

EMC[®] Storage Analytics

Version 2.4.1

Installation and User Guide

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EMC²

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CHAPTER 1

Introduction

This chapter contains the following topics.

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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:

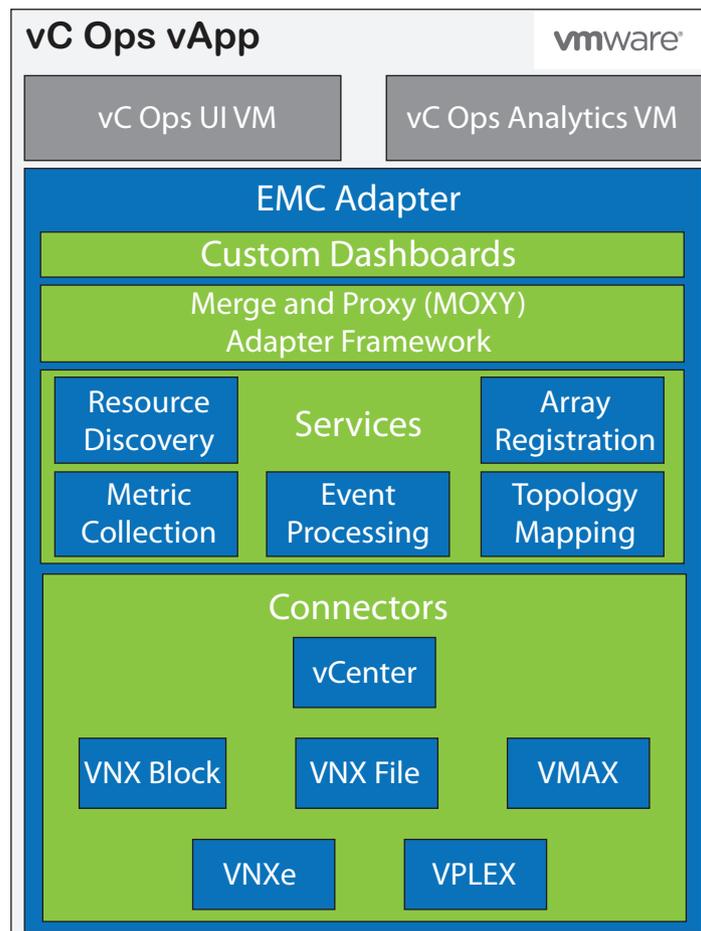
- Through alerts that warn of potential or occurring problems.
- In configurable dashboards and predefined pages that show commonly needed information.
- In predefined reports.

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.

Figure 1 EMC adapter architecture



References

This topic provides a list of documentation for reference.

VMware vCenter Operations Manager documentation includes:

- *vCenter Operations Manager Release Notes*. Contains descriptions of known issues and workarounds.
- *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.
- *vCenter Operations Manager Administration Guide*. Describes how to configure and manage the vCenter Operations Manager custom interface.
- *vCenter Operations Manager Adapter Guide*. Provides information on how vCenter Operations Manager uses adapters to consume data from the enterprise.

VMware documentation is available at <http://www.vmware.com/support/pubs>.

EMC documentation includes:

- *EMC Storage Analytics Release Notes*. Provides a list of the latest supported features, licensing information, and known bugs.
- *EMC Storage Analytics Installation and User Guide* (this document). Provides installation and licensing instructions, a list of resource kinds and their metrics, and information about storage topologies and dashboards.

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.

icon

A pictorial element in a widget that enables a user to perform a specific function. Hovering over an icon displays a tooltip that describes the function.

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.

widget

An area of the EMC Storage Analytics graphical user interface (GUI) that displays metrics-related information. A user can customize widgets to their own environments.

CHAPTER 2

Installation and licensing

This chapter contains the following topics.

- [Installation overview](#) 14
- [Installation and operating requirements](#) 16
- [Installing vCenter Operations Manager for EMC Storage](#) 19
- [Installing the EMC Adapter and dashboards](#) 20
- [Adapter instances](#) 21

Installation overview

EMC Storage Analytics 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 developed specifically for EMC storage customers. Installation instructions are in the *vCenter Operations Manager vApp Deployment and Configuration Guide* at <http://www.vmware.com/support/pubs/vcops-pubs.html>. The VMware version of vCenter Operations Manager also supports EMC Storage Analytics.

Licensing depends on the version of the vCenter Operations Manager you install:

Table 1 Licensing options for vCenter Operations Manager

vCenter Operations Manager version	Required license	Notes
vCenter Operations Manager for EMC Storage	EMC license for EMC Storage Analytics. The license key is delivered as a Right To Use certificate or through electronic licensing. It is described as "VMware vCenter Operations Manager for EMC® Storage License Key."	Enables a storage-only view of supported EMC storage arrays. This license disables the vSphere user interface.
vCenter Operations Manager Advanced or Enterprise	VMware license for vCenter Operations Manager Advanced or Enterprise	Provides a view of all vCenter-managed resources, including EMC storage arrays. Do not install the EMC-issued license for vCenter Operations Manager; installing the EMC-issued license restricts vCenter Operations Manager to storage-only mode.

NOTICE

VPLEX uses an electronic licensing model. When you purchase a VPLEX license for EMC Storage Analytics, you will receive a letter that directs you to an electronic licensing system to activate the software to which you are entitled.

A 90-day trial license is available with EMC Storage Analytics 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.

To collect metrics from resources, you must install the EMC Adapter. The license that EMC provides for the storage array is required to add the adapter instance. Both versions of the vCenter Operations Manager ([Table 1 on page 14](#)) support the EMC Adapter.

The adapter installation includes:

- Installing the EMC Adapter and dashboards.
- Adding one or more EMC adapter instances and applying license keys from EMC.

[Installing the EMC Adapter and dashboards on page 20](#) provides the installation instructions. Then you will add an EMC adapter license key for each storage instance and enter the EMC license key as described in [Adding EMC Adapter instances for your storage system on page 24](#).

[Table 2 on page 15](#) 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.

Table 2 Installation and Upgrade options

Task	Instructions
Install VMware vCenter Operations Manager 5.8.2 with EMC Storage Analytics 2.4.	<ul style="list-style-type: none"> • <i>vCenter Operations Manager vApp Deployment and Configuration Guide</i> at http://www.vmware.com/support/pubs/vcops-pubs.html • Installing the EMC Adapter and dashboards on page 20 • Adding EMC Adapter instances for your storage system on page 24
Upgrade EMC Adapter 2.0, 2.1, or 2.3 to EMC Storage Analytics 2.4 on a system running VMware vCenter Operations Manager 5.8.0, 5.8.1, or 5.8.2 (recommended).	<ul style="list-style-type: none"> • Installing the EMC Adapter and dashboards on page 20 • Editing EMC Adapter instances for your storage system on page 27
Install EMC Storage Analytics 2.4 on a system running VMware vCenter Operations Manager 5.8.2.	<ul style="list-style-type: none"> • Installing the EMC Adapter and dashboards on page 20 • Adding EMC Adapter instances for your storage system on page 24
Install vCenter Operations Manager for EMC Storage and EMC Storage Analytics 2.4.	<ul style="list-style-type: none"> • Installing vCenter Operations Manager for EMC Storage on page 19 • Installing the EMC Adapter and dashboards on page 20 • Adding EMC Adapter instances for your storage system on page 24

NOTICE

The *EMC Storage Analytics Release Notes* provide the most recent information about supported releases.

Installation and operating requirements

Before installing the EMC Adapter, verify that these installation and operating requirements are satisfied.

EMC Adapter requirements

Supported vCenter Operations Manager versions

- vCenter Operations Manager Advanced or Enterprise editions from VMware

Note

EMC Storage Analytics does not support vCenter Operations Manager Foundation and Standard editions.

- vCenter Operations Manager for EMC Storage

Deploy the vApp for vCenter Operations Manager before installing the EMC Adapter. Check the *vCenter Operations Manager vApp Deployment and Configuration Guide* at <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 apply to vCenter Operations Manager for EMC Storage.

Supported product models

See the *EMC Storage Analytics Release Notes* for a complete list of supported product models.

Supported web browser

See the latest vCenter Operations Manager release notes for a list of supported browsers.

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 IP addresses that are reachable from the vCenter Operations Manager server. Bidirectional traffic for this connection flows through port 443 (HTTPS). Statistics logging must be enabled on each storage processor (SP) for metric collection (**System** > **System Properties** > **Statistics Logging in Unisphere**).

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). If you are using the EMC VNX `nas_stig` script for security (`/nas/tools/nas_stig`), do not use root in password credentials. Setting `nas_stig` to ON limits direct access for root accounts, preventing the adapter instance from collecting metrics for VNX File.

SMI-S Provider for VMAX requirements

The EMC SMI-S Provider for VMAX must be on the network and accessible through port 5988 (non-secure port) or port 5989 (secure port) for communication. If the SMI-S Provider is also used for vSphere vStorage API for Storage Awareness (VASA), follow the recommendations in the *SMI-S Provider Release Notes* to increase the number of available connections. The user configured in the EMC Adapter instance and connecting to the SMI-S instance must have the role of monitor or administrator. See the *EMC Storage Analytics Release Notes* for the version of the SMI-S Provider that is required.

VPLEX EMC adapter instance

Only one EMC adapter instance is required for VPLEX Local or VPLEX Metro. You can monitor both clusters in a VPLEX Metro by adding a single EMC adapter instance for one of the clusters. (Adding an EMC adapter instance for each cluster in a VPLEX Metro introduces unnecessary stress on the system.)

VPLEX data migrations

EMC VPLEX systems are commonly used to perform non-disruptive data migrations. When monitoring a VPLEX system with EMC Storage Analytics, a primary function is to perform analytics of trends on the storage system. When swapping a back-end storage system on VPLEX, the performance and trends for the entire VPLEX storage environment are impacted. Therefore, EMC recommends that you start a new EMC Storage Analytics baseline for the VPLEX after data migration. To start a new baseline:

1. Before you begin data migration, delete all resources associated with the existing EMC Storage Analytics VPLEX adapter instance.
2. Remove the existing EMC Storage Analytics VPLEX adapter instance by using the **Manage Adapter Instances** dialog.
3. Perform the data migration.
4. Create a new EMC Storage Analytics VPLEX adapter instance to monitor the updated VPLEX system.

Optionally, you can stop the VPLEX adapter instance collects during the migration cycle. When collects are restarted after the migration, orphaned VPLEX resources will appear in EMC Storage Analytics, but those resources will be down. Remove the resources manually.

Minimum OE requirements

See the *EMC Storage Analytics Release Notes* for a complete list of minimum OE requirements for supported product models.

User accounts

To create an EMC Adapter instance for a storage array, you must have a user account that allows you to connect to the storage array or SMI-S Provider. For example, to add an EMC Adapter for a VNX array, use a global account with operator or administrator role (a local account will not work).

To create an EMC Adapter instance for vCenter (where **Adapter Kind** = **EMC Adapter** and **Connection Type** = **VMware vSphere**), you must have an account that allows you access to vCenter and the objects it monitors. In this case, vCenter enforces access credentials (not the EMC Adapter). To create an EMC Adapter instance for vCenter, use, at minimum, an account assigned to the **Read-Only** role at the root of vCenter, and enable propagation of permissions to descendant objects. Depending on the size of the vCenter, wait approximately 30 seconds before testing the EMC Adapter. More information on user accounts and access rights is available in the *vSphere API/SDK Documentation* (see information about authentication and authorization for ESXi and vCenter Server).

DNS configuration

To use the EMC Adapter, the vCenter Operations Manager vApp requires network connectivity to the 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 EMC Storage Analytics resources by using Network Time Protocol (NTP). Also, set correct time zones for EMC Storage Analytics resources (including the SMI-S Provider if using an adapter for VMAX) and related systems. Failure to observe these practices may affect the collection of performance metrics and topology updates.

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

- Obtain the OVA installation package for vCenter Operations Manager from VMware or vCenter Operations Manager for EMC Storage.
- Obtain a vCenter Operations Manager for EMC Storage license key.
- Obtain a copy of the *vCenter Operations Manager vApp Deployment and Configuration Guide* at <http://www.vmware.com/support/pubs/vcops-pubs.html>.

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

Procedure

1. Review the system requirements.
2. Follow instructions for installing vCenter Operations Manager.
When assigning the vCenter Operations Manager license, enter the vCenter Operations Manager for EMC Storage license that you received.
3. Conclude the installation by following instructions for verifying the vCenter Operations Manager installation.

Installing the EMC Adapter and dashboards

Before you begin

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.

WARNING

Upgrading EMC Storage Analytics overwrites the standard dashboards. To customize a standard dashboard, clone it, rename it, and then customize it.

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, `https://<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 Manager 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. Supported adapter instances include:

- vCenter (prerequisite for other adapter instances)
- VNX File
- VNX Block
- VMAX
- VNXe
- VPLEX

See the *EMC Storage Analytics Release Notes* for a list of the supported models for each adapter instance and related OEs.

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

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 45 minutes to collect metrics and resources and update dashboards. This is a one-time event; future statistical collections run quickly.

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 admin.

For example in a web browser, type: `https://<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:

Collector	vCenter Operations Standard Server
Adapter Kind	EMC Adapter
Adapter Instance Name	Any descriptive name. For example, My vCenter .
Management IP	IP address of the vCenter server.

Array ID (optional)	This field must be blank for VMware vSphere connection type.
Connection Type	VMware vSphere
License (optional)	Leave blank. Not applicable for EMC Adapter instance for vCenter.
Log Level	<p>Configure log levels for each adapter instance. The four levels for logging information are ERROR, WARN, INFO, and DEBUG.</p> <p>ERROR The ERROR level logs only error conditions. The ERROR level provides the smallest amount of logging information.</p> <p>WARN The WARN level logs information when an operation completes successfully but there are issues with the operation.</p> <p>INFO The INFO level logs information about workflow. It describes how an operation occurs.</p> <p>DEBUG The DEBUG level logs all details related to an operation. If logging is set to DEBUG, all other levels of logging information are displayed in the log file.</p> <p>TRACE The TRACE level provides the most detailed information and context to understand the steps leading up to errors and warnings.</p>
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:

Credential kind	Password Credentials
Instance name	Any descriptive name. For example, My VMware Credentials .
Username	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.
Password	Password for the EMC Storage Analytics username on the VMware vCenter system.

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.

Note

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. Observe these exceptions and requirements:

- A VNX Unified array can use the same license for VNX File and VNX Block.
- Global Scope is required for VNX Block access.
- For VPLEX Metro, add an adapter instance for only one of the clusters (either one); this action enables you to monitor both clusters with a single adapter instance.

Procedure

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

For example in a web browser, type: `https://<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:

Field	Value to enter
Collector	vCenter Operations Standard Server
Adapter Kind	EMC Adapter
Adapter Instance Name	Any descriptive name. For example, My Storage System or the array ID.
License (optional)	License key required for the array. Verify that the license is for the array you want to monitor. The license key for the adapter instance appears on the Right to Use Certificate delivered to you (or, for VPLEX, via electronic licensing).
Log Level	<p>Configure log levels for each adapter instance. The four levels for logging information are ERROR, WARN, INFO, and DEBUG.</p> <p>ERROR The ERROR level logs only error conditions. The ERROR level provides the smallest amount of logging information.</p> <p>WARN The WARN level logs information when an operation completes successfully but there are issues with the operation.</p> <p>INFO The INFO level logs information about workflow. It describes how an operation occurs.</p> <p>DEBUG The DEBUG level logs all details related to an operation. If logging is set to DEBUG, all other levels of logging information are displayed in the log file.</p> <p>TRACE The TRACE level provides the most detailed information and context to understand the steps leading up to errors and warnings.</p>
Credential	Select any previously defined credentials for this storage system, otherwise, click Add .

Supported product	Field: Management IP	Field: Array ID (optional)	Field: Connection Type
VNX Block arrays	Use the IP address of one Storage Processor (SP) in a single array. Do not add an adapter instance for each SP.	Not applicable	VNX Block
VNX File and Unified models, VG2 and VG8 gateway models	Use the IP address of the primary Control Station.	Not applicable	VNX File

Supported product	Field: Management IP	Field: Array ID (optional)	Field: Connection Type
VMAX, VMAXe, VMAX 10K, VMAX 20K, VMAX 40K	Use the IP address of the configured SMI-S Provider.	Required with prefixed zeros. Example: 000195901003	VMAX
VNXe3200	Use the IP address of the management server.	Not applicable	VNXe
VPLEX Local or VPLEX Metro	Use the IP address of the management server. For a Metro cluster, use the IP address of either management server, but not both.	Not applicable	VPLEX

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

5. Set the following:

Field	Value to enter
Adapter kind	EMC Adapter. Retain the setting.
Credential kind	Password Credentials.
Instance name	Any descriptive name. For example, Default Credentials .
Username	Username that EMC Storage Analytics uses to connect to the storage system. <ul style="list-style-type: none"> For VNX File, use the credentials of the Control Station. For VNX Block, use the credentials of the Storage Processor. For VMAX, use the credentials of an ECOM user with monitor or administrator privileges. The default user/password combination is admin/#1Password. For VNXe, use the credentials of the management server. For VPLEX, use the credentials of the management server (for example, the service user). The default credentials are service/Mi@Dim7T.
Password	Password for the EMC Storage Analytics username on the storage system.

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.

NOTICE

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

- 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 VNX Unified array can use the same license for VNX File and VNX Block.

Procedure

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

For example in a web browser, type: `https://<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.

The **Edit Adapter Instance** screen appears.

4. Enter the license from the EMC Storage Analytics Software Key Card into the **License (optional)** field. The EMC Adapter instance license key is issued for the storage system. Verify that the value of the **Management IP** field matches the 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**.

CHAPTER 3

EMC Storage Analytics Dashboards

This chapter contains the following topics.

- [Topology mapping](#).....30
- [EMC dashboards](#)..... 38

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:

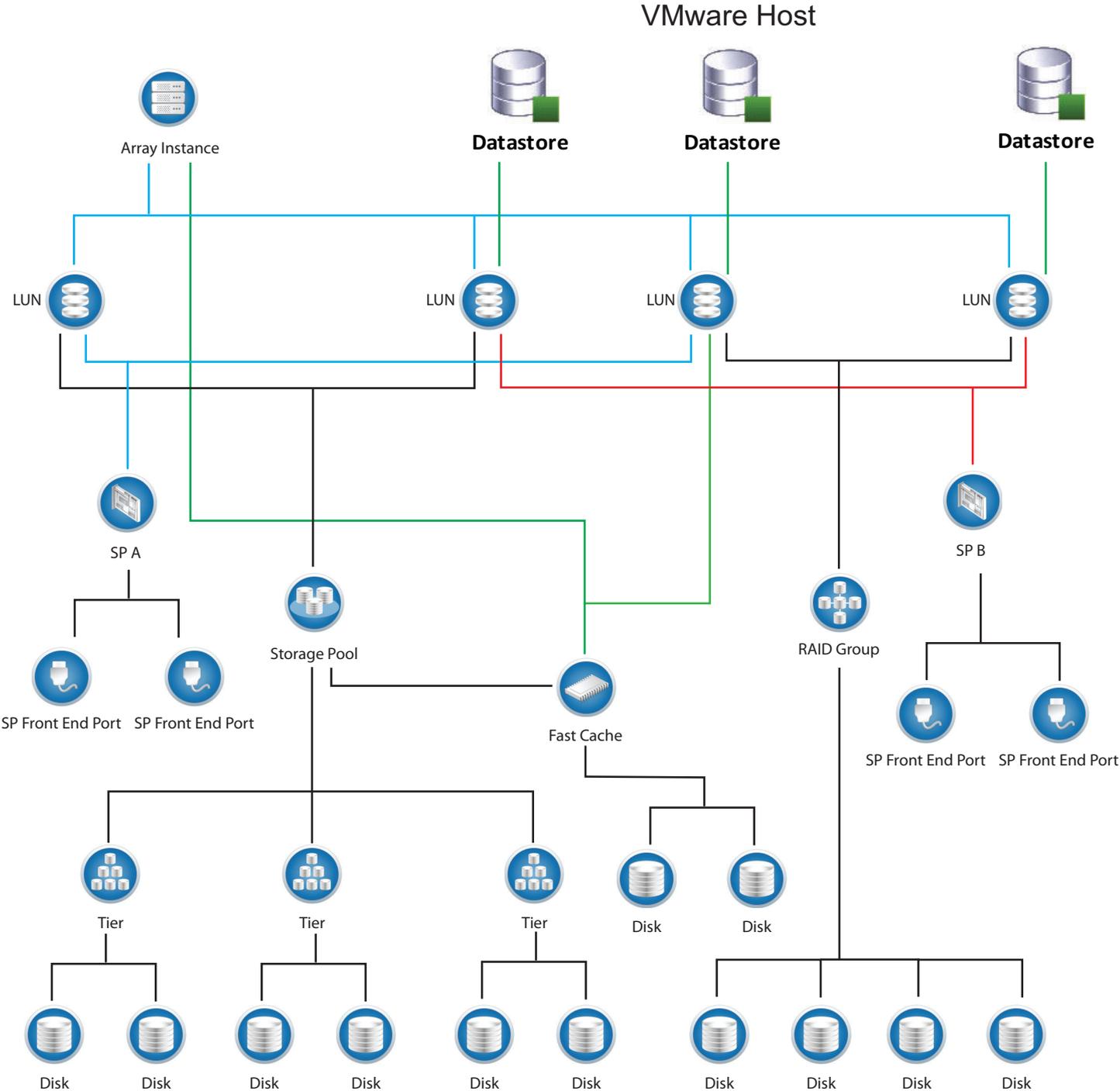
- Storage system components
- Storage system objects and vCenter objects

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.

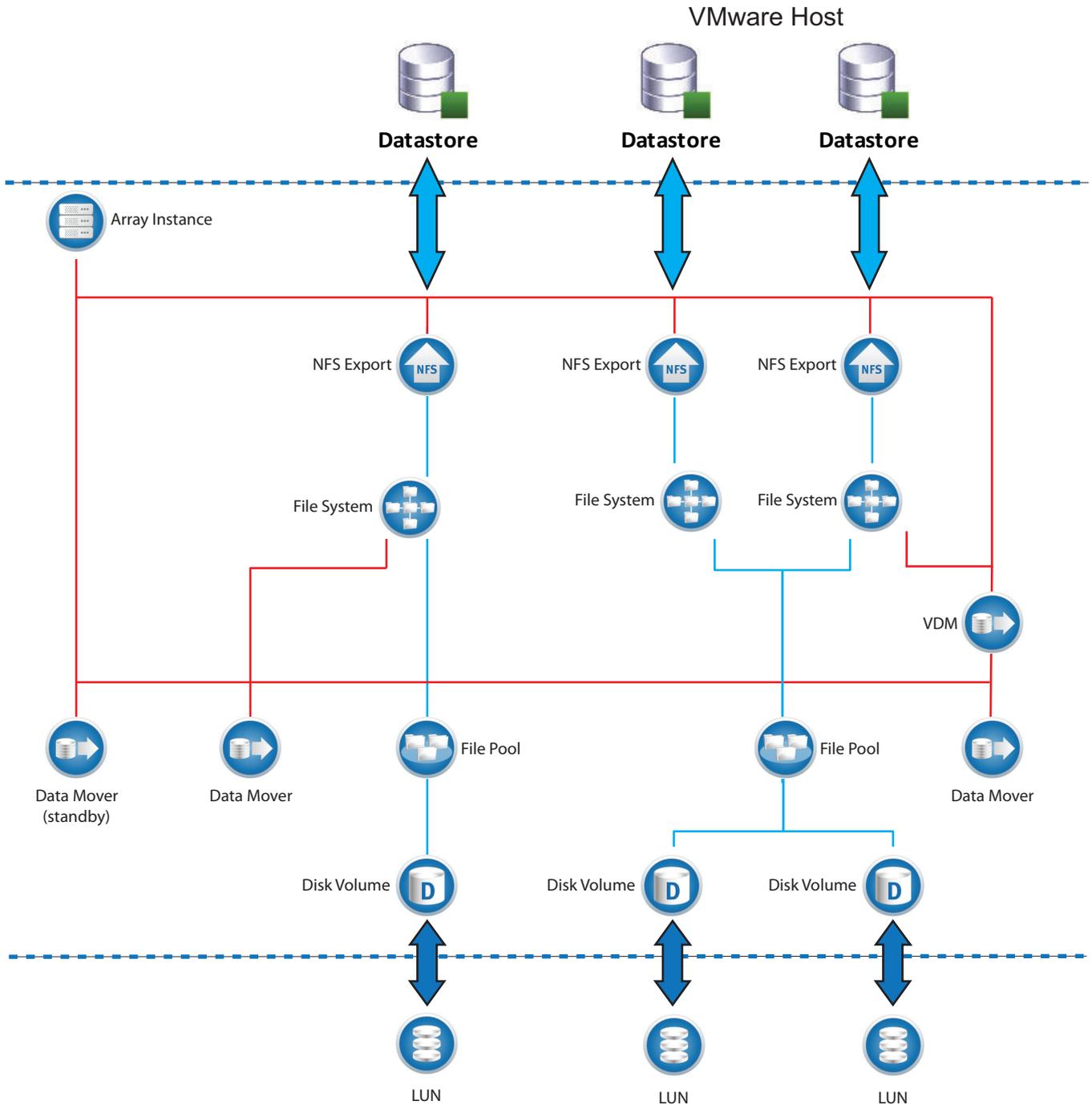
Figure 2 VNX Block topology



VNX File topology

EMC Storage Analytics implements the following topology for VNX File.

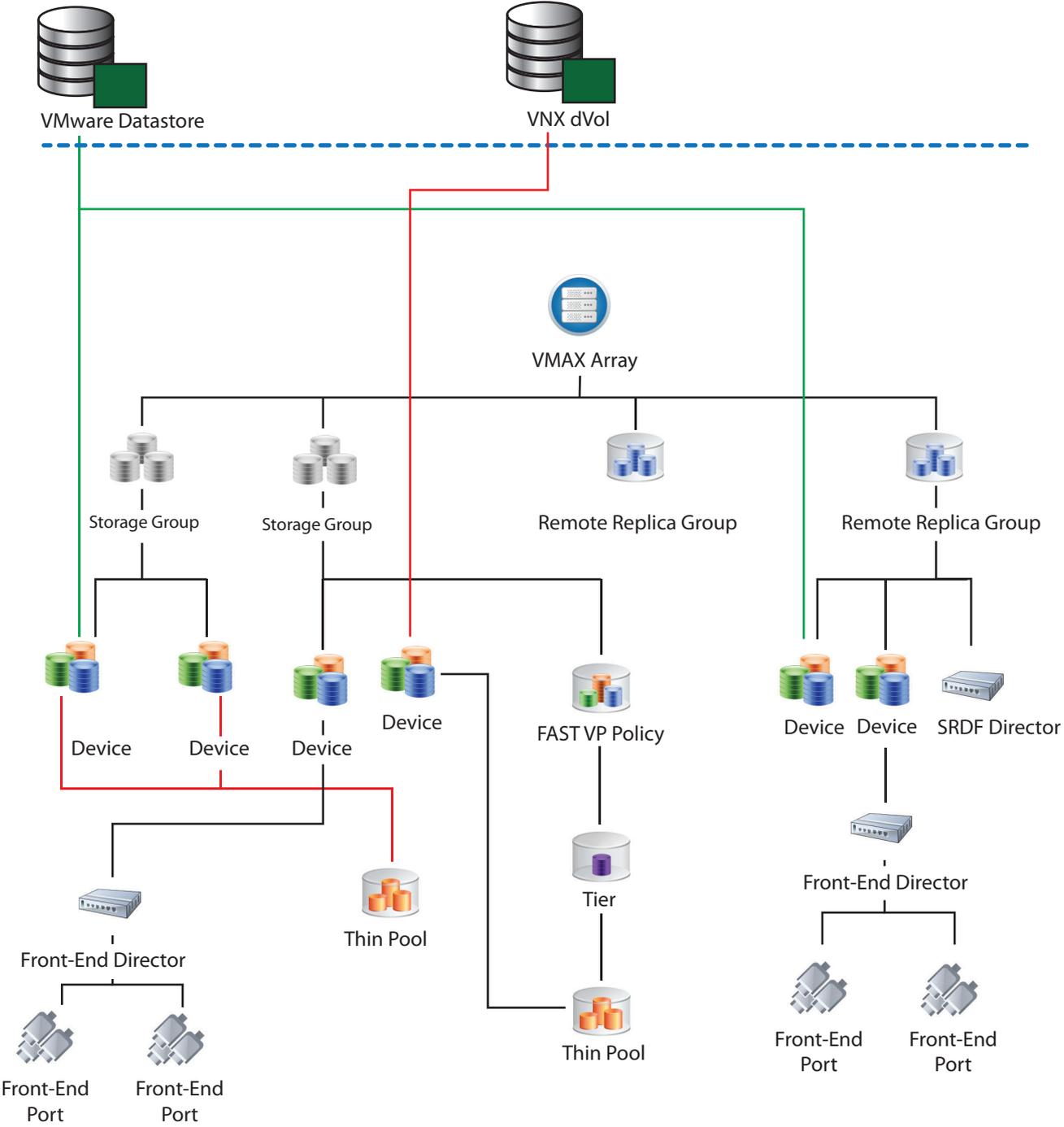
Figure 3 VNX File topology



VMAX topology

EMC Storage Analytics implements the following topology for VMAX.

Figure 4 VMAX topology



VMAX topology rules

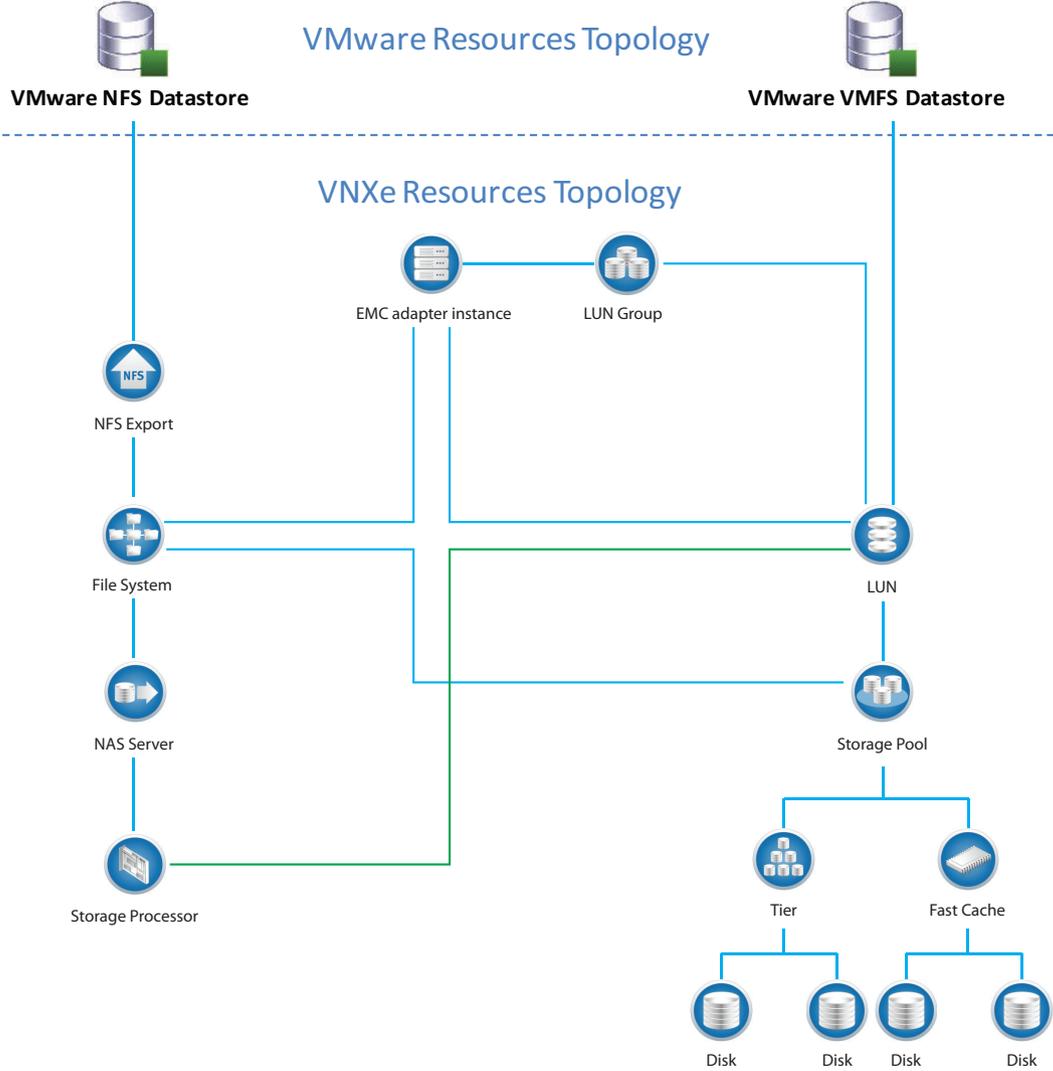
The following rules govern how objects are displayed in the VMAX topology dashboard and which metrics are collected for them.

- vCenter Operations Manager does not display devices that are unmapped and unbound.
- vCenter Operations Manager does not display devices that are mapped and bound but unused by VMware or VNX. Performance metrics for these devices are aggregated into the parent Storage Group performance metrics.
- If the corresponding EMC vSphere adapter instance is running on the same vCenter Operations Manager appliance, then the vCenter Operations Manager displays devices that are mapped, bound, and used by VMware datastores or RDMS.
- If the corresponding EMC VNX File adapter instance is running on the same vCenter Operations Manager appliance, then the vCenter Operations Manager displays devices that are mapped, bound, and used by VNX File Disk Volumes.
- vCenter Operations Manager does not display Storage Groups with unmapped and unbound devices.
- vCenter Operations Manager displays Storage Groups that contain mapped and bound devices, and their metrics are aggregates of the member devices.

VNXe topology

EMC Storage Analytics implements the following topology for VNXe.

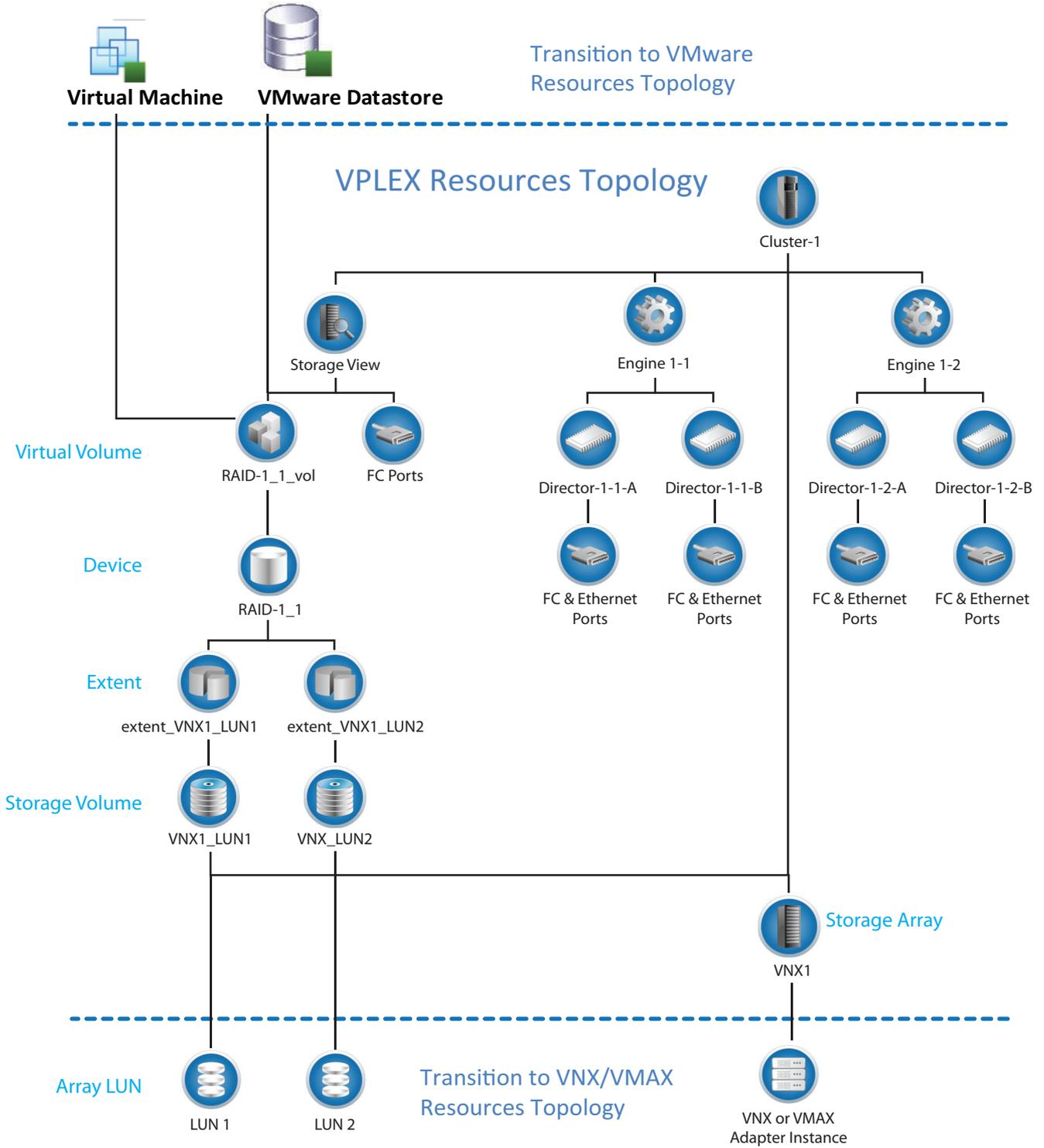
Figure 5 VNXe topology



VPLEX Local topology

EMC Storage Analytics implements the following topology for VPLEX Local.

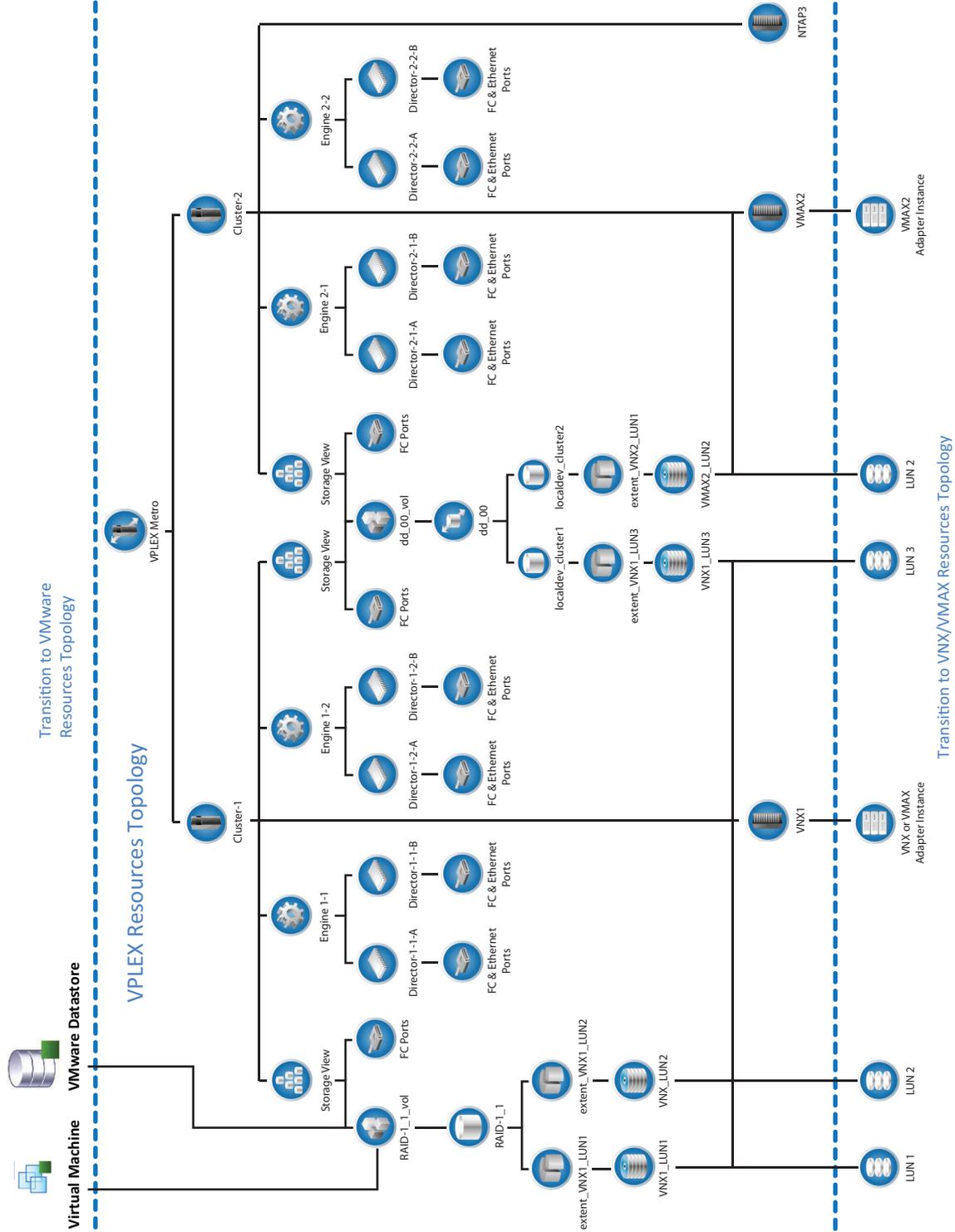
Figure 6 VPLEX Local topology



VPLEX Metro topology

EMC Storage Analytics implements the following topology for VPLEX Metro.

Figure 7 VPLEX Metro topology



EMC dashboards

Use dashboards to view metrics.

The standard dashboards are delivered as templates - if a dashboard is accidentally deleted or changed, you can generate a new one. [Table 3 on page 38](#) lists the EMC dashboards available for each EMC platform.

Table 3 Dashboard-to-platform matrix

Dashboard name	VNX	VNXe	VMAX	VPLEX
Storage Topology	X	X	X	X
Storage Metrics	X	X	X	X
⟨platform_name⟩ Overview	X	X	X	X
⟨platform_name⟩ Topology	X	X	X	X
⟨platform_name⟩ Metrics	X	X	X	---
⟨platform_name⟩ Top-N	X	X	X	---
VPLEX Performance	---	---	---	X
VPLEX Communication	---	---	---	X

You can use the standard vCenter Operations Manager dashboard customization features to create additional dashboards that are based on your site requirements (some restrictions may apply).

Storage Topology dashboard

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

Click the **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 the widget.

The 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.

Storage Metrics dashboard

Click the **Storage Metrics** tab to display resource and metrics for storage systems and view graphs of resource metrics.

The Storage Metrics dashboard contains the following widgets:

Storage System Selector

This Resource widget lists all configured EMC Adapter instances. 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**. To populate the **Metric 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. The search feature of this widget allows users to locate specific objects. 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.

VNX Overview dashboard

Click the **VNX Overview** tab to view a collection of heat maps that provide 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.

The VNX Overview dashboard displays the following heat maps:

CPU performance

This heat map 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 heat map 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.
- Gray 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 heat map 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 heat map 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.

VMAX Overview dashboard

Click the **VMAX Overview** tab to view a collection of heat maps that provide a single view of the performance and capacity for all VMAX resources with configured adapter instances. Heat maps on this dashboard group the contents by adapter instance.

The VMAX Overview dashboard displays the following heat maps. For each heat map and selected metric, the configured VMAX adapter is shown:

Thin Pool Usage

This heat map displays the Percent Allocated metric. Percent Allocated displays the allocated capacity in each thin pool. The color of the heat map entries ranges from green to red and corresponds to the percent allocated as follows:

- Green indicates that 0% of the thin pool is allocated.
- Yellow indicates that 50% of the thin pool is allocated.
- Red indicates that 100% of the thin pool is allocated.

Storage Group

This heat map has four modes: Total Reads (IO/s), Total Writes (IO/s), Read Latency (ms), and Write Latency (ms).

Total Reads and Writes represent the aggregate reads or writes for all LUNs in the storage group. Write and Read Latency is the average write or read latency of all LUNs in the storage group.

For Total Reads and Writes, the color of the heat map entries shows the relative number of total reads or writes across all the storage groups. The color ranges from light blue to dark blue. Dark blue indicates the storage group(s) with the highest number of total reads or writes while light blue indicates the lowest. Because the range of values for total reads or writes has no lower or upper limits, the numerical difference between light and dark blue may be very small.

For Write and Read Latency, the color of the heat map entries is based on a scale of latency from 0 to 40ms. This scale is based on average customer requirements and may not represent a customer's particular requirements for latency. In such cases, EMC recommends adjusting the scale appropriately. The color of the heat map entries ranges from green to red as follows:

- Green indicates a latency of 0ms.
- Yellow indicates a latency of 20ms.
- Red indicates a latency of 40ms.

LUN Performance

This heat map has four modes: Reads (IO/s), Writes (IO/s), Read Latency (ms), and Write Latency (ms).

Reads and Writes represent the total reads or writes for a particular LUN. Read and Write Latency is the average read or write latency of all LUNs in the storage group.

For Reads and Writes, the color of the heat map entries shows the relative number of reads or writes across all the LUNs. The color ranges from light blue to dark blue. Dark blue indicates the LUN(s) with the highest number of reads or writes while light blue indicates the lowest. Because the range of values for reads or writes has no lower or upper limits, the numerical difference between light and dark blue may be very small.

For Read and Write Latency, the color of the heat map entries ranges from green to red and is based on a scale of latency from 0 to 40ms. This scale is based on average customer requirements and may not represent a customer's particular requirements for latency. In such cases EMC recommends adjusting the scale appropriately. The color of the heat map entries range from green to red as follows:

- Green indicates a latency of 0ms.
- Yellow indicates a latency of 20ms.
- Red indicates a latency of 40ms.

Front End Director

This heat map has two modes: Total Bandwidth (MB/s) and Total Operations (IO/s).

Total Bandwidth is the cumulative amount of data transferred over all ports of the front-end director. Total Operations is the total number of operations taking place over all ports of a front-end director.

The color of the heat map entries is the same for both metrics. It shows the relative total bandwidth or relative total number of operations, depending on the selected metric. The color ranges from light blue to dark blue. Dark blue indicates the front-end director(s) with the highest number of total operations or the greatest total bandwidth, depending on the selected metric. Light blue indicates the lowest number of operations or the least total bandwidth. Because the range of values for operations or bandwidth has no lower or upper limits, the numerical difference between light and dark blue may be very small.

SRDF Director

This heat map has two modes: Total Bandwidth (MB/s) and Total Writes (IO/s).

Total Bandwidth is the cumulative amount of data transferred over an SRDF director. Total Writes is the total number of writes over an SRDF director.

The color of the heat map entries is the same for both metrics. It shows the relative total bandwidth or relative total number of writes, depending on the selected metric. The color ranges from light blue to dark blue. Dark blue indicates the SRDF director(s) with the highest number of total writes or the greatest total bandwidth, depending on the selected metric. Light blue indicates the lowest number of writes or the least total bandwidth. Because the range of values for bandwidth or writes has no lower or upper limits, the numerical difference between light and dark blue may be very small.

SRDF Groups

This heat map has four modes: Devices in Session (count), Average Cycle Time (s), Writes (IO/s), and Writes (MB/s).

Devices in Session represents the number of devices in an SRDF session in the SRDF group. The Average Cycle Time is an SRDF/A metric that provides the average elapsed time between data transfer cycles. Writes (IO/s) represents the number of writes per second on the devices in the SRDF group. Writes (MB/s) represents the number of megabytes per second sent from the SRDF group.

The color of the heat map entries is the same for all metrics. It shows the relative devices in session, average cycle time, total bandwidth, or the relative number of writes, depending on the selected metric. The color ranges from light blue to dark blue. Dark blue indicates the SRDF group(s) with the highest number of one these metrics and light blue indicates the lowest number of one of these metrics. Because the range of values has no lower or upper limits, the numerical difference between light and dark blue may be very small.

VNXe Overview dashboard

Click the **VNXe Overview** tab to view a collection of heat maps that provide a single view of the performance and capacity for all VNXe resources with configured adapter instances. Heat maps on this dashboard group the contents by adapter instance.

The VNXe Overview dashboard displays the following heat maps:

CPU Performance

This heat map displays the CPU Utilization, such as % busy, of each Storage Processor on each configured adapter instance. The color of the heat map entries shows % busy:

- Green indicates 0% busy
- Red indicates 100% busy

Pool capacity

This heat map has two modes: Storage Pool Capacity Utilization and Storage Pool Available Capacity.

In Capacity Utilization mode, the color of the heat map entries shows the value of the % full metric for all 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 Performance

This heat map has two modes: LUN Read IOPS and LUN Write IOPS.

LUN Read IOPS and LUN Write IOPS represent the total reads or writes for a particular LUN. The color of the heat map entries shows the relative number of reads or writes across all the LUNs. The color ranges from light green to dark green. Dark green indicates the LUN(s) with the highest number of reads or writes while light green indicates the lowest. Because the range of values for reads or writes has no lower or upper limits, the numerical difference between light and dark green may be very small.

VPLEX Overview dashboard

Click the **VPLEX Overview** tab to view a collection of scorecard widgets that provide an overview of the health for the VPLEX system.

The EMC VPLEX Overview dashboard displays the following widgets:

Note

Red, yellow, and orange colors correlate with the Health State or Operational Status of the object. Any Health State or Operational Status other than those listed below will show green (Ok). Also note that because VMware expects numeric values, you cannot modify these widgets.

CPU Health

This widget displays the CPU usage, as a percentage, for each director on the VPLEX. The color of the directors in the widget reflects the CPU usage:

- Green indicates CPU usage of 0 - 75%.
- Yellow indicates CPU usage of 75 - 85%.
- Orange indicates CPU usage of 85 - 95%.
- Red indicates CPU usage of 95 - 100%.

Generally, a director should stay below 75% CPU usage. Correct an imbalance of CPU usage across directors by adjusting the amount of I/O to the busier directors; make this adjustment by modifying existing storage view configurations. Identify busier volumes and hosts and move them to less busy directors. Alternately, add more director ports to a storage view to create a better load balance across the available directors.

Extent Health

This widget displays the extent health, which is determined by the value of its health state:

- Green indicates that the extent is functioning normally (Health State = Ok).
- Yellow indicates that the extent is degraded (Health State = Degraded).
- Orange indicates that the extent status is unknown or invalid (Health State = Unknown).
- Red indicates that the extent has a critical failure (Health State = Critical failure).

Cluster Health

This widget displays the cluster health, which is determined by the values of its health state and operational status:

- Green indicates that the cluster is functioning normally (Health State = Ok).
- Yellow indicates that the cluster is degraded (Health State = Minor failure; Operational Status = Degraded).
- Orange indicates that the cluster is failing and some I/O operations are suspended (Health State = Major failure; Operational Status = Suspended-exports).
- Red indicates that the cluster has a critical failure (Health State = Critical failure; Operational Status = Cluster departure).

Director Health

This widget displays the extent health, which is determined by the value of its health state:

- Green indicates that the director is functioning normally (Operational Status = Ok).
- Yellow indicates that the director may be out-of-date compared to its mirror (Operational State = Degraded).
- Orange indicates that the director status is unknown or invalid (Operational State = Stressed).
- Red indicates that the director has a critical failure (Operational State = Error).

Memory Health

This widget displays the memory usage, as a percentage, of each director on the VPLEX. The color of the directors in the widget reflects the memory usage:

- Green indicates memory usage of 0 - 70%.
- Yellow indicates memory usage of 70 - 80%.
- Orange indicates memory usage of 80 - 90%.
- Red indicates memory usage of 90 - 100%.

Storage Volume Health

This widget displays storage volume health based on the value of its health state:

- Green indicates that the storage volume is functioning normally (Health State = Ok).
- Yellow indicates that the storage volume may be out-of-date compared to its mirror (Health State = Degraded).
- Orange indicates that the storage volume health cannot be determined or is invalid (Health State = Unknown).
- Red indicates that the VPLEX has marked the storage volume as hardware-dead (Health State = Critical failure).

VPLEX Performance dashboard

Click the **VPLEX Metrics** tab to view a collection of heat maps that provide a single view of the most important performance metrics for VPLEX resources.

The EMC VPLEX Metrics dashboard displays two types of heat maps:

- Metrics with definitive measurements such as CPU usage (0-100%) or response time latency (0-15ms) are assigned color ranges from lowest (green) to highest (red).
- Metrics with varied values that cannot be assigned a range show relative values from lowest (light blue) to highest (dark blue).

Front-end Bandwidth

This heat map has three modes: Reads (MB/s), Writes (MB/s), and Active Operations (Counts/s)

Reads and Writes represent the total reads or writes for the storage volumes across the front-end ports on a director.

For Reads and Writes, the color of the heat map entries shows the relative front-end bandwidth on a director, depending upon the selected metric.

Active Operations represents the number of active, outstanding I/O operations on the director's front-end ports.

Back-end Bandwidth

This heat map has three modes: Reads (MB/s), Writes (MB/s), and Operations (Counts/s).

Reads and Writes represent the total reads or writes for the storage volumes across the back-end ports on a director.

For Reads and Writes, the color of the heat map entries shows the relative back-end bandwidth on a director, depending upon the selected metric.

Operations represents the number of I/O operations per second through the director's back-end ports.

Back-end Errors

This heat map has three modes: Resets (count/s), Timeouts (count/s), and Aborts (count/s). Resets are LUN resets sent by VPLEX to a storage array LUN when it does not respond to I/O operations for over 20 seconds. Timeouts occur when an I/O from VPLEX to a storage array LUN takes longer than 10 seconds to complete. Aborts occur when an I/O from VPLEX to a storage array LUN is cancelled in transit. Resets indicate more serious problems than timeouts and aborts.

The color of the heat map entries is the same for all metrics. It shows the relative amount of resets, timeouts, or aborts, depending on the selected metric.

Front-end Latency

This heat map has three modes: Read Latency (ms), Write Latency (ms), and Queued Operations (Counts/s).

Write and Read Latency is the average write or read latency for all virtual volumes across all front-end ports on a director.

For Read and Write Latency, the color of the heat map entries is based on a scale of latency from 0 to 15ms, depending upon the selected metric. This scale is based on average customer requirements and may not represent a customer's particular requirements for latency. In such cases, EMC recommends adjusting the scale appropriately.

For VPLEX Metro systems consisting primarily of distributed devices, the WAN round-trip time greatly affects the front-end write latency. See the COM Latency widgets and the WAN Link Usage widget in the VPLEX Communication dashboard.

Virtual Volumes Latency

This heat map has three modes: Read Latency (ms), Write Latency (ms), and Total Reads & Writes (Counts/s).

Write and Read Latency is the average write or read latency for all virtual volumes on a director.

For Read and Write Latency, the color of the heat map entries is based on a scale of latency from 0 to 15ms, depending on the selected metric. This scale is based on average customer requirements and may not represent a customer's particular requirements for latency. In such cases, EMC recommends adjusting the scale appropriately.

Total Reads & Writes represents the virtual volume total reads and writes per director.

Storage Volumes Latency

This heat map has two modes: Read Latency (ms) and Write Latency (ms).

Write and Read Latency is the average write or read latency for all storage volumes on a director.

For Read and Write Latency, the color of the heat map entries is based on a scale of latency from 0 to 15ms, depending on the selected metric. This scale is based on average customer requirements and may not represent a customer's particular requirements for latency. In such cases, EMC recommends adjusting the scale appropriately.

VPLEX Communication dashboard

Click the **VPLEX Communication** tab to view a collection of heat maps that provide a single view of the performance of the communication links for a VPLEX configuration.

The EMC VPLEX Communication dashboard displays two types of heat maps:

- Metrics with definitive measurements such as intra-cluster local COM latency (0-15ms) are assigned color ranges from lowest (green) to highest (red).
- Metrics with varied values that cannot be assigned a range show relative values from lowest (light blue) to highest (dark blue).

Cluster-1 COM Latency

This heat map has one mode: Average Latency (ms).

The Cluster-1 latency statistics represent the intra-cluster local COM latency, which occurs within the rack and is typically fast (less than 1 msec).

For COM Latency, the color of the heat map entries is based on a scale of latency from 0 to 15ms, depending upon the selected metric. This scale is based on average customer requirements and may not represent a customer's particular requirements for latency. In such cases, EMC recommends adjusting the scale appropriately.

For VPLEX Metro, EMC recommends adjusting the scale based on your discovered WAN round-trip time.

Cluster-2 COM Latency

This heat map has one mode: Average Latency (ms).

The Cluster-2 latency statistics represent the intra-cluster local COM latency, which occurs within the rack and is typically fast (less than 1 msec).

For COM Latency, the color of the heat map entries is based on a scale of latency from 0 to 15ms, depending upon the selected metric. This scale is based on average customer requirements and may not represent a customer's particular requirements for latency. In such cases, EMC recommends adjusting the scale appropriately.

For VPLEX Metro, EMC recommends adjusting the scale based on your discovered WAN round-trip time.

WAN Link Usage (VPLEX Metro only)

This heat map has four modes:

- Distributed Device Bytes Received (MB/s)
- Distributed Device Bytes Sent (MB/s)
- Distributed Device Rebuild Bytes Received (MB/s)
- Distributed Device Rebuild Bytes Sent (MB/s)

Distributed Device Bytes Received or Sent represent the total amount of traffic received or sent for all distributed devices on a director.

Distributed Device Rebuild Bytes Received or Sent represent the total amount of rebuild/migration traffic received or sent for all distributed devices on a director.

The color of the heat map entries shows the relative number of distributed device bytes transferred on a director, depending upon the selected metric.

Topology dashboards

The topology dashboards provide an entry point for viewing resources and relationships between storage and virtual infrastructure objects for supported adapter instances.

The Topology dashboards are available for VNX, VNXe, VMAX, and VPLEX.

Depending on the EMC adapter instance you installed, click the:

- **VNX Topology** tab
- **VNXe Topology** tab
- **VMAX Topology** tab
- **VPLEX 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.

The VNX, VNXe, VMAX, and VPLEX topology dashboards contain the following widgets:

Resource Tree

This widget shows the end-to-end topology and health of resources across vSphere and storage domains. You can configure the hierarchy that is shown by changing the widget settings; changing these settings does not alter the underlying object relationships in the database. Select any resource in this widget to view related resources in the stack.

Health Tree

The **Health Tree** widget provides a navigable visualization of resources that have parent or child relationships to the resource you select in the **Resource Tree** widget. Single-click to select resources, or double-click to change the navigation focus.

Metric Sparklines

This widget shows sparklines for the metrics of the resource you select in the **Resource Tree** widget.

Metrics dashboards

The metrics dashboards display resources and metrics for storage systems and allow the user to view graphs of resource metrics.

The Metrics dashboards are available for VNX, VNXe, and VMAX.

Depending on the EMC adapter instance you installed, click the:

- **VNX Metrics** tab
- **VNXe Metrics** tab
- **VMAX Metrics** tab

Widgets for the VNX, VNXe, and VMAX Metrics dashboards are described next.

Resource Tree

This widget shows the end-to-end topology and health of resources across vSphere and storage domains. You can configure the hierarchy that is shown by changing the widget settings; changing these settings does not alter the underlying object relationships in the database. Select any resource in this widget to view related resources in the stack.

Metric Selector

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

Metric Graph

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

Resource Events (VNX only)

Note

This widget supports only VNX resources.

The resource event widget shows a graph that illustrates the health of the selected object over a period of time. Object events are labeled on the graph. When you hover over or click a label, event details appear in a message box:

```
Id: 460
Start Time: May 23, 2014 4:30:52 AM
Cancel Time: May 23, 2014 4:38:28 AM
Trigger: Notification
Resource: Pool 0 (Storage Pool)
Details: FAST VP relocation completed.
```

The message box includes the event ID, start time, cancel time, trigger, resource name, and event details.

To close the message box, click the X button at the top-right corner.

Top-N dashboards

Click a Top-N dashboard to view your top performers at a glance.

The Top-N dashboards are available for VNX, VNXe, or VMAX.

By default, a Top-N dashboard shows the top 5 devices in the following categories across your systems. If required, you can change the number of objects in your top performer list.

- Top-5 by Read (IO/s)
- Top-5 by Write (IO/s)
- Top-5 by Read (MB/s)
- Top-5 by Write (MB/s)
- Either:
 - Top-5 by Read Latency (ms) for Top-5 Devices dashboard
 - Top-5 by Consumed Capacity for Top-5 VNX LUNs or Top-5 VNX File Systems dashboards

Top performers are selected based on the current value of the associated metric that you configured for each widget. You can change the time period.

You can also configure each widget on the dashboard to show more than 5 top performers in your environment.

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 provides these 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

The EMC Storage Analytics Dashboard XChange is available at <https://community.emc.com/community/connect/esa>. Note that there are XChange Zones for supported platforms.

CHAPTER 4

Resource Kinds and Metrics

This chapter contains the following topics.

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VNX Block metrics

EMC Storage Analytics provides metrics for these Resource Kinds:

- [EMC Adapter Instance on page 56](#) (array)
- [Disk on page 56](#)
- [FAST Cache on page 57](#)
- [Pool LUN on page 58](#)
- [RAID Group on page 60](#)
- [RAID Group LUN on page 60](#)
- [SP Front-end Port on page 61](#)
- [Storage Pool on page 62](#)
- [Storage Processor on page 63](#)
- [Tier on page 64](#)

Table 4 VNX Block metrics for Array

Metric	Additional information
Elapsed collect time (ms)	Time elapsed during the collection.
New metrics in each collect call	Number of new metrics per collection.
New resources in each collect call	Number of new resources per collection.
Number of down resources	Number of down resources for this adapter instance.
Number of metrics collected	Number of metrics collected by this adapter instance.
Number of resources collected	Number of resources collected by this adapter instance.

Table 5 VNX Block metrics for Disk

Metric	Additional information
Busy (%)	The percentage of time during which the disk is servicing any requests.
Capacity (GB)	Total capacity of the disk.
Hard Read Errors	Number of hard read errors.
Hard Write Errors	Number of hard write errors.
LUN Count	Total number of LUNs that the disk is serving.
Queue Length	The average number of requests within a polling interval that are waiting to be serviced by the disk, including the one currently in service.
Read Size (MB)	Appears in the Performance metric group. The average size of data read.

Table 5 VNX Block metrics for Disk (continued)

Metric	Additional information
Reads (IO/s)	The average number of read requests from the disk per second.
Reads (MB/s)	The average amount of data read from the disk in megabytes per second.
State	Current state of the disk.
Total Latency (ms)	The average time, in milliseconds, that it takes for one request to pass through the disk, including any waiting time.
Total Operations (IO/s)	The total number of read and write requests per second that pass through the disk.
Total Bandwidth (MB/s)	The total number of host read and write data per second that pass through the disk.
Write Size (MB)	Appears in the Performance metric group. The average size of data written.
Writes (IO/s)	The average number of write requests to the disk per second.
Writes (MB/s)	The average amount of data written to the disk in megabytes per second.

Table 6 VNX Block metrics for FAST Cache

Metric	Additional information
Current Operation	Creating or Destroying.
Current Operation Status	If there is a current FAST Cache operation in progress such as destroying or creating, this displays the percentage complete.
Current Operation Complete (%)	If there is a current FAST Cache operation in progress such as destroying or creating, this displays the percentage complete.
Dirty (%)	Appears in the Performance > SPA and Performance > SPB metric groups. Percentage of write cache pages owned by the SP that contain data that has not yet been flushed out to the FAST Cache.
Flushed (MB)	Appears in the Performance > SPA and Performance > SPB metric groups. The average amount of data in megabytes that was written from the write cache to the FAST Cache.
Mode	Read/Write.
RAID Type	The RAID Type of FAST Cache.
Read Cache Hit Ratio (%)	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.

Table 6 VNX Block metrics for FAST Cache (continued)

Metric	Additional information
Read Cache Hits (Hits/s)	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.
Read Cache Misses (Misses/s)	Average number of read requests per second that required one or multiple disk accesses.
Size (GB)	The capacity of FAST Cache.
Write Cache Hit Ratio (%)	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.
Write Cache Hits (Hits/s)	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.
Write Cache Misses (Misses/s)	Average number of write requests per second that required one or multiple disk accesses.

Table 7 VNX Block metrics for Pool LUN

Metric	Additional information
Average Busy Queue Length	Appears in the Performance metric group. The average number of outstanding requests when the LUN was busy.
Busy (%)	Appears in the Performance > SPA and Performance > SPB metric groups. 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.
Capacity Tier Distribution (%)	The distribution (%) of the Capacity Tier.
Consumed Capacity (GB)	The amount of space consumed in the pool by the LUN plus overhead.
Explicit trespasses	Appears in the Performance > SPA and Performance > SPB metric groups. 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.
Extreme Performance Tier Distribution (%)	The distribution (%) of the Extreme Performance Tier.
Implicit trespasses	Appears in the Performance > SPA and Performance > SPB metric groups.

Table 7 VNX Block metrics for Pool LUN (continued)

Metric	Additional information
	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.
Initial Tier	The initial tier that was used for initial placement of the new LUN.
Performance Tier Distribution (%)	The distribution (%) of the Performance Tier.
Queue Length	The length of the LUN queue.
Read Cache State	The enabled or disabled state of the read cache.
Read Size (MB)	Appears in the Performance metric group. The average size of data read.
Reads (IO/s)	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.
Reads (MB/s)	The average amount of host read data in megabytes that is passed through the LUN per second. Larger requests usually result in a higher bandwidth than smaller requests.
Service Time (ms)	Appears in the Performance metric group. Average service time for successful completion of I/O without retries and queuing delays.
Tiering Policy	The tiering policy of this Pool LUN.
Total Latency (ms)	The average time, in milliseconds, that a request to this LUN is outstanding, including its waiting time.
Total Operations (IO/s)	The total number of read and write requests per second that pass through the LUN.
Total Bandwidth (MB/s)	The total number of host read and write data per second that pass through the LUN.
User Capacity (GB)	The amount of space consumed in the pool by the LUN.
Write Cache State	The enabled or disabled state of the write cache.
Write Size (MB)	Appears in the Performance metric group. The average size of data written.
Writes (IO/s)	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.
Writes (MB/s)	The average amount of host write data in megabytes that is passed through the LUN per second. Larger requests usually result in higher bandwidth than smaller requests.

Table 8 VNX Block metrics for RAID Group

Metric	Additional information
Available Capacity (GB)	The remaining free capacity of this RAID Group.
Defragmented (%)	When a defragment operation in progress, this displays the percentage complete.
Disk Count	Number of disks in this RAID Group.
Free Continuous Group of Unbound Segments (GB)	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.
Full (%)	Percentage of total capacity that is consumed.
LUN Count	Number of LUNs in this RAID Group.
Max Disks	Maximum number of disks allowed for this RAID Group.
Max LUNs	Maximum number of LUNs allowed for this RAID Group.
Raw Capacity (GB)	The total amount of space available in the RAID Group prior to RAID protection.
User Capacity (GB)	The amount of space available in the RAID Group.

Table 9 VNX Block metrics for RAID Group LUN

Metric	Additional information
Average Busy Queue Length	Appears in the Performance metric group. The average number of outstanding requests when the LUN was busy.
Busy (%)	Appears in the Performance > SPA and Performance > SPB metric groups. 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.
Queue Length	The length of the LUN queue.
Read Cache State	The enabled or disabled state of the read cache.
Read Size (MB)	Appears in the Performance metric group. The average size of data read.
Reads (IO/s)	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.
Reads (MB/s)	The average amount of host read data in megabytes that is passed through the LUN per second. Larger requests usually result in a higher bandwidth than smaller requests.
Service Time (ms)	Appears in the Performance metric group.

Table 9 VNX Block metrics for RAID Group LUN (continued)

Metric	Additional information
	Average service time for successful completion of I/O without retries and queuing delays.
Total Latency (ms)	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.
Total Operations (IO/s)	The total number of read and write requests per second that pass through the LUN.
Total Bandwidth (MB/s)	The total number of host read and write data per second that pass through the LUN.
User Capacity (GB)	The amount of space available in the RAID Group LUN.
Write Cache State	The enabled or disabled state of the write cache.
Write Size (MB)	Appears in the Performance metric group. The average size of data written.
Writes (IO/s)	The average number of host write requests that is passed through the LUN per second.
Writes (MB/s)	The average amount of host write data in megabytes that is passed through the LUN per second.

Table 10 VNX Block metrics for SP Front-end Port

Metric	Additional information
Queue Full Count	The number of times that a front-end port issued a queue full response to the hosts.
Reads (IO/s)	The average number of read requests per second that pass through the SP front-end port.
Reads (MB/s)	The average amount of data read from the disk in megabytes per second.
Total Operations (IO/s)	The total number of read and write requests per second that pass through the SP front-end port.
Total Bandwidth (MB/s)	The total number of host read and write data per second that pass through the SP front-end port.
Writes (IO/s)	The average number of write requests per second that pass through the SP front-end port.
Writes (MB/s)	The average amount of data written to the disk in megabytes per second.

Table 11 VNX Block metrics for Storage Pool

Metric	Additional information
Available Capacity (GB)	Capacity available for use in this Storage Pool.
Auto-Tiering	Shows if auto-tiering is scheduled.
Auto-Tiering State	The enabled or disabled state of auto-tiering.
Consumed Capacity (GB)	Capacity used in this Storage Pool.
Current Operation	Displays the current operation in the pool.
Current Operation Complete (%)	If there is a thin pool operation in progress such as a re-balance, this displays the percentage complete.
Current Operation State	Displays the current operation state.
Current Operation Status	Displays additional descriptive information for the current state of the thin pool.
Data Movement Completed (GB)	Amount of data that has been moved up or down.
Data to Move Down (GB)	Amount of data that is going to be moved down.
Data to Move Up (GB)	Amount of data that is going to be moved up.
Data to Move Within (GB)	Amount of data to move within tiers.
Deduplicated LUNs Shared Capacity (GBs)	Shared capacity of deduplicated LUNs.
Deduplication and Snapshot Savings (GBs)	Capacity savings through deduplication and Snapshots.
Deduplication Rate	Rate of deduplication.
Deduplication State	The deduplication state can take any of these values: Idle (No deduplicated LUNs) Idle (No deduplicated LUNs) - Faulted Pending Pending - Faulted Running (% complete, GB remaining) Running - Faulted (% complete, GB remaining) Paused Paused - Faulted
Disk Count	Number of disks consumed by this Storage Pool.
Disk Type	Type of disks in this Storage Pool.
Estimated Time to Complete	Estimated time to complete the data relocation.
FAST Cache	The enabled or disabled state of the FAST Cache for this Storage Pool.
Full (%)	Percentage of total capacity that is consumed.
Initial Tier	Initial tier can be any of the values available for Tiering Policy (above).
LUN Count	Number of LUNs hosted by this Storage Pool.

Table 11 VNX Block metrics for Storage Pool (continued)

Metric	Additional information
Oversubscribed (GB)	How much the Storage Pool is oversubscribed.
Relocation Rate	Rate at which relocation occurs.
Relocation Start Time	Start time for the relocation.
Relocation Status	Relocation is active or inactive.
Relocation Stop Time	Stop time for the relocation.
Relocation Type	Scheduled or manual relocation.
Schedule Duration Remaining	If using scheduled relocation, this displays the remaining time for the relocation.
Subscribed (%)	Percentage of total capacity that is subscribed.
Threshold (%)	Threshold as percentage of total capacity.
Tiering Policy	<p>With FAST VP enabled, tiering policy can take any of these values:</p> <ul style="list-style-type: none"> Start High then Auto-Tier (recommended) Auto Tier Highest Available Tier Lowest Available Tier No Data Movement <p>With FAST VP disabled, tiering policy can be:</p> <ul style="list-style-type: none"> Optimize for Pool Performance (default) Highest Available Tier Lowest Available Tier

Table 12 VNX Block metrics for Storage Processor

Metric	Additional information
Busy (%)	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.
Dirty Cache Pages (%)	The amount of dirty cache pages by percentage. This metric is for 1st generation VNX models.
Dirty Cache Pages (MB)	The amount of dirty cache pages in megabytes. This metric is for 2nd generation VNX models.
Read Cache Hit Ratio (%)	The ratio of read requests that the SP Cache satisfied without requiring any disk access versus the total number of read requests.
Read Cache Size (MB)	The size of the read cache in megabytes. This metric is only for 1st generation VNX models.

Table 12 VNX Block metrics for Storage Processor (continued)

Metric	Additional information
Read Cache State	The enabled or disabled state of the read cache.
Read Size (MB)	Appears in the Disk metric group. The average size of data read.
Reads (IO/s)	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.
Reads (MB/s)	The average amount of host read data in megabytes that is passed through the SP per second. Larger requests usually result in a higher bandwidth than smaller requests.
Total Operations (IO/s)	The total number of read and write requests per second at the time when the SP is polled.
Total Bandwidth (MB/s)	The total number of read and write requests that pass through the SP per second.
Write Cache Hit Ratio (%)	The ratio of write requests that the SP Cache satisfied without requiring any disk access versus the total number of write requests.
Write Cache Flushes (MB/s)	The average amount of data in megabytes that was written from the write cache to the disks per second. The value is a measure of back-end activity.
Write Cache Size (MB)	The size of the write cache in megabytes. This metric is only for 1st generation VNX models.
Write Cache State	The enabled or disabled state of the write cache.
Write Size (MB)	Appears in the Disk metric group. The average size of data written.
Writes (IO/s)	The number of writes per second at the time when the SP is polled. Smaller requests usually result in a higher write throughput than larger requests.
Writes (MB/s)	The average write request size in megabytes that passes through the SP per second. Larger requests usually result in higher bandwidth than smaller requests.

Table 13 VNX Block metrics for Tier

Metric	Additional information
Available Capacity (GB)	Capacity still available for use.
Consumed Capacity (GB)	Used capacity.
Disk Count	Number of disks in the tier.
Higher Tier (GB)	Amount of data targeted for higher tiers.
Lower Tier (GB)	Amount of data targeted for lower tiers.

Table 13 VNX Block metrics for Tier (continued)

Metric	Additional information
RAID Type	Type of RAID applied to the tier.
Subscribed (%)	Percentage of tier that is subscribed.
User Capacity (GB)	Free capacity for users.

VNX File metrics

EMC Storage Analytics provides metrics for these Resource Kinds:

- [EMC Adapter Instance on page 66](#) (array)
- [Data Mover on page 66](#) (includes Virtual Data Mover)
- [dVol on page 70](#)
- [File Pool on page 71](#)
- [File System on page 71](#)

Table 14 VNX File metrics for Array

Metric	Additional information
Elapsed collect time (ms)	Amount of elapsed time for the collection.
New metrics in each collect call	Number of new metrics per collection.
New resources in each collect call	Number of new resources per collection.
Number of down resources	Number of down resources for this adapter instance.
Number of metrics collected	Number of metrics collected by this adapter instance.
Number of resources collected	Number of resources collected by this adapter instance.

Table 15 VNX File metrics for Data Mover

Metric	Metric Group	Description
Buffer Cache Hit Ratio (%)	Cache	Buffer Cache Hit ratio percentage.
DNLC Hit Ratio (%)	Cache	Directory Name Lookup Cache (DNLC) hit ratio percentage used for pathname resolution logic.
Open File Cache Hit Ratio (%)	Cache	Open File Cache Hit ratio percentage.
Type	Configuration	Data Mover type. The value can be Active (for the primary Data Mover), Standby, or VDM.
Busy (%)	CPU	CPU utilization percentage during this interval.
Reads (MB/s)	Disk	Storage in Mbytes received from all server-storage interfaces.
Total Bandwidth (MB/s)	Disk	The total bandwidth for the Data Mover.
Writes (MB/s)	Disk	Storage in Mbytes sent to all server-storage interfaces.
CIFS Average Read Size (KB)	Network	Average CIFS read size

Table 15 VNX File metrics for Data Mover (continued)

Metric	Metric Group	Description
CIFS Average Write Size (KB)	Network	Average CIFS write size
CIFS Reads (IO/s)	Network	IOs per second for CIFS reads
CIFS Reads (MB/s)	Network	Megabytes per second for CIFS reads
CIFS Total Operations (IO/s)	Network	The total number of CIFS read and write requests per second that pass through the Data Mover.
CIFS Total Bandwidth (MB/s)	Network	The total number of CIFS read and write data per second that pass through the Data Mover.
CIFS Writes (IO/s)	Network	IOs per second for CIFS writes
CIFS Writes (MB/s)	Network	Megabytes per second for CIFS writes
NFS Average Read Size (Bytes)	Network	Average size of data read.
NFS Average Write Size (Bytes)	Network	Average size of data written.
NFS Reads (IO/s)	Network	NFS read operations per second.
NFS Reads (MB/s)	Network	NFS read data response in Mbytes per second.
NFS Total Bandwidth (MB/s)	Network	The total number of NFS read and write data per second that pass through the Data Mover.
NFS Total Operations (IO/s)	Network	The total number of NFS read and write requests per second that pass through the Data Mover.
NFS Writes (IO/s)	Network	NFS write operations per second.
NFS Writes (MB/s)	Network	NFS write data response in Mbytes per second.
Network In Bandwidth (MB/s)	Network	Network in bandwidth. Megabytes received per second.
Network Out Bandwidth (MB/s)	Network	Network out bandwidth. Megabytes sent per second.
Total Network Bandwidth (MB/s)	Network	The total network bandwidth per second.
Read Calls/s	Network > NFSv2, NFSv3, and NFSv4	Read calls per second
Read Errors/s	Network > NFSv2, NFSv3, and NFSv4	Read errors per second
Read Response Time (ms)	Network > NFSv2, NFSv3, and NFSv4	Total read response time
Write Calls/s	Network > NFSv2, NFSv3, and NFSv4	Write calls per second

Table 15 VNX File metrics for Data Mover (continued)

Metric	Metric Group	Description
Write Errors/s	Network › NFSv2, NFSv3, and NFSv4	Write errors per second
Write Response Time (ms)	Network › NFSv2, NFSv3, and NFSv4	Total write response time
Access Calls/s	Network › NFSv3	Access calls per second
Access Errors/s	Network › NFSv3	Access errors per second
Access Response Time (ms)	Network › NFSv3	Total access response time
GetAttr Calls/s	Network › NFSv3	Get file attributes (GetAttr) per second
GetAttr Errors/s	Network › NFSv3	GetAttr errors per second
GetAttr Response Time (ms)	Network › NFSv3	Total response time for GetAttr
Lookup Calls/s	Network › NFSv3	Lookup calls per second
Lookup Errors/s	Network › NFSv3	Lookup errors per second
Lookup Response Time (ms)	Network › NFSv3	Total lookup response time
SetAttr Calls/s	Network › NFSv3	Set file attributes (SetAttr) per second
SetAttr Errors/s	Network › NFSv3	SetAttr errors per second
SetAttr Response Time (ms)	Network › NFSv3	Total response time for SetAttr
Close Calls/s	Network › NFSv4	Close calls per second
Close Errors/s	Network › NFSv4	Close errors per second
Close Response Time (ms)	Network › NFSv4	Total close response time
Compound Calls/s	Network › NFSv4	Compound calls per second
Compound Errors/s	Network › NFSv4	Compound errors per second
Compound Response Time (ms)	Network › NFSv4	Total compound response time
Open Calls/s	Network › NFSv4	Open calls per second
Open Errors/s	Network › NFSv4	Open errors per second
Open Response Time (ms)	Network › NFSv4	Total open response time
Close Average Response Time (ms)	Network › SMB1	Close average response time
Close Calls/s	Network › SMB1	Close calls per second

Table 15 VNX File metrics for Data Mover (continued)

Metric	Metric Group	Description
Close Max Response Time (ms)	Network > SMB1	Close maximum response time
NCreateX Average Response Time (ms)	Network > SMB1	NCreateX average response time
NCreateX Calls/s	Network > SMB1	NCreateX calls per second
NCreateX Max Response Time (ms)	Network > SMB1	NCreateX maximum response time
ReadX Average Response Time (ms)	Network > SMB1	Average response time for ReadX
ReadX Calls/s	Network > SMB1	ReadX calls per second
ReadX Max Response Time (ms)	Network > SMB1	ReadX maximum response time
Trans2Prim Average Response Time (ms)	Network > SMB1	Trans2Prim average response time
Trans2Prim Calls/s	Network > SMB1	Trans2Prim calls per second
Trans2Prim Max Response Time (ms)	Network > SMB1	Trans2Prim maximum response time
WriteX Average Response Time (ms)	Network > SMB1	WriteX average response time
WriteX Calls/s	Network > SMB1	WriteX calls per second
WriteX Max Response Time (ms)	Network > SMB1	WriteX maximum response time
Close Average Response Time (ms)	Network > SMB2	Close average response time
Close Calls/s	Network > SMB2	Close calls per second
Close Max Response Time (ms)	Network > SMB2	Close maximum response time
Flush Average Response Time (ms)	Network > SMB2	Flush average response time
Flush Calls/s	Network > SMB2	Flush calls per second
Flush Max Response Time (ms)	Network > SMB2	Flush maximum response time
Create Average Response Time (ms)	Network > SMB2	Create average response time
Create Calls/s	Network > SMB2	Create calls per second
Create Max Response Time (ms)	Network > SMB2	Create maximum response time

Table 15 VNX File metrics for Data Mover (continued)

Metric	Metric Group	Description
IOCTL Average Response Time (ms)	Network > SMB2	IO Control average response time
IOCTL Calls/s	Network > SMB2	IO Control (IOCTL) calls per second
IOCTL Max Response Time (ms)	Network > SMB2	IO Control maximum response time
Queryinfo Average Response Time (ms)	Network > SMB2	Query information average response time
Queryinfo Calls/s	Network > SMB2	Query information calls per second
Queryinfo Max Response Time (ms)	Network > SMB2	Query information maximum response time
Read Average Response Time (ms)	Network > SMB2	Read average response time
Read Calls/s	Network > SMB2	Read calls per second
Read Max Response Time (ms)	Network > SMB2	Read maximum response time
Write Average Response Time (ms)	Network > SMB2	Write average response time
Write Calls/s	Network > SMB2	Write calls per second
Write Max Response Time (ms)	Network > SMB2	Write maximum response time

Table 16 VNX File metrics for dVol

Metric	Additional information
Average Read Size (Bytes)	Average size of data read.
Average Write Size (Bytes)	Average size of data written.
Average Completion Time (μ Sec/call)	Average time for completion of an I/O.
Average Service Time (μ Sec/call)	Average service time for successful completion of I/O without retries and queuing delays.
Capacity (GB)	Total capacity of the disk volume.
IO Retries (IO/s)	Number of I/O retries per second.
Queue Length	Length of disk queue
Reads (IO/s)	Number of read operations on the disk per second.
Reads (MB/s)	Mbytes read from the disk per second.
Total Operations (IO/s)	Number of I/O operations on the disk volume per second.
Total Bandwidth (MB/s)	Total bandwidth of the disk volume.
Utilization (%)	Percentage time that disk has been utilized.

Table 16 VNX File metrics for dVol (continued)

Metric	Additional information
Writes (IO/s)	Number of write operations on the disk per second.
Writes (MB/s)	Mbytes written to the disk per second.

Table 17 VNX File metrics for File Pool

Metric	Additional information
Available Capacity (GB)	Capacity still available for use.
Capacity (GB)	Total capacity of the file pool.
Consumed Capacity (GB)	Consumed capacity of the file pool.

Table 18 VNX File metrics for File System

Metric	Additional information
Available Capacity (GB)	Capacity still available for use.
Average Read Size (Bytes)	Average size of data read.
Average Write Size (Bytes)	Average size of data written.
Capacity (GB)	Total space available for storage of user data (does not include metadata).
Consumed Capacity (GB)	Consumed capacity of the File System.
Thin Provisioning	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.
Max Capacity (GB)	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.
Read IO Ratio (%)	Percentage of total IOs that are read IOs.
Read Requests (Requests/s)	Read operations per second in the interval.
Reads (IO/s)	The average read operations per second.
Reads (MB/s)	Read data response per second.
Total Bandwidth (MB/s)	The total number of read and write data per second for the file system.
Total Operations (IO/s)	The total number of read and write data per second for the file system.

Table 18 VNX File metrics for File System (continued)

Metric	Additional information
Write IO Ratio (%)	Percentage of total IOs that are write IOs.
Write Requests (Requests/s)	Write operations per second in the interval.
Writes (IO/s)	The average write operations per second.
Writes (MB/s)	Write data response per second.

VMAX metrics

EMC Storage Analytics provides metrics for these Resource Kinds:

- [EMC Adapter Instance \(array\)](#)
- [Device on page 73](#)
- [FAST VP Policy on page 73](#)
- [Front-End Director on page 73](#)
- [Front-End Port on page 74](#)
- [Remote Replica Group on page 74](#)
- [SRDF Director on page 74](#)
- [Storage Group on page 75](#)
- [Thin Pool on page 75](#)

Table 19 VMAX metrics for Device

Metric	Definition
Read Latency (ms)	The average time it took the Symmetrix array to serve one Read IO for this device.
Reads (IO/s)	The number of Read operations performed each second on the device.
Reads (MB/s)	The cumulative number of MBs read per second from the device.
Total Bandwidth (MB/s)	The total number of read and write MBs performed each second on the device.
Total Operations (IO/s)	The total reads and writes performed each second on the device.
Write Latency (ms)	The average time it took the Symmetrix array to serve one Write IO for this device.
Writes (IO/s)	The total number of Write IO operations performed each second by the Symmetrix volume (LUN).
Writes (MB/s)	The cumulative number of MBs written per second to the device.

Table 20 VMAX metrics for FAST VP Policy

Metric	Metric group	Definition
Name	Tier 1, Tier 2, Tier 3, Tier 4	The name of the FAST VP policy.
Percent in policy	Tier 1, Tier 2, Tier 3, Tier 4	Percentage of tier within a policy.

Table 21 VMAX metrics for Front-End Director

Metrics	Definition
Reads (IO/s)	The total read operations the front-end director processes per second.
Total Bandwidth (MB/s)	The total number of MBs sent and received per second by the director.

Table 21 VMAX metrics for Front-End Director (continued)

Metrics	Definition
Total Hits (IO/s)	The total number of requests that were immediately serviced from cache.
Total Operations (IO/s)	The total reads and writes the front-end director processes per second.
Writes (IO/s)	The total write operations the front-end director processes per second.

Table 22 VMAX metrics for Front-End Port

Metrics	Definition
Total Operations (IO/s)	The total reads and writes the front-end port processes per second.
Total Bandwidth (MB/s)	The number of MBs transferred per second.

Table 23 VMAX metrics for Remote Replica Group

Metrics	Definition
Average Cycle Time (s)	The average time it takes for each cycle to complete.
Delta Set Extension Threshold	The percent of write pendings before DSE activates.
Devices in Session (count)	The number of devices in the group.
HA Repeat Writes (counts/s)	Writes to a slot already in the active cycle. Total host adapter repeat writes, measured in write commands to SRDF/A volumes only. This counter helps estimate the cache locality of reference, i.e., how much cache is saved by the re-writes. This does not give any indication to the bandwidth locality of reference.
Minimum Cycle Time (s)	The setting for the minimum number of seconds for a cycle.
Writes (IO/s)	The number of write IOs coming in for the volumes in this session.
Writes (MB/s)	The total number of MBs sent per second by the group.

Table 24 VMAX metrics for SRDF Director

Metrics	Definition
Reads (IO/s)	The total read operations the SRDF director processes per second.
Total Bandwidth (MB/s)	The total number of MBs sent and received per second by the RDF director.
Total Operations (IO/s)	The total reads and writes the SRDF director processes per second.
Writes (IO/s)	The total write operations the SRDF director processes per second.

Table 25 VMAX metrics for Storage Group

Metric	Definition
Read Latency (ms)	The average time it took the Symmetrix array to serve one Read IO for this storage group.
Reads (IO/s)	The number of read operations performed each second by the storage group.
Reads (MB/s)	The cumulative number of MBs read per second by the storage group.
Total Bandwidth (MB/s)	The total number of MBs sent and received per second by the storage group.
Total Latency (ms)	The average time it took the Symmetrix array to serve one IO for this storage group.
Total Operations (IO/s)	The total reads and writes performed each second by the storage group.
Write Latency (ms)	The average time it took the Symmetrix array to serve one Write IO for this storage group.
Writes (IO/s)	The number of write operations performed each second by the storage group.
Writes (MB/s)	The cumulative number of MBs written per second by the storage group.

Table 26 VMAX metrics for Thin Pool

Metric	Definition
Allocated Capacity (GB)	The allocated thin pool capacity.
Full (%)	The percent that the thin pool has been allocated.
Total Capacity (GB)	The total thin pool capacity.
Used Capacity (GB)	The used thin pool capacity.

VNXe metrics

EMC Storage Analytics provides metrics for these Resource Kinds:

Note

Only the Resource Kinds with associated metrics are shown.

- [EMC Adapter Instance on page 76](#)
- [Disk on page 76](#)
- [FAST Cache on page 77](#)
- [File System on page 77](#)
- [LUN on page 77](#)
- [Storage Pool on page 78](#)
- [Storage Processor on page 78](#)
- [Tier on page 83](#)

Table 27 VNXe metrics for EMC Adapter Instance

Metric	Additional information
Elapsed collect time (ms)	Time elapsed during the collection.
New metrics in each collect call	Number of new metrics per collection.
New resources in each collect call	Number of new resources per collection.
Number of down resources	Number of down resources for this adapter instance.
Number of metrics collected	Number of metrics collected by this adapter instance.
Number of resources collected	Number of resources collected by this adapter instance.

Table 28 VNXe metrics for Disk

Metric	Metric Group	Description
Size (GB)	Capacity	The total capacity of the disk.
State	Configuration	Current state of the disk.
Busy (%)	Performance	The percentage of time during which the disk is servicing any requests.
Reads (IO/s)	Performance	The percentage of time during which the disk is servicing any requests.
Reads (MB/s)	Performance	The average amount of data read from the disk in megabytes per second.
Total Latency (ms)	Performance	The average time, in milliseconds, that it takes for one request to pass through the disk, including any waiting time.

Table 28 VNXe metrics for Disk (continued)

Metric	Metric Group	Description
Writes (IO/s)	Performance	The average number of write requests to the disk per second.
Writes (MB/s)	Performance	The average amount of data written to the disk in megabytes per second.

Table 29 VNXe metrics for Fast Cache

Metric	Metric group	Description
Available Capacity (GB)	Capacity	Capacity still available for use.
Raid Type	Configuration	The RAID Type of FAST Cache.

Table 30 VNXe metrics for File System

Metric	Metric group	Description
Available Capacity (GB)	Capacity	Capacity still available for use.
Capacity (GB)	Capacity	Total space available for storage of user data (does not include metadata).
Consumed Capacity (GB)	Capacity	Consumed capacity of the File System.
Max Capacity (GB)	Capacity	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.
Thin Provisioning	Capacity	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, whichever is larger.

Table 31 VNXe metrics for LUN

Metric	Metric group	Description
Consumed Capacity (GB)	Capacity	Capacity used in this LUN.
Total Capacity (GB)	Capacity	Total LUN capacity.

Table 31 VNXe metrics for LUN (continued)

Metric	Metric group	Description
Queue Length	Performance	The length of the LUN queue.
Reads (IO/s)	Performance	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.
Reads (MB/s)	Performance	The average amount of host read data in megabytes that is passed through the LUN per second. Larger requests usually result in a higher bandwidth than smaller requests.
Writes (IO/s)	Performance	The average number of host write requests that is passed through the LUN per second.
Writes (MB/s)	Performance	The average amount of host write data in megabytes that is passed through the LUN per second.

Table 32 VNXe metrics for Storage Pool

Metric	Metric group	Description
Available Capacity (GB)	Capacity	Capacity available for use in this Storage Pool.
Consumed Capacity (GB)	Capacity	Capacity used in this Storage Pool.
Full (%)	Capacity	Percentage of total capacity that is consumed.
Subscribed (%)	Capacity	Percentage of total capacity that is subscribed.
User Capacity (GB)	Capacity	The amount of space available in the Storage Pool.
Fast Cache	Configuration	The enabled or disabled state of the FAST Cache for this Storage Pool.

Table 33 VNXe metrics for Storage Processor

Metric	Metric group	Description
Dirty Cache Pages (MB)	Cache	The amount of dirty cache pages in megabytes.
Read Cache Hit Ratio (%)	Cache	The ratio of read requests that the SP Cache satisfied without requiring any disk access versus the total number of read requests.
Write Cache Hit Ratio (%)	Cache	The ratio of write requests that the SP Cache satisfied without requiring any disk access versus the total number of write requests.
CIFS Reads (IO/s)	Network	IOs per second for CIFS reads.

Table 33 VNXe metrics for Storage Processor (continued)

Metric	Metric group	Description
CIFS Reads (MB/s)	Network	Megabytes per second for CIFS reads.
CIFS Writes (IO/s)	Network	IOs per second for CIFS writes.
CIFS Writes (MB/s)	Network	Megabytes per second for CIFS writes.
Network In Bandwidth (MB/s)	Network	Network in bandwidth (megabytes received per second).
Network Out Bandwidth (MB/s)	Network	Network out bandwidth (megabytes sent per second).
NFS Reads (IO/s)	Network	NFS read operations per second.
NFS Reads (MB/s)	Network	NFS read data response in megabytes per second.
NFS Writes (IO/s)	Network	NFS write operations per second.
NFS Writes (MB/s)	Network	NFS write data response in megabytes per second.
<hr/>		
Read Calls/s	Network › NFSv2	Read calls per second.
Read Errors/s	Network › NFSv2	Read errors per second.
Read Response Time (ms)	Network › NFSv2	Read response time.
Reads (IO/s)	Network › NFSv2	NFS V2 read operations per second.
Write Calls/s	Network › NFSv2	Write calls per second.
Write Errors/s	Network › NFSv2	Write errors per second.
Write Response Time (ms)	Network › NFSv2	Write average response time.
Writes (IO/s)	Network › NFSv2	NFS V2 write operations per second.
<hr/>		
Access Calls/s	Network › NFSv3	Access calls per second.
Access Errors/s	Network › NFSv3	Access errors per second.
Access Response Time (ms)	Network › NFSv3	Access average response time.
GetAttr Calls/s	Network › NFSv3	Get file attributes (GetAttr) per second.
GetAttr Errors/s	Network › NFSv3	GetAttr errors per second.
GetAttr Response Time (ms)	Network › NFSv3	GetAttr average response time.
Lookup Calls/s	Network › NFSv3	Lookup calls per second.
Lookup Errors/s	Network › NFSv3	Lookup errors per second.
Lookup Response Time (ms)	Network › NFSv3	Lookup average response time.
Read Calls/s	Network › NFSv3	Read calls per second.
Read Errors/s	Network › NFSv3	Read errors per second.

Table 33 VNXe metrics for Storage Processor (continued)

Metric	Metric group	Description
Read Response Time (ms)	Network › NFSv3	Read average response time.
Reads (IO/s)	Network › NFSv3	NFS V3 read operations per second.
SetAttr Calls/s	Network › NFSv3	SetAttr per second.
SetAttr Errors/s	Network › NFSv3	SetAttr errors per second.
SetAtt Response Time (ms)	Network › NFSv3	Set file attributes (SetAttr) average response time.
Write Calls/s	Network › NFSv3	Write calls per second.
Write Errors/s	Network › NFSv3	Write errors per second.
Write Response Time (ms)	Network › NFSv3	Write average response time
Writes (IO/s)	Network › NFSv3	NFS V3 write operations per second.
Close Average Response Time (ms)	Network › SMB1	Close average response time.
Close Calls/s	Network › SMB1	Close calls per second.
Close Max Response Time (ms)	Network › SMB1	Close maximum response time.
NTCreateX Average Response Time (ms)	Network › SMB1	NTCreateX average response time.
NTCreateX Calls/s	Network › SMB1	NTCreateX calls per second.
NTCreateX Max Response Time (ms)	Network › SMB1	NTCreateX maximum response time.
Reads (IO/s)	Network › SMB1	IOs per second for CIFS SMB1 reads.
Reads (MB/s)	Network › SMB1	Megabytes per second for CIFS SMB1 reads.
ReadX Average Response Time (ms)	Network › SMB1	Average response time for ReadX.
ReadX Calls/s	Network › SMB1	ReadX calls per second.
ReadX Max Response Time (ms)	Network › SMB1	Maximum response time for ReadX.
Trans2Prim Average Response Time (ms)	Network › SMB1	Trans2Prim average response time.
Trans2Prim Calls/s	Network › SMB1	Trans2Prim calls per second.

Table 33 VNXe metrics for Storage Processor (continued)

Metric	Metric group	Description
Trans2Prim Max Response Time (ms)	Network › SMB1	Trans2Prim maximum response time.
Writes (IO/s)	Network › SMB1	IOs per second for CIFS SMB1 writes.
Writes (MB/s)	Network › SMB1	Megabytes per second for CIFS SMB1 writes.
WriteX Average Response Time (ms)	Network › SMB1	WriteX average response time.
WriteX Calls/s	Network › SMB1	WriteX calls per second.
WriteX Max Response Time (ms)	Network › SMB1	WriteX maximum response time.
Close Average Response Time (ms)	Network › SMB2	Close average response time.
Close Calls/s	Network › SMB2	Close calls per second.
Close Max Response Time (ms)	Network › SMB2	Close maximum response time.
Create Average Response Time (ms)	Network › SMB2	Create average response time.
Create Calls/s	Network › SMB2	Create calls per second.
Create Max Response Time (ms)	Network › SMB2	Create maximum response time.
Flush Average Response Time (ms)	Network › SMB2	Flush average response time.
Flush Calls/s	Network › SMB2	Flush calls per second.
Flush Max Response Time (ms)	Network › SMB2	Flush maximum response time.
Ioctl Average Response Time (ms)	Network › SMB2	IO Control (IOCTL) average response time.
Ioctl Calls/s	Network › SMB2	IOCTL calls per second.
Ioctl Max Response Time	Network › SMB2	IOCTL maximum response time.

Table 33 VNXe metrics for Storage Processor (continued)

Metric	Metric group	Description
Queryinfo Average Response Time (ms)	Network › SMB2	Queryinfo average response time.
Queryinfo Calls/s	Network › SMB2	Queryinfo calls per second.
Queryinfo Max Response Time (ms)	Network › SMB2	Queryinfo maximum response time.
Read Average Response Time (ms)	Network › SMB2	Read average response time.
Read Calls/s	Network › SMB2	Read calls per second.
Read Max Response Time (ms)	Network › SMB2	Read maximum response time.
Reads (IO/s)	Network › SMB2	IOs per second for CIFS SMB2 reads.
Reads (MB/s)	Network › SMB2	Megabytes per second for CIFS SMB2 reads.
Write Average Response Time (ms)	Network › SMB2	Write average response time.
Write Calls/s	Network › SMB2	Write calls per second.
Write Max Response Time (ms)	Network › SMB2	Write maximum response time.
Writes (IO/s)	Network › SMB2	IOs per second for CIFS SMB2 writes.
Writes (MB/s)	Network › SMB2	Megabytes per second for CIFS SMB2 writes.
Busy (%)	Performance	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%. An increase in workload will have no further impact on the SP throughput, but the I/O response time will start increasing more aggressively.
Reads (IO/s)	Performance	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.
Reads (MB/s)	Performance	The average amount of host read data in megabytes that is passed through the SP per second. Larger requests usually result in a higher bandwidth than smaller requests.
Writes (IO/s)	Performance	The number of writes per second at the time when the SP is polled, that is passed through the SP per

Table 33 VNXe metrics for Storage Processor (continued)

Metric	Metric group	Description
		second. Smaller requests usually result in a higher write throughput than larger requests.
Writes (MB/s)	Performance	The average write request size in megabytes that passes through the SP per second. Larger requests usually result in higher bandwidth than smaller requests.

Table 34 VNXe metrics for Tier

Metric	Description
Available Capacity (GB)	Capacity available for use in this tier
Consumed Capacity (GB)	Capacity used in this tier
Data to Move Down (GB)	Amount of data that is going to be moved down
Data to Move Up (GB)	Amount of data that is going to be moved up
Data to Move Within (GB)	Amount of data to move within tiers
Disk Count	Number of disks in the tier
Full (%)	Percentage of total capacity that is consumed
Raid Type	Type of RAID applied to the tier
User Capacity (GB)	The amount of space available in this tier

VPLEX metrics

EMC Storage Analytics provides metrics for these Resource Kinds:

- [EMC Adapter Instance \(array\)](#)
- [Cluster on page 84](#)
- [Director on page 86](#)
- [Distributed Device on page 89](#)
- [Engine on page 90](#)
- [Ethernet Port on page 90](#)
- [Extent on page 90](#)
- [FC Port on page 91](#)
- [Local Device on page 91](#)
- [Storage Array on page 93](#)
- [Storage View on page 93](#)
- [Storage Volume on page 93](#)
- [Virtual Volume on page 94](#)
- [VPLEX Metro on page 95](#)

Table 35 VPLEX metrics for Cluster

Metric	Metric Group	Definition
Cluster Type	Status	Local or Metro.
Health State	Status	<p>Possible values include:</p> <p>Ok - The cluster is functioning normally.</p> <p>Degraded - The cluster is not functioning at an optimal level. This may indicate non-functioning remote virtual volumes, unhealthy devices or storage volumes, suspended devices, conflicting director count configuration values, or out-of-date devices.</p> <p>Unknown - VPLEX cannot determine the cluster's health state, or the state is invalid.</p> <p>Major failure - The cluster is failing and some functionality may be degraded or unavailable. This may indicate complete loss of back-end connectivity.</p> <p>Minor failure - The cluster is functioning, but some functionality may be degraded. This may indicate one or more unreachable storage volumes.</p> <p>Critical failure - The cluster is not functioning and may have failed completely. This may indicate a complete loss of back-end connectivity.</p>

Table 35 VPLEX metrics for Cluster (continued)

Metric	Metric Group	Definition
Operational Status	Status	<p>During transition periods, the cluster moves from one operational state to another. Possible values include:</p> <p>Ok - The cluster is operating normally.</p> <p>Cluster departure - One or more of the clusters cannot be contacted. Commands affecting distributed storage are refused.</p> <p>Degraded - The cluster is not functioning at an optimal level. This may indicate non-functioning remote virtual volumes, unhealthy devices or storage volumes, suspended devices, conflicting director count configuration values, or out-of-date devices.</p> <p>Device initializing - If clusters cannot communicate with each other, then the distributed-device will be unable to initialize.</p> <p>Device out of date - Child devices are being marked fully out of date. Sometimes this occurs after a link outage.</p> <p>Expelled - The cluster has been isolated from the island either manually (by an administrator) or automatically (by a system configuration setting).</p> <p>Shutdown - The cluster's directors are shutting down.</p> <p>Suspended exports - Some I/O is suspended. This could be result of a link failure or loss of a director. Other states might indicate the true problem. The VPLEX might be waiting for you to confirm the resumption of I/O.</p> <p>Transitioning - Components of the software are recovering from a previous incident (for example, the loss of a director or the loss of an inter-cluster link).</p>
Exported Virtual Volumes	Capacity	Number of exported virtual volumes.
Exported Virtual Volumes (GB)	Capacity	Gigabytes of exported virtual volumes.
Used Storage Volumes	Capacity	Number of used storage volumes.
Used Storage Volumes (GB)	Capacity	Gigabytes of used storage volumes.
Unused Storage Volumes	Capacity	Number of unused storage volumes.
Unused Storage Volumes (GB)	Capacity	Gigabytes of unused storage volumes.

Table 36 VPLEX metrics for Director

Metric	Metric Group	Definition
Busy (%)	CPU	Percentage of director CPU usage.
Operational Status	Status	<p>Possible values include:</p> <p>OK - Functioning normally.</p> <p>Degraded - May be out-of-date compared to its mirror.</p> <p>Unknown - Cannot determine the health state, or the state is invalid.</p> <p>Error - VPLEX has marked the object as hardware-dead.</p> <p>Starting - Not yet ready.</p> <p>Lost-communication - The object is unreachable.</p>
Memory Used (%)	Memory	Percentage of memory heap usage by the firmware for its accounting on the director. This value is not the percentage of cache pages in use for user data.
Aborts (counts/s)	Front-end Director	Number of aborted I/O operations per second through the director's front-end ports.
Active Operations (counts)	Front-end Director	Number of active, outstanding I/O operations on the director's front-end ports.
Compare and Write Latency (ms)	Front-end Director	The average time, in milliseconds, that it takes for VAAI CompareAndWrite request to complete on the director's front-end ports.
Operations (counts/s)	Front-end Director	Number of I/O operations per second through the director's front-end ports.
Queued Operations (counts)	Front-end Director	Number of queued, outstanding I/O operations on the director's front-end ports.
Read Latency (ms)	Front-end Director	The average time, in milliseconds, that it takes for read requests to complete on the director's front-end ports. The total time it takes VPLEX to complete a read request.
Reads (counts/s)	Front-end Director	Number of read operations per second on the director's front-end ports.
Reads (MB/s)	Front-end Director	Number of bytes per second read from the director's front-end ports.
Write Latency (ms)	Front-end Director	The average time, in milliseconds, that it takes for write requests to complete on the director's front-end ports. The total time it takes VPLEX to complete a write request.
Writes (counts/s)	Front-end Director	Number of write operations per second on the director's front-end ports.

Table 36 VPLEX metrics for Director (continued)

Metric	Metric Group	Definition
Writes (MB/s)	Front-end Director	Number of bytes per second written to the director's front-end ports.
Aborts (counts/s)	Back-end Director	Number of aborted I/O operations per second on the director's back-end ports.
Operations (counts/s)	Back-end Director	Number of I/O operations per second through the director's back-end ports.
Read Latency (ms)	Back-end Director	The average time, in milliseconds, that it takes for read requests to complete on the director's back-end ports. The time it takes VPLEX to complete a read request to the storage array(s).
Reads (counts/s)	Back-end Director	Number of read operations per second by the director's back-end ports.
Reads (MB/s)	Back-end Director	Number of bytes read per second by the director's back-end ports.
Resets (counts/s)	Back-end Director	Number of LUN resets issued per second through the director's back-end ports. LUN resets are issued after 20 seconds of LUN unresponsiveness to outstanding operations.
Timeouts (counts/s)	Back-end Director	Number of timed out I/O operations per second on the director's back-end ports. Operations time out after 10 seconds.
Write Latency (ms)	Back-end Director	The average time, in milliseconds, that it takes for write requests to complete on the director's back-end ports. The time it takes VPLEX to complete a write request to the storage array(s).
Writes (MB/s)	Back-end Director	Number of bytes written per second by the director's back-end ports.
Average Latency (ms)	COM Latency	The average time, in milliseconds, that it took for inter-director WAN messages to complete on this director to the specified cluster in the last 5-second interval.
Maximum Latency (ms)	COM Latency	The maximum time, in milliseconds, that it took for an inter-director WAN message to complete on this director to the specified cluster in the last 5-second interval.
Minimum Latency (ms)	COM Latency	The minimum time, in milliseconds, that it took for an inter-director WAN message to complete on this director to the specified cluster in the last 5-second interval.
Distributed Device Bytes Received (MB/s)	WAN Link Usage	Number of bytes of distributed-device traffic per second received on the director's WAN ports.

Table 36 VPLEX metrics for Director (continued)

Metric	Metric Group	Definition
Distributed Device Bytes Sent (MB/s)	WAN Link Usage	Number of bytes of distributed-device traffic per second sent on the director's WAN ports.
Distributed Device Rebuild Bytes Received (MB/s)	WAN Link Usage	Number of bytes of distributed-device, rebuild/migration traffic per second received on the director's WAN ports.
Distributed Device Rebuild Bytes Sent (MB/s)	WAN Link Usage	Number of bytes of distributed-device rebuild/migration per second traffic sent on the director's WAN ports.
Bytes Received (MB/s)	FC WAN COM	Number of bytes of WAN traffic per second received on this director's FibreChannel port.
Bytes Sent (MB/s)	FC WAN COM	Number of bytes of WAN traffic per second sent on this director's FibreChannel port.
Packets Received (counts/s)	FC WAN COM	Number of packets of WAN traffic per second received on this director's FibreChannel port.
Packets Sent (counts/s)	FC WAN COM	Number of packets of WAN traffic per second sent on this director's FibreChannel port.
Average Latency (ms)	IP WAN COM	The average time, in milliseconds, that it took for inter-director WAN messages to complete on this director's IP port in the last 5-second interval.
Bytes Received (MB/s)	IP WAN COM	Number of bytes of WAN traffic per second received on this director's IP port.
Bytes Sent (MB/s)	IP WAN COM	Number of bytes of WAN traffic per second sent on this director's IP port.
Maximum Latency (ms)	IP WAN COM	The maximum time, in milliseconds, that it took for an inter-director WAN message to complete on this director's IP port in the last 5-second interval.
Minimum Latency (ms)	IP WAN COM	The minimum time, in milliseconds, that it takes for an inter-director WAN message to complete on this director's IP port in the last 5-second interval.
Packets Received (counts/s)	IP WAN COM	Number of packets of WAN traffic per second received on this director's IP port.
Packets Resent (counts/s)	IP WAN COM	Number of WAN traffic packets re-transmitted per second that were sent on this director's IP port.
Packets Sent (counts/s)	IP WAN COM	Number of packets of WAN traffic per second sent on this director's IP port.
Received Packets Dropped (counts/s)	IP WAN COM	Number of WAN traffic packets dropped per second that were received on this director's IP port.
Sent Packets Dropped (counts/s)	IP WAN COM	Number of WAN traffic packets dropped per second that were sent on this director's IP port.

Table 37 VPLEX metrics for Distributed Device

Metric	Metric Group	Definition
Capacity (GB)	Capacity	Capacity in gigabytes.
Health State	Status	<p>Possible values include:</p> <p>Ok - Functioning normally.</p> <p>Degraded - May be out-of-date compared to its mirror.</p> <p>Unknown - Cannot determine the health state, or the state is invalid.</p> <p>Non-recoverable error - May be out-of-date compared to its mirror, or VPLEX cannot determine the health state.</p> <p>Critical failure - VPLEX has marked the object as hardware-dead.</p>
Operational Status	Status	<p>Possible values include:</p> <p>OK - Functioning normally.</p> <p>Degraded - May be out-of-date compared to its mirror.</p> <p>Unknown - Cannot determine the health state, or the state is invalid.</p> <p>Error - VPLEX has marked the object as hardware-dead.</p> <p>Starting - Not yet ready.</p> <p>Lost-communication - The object is unreachable.</p>
Service Status	Status	<p>Possible values include:</p> <p>Cluster unreachable - VPLEX cannot reach the cluster; the status is unknown.</p> <p>Need resume - The other cluster detached the distributed device while it was unreachable. The distributed device needs to be manually resumed for I/O to resume at this cluster.</p> <p>Need winner - All clusters are reachable again, but both clusters had detached this distributed device and resumed I/O. You must pick a winner cluster whose data will overwrite the other cluster's data for this distributed device.</p> <p>Potential conflict - The clusters have detached each other resulting in a potential for detach conflict.</p> <p>Running - The distributed device is accepting I/O.</p> <p>Suspended - The distributed device is not accepting new I/O; pending I/O requests are frozen.</p>

Table 37 VPLEX metrics for Distributed Device (continued)

Metric	Metric Group	Definition
		Winner-running - This cluster detached the distributed device while the other cluster was unreachable, and is now sending I/O to the device.

Table 38 VPLEX metrics for Engine

Metric	Metric Group	Definition
Operational Status	Status	<p>Possible values include:</p> <p>OK - Functioning normally.</p> <p>Degraded - May be out-of-date compared to its mirror.</p> <p>Unknown - Cannot determine the health state, or the state is invalid.</p> <p>Error - VPLEX has marked the object as hardware-dead.</p> <p>Starting - Not yet ready.</p> <p>Lost-communication - The object is unreachable.</p>

Table 39 VPLEX metrics for Ethernet Port

Metric	Metric Group	Definition
Operational Status	Status	<p>Possible values include:</p> <p>OK - Functioning normally.</p> <p>Degraded - May be out-of-date compared to its mirror.</p> <p>Unknown - Cannot determine the health state, or the state is invalid.</p> <p>Error - VPLEX has marked the object as hardware-dead.</p> <p>Starting - Not yet ready.</p> <p>Lost-communication - The object is unreachable.</p>

Table 40 VPLEX metrics for Extent Device

Metric	Metric Group	Definition
Capacity (GB)	Capacity	Capacity in gigabytes.
Health State	Status	Possible values include:

Table 40 VPLEX metrics for Extent Device (continued)

Metric	Metric Group	Definition
		<p>OK - The extent is functioning normally.</p> <p>Degraded - The extent may be out-of-date compared to its mirror (applies only to extents that are part of a RAID 1 device).</p> <p>Unknown - VPLEX cannot determine the extent's operational state, or the state is invalid.</p> <p>Non-recoverable error - The extent may be out-of-date compared to its mirror (applies only to extents that are part of a RAID 1 device), and/or the health state cannot be determined.</p>
Operational Status	Status	<p>Possible values include:</p> <p>OK - The extent is functioning normally.</p> <p>Degraded - The extent may be out-of-date compared to its mirror (applies only to extents that are part of a RAID 1 device).</p> <p>Unknown - VPLEX cannot determine the extent's operational state, or the state is invalid.</p> <p>Starting - The extent is not yet ready.</p>

Table 41 VPLEX metrics for FC Port

Metric	Metric Group	Definition
Operational Status	Status	<p>Possible values include:</p> <p>OK - Functioning normally.</p> <p>Degraded - May be out-of-date compared to its mirror.</p> <p>Unknown - Cannot determine the health state, or the state is invalid.</p> <p>Error - VPLEX has marked the object as hardware-dead.</p> <p>Starting - Not yet ready.</p> <p>Lost-communication - The object is unreachable.</p>

Table 42 VPLEX metrics for Local Device

Metric	Metric Group	Definition
Capacity (GB)	Capacity	Capacity in gigabytes.
Health State	Status	<p>Possible values include:</p> <p>Ok - Functioning normally.</p>

Table 42 VPLEX metrics for Local Device (continued)

Metric	Metric Group	Definition
		<p>Degraded - May be out-of-date compared to its mirror.</p> <p>Unknown - Cannot determine the health state, or the state is invalid.</p> <p>Non-recoverable error - May be out-of-date compared to its mirror, or VPLEX cannot determine the health state.</p> <p>Critical failure - VPLEX has marked the object as hardware-dead.</p>
Operational Status	Status	<p>Possible values include:</p> <p>OK - Functioning normally.</p> <p>Degraded - May be out-of-date compared to its mirror.</p> <p>Unknown - Cannot determine the health state, or the state is invalid.</p> <p>Error - VPLEX has marked the object as hardware-dead.</p> <p>Starting - Not yet ready.</p> <p>Lost-communication - The object is unreachable.</p>
Service Status	Status	<p>Possible values include:</p> <p>Cluster unreachable - VPLEX cannot reach the cluster; the status is unknown.</p> <p>Need resume - The other cluster detached the distributed device while it was unreachable. The distributed device needs to be manually resumed for I/O to resume at this cluster.</p> <p>Need winner - All clusters are reachable again, but both clusters had detached this distributed device and resumed I/O. You must pick a winner cluster whose data will overwrite the other cluster's data for this distributed device.</p> <p>Potential conflict - The clusters have detached each other resulting in a potential for detach conflict.</p> <p>Running - The distributed device is accepting I/O.</p> <p>Suspended - The distributed device is not accepting new I/O; pending I/O requests are frozen.</p> <p>Winner-running - This cluster detached the distributed device while the other cluster was</p>

Table 42 VPLEX metrics for Local Device (continued)

Metric	Metric Group	Definition
		unreachable, and is now sending I/O to the device.

Table 43 VPLEX metrics for Storage Array

Metric	Metric Group	Definition
Allocated Storage Volumes	Capacity	Number of allocated storage volumes.
Allocated Storage Volumes (GB)	Capacity	Gigabytes of allocated storage volumes.
Used Storage Volumes	Capacity	Number of used storage volumes.
Used Storage Volumes (GB)	Capacity	Gigabytes of used storage volumes.

Table 44 VPLEX metrics for Storage View

Metric	Metric Group	Definition
Virtual Volumes (GB)	Capacity	Gigabytes of virtual volumes.
Operational Status	Status	<p>Possible values include:</p> <p>OK - Functioning normally.</p> <p>Degraded - May be out-of-date compared to its mirror.</p> <p>Unknown - Cannot determine the health state, or the state is invalid.</p> <p>Error - VPLEX has marked the object as hardware-dead.</p> <p>Starting - Not yet ready.</p> <p>Lost-communication - The object is unreachable.</p>

Table 45 VPLEX metrics for Storage Volume

Metric	Metric Group	Definition
Capacity (GB)	Capacity	Capacity in gigabytes.
Health State	Status	<p>Possible values include:</p> <p>Ok - The storage volume is functioning normally.</p> <p>Degraded - The storage volume may be out-of-date compared to its mirror.</p>

Table 45 VPLEX metrics for Storage Volume (continued)

Metric	Metric Group	Definition
		<p>Unknown - Cannot determine the health state, or the state is invalid.</p> <p>Non-recoverable error - May be out-of-date compared to its mirror, or VPLEX cannot determine the health state.</p> <p>Critical failure - VPLEX has marked the object as hardware-dead.</p>
Operational Status	Status	<p>Possible values include:</p> <p>OK - Functioning normally.</p> <p>Degraded - May be out-of-date compared to its mirror. (This state applies only to a storage volume that is part of a RAID 1 Metadata Volume.)</p> <p>Unknown - Cannot determine the health state, or the state is invalid.</p> <p>Error - VPLEX has marked the object as hardware-dead.</p> <p>Starting - Not yet ready.</p> <p>Lost-communication - The object is unreachable.</p>

Table 46 VPLEX metrics for Virtual Volume

Metric	Metric Group	Definition
Capacity (GB)	Capacity	Capacity in gigabytes.
Locality	Locality	<p>Possible values include:</p> <p>Local - The volume is local to the enclosing cluster.</p> <p>Remote - The volume is made available by a different cluster than the enclosing cluster, and is accessed remotely.</p> <p>Distributed - The virtual volume either has, or is capable of having, legs at more than one cluster.</p>
Health State	Status	<p>Possible values include:</p> <p>Ok - Functioning normally.</p> <p>Unknown - Cannot determine the health state, or the state is invalid.</p> <p>Major failure - One or more of the virtual volume's underlying devices is out-of-date, but will never rebuild.</p>

Table 46 VPLEX metrics for Virtual Volume (continued)

Metric	Metric Group	Definition
		Minor failure - One or more of the virtual volume's underlying devices is out-of-date, but will rebuild.
Operational Status	Status	<p>Possible values include:</p> <p>OK - Functioning normally.</p> <p>Degraded - The virtual volume may have one or more out-of-date devices that will eventually rebuild.</p> <p>Unknown - VPLEX cannot determine the virtual volume's operational state, or the state is invalid.</p> <p>Error - One or more of the virtual volume's underlying devices is hardware-dead.</p> <p>Starting - Not yet ready.</p> <p>Stressed - One or more of the virtual volume's underlying devices is out-of-date and will never rebuild.</p>
Service Status	Status	<p>Possible values include:</p> <p>Running - I/O is running.</p> <p>Inactive - The volume is part of an inactive storage-view and is not visible from the host.</p> <p>Unexported - The volume is unexported.</p> <p>Suspended - I/O is suspended for the volume.</p> <p>Cluster-unreachable - Cluster is unreachable at this time.</p> <p>Need-resume - Issue re-attach to resume after link has returned.</p>

Table 47 VPLEX metrics for VPLEX Metro

Metric	Metric Group	Definition
Health State	Status	<p>Possible values include:</p> <p>Ok - The cluster is functioning normally.</p> <p>Degraded - The cluster is not functioning at an optimal level. This may indicate non-functioning remote virtual volumes, unhealthy devices or storage volumes, suspended devices, conflicting director count configuration values, or out-of-date devices.</p> <p>Unknown - VPLEX cannot determine the cluster's health state, or the state is invalid.</p>

Table 47 VPLEX metrics for VPLEX Metro (continued)

Metric	Metric Group	Definition
		<p>Major failure - The cluster is failing and some functionality may be degraded or unavailable. This may indicate complete loss of back-end connectivity.</p> <p>Minor failure - The cluster is functioning, but some functionality may be degraded. This may indicate one or more unreachable storage volumes.</p> <p>Critical failure - The cluster is not functioning and may have failed completely. This may indicate a complete loss of back-end connectivity.</p>
Operational Status	Status	<p>During transition periods, the cluster moves from one operational state to another. Possible values include:</p> <p>Ok - The cluster is operating normally.</p> <p>Cluster departure - One or more of the clusters cannot be contacted. Commands affecting distributed storage are refused.</p> <p>Degraded - The cluster is not functioning at an optimal level. This may indicate non-functioning remote virtual volumes, unhealthy devices or storage volumes, suspended devices, conflicting director count configuration values, or out-of-date devices.</p> <p>Device initializing - If clusters cannot communicate with each other, then the distributed-device will be unable to initialize.</p> <p>Device out of date - Child devices are being marked fully out of date. Sometimes this occurs after a link outage.</p> <p>Expelled - The cluster has been isolated from the island either manually (by an administrator) or automatically (by a system configuration setting).</p> <p>Shutdown - The cluster's directors are shutting down.</p> <p>Suspended exports - Some I/O is suspended. This could be result of a link failure or loss of a director. Other states might indicate the true problem. The VPLEX might be waiting for you to confirm the resumption of I/O.</p> <p>Transitioning - Components of the software are recovering from a previous incident (for example, the loss of a director or the loss of an inter-cluster link).</p>

CHAPTER 5

Troubleshooting

This chapter contains the following topics.

- [Event correlation](#) 98
- [Launching Unisphere](#) 106
- [Installation logs](#) 106
- [Error handling and event logging](#) 106
- [Log file sizes and rollover counts](#) 107
- [Editing the Collection Interval for a resource](#) 110
- [Frequently Asked Questions - General](#) 111
- [Frequently Asked Questions for VNX](#) 113
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Event correlation

Event correlation enables users to correlate alerts with the resources that generate them.

Event correlation is available for:

- VNX Block
- VNX File

EMC adapter instances registered with the vCenter Operations Manager monitor events on select resources. These events appear as alerts in vCenter Operations Manager. The events are associated with the resources that generate them and aid the user in troubleshooting problems that may occur.

vCenter Operations Manager manages the life cycle of an alert and will cancel an active alert based on its rules. For example, vCenter Operations Manager may cancel an alert if EMC Storage Analytics no longer reports it.

vCenter Operations Manager-generated events influence the health score calculation for select resources. For example, in the **RESOURCE::DETAILS** pane for a selected resource, vCenter Operations Manager-generated events that contribute to the health score appear as alerts.

vCenter Operations Manager only generates events and associates them with the resources that triggered them. vCenter Operations Manager determines how the alerts appear and how they affect the health scores of the related resources.

Note

When a resource is removed, vCenter Operations Manager automatically removes existing alerts associated with the resource, and the alerts no longer appear in the user interface.

Viewing all alerts

This procedure shows you how to view a list of all the alerts in the vCenter Operations Manager system.

Procedure

1. Log into the vCenter Operations Manager user interface.
2. From the vCenter Operations Manager menu, select **ALERTS > ALERTS OVERVIEW**.
A list of alerts appears in the **ALERTS OVERVIEW** window.
3. (Optional) To refine your search, use the tools in the menu bar. For example, select a start and end date or enter a search string.
4. (Optional) To view a summary of information about a specific alert, select the alert and double-click it.

The **ALERT SUMMARY** window appears and provides reason, impact, and root cause information for the alert.

Finding resource alerts

An alert generated by EMC Storage Analytics is associated with a resource. This procedure shows you how to find an alert for a specific resource.

Procedure

1. Log into the vCenter Operations Manager user interface.
2. Select the resource from one of the dashboard views.
The number that appears on the alert icon represents the number of alerts for this resource.
3. Click the **Show Alerts** icon on the menu bar to view the list of alerts for the resource.
Alert information for the resource appears in the popup window.

Locating alerts that affect the health score for a resource

This procedure shows how to locate an alert that affects the health score of a resource.

Different types of alerts can contribute to the health score of a resource, but a resource with an abnormal health score might not have triggered the alert. For example, the alert might be triggered by a parent resource. To locate an alert that affects the health score of a resource:

Procedure

1. Log into the vCenter Operations Manager user interface.
2. View the **RESOURCE DETAIL** window for a resource that shows an abnormal health score.
Events that contributed to the resource health score appear in the **ROOT CAUSE RANKING** pane.
3. Click an event to view the event details and investigate the underlying cause.

List of alerts

EMC Storage Analytics generates the listed events when the resources are queried.

These alerts are provided:

- [VNX Block alerts on page 99](#)
- [VNX File alerts on page 101](#)

VNX Block alerts

Category	Message	Critical level	Resource kind	Event type
Disk failure	Resource is down. Resource Disk: Bus <bus> Enclosure <enclosure> Disk <disk> has been removed.	Immediate	Disk	Resource down
Link down	Link down occurred	Immediate	SP Front-end Port	Resource down
Background Event	Disk rebuilding started	Info	Disk	Notification
Background Event	Disk rebuilding completed	Info	Disk	Notification
Background Event	Disk zeroing started	Info	Disk	Notification

Category	Message	Critical level	Resource kind	Event type
	<hr/> Note This alert is not available for 1st generation models.			
Background Event	Disk zeroing completed <hr/> Note This alert is not available for 1st generation models.	Info	Disk	Notification
Background Event	LUN migration queued	Info	LUN	Notification
Background Event	LUN migration completed	Info	LUN	Notification
Background Event	LUN migration halted	Info	LUN	Notification
Background Event	LUN migration started	Info	LUN	Notification
Background Event	Fast VP relocation resumed <hr/> Note This alert is not available for 1st generation models.	Info	EMC Adapter Instance	Notification
Background Event	Fast VP relocation paused <hr/> Note This alert is not available for 1st generation models.	Info	EMC Adapter Instance	Notification
Background Event	Fast VP relocation started	Info	Storage Pool	Notification
Background Event	Fast VP relocation stopped	Info	Storage Pool	Notification
Background Event	Fast VP relocation completed	Info	Storage Pool	Notification
Background Event	SP boot up	Info	Storage Processor	Notification
Background Event	SP is down <hr/> Note This alert is not available for 1st generation models.	Info	Storage Processor	Notification
Background Event	FAST Cache started	Info	FAST cache	Notification
Configuration	Storage Pool background initialization started	Info	Storage Pool	Notification
Configuration	Storage Pool background initialization completed	Info	Storage Pool	Notification
Configuration	LUN creation started	Info	LUN	Notification
Configuration	LUN creation completed	Info	LUN	Notification
Configuration	Snapshot <i><snapshot name></i> creation completed	Info	LUN	Notification
Configuration	SP Write Cache was disabled	Info	EMC Adapter Instance	Notification
Configuration	SP Write Cache was enabled	Info	EMC Adapter Instance	Notification

Category	Message	Critical level	Resource kind	Event type
	<hr/> Note This alert is not available for 1st generation models.			
Configuration	Non-Disruptive upgrading started	Info	EMC Adapter Instance	Notification
Configuration	Non-Disruptive upgrading completed	Info	EMC Adapter Instance	Notification
Configuration	Deduplication on LUN was disabled <hr/> Note This alert is not available for 1st generation models.	Info	LUN	Notification
Configuration	Deduplication on LUN was enabled <hr/> Note This alert is not available for 1st generation models.	Info	LUN	Notification
Configuration	Deduplication on Storage Pool paused <hr/> Note This alert is not available for 1st generation models.	Info	Storage Pool	Notification
Configuration	Deduplication on Storage Pool resumed <hr/> Note This alert is not available for 1st generation models.	Info	Storage Pool	Notification
Configuration	Compression on LUN started	Info	LUN	Notification
Configuration	Compression on LUN completed	Info	LUN	Notification
Configuration	Compression on LUN was turned off	Info	LUN	Notification

VNX File alerts

Event KeyBinding	Message	Critical level	Resource kind	Event type
CS_CORE.CommandService.3	The NAS Command Service daemon is shutting down abnormally. (MessageID: <id>)	Warning	Array	Notification
CS_CORE.CommandService.4	The NAS Command Service daemon is shutting down abnormally. (MessageID: <id>)	Info	Array	Notification
CS_CORE.CommandService.5	The NAS Command Service daemon is shutdown completely.	Info	Array	Notification
CS_CORE.CommandService.6	The NAS Command Service daemon is forced to shutdown. (MessageID: <id>)	Warning	Array	Notification
CS_CORE.common.1	Warm reboot is about to start on this data mover.	Info	Data Mover	Notification
CS_CORE.common.2	Unable to warm reboot this data mover. Cold reboot has been performed.	Info	Data Mover	Notification

Event KeyBinding	Message	Critical level	Resource kind	Event type
CS_PLATFORM.BoxMonitor.58	AC power has been lost. VNX storage system will be powerdown in <i><value></i> seconds. (MessageID: <i><id></i>) (timeout_wait)	Immediate	EMC adapter instance	Notification
CS_PLATFORM.BoxMonitor.59	AC power is restored and back on.	Info	EMC adapter instance	Notification
CS_PLATFORM.CFS.101	Automatic extension failed. Reason: Internal error. COMMAND: <i><value></i> , ERROR: <i><value></i> , STAMP: <i><value></i> (MessageID: <i><id></i>)(COMMAND, DM_EVENT_STAMP, ERROR)	Warning	File system	Notification
CS_PLATFORM.CFS.102	Automatic extension started.	Info	File system	Notification
CS_PLATFORM.CFS.103	Automatic extension failed. Reason: Filesystem has reached the maximum size. STAMP: <i><value></i> (MessageID: <i><id></i>) (DM_EVENT_STAMP)	Warning	File system	Notification
CS_PLATFORM.CFS.104	Automatic extension failed. Reason: Percentage used could not be determined. STAMP: <i><value></i> (MessageID: <i><id></i>) (DM_EVENT_STAMP)	Warning	File system	Notification
CS_PLATFORM.CFS.105	Automatic extension failed. Reason: Filesystem size could not be determined. STAMP: <i><value></i> (MessageID: <i><id></i>) (DM_EVENT_STAMP)	Warning	File system	Notification
CS_PLATFORM.CFS.106	Automatic extension failed. Reason: Available space could not be determined. STAMP: <i><value></i> (MessageID: <i><id></i>) (DM_EVENT_STAMP)	Warning	File system	Notification
CS_PLATFORM.CFS.107	Automatic extension failed. Reason: Filesystem is not RW mounted. STAMP: <i><value></i> (MessageID: <i><id></i>) (DM_EVENT_STAMP)	Warning	File system	Notification
CS_PLATFORM.CFS.108	Automatic extension failed. Reason: Insufficient available sapace. STAMP: <i><value></i> (MessageID: <i><id></i>) (DM_EVENT_STAMP)	Warning	File system	Notification
CS_PLATFORM.CFS.109	Automatic extension failed. Reason: Available pool size could not be determined. STAMP: <i><value></i> (MessageID: <i><id></i>) (DM_EVENT_STAMP)	Warning	File system	Notification
CS_PLATFORM.CFS.110	Automatic extension failed. Reason: Slice flag could not be determined. STAMP: <i><value></i> (MessageID: <i><id></i>) (DM_EVENT_STAMP)	Warning	File system	Notification
CS_PLATFORM.CFS.111	Automatic extension failed. Reason: Available space is not sufficient for minimum size extension. STAMP: <i><value></i> (MessageID: <i><id></i>) (DM_EVENT_STAMP)	Warning	File system	Notification
CS_PLATFORM.CFS.114	Automatic extension failed. Reason: Maximum filesystem size could not be determined. STAMP: <i><value></i> (MessageID: <i><id></i>) (DM_EVENT_STAMP)	Warning	File system	Notification
CS_PLATFORM.CFS.115	Automatic extension failed. Reason: High Water Mark (HWM) could not be determined. STAMP: <i><value></i> (MessageID: <i><id></i>) (DM_EVENT_STAMP)	Warning	File system	Notification
CS_PLATFORM.CFS.116	Forced automatic extension started.	Info	File system	Notification

Event KeyBinding	Message	Critical level	Resource kind	Event type
CS_PLATFORM.CFS.117	Automatic extension ended.	Info	File system	Notification
CS_PLATFORM.CFS.118	Automatic extension ended. The filesystem is now at its maximum size limit.	Info	File system	Notification
CS_PLATFORM.CFS.119	Forced automatic extension is cancelled. The requested extension size is less than the high water mark (HWM) set for the filesystem.	Info	File system	Notification
CS_PLATFORM.CFS.120	The filesystem's available storage pool size will be used as the extension size instead of the requested size.	Info	File system	Notification
CS_PLATFORM.CFS.121	Automatic extension completed.	Info	File system	Notification
CS_PLATFORM.CFS.122	Forced automatic extension completed. The file system is at the maximum size.	Info	File system	Notification
CS_PLATFORM.CFS.123	Automatic extension failed. Reason: Volume id could not be determined. STAMP: <i><value></i> (MessageID: <i><id></i>) (DM_EVENT_STAMP)	Warning	File system	Notification
CS_PLATFORM.CFS.124	Automatic extension failed. Reason: Storage system id could not be determined. STAMP: <i><value></i> (MessageID: <i><id></i>) (DM_EVENT_STAMP)	Warning	File system	Notification
CS_PLATFORM.CFS.125	Automatic extension failed. Reason: Filesystem is spread across multiple storage systems. STAMP: <i><value></i> (MessageID: <i><id></i>) (DM_EVENT_STAMP)	Warning	File system	Notification
CS_PLATFORM.CFS.126	Automatic extension failed. STAMP: <i><value></i> (MessageID: <i><id></i>) (DM_EVENT_STAMP)	Warning	File system	Notification
CS_PLATFORM.JServer.101	The JServer is not able to start. VNX File System statistics will be impacted. (MessageID: <i><id></i>)	Warning	EMC adapter instance	Notification
CS_PLATFORM.JServer.210	Filesystem is using <i><value></i> of its <i><value></i> <i><value></i> capacity. (condition, cap_setting, prop_name)	Warning	File system	Notification
CS_PLATFORM.JServer.211	Filesystem has <i><value></i> of its <i><value></i> <i><value></i> capacity available. (condition, cap_setting, prop_name)	Warning	File system	Notification
CS_PLATFORM.JServer.212	Storage pool is using <i><value></i> of its <i><value></i> <i><value></i> capacity (condition, cap_setting)	Warning	File pool	Notification
CS_PLATFORM.JServer.213	Storage pool has <i><value></i> of its <i><value></i> capacity available. (condition, cap_setting)	Warning	File pool	Notification
CS_PLATFORM.JServer.214	Filesystem is using <i><value></i> of the maximum allowable file system size (16 TB). (condition)	Warning	File system	Notification
CS_PLATFORM.JServer.215	Filesystem has <i><value></i> of the maximum allowable file system size (16 TB). (condition)	Warning	File system	Notification
CS_PLATFORM.JServer.216	Filesystem is using <i><value></i> of the maximum storage pool capacity available. (condition)	Warning	File system	Notification
CS_PLATFORM.JServer.217	Filesystem has <i><value></i> of the maximum storage pool capacity available.(condition)	Warning	File system	Notification
CS_PLATFORM.JServer.218	Filesystem will fill its <i><value></i> <i><value></i> capacity on <i><value></i> . (cap_setting, prop_name, sdate)	Warning	File system	Notification

Event KeyBinding	Message	Critical level	Resource kind	Event type
CS_PLATFORM.JServer.219	Storage pool will fill its <i><value></i> capacity on <i><value></i> . (cap_setting, sdate)	Warning	File pool	Notification
CS_PLATFORM.JServer.220	Filesystem will reach the 16 TB file system size limit on <i><value></i> . (sdate)	Warning	File system	Notification
CS_PLATFORM.JServer.221	Filesystem will fill its storage pool's maximum capacity on <i><value></i> . (sdate)	Warning	File system	Notification
CS_PLATFORM.JServer.222	Data Mover is using <i><value></i> of its <i><value></i> capacity. (stat_value, stat_name)	Warning	Data Mover	Notification
CS_PLATFORM.JServer.223	Storage usage has crossed threshold value <i><value></i> and has reached to <i><value></i> . (threshold, pool_usage_percentage)	Warning	File pool	Notification
CS_PLATFORM.JServer.224	Storage usage has crossed threshold value <i><value></i> and has reached to <i><value></i> . (threshold, pool_usage_percentage)	Immediate	File pool	Notification
CS_PLATFORM.JServer.225	Filesystem has filled its <i><value></i> <i><value></i> capacity. (cap_setting, prop_name)	Warning	File system	Notification
CS_PLATFORM.JServer.226	Storage pool has filled its <i><value></i> capacity. (cap_setting)	Warning	File pool	Notification
CS_PLATFORM.JServer.227	Filesystem has almost filled its <i><value></i> <i><value></i> capacity. (cap_setting, prop_name)	Warning	File system	Notification
CS_PLATFORM.JServer.228	Storage pool has almost filled its <i><value></i> capacity. (cap_setting)	Warning	File pool	Notification
CS_PLATFORM.JServer.1002	Filesystem is using <i><value></i> of its current inode capacity. (condition)	Warning	File system	Notification
DART.CAM.1	The SCSI HBA <i><value></i> is operating normally. (hbano)	Warning	Data Mover	Notification
DART.CAM.2	The SCSI HBA <i><value></i> has failed. (MessageID: <i><id></i>) (hbano)	Warning	Data Mover	Notification
DART.CAM.3	The SCSI HBA <i><value></i> is inaccessible. (MessageID: <i><id></i>) (hbano)	Warning	Data Mover	Notification
DART.CFS.12	Filesystem has encountered a critical fault and is being unmounted internally. (MessageID: <i><id></i>)	Immediate	File system	Notification
DART.CFS.13	Filesystem has encountered a corrupted metadata and filesystem operation is being fenced. (MessageID: <i><id></i>)	Warning	File system	Notification
DART.CFS.14	Filesystem usage rate <i><value></i> % crossed the high water mark threshold <i><value></i> %. Its size will be automatically extended. (currentUsage, usageHWM)	Info	File system	Notification
DART.CFS.15	Filesystem is full.	Warning	File system	Notification
DART.CHAMII.1	Power Supply A in Data Mover Enclosure was removed.	Info	EMC adapter instance	Notification
DART.CHAMII.5	Power Supply A in Data Mover Enclosure is OK.	Info	EMC adapter instance	Notification

Event KeyBinding	Message	Critical level	Resource kind	Event type
DART. CHAMII.6	Power Supply A in Data Mover Enclosure failed: <i><value></i> (MessageID: <i><id></i>) (details)	Immediate	EMC adapter instance	Notification
DART. CHAMII.10	Power Supply B in Data Mover Enclosure was installed.	Info	EMC adapter instance	Notification
DART. CHAMII.11	Power Supply B in Data Mover Enclosure was removed.	Info	EMC adapter instance	Notification
DART. CHAMII.15	Power Supply B in Data Mover Enclosure is OK.	Info	EMC adapter instance	Notification
DART. CHAMII.16	Power Supply B in Data Mover Enclosure failed: <i><value></i> (MessageID: <i><id></i>) (details)	Immediate	EMC adapter instance	Notification
DART. CHAMII.21	One or more fans in Fan Module 1 in Data Mover Enclosure failed. (MessageID: <i><id></i>)	Immediate	EMC adapter instance	Notification
DART. CHAMII.23	One or more fans in Fan Module 2 in Data Mover Enclosure failed. (MessageID: <i><id></i>)	Immediate	EMC adapter instance	Notification
DART. CHAMII.25	One or more fans in Fan Module 3 in Data Mover Enclosure failed. (MessageID: <i><id></i>)	Immediate	EMC adapter instance	Notification
DART. CHAMII.26	Multiple fans in Data Mover Enclosure failed. (MessageID: <i><id></i>)	Immediate	EMC adapter instance	Notification
DART. CHAMII.28	All Fan Modules in Data Mover Enclosure are in OK status.	Info	EMC adapter instance	Notification
DART. CHAMII.31	Power Supply A in Data Mover Enclosure is going to shutdown due to over heating. (MessageID: <i><id></i>)	Immediate	EMC adapter instance	Notification
DART. CHAMII.32	Power Supply B in Data Mover Enclosure is going to shutdown due to over heating. (MessageID: <i><id></i>)	Immediate	EMC adapter instance	Notification
DART. CHAMII.33	Both Power Supplies in Data Mover Enclosure are going to shutdown due to over heating. (MessageID: <i><id></i>)	Immediate	EMC adapter instance	Notification
DART. CHAMII.50	Power Supply A in Data Mover Enclosure was installed.	Info	EMC adapter instance	Notification
DART. DNS.1	DNS server <i><value></i> is not responding. Reason: <i><value></i> (MessageID: <i><id></i>) (serverAddr, reason)	Warning	Data Mover	Notification
DART. DRIVERS.6	Network device <i><value></i> is down. (MessageID: <i><id></i>) (deviceName)	Warning	Data Mover	Notification
DART. FSTOOLS.1	Automatic fsck is started via Data Mover <i><value></i> . Filesystem may be corrupted. (MessageID: <i><id></i>) (DATA_MOVER_NAME)	Immediate	File system	Notification
DART. FSTOOLS.2	Manual fsck is started via Data Mover <i><value></i> . (DATA_MOVER_NAME)	Info	File system	Notification
DART. FSTOOLS.3	Automatic fsck succeeded via Data mover <i><value></i> . (DATA_MOVER_NAME)	Immediate	File system	Notification
DART. FSTOOLS.4	Manual fsck succeeded via Data mover <i><value></i> . (DATA_MOVER_NAME)	Immediate	File system	Notification

Event KeyBinding	Message	Critical level	Resource kind	Event type
DART.FSTOOLS.5	Automatic fsck failed via Data mover <i><value></i> . (DATA_MOVER_NAME)	Immediate	File system	Notification
DART.FSTOOLS.6	Manual fsck failed via Data mover <i><value></i> . (DATA_MOVER_NAME)	Info	File system	Notification

Launching Unisphere

EMC Storage Analytics provides metrics that enable you to assess the health of monitored resources. If the resource metrics indicate that you need to troubleshoot those resources, EMC Storage Analytics provides a way to launch Unisphere on the array.

The capability to launch Unisphere on the array is available for:

- VNX Block
- VNX File
- VNXe

To launch Unisphere on the array, select the resource and click the **Link and Launch** icon. The **Link and Launch** icon is available on most widgets (hovering over an icon displays a tooltip that describes its function).

Note

This feature requires a fresh installation of the EMC Adapter (not an upgrade) and vCenter Operations Manager 5.8.0 or later. You must select the object to launch Unisphere. Unisphere launch capability does not exist for VMAX or VPLEX objects.

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 vCenter Operations Manager logs.

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

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.

Creating and downloading a support bundle

Procedure

1. On the **Logs** tab, click the **Create Support Bundle** icon.

The bundle encapsulates all necessary logs.

2. Select the bundle name and click the **Download Bundle** icon.

Log file sizes and rollover counts

This topic describes the default log file size and rollover count for EMC adapter instances.

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

Log files in this directory follow this naming convention:

`<EMC_adapter_name>-<adapter_instance_ID>.log.<rollover_count>`

For example: `VNX_File-131.log.9`

The log filename begins with the name of the EMC Adapter instance. 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 rollover increment. When the default log file size is reached, the system starts a new log file with a new increment. The lowest-numbered increment represents the most recent log. Each rollover is 10 MB (default value, recommended). Ten rollovers (default value) are allowed; the system deletes the oldest log files.

Finding adapter instance IDs

This topic describes how to find the ID for an EMC adapter instance.

You will need the ID of the EMC adapter instance to change the default log file size and rollover count properties for that adapter instance.

Procedure

1. In vCenter Operations Manager, select **Environment > Environment Overview > Adapter Kinds > EMC Adapter**.
2. In the **List** tab, locate the adapter kind ID in the **ID** column.

Configuring log file sizes and rollover counts

This topic describes how to change the default values for all adapter instances or for a specific adapter instance.

Before you begin

EMC recommends that you not increase the 10 MB default value for the log file size. Increasing this value makes the log file more difficult to load and process as it grows in size. If more retention is necessary, increase the rollover count instead.

Procedure

1. On the vCenter Operations Manager virtual machine, find and edit the `adaptor.properties` file:

```
/usr/lib/vmware-vcops/user/plugins/inbound/emc-adapter-vcops/conf/adaptor.properties
```

2. Locate these EMC adapter instance properties:

```
com.emc.vcops.adapter.log.size=10MB
com.emc.vcops.adapter.log.count=10
```

3. To change the properties for all EMC adapter instances, edit only the log size or log count values. For example:

```
com.emc.vcops.adapter.log.size=12MB
com.emc.vcops.adapter.log.count=15
```

4. To change the properties for a specific EMC adapter instance, insert the EMC adapter instance ID as shown in this example:

```
com.emc.vcops.adapter.356.log.size=8MB
com.emc.vcops.adapter.356.log.count=15
```

Activating configuration changes

This topic describes how to activate changes you made to the log file size or rollover count for an EMC adapter instance.

Procedure

1. In vCenter Operations Manager, select **Environment > Environment Overview > Adapter Kinds > EMC Adapter**.
2. Select the adapter in the **List** tab.
3. Click the **Edit Resource** icon.

The **Resource Management** window for the EMC adapter opens.

4. Click the **OK** button. No other changes are required.

This step activates the changes you made to the log file size or rollover count for the EMC adapter instance.

Verifying configuration changes

This topic describes how to verify the changes you made to the log file size or rollover counts of an EMC adapter instance.

Procedure

1. Log into vCenter Operations Manager.
2. Change directories to `/data/vcops/log/EmcAdapter`.
3. Verify the changes you made to the size of the log files or the number of saved rollover backups.

If you changed:

- Only the default properties for log file size and rollover count, all adapter instance logs will reflect the changes
- Properties for a specific adapter instance, only the logs for that adapter instance will reflect the changes
- Log file size or rollover count to higher values, you will not notice the resulting changes until those thresholds are crossed

Editing the Collection Interval for a resource

From the vCenter Operations Manager user interface, 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 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.

Note

For VNXe, the maximum collection interval is 5 minutes.

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

Frequently Asked Questions - General

How does a trial license work?

A 90-day trial license is provided for each platform that EMC Storage Analytics supports. 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 at 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 vCenter Operations Manager and EMC Storage Analytics in full profile mode, it can support up to 12,000 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 Release Notes* at <https://www.vmware.com/support/pubs/vcops-pubs.html>.

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.

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 `Resource down`. To verify that a valid

license exists, select **Environment Overview**. The list that appears shows the license status.

What is the difference between vCenter Operations Manager 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 (Advanced or Enterprise 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 **?**.

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 to the vCenter Operations Manager Advanced edition. No upgrade is required for the EMC Adapter.

How do I uninstall EMC Storage Analytics?

No uninstall utility exists. However, to remove EMC Storage Analytics objects, remove adapter instances for which the Adapter Kind is **EMC Adapter (Environment > Configuration > Adapter Instances)**. Then delete objects in the **Environment Overview** for which the Data Source is **EMC (Environment > Environment Overview)**.

Frequently Asked Questions for VNX

Which VNX arrays does EMC Storage Analytics support?

It supports first- and second-generation VNX platforms. A complete list of the supported models in each of these series is available in [Installation and operating requirements on page 16](#).

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 navisecli commands and VNX File metrics are gathered through CLI commands. However, statistics logging must be enabled on each storage processor (SP) on VNX Block, and statistics logging will have a performance impact on the array. No additional services are required for VNX File.

How does the FAST Cache heat map work?

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

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.

The disk utilization metric is not visible for my VNX Block array. Why not?

The disk utilization metric is not supported on VNX arrays running a VNX Block OE earlier than Release 32. Upgrade to VNX Block OE Release 32 or later to see this metric in vCenter Operations Manager.

I am unable to successfully configure an EMC Adapter instance for VNX File when using a user with read-only privileges. Why does this happen?

A user with administrative privileges is required while configuring an EMC Adapter instance for VNX File arrays running an OE earlier than 7.1.56.2. Upgrade to VNX File OE 7.1.56.2 or later to be able to configure an adapter instance using a user with read-only privileges.

The user LUNs on my VNX Block vault drives are not reporting performance metrics. Why not?

Performance metrics are not supported for user LUNs on vault drives. Place user LUNs on drives other than vault drives.

Frequently Asked Questions for VMAX

I deleted a VMAX adapter, but all the dependent objects still remain in vCenter Operations Manager. Why?

Deleting a VMAX adapter instance does not remove its dependent objects. The objects enter an unknown state (blue) but retain their historical metrics. If desired, delete the objects from the **Environment Overview** page.

If I test a VMAX connection and it fails, how do I know which field is wrong?

Unfortunately, the only field that produces a unique message when it is wrong is the license number field. If any other field is wrong, the user is informed the connection was not successful. To resolve the issue, verify all the other fields are correct. Remove any white spaces after the end of the values.

Why is my VMAX array showing as red rather than blue (unknown) just after adding it?

If the array is red, the SMI-S may be down or there may be an incorrect parameter in the adapter configuration. Return to the adapter instance configuration and test the configured instance. If it fails, verify all fields are correct. Determine if the SMI-S server is running and can recognize the VMAX array that you are configuring.

All my configured VMAX adapter instances changed to red. Why?

This usually happens when the SMI-S Provider is unavailable or there is a clock synchronization problem. This might be network-related or application-related. The SMI-S Provider may have reached the connection limit if the network IP is available. Look for errors in the cimom.log file on the SMI-S box similar to:

```
26-Mar-2013 05:47:59.817 -900-E- WebServer: The webserver hits its
connection limit, closing connection.
```

Follow the steps in the *SMI-S Provider Release Notes* to increase the count.

A message next to the array will indicate a clock synchronization problem if a problem exists.

Can I modify or delete the VMAX Overview (or another) dashboard?

Yes, the environment can be customized to suit the needs of the user. Rename the dashboard so that it is not overwritten during an upgrade.

I received the following error when I attempted to modify the VNX Overview dashboard although I have only VMAX arrays. Is this a problem?

```
Error occurred
```

```
An error occurred on the page; please contact support.
Error Message: org.hibernate.exception.SQLGrammarException: could not
execute query
```

No, this is a generic error that VMware produces when you attempt to modify a component you do not have.

Why do some of the boxes appear white in the VMAX Overview dashboard?

While the metrics are being gathered for an adapter instance, some of the heat maps in the dashboard may be white. This is normal. Another reason the boxes may appear white is that the adapter itself or an individual resource (e.g. a VMAX device) has been deleted, but the resources remain until they are removed from the **Environment Overview** page.

