be running to collect metrics?
No. VNX Block metrics are gathered through naviseccli commands and VNX File metrics are gathered through CLI commands. However, statistics logging on VNX Block will
automatically be enabled once the array is added as an adapter instance. And statistics logging will have a performance impact on the array. This cannot be disabled. No additional services are required for VNX File.

How does the FAST Cache heatmap work?
The FAST Cache heatmaps are based on the FAST Cache read and write hit ratios. This heatmap will turn red if these ratios are low because that indicates that FAST Cache is not being utilized efficiently. These heatmaps will turn green when FAST Cache is servicing a high percentage of I/O.

Why are my EMC adapter instances marked down after upgrading to the latest version of the EMC adapter?
EMC adapter instances require a license to operate. Edit your EMC adapter instances to add license keys obtained from EMC. Select Environment Overview > Configuration > Adapter Instances.

I have added license keys for EMC adapter instances. Why are my resources still marked down?
License keys are specific to the model for which the license was purchased. Verify that you are using the correct license key for the adapter instance. You can also click the Test button to test the configuration after editing adapter instances.

I have multiple EMC adapter instances for my storage systems, and I have added license keys for each of them. Why are they still marked down?
After adding a license, click the Test button to test the configuration and validate the license key. If you saved the configuration without performing a test and the license is invalid, the adapter instance will be marked down. To verify that a valid license exists, select Environment Overview. The list that appears shows the license status.

Figure 8  Status shows: Resource down

I purchased a license for the model of the VNX array that I plan to monitor. When I configure the adapter instance for VNX File, why does an "invalid license" error message appear?
Control Station may not be reporting the correct model or the array. Log into Control Station and check the array model with the command: /nas/sbin/model. Verify that the array model returned matches the model on the Right to Use certificate.

After a Control Station failover, why is the VNX File adapter Instance marked down and why does metric collection stop?
The failover may have been successful, but the new Control Station may not be reporting the correct model of the array. This results in a failure to validate the license and all data collection stops. Log into Control Station and check the array model with the command: /nas/sbin/model. If the model returned does not match the actual model of the array, Primus case emc261291 in the EMC Knowledgebase provides possible solutions.
What is the difference between vCenter Operations Manager 5.7 from VMware and vCenter Operations Manager included with EMC Storage Analytics?

vCenter Operations Manager included with EMC Storage Analytics is based on vCenter Operations Manager 5.7 (Advanced Edition) from VMware. However, EMC Storage Analytics is restricted to storage view. For vCenter resources such as virtual machines, you can only see storage or disk related metrics.

How is the detailed view of vCenter resources affected in EMC Storage Analytics?

Any changes in the disk system affects the health of vCenter resources such as virtual machines, but EMC Storage Analytics does not show changes in other subsystems. Metrics for other subsystems will either show ‘No Data’ or ‘?’.

Figure 9  Workload shows: No Data
Can I see relationships between my vCenter and EMC storage resources?
Yes. Relationships between resources are not affected and you can see a top to bottom view of the virtual and storage infrastructures if the two are connected.

What if I want to see metrics for other subsystems instead of 'No Data' or '?'?
To view metrics for other subsystems, upgrade from vCenter Operations Manager for EMC Storage Analytics to the full vCenter Operations Manager 5.7. No upgrade is required for the EMC Adapter.
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