Dell PowerStore

Monitoring Your System

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Notes, cautions, and warnings

NOTE: A NOTE indicates important information that helps you make better use of your product.

CAUTION: A CAUTION indicates either potential damage to hardware or loss of data and tells you how to avoid the problem.

WARNING: A WARNING indicates a potential for property damage, personal injury, or death.

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Preface

As part of an improvement effort, revisions of the software and hardware are periodically released. Some functions that are described in this document are not supported by all versions of the software or hardware currently in use. The product release notes provide the most up-to-date information about product features. Contact your service provider if a product does not function properly or does not function as described in this document.

NOTE: PowerStore X model customers: For the latest how-to technical manuals and guides for your model, download the *PowerStore 3.2.x Documentation Set* from the PowerStore Documentation page at dell.com/powerstoredocs.

Where to get help

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

- **Product information**—For product and feature documentation or release notes, go to the PowerStore Documentation page at dell.com/powerstoredocs.
- **Troubleshooting**—For information about products, software updates, licensing, and service go to Dell Support and locate the appropriate product support page.
- **Technical support**—For technical support and service requests, go to Dell Support and locate the **Service Requests** page. To open a service request, you must have a valid support agreement. Contact your Sales Representative for details about obtaining a valid support agreement or to answer any questions about your account.

1

Monitoring your system overview

This chapter includes:

Topics:

- Overview

Overview

This document describes the functionality available in the PowerStore Manager to monitor, and optimize various PowerStore appliances.

Monitoring features

PowerStore Manager provides the following features and functionality to monitor your system:

- Events to notify when there are changes in the system.
- Alerts to inform you that an event occurred that requires your attention.
- Capacity charts display current capacity usage of a PowerStore cluster and resources.
- Performance charts indicate the system health so you can anticipate problems before they occur.

Optimizing features and functionality

As you monitor the system, alert notifications provide a mechanism to respond to the issue and reduce troubleshooting times.

Understanding how the system capacity is being used can:

- Alert you to the resources that are the top consumers of storage space.
- Help you to balance the load across your available storage.
- Indicate when you may need to add more storage to your cluster.

Finally, should an event occur that requires further troubleshooting, PowerStore has a mechanism for collecting support materials which helps analyze and resolve the issue.

2

Managing alerts

This chapter includes:

Topics:

- Events and alerts
- Monitor alerts
- APEX AIOps Observability
- Configure email notification preferences
- Temporarily disable support notifications
- Configure SNMP
- Critical information banner
- System checks
- Remote logging

Events and alerts

Events provide information about changes to the system. Alerts are events that require attention and most alerts indicate that there is a problem with the system. Clicking the description of an alert reveals additional information about the alert.

Active and unacknowledged alerts are displayed in the **Alerts** card on the dashboard and the **Alerts** page under **Monitoring**. You can view and monitor alerts for individual objects in a cluster such as an appliance, storage resource, or virtual machine, from the **Alerts** card on the details page of the object.

To review events that do not rise to the level of an alert, go to **Monitoring** > **Events**.

When you view events and alerts, you can sort the alerts by the columns and filter the alerts by the column categories. The default filters for alerts are:

- **Severity**—Event and alerts can be filtered by the severity of the event or alert. You can select the severities to display by clicking the **Severity** filter and selecting one or more severities from the dialog box.
  - **Critical**—An event has occurred that has a significant impact on the system and must be remedied immediately. For example, a component is missing or has failed and recovery may not be possible.
  - **Major**—An event has occurred that may have an impact on the system and should be remedied as soon as possible. For example, the last synchronization time for a resource does not match the time that its protection policy indicates.
  - **Minor**—An event has occurred that you should be aware of but does not have a significant impact on the system. For example, a component is working, but its performance may not be optimum.
  - **Info**—An event has occurred that does not impact system functions. No action is required. For example, new software is available for download.
- **Resource Type**—Events and alerts can be filtered by the resource type that is associated with the event or alert. You can select the resource types to display by clicking the **Resource Type** filter and selecting one or more resource types from the dialog box.
- **Acknowledged**—Alerts can be filtered by whether the alert is acknowledged or not. When a user acknowledges an alert, the alert is hidden from the default view on the **Alerts** page. You can view acknowledged alerts by clicking the Acknowledged filter and selecting the **Acknowledged** check box in the filter dialog box.

  NOTE: Acknowledging an alert does not indicate that the issue is resolved. Acknowledging an alert only indicates that the alert has been acknowledged by a user.

- **Cleared**—Alerts can be filtered by whether the alert is cleared or not. When an alert is no longer relevant or is resolved, the system clears the alert with no user intervention. Cleared alerts are hidden from the default view on the Alerts page. You can view a cleared alert by clicking the Cleared filter and selecting the **Cleared** check box in the filter dialog box.

Monitor alerts

PowerStore Manager provides alert views at multiple levels, from the overall cluster to individual objects.

About this task

The alerts page is automatically refreshed every 30 seconds.

Steps

1. Find the alert view that you are interested in.
   - To view alerts at the cluster level, click **View All Alerts** in the **Alerts** card on the dashboard or select **Monitoring** > **Alerts**.
   - To view alerts for an individual object, such as a volume, view the object and select the **Alerts** card.
2. From the Alerts page or Alerts card, you can:
   - Show or hide acknowledged and cleared alerts.
   - Filter the alert list by category.
   - Choose the columns to be displayed in the table.
   - Export the alerts to a `.csv` or `.xlsx` file.
   - Refresh the table.
3. Click the description of an alert to see more information, including its impact on the system, timeline, suggested remediation, and other associated events.

   NOTE: The **Associated Events** table can display only ten events. To view the full list of events associated with a resource, go to the **Monitoring** > **Events** and filter the displayed events by the resource name.

4. To acknowledge an alert, select the alert check box and click **Acknowledge**. When you acknowledge an alert, the system removes the alert from the alert list, unless acknowledged alerts are displayed in the alert list.

APEX AIOps Observability

Displaying the APEX AIOps Observability Health Score provides a high-level overview of the cluster health and enables you to quickly identify existing issues.

NOTE: Support Connectivity must be enabled on the cluster to send data to APEX AIOps Observability.

NOTE: The PowerStore Manager displays the APEX AIOps Observability Health Score card on the Dashboard screen. The health score card provides an overview of the system health status by displaying an overall health score and health status of five attributes (components, configuration, capacity, performance, and data protection). For each attribute, the health score card displays the number of existing issues. You can hover over the attribute and select **View Related Alert Details** to view the details of the related alerts.

PowerStore automatically uploads an updated health score every five minutes.

To enable the APEX AIOps Observability Health Score card, select **Settings** > **Support** > **Support Connectivity**, then select the **Connection Type** tab and select **Enable**. If the **Connect to APEX AIOps Observability** checkbox is not enabled, select to enable it.

The APEX AIOps Observability Health Score card is enabled only for systems that are connected to Secure Remote Services and have APEX AIOps Observability connectivity:

- When APEX AIOps Observability is not enabled, the Dashboard does not display the Health Score card.
- When APEX AIOps Observability is enabled, the connection is active, and data is available. The Health Score card is displayed and indicates the updated health score.
- If connection to Secure Remote Services is disrupted, the Health Score card is disabled and indicates a connection error.

Configure email notification preferences

You can configure your system to send alert notifications to email subscribers.

About this task

For more information about SMTP server settings, see the context-sensitive help entry for this feature in PowerStore Manager.

Steps

1. Select the **Settings** icon, and then select **SMTP Server** in the **Networking** section.
2. If the SMTP Server feature if disabled, click the toggle button to enable the feature.
3. Add address of the SMTP server in the **Server Address** field.
4. Add the email address from which alert notifications are sent in the **From Email Address** field.
5. Click **Apply**.
   (Optional) Send a test email to verify that the SMTP server is set up correctly.
6. Click **Add/remove email subscribers** under Email Notifications.
7. To add an email subscriber, click **Add** and type the email address to which you want to send alert notifications in the **Email Address** field.

   When you add an email subscriber, you can select the severity level of the alert notifications that are sent to the email address.

   (Optional) To verify that the email address can receive alert notifications, select the check box for the email address, and click **Send Test Email**.

Temporarily disable support notifications

Disable support notifications to prevent call home alerts from being sent to Support when performing actions such as unplugging cables, swapping out drives, or upgrading software.

Steps

1. On the **Settings** page, select **Maintenance Window** in the **Support** section.
2. Select the appliance on which to temporarily disable notifications and then select **Enable/Modify**.
3. In the **Maintenance Window** slide-out panel, specify the number of days and hours to disable notifications in the **Maintenance Window Duration** field.

   NOTE: Support notifications are automatically re-enabled after the maintenance window ends.

4. Select **Apply**.
   The time that the maintenance window ends is displayed in the table.

Configure SNMP

About this task

You can configure your system to send alert information to up to 10 designated SNMP Managers (trap destinations).

NOTE: Only notifications are supported.

The authoritative **Local Engine ID** used for SNMPv3 messages is given as a hexadecimal string. It is discovered and added automatically.

NOTE: To verify the **Local Engine ID** select **Settings**, and under **Networking**, select **SNMP**. The **Local Engine ID** appears under **Details**.

Using PowerStore Manager, do the following:

Steps

1. Select **Settings** and, under **Networking**, select **SNMP**.
   The **SNMP** card appears.
2. To add an SNMP Manager, click **Add** under **SNMP Managers**.
   The **Add SNMP Manager** slide out appears.
3. Depending on the version of SNMP, configure the following information for the SNMP Manager:
   - For SNMPv2c:
     - Network Name or IP address
     - Port
     - Minimal Severity Level of Alerts
     - Version
     - Trap Community String
   - For SNMPv3
     - Network Name or IP address
     - Port
     - Minimal Severity Level of Alerts
     - Version
     - Security Level

       NOTE: Depending on the security level selected, additional fields appear.
       - For the level None, only **Username** appears.
       - For the level **Authentication only**, **Password** and **Authentication Protocol** appear along with **Username**.
       - For the level **Authentication and privacy**, **Password**, **Authentication Protocol**, and **Privacy Protocol** appear along with **Username**.

     - Username

       NOTE: When the Security Level of **None** is selected, the username must be NULL. When a Security Level of **Authentication only** or **Authentication and privacy** is selected, the username is the Security Name of the SNMPv3 user sending the message. The SNMP username can contain up to 32 characters in length and include any combination of alphanumeric characters (uppercase letters, lowercase letters, and numbers).

     - Password

       NOTE: When a Security Level of either **Authentication only** or **Authentication and privacy** is selected, the system determines the password.

     - Authentication Protocol

       NOTE: When a Security Level of either **Authentication only** or **Authentication and privacy** is selected, select either **MD5** or **SHA256**.

     - Privacy Protocol

       NOTE: When a Security Level of **Authentication and privacy** is selected, select either **AES256** or **TDES**.
4. Click **Add**.
5. (Optional) To verify whether SNMP Manager destinations can be reached and the correct information is received, click **Sent Test SNMP Trap**.

Critical information banner

A banner displays critical information for system users.

The information banner, which is displayed at the top of PowerStore Manager, displays information about global alerts to all users logged into the system.

When only a single global alert is issued, the banner displays the description of the alert. When there are multiple alerts, the banner indicates the number of active global alerts.

The color of the banner matches the alert with the highest severity level as follows:

- Information alerts - blue (information) banner
- Minor/Major alerts - yellow (warning) banner
- Critical alerts - Red (error) banner

The banner disappears when the system clears the alerts.

System checks

The **System Checks** page enables you to initiate health checks on the overall system, independent of the system-issued alerts.

About this task

You can launch a system check before actions such as upgrade or enabling Support Connectivity. Performing a system check enables intercepting and resolving any issues before upgrading the system or enabling Support Connectivity.

NOTE: In PowerStoreOS 4.x and later, the **System Checks** page displays the system check profile above the **System Checks** table. The displayed profile is of the last system check that was run, and the displayed results are based on the respective profile. Selecting **Run System Check** only triggers the **Service Engagement** profile. However, other operations or actions within PowerStore Manager can trigger other profiles. For example, when you enable Support Connectivity from the **Settings** page or through the Initial Configuration Wizard (ICW), the **System Check** page shows the results of the system check for Support Connectivity and **Support Connectivity** appears as the **Profile**.

The System Check table displays the following information:

Table 1. System check information

Name	Description
Item	The health check item.
Description	The description of the health check result.
Status	The health check result (Passed or failed).
Category	The health check category (Configured Resource, Hardware, or Software Services).
Appliance	The appliance for which the health check item was performed.
Node	The node for which the health check item was performed.

You can add and remove filters to narrow the displayed results according to your needs.

Steps

1. Under **Monitoring**, select **System Checks**.
2. Click **Run System Check**.

Results

The results of the system check are listed in the table. Clicking a failed item reveals additional information about the check results. Also, the **Profile** and **Last Run** information are updated.

Remote logging

The storage system supports sending audit log messages and system alert-related events to a maximum of two hosts. The hosts must be accessible from the storage system. Audit log message transfers can use a one-way authentication (Server CA Certificates) or an optional two-way authentication (Mutual Authentication Certificate). An imported certificate applies to each remote syslog server that is configured to use TLS Encryption.

To review or update remote logging settings, log in to PowerStore and click **Settings**. In the **Settings** side bar, under **Security**, select **Remote Logging**.

For more information about remote logging, see *PowerStore Security Configuration Guide* on the PowerStore Documentation page.

3

Monitoring capacity

This chapter includes:

Topics:

- About monitoring system capacity
- Capacity data collection and retention periods
- Capacity forecasting and recommendations
- Capacity data locations in PowerStore Manager
- Start monitoring capacity usage
- Data savings features

About monitoring system capacity

PowerStore provides various current usage, and historical metrics. The metrics can help you monitor the amount of space that your system resources use, and determine your future storage needs.

Capacity data can be viewed from the PowerStore CLI, REST API, and PowerStore Manager. This document describes how to view this information from PowerStore Manager. See the PowerStore Online Help for specific capacity metric definitions and calculations.

Monitoring current usage capacity

You can use the PowerStore Manager, REST API, or CLI to monitor the current capacity usage for a cluster, and for individual storage resources such as storage containers, volumes, file systems, and appliances.

NOTE: Monitoring capacity metrics is enabled when an appliance is in Out Of Space (OOS) mode. This enables you to monitor the amount of space that is freed as a result of deleting unused snapshots and storage resources.

Monitoring historical usage and forecasting

PowerStore capacity trending and predictive metrics are also collected for forecasting future storage needs of a cluster or appliance. Also, the trending and predictive metrics can be shared with the Dell Technologies Support Center when PowerStore is configured with Dell SupportAssist. These metrics provide intelligent insight on how capacity is being used and help to predict future capacity needs.

Capacity data collection and retention periods

Collection of capacity metrics is always enabled.

Current capacity data collection and retention periods

Capacity data for system resources is collected at 5 minute intervals and rolled up to 1 hour and 1-day aggregates.

The capacity charts refresh interval is set according to the selected granularity level as follows:

Table 2. Capacity charts refresh intervals

Granularity Level	Refresh Interval
Last 24 hours	5 minutes

Table 2. Capacity charts refresh intervals (continued)

Granularity Level	Refresh Interval
Last month	1 hour
Last 2 years	1 day

The following table displays the retention periods for each timescale and the resources to which they apply:

Table 3. Real-time capacity data retention periods

Timescale	Retention period	Resources
5 minutes	1 day	Cluster, appliances, volume groups, volumes, vVols, and virtual machines
1 hour	30 days	Cluster, appliances, volume groups, volumes, vVols, and virtual machines
1 day	2 years	Cluster, appliances, volume groups, volumes, vVols, and virtual machines

Historical capacity data collection and retention periods

Historical capacity is displayed once data collection begins. One year of capacity usage data is displayed in the charts, and the data is retained for up to 2 years. Historical charts scroll automatically to the left when new data is available.

Capacity forecasting and recommendations

PowerStore uses historical capacity metrics to forecast when your appliance or cluster may run out of storage space, and to provide recommendations on how to free up the system resources.

Capacity forecasting

There are three threshold levels that are used to forecast system capacity alerts. Thresholds are set by default and cannot be changed.

Table 4. Capacity alert thresholds

Priority	Threshold
Major	1–4 days until the appliance or cluster is full.
Minor	15–28 days until the appliance or cluster is full.
Okay	4+ weeks until the appliance or cluster is full.

Alerts appear in the appliance or cluster charts, and also in the **Notifications** > **Alerts** page.

Forecasting starts after 15 days of data collection for the cluster or appliance. Before 15 days of data collection, an "Insufficient data to predict time to full" message appears in the Physical Capacity area next to the chart. Forecasting includes data for up to one year, with a two-year retention period.

You can look at the capacity chart to get a graphic visualization of the capacity forecast for the cluster. To open the capacity chart, go to the **Dashboard** window and select the **Capacity** tab.

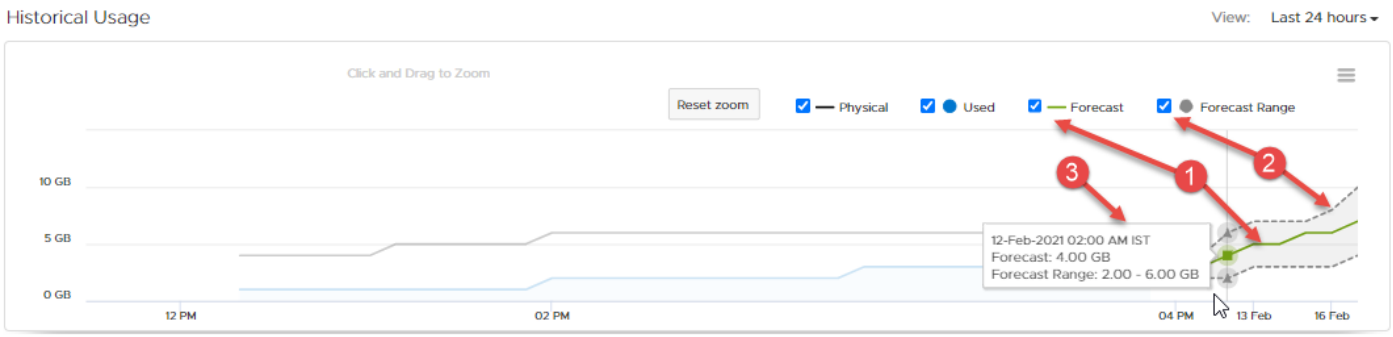

Figure 1. Cluster capacity chart - forecasting

1. Selecting the **Forcast** option, displays the mean predicted physical usage (for the next seven days).
2. Selecting the **Forcast Range** option, displays the range of low-to-high predicted physical usage (for the next seven days).
3. Hovering over the forecast section of the capacity chart, displays the values for mean-predicted usage and range of predicted usage.

Capacity recommendations

PowerStore also provides a recommended repair flow. The repair flow provides options to free up space on the cluster or appliance. The **Repair Flow** options are provided in the **Alerts** panel and include the following:

Table 5. Capacity recommendations

Option	Description
Assisted Migration	Provides recommendations of volumes, or volume groups to migrate from one appliance to another. Migration recommendations are generated based on factors such as appliance capacity, and health. You can also choose to manually migrate volumes, or volume groups, based on your own calculations, when your cluster or appliance is approaching capacity. Migration is not supported for file systems. Migration is supported within a single cluster with multiple appliances. Migration recommendations are provided in the PowerStore Manager after a Major threshold is met. However, you can use the PowerStore REST API to review migration recommendations at any time.
Clean Up System	Delete system resources that are no longer being used.
Add More Devices	Purchase additional storage for your appliance.

Recommendations expire in 24 hours to ensure that the recommendation is always current.

Capacity data locations in PowerStore Manager

You can view capacity charts for PowerStore systems, and system resources from the PowerStore Manager **Capacity** cards and views in the following locations:

Table 6. Capacity data locations

For	Access path
Cluster	**Dashboard** > **Capacity**
Appliance	**Hardware** > **[appliance]** opens the **Capacity** card.
Virtual Machine	**Compute** > **Virtual Machines** > **[virtual machine]** opens the **Capacity** card.
Virtual Volume (vVol)	**Compute** > **Virtual Machines** > **[virtual machine]** > **Virtual Volumes** > **[virtual volume]** opens the **Capacity** card.

Table 6. Capacity data locations (continued)

For	Access path
Volume	**Storage** > **Volumes** > **[volume]** opens the **Capacity** card.
Volume Family	**Storage** > **Volumes**. Select the checkbox next to the volume and select **More Actions** > **View Topology**. In the Topology view, select **Capacity**.[a]
Storage Container	**Storage** > **Storage Containers** > **[storage container]** opens the **Capacity** card.
Volume Group	**Storage** > **Volume Groups** > **[volume group]** opens the **Capacity** card.
Volume Group Family	**Storage** > **Volume Groups**. Select the checkbox next to the volume group and select **More Actions** > **View Topology**. In the Topology view, select **Capacity**.[b]
Volume Group member (volume)	**Storage** > **Volume Groups** > **[volume group]** > **Members** > **[member]** opens the **Capacity** card.
File System	**Storage** > **File Systems** > **[file system]** opens the **Capacity** card. **NOTE:** Only available with PowerStore T model and PowerStore Q model appliances.
NAS Server	**Storage** > **NAS Servers** > **[NAS server]** opens the **Capacity** card. **NOTE:** Only available with PowerStore T model and PowerStore Q model appliances.

a. Family Capacity displays all the space that the base volume, snapshots, and clones use. The Family Capacity space values may include system snapshots that are used for replication, but do not appear in the volume topology diagram. As a result, the Family Capacity space values may not match the objects in the topology.
b. Family Capacity displays all the space that the base volume group, snapshots, and clones use. The Family Capacity space values may include system snapshots that are used for replication, but do not appear in the volume group topology diagram. As a result, the Family Capacity space values may not match the objects in the topology.

NOTE: To zoom in and out of the topology view, press the Ctrl key and scroll up and down respectively, using the mouse wheel.

Start monitoring capacity usage

You can start to evaluate your capacity usage and needs from the PowerStore Manager **Dashboard** > **Capacity** card.

Current capacity usage

The cluster capacity dashboard presents the current amount of storage being used, and the amount of available storage in the cluster. When there is a risk to the capacity usage of a cluster, alerts are also in the **Capacity** area of the capacity dashboard.

PowerStore Manager displays all capacities in base 2 by default. To view capacity values in base 2 and base 10, hover over the Percentage Used, Free, and Physical values (at the top of the Capacity tab). For more information, see Dell Knowledge Base Article 000188491 PowerStore: How PowerStore physical capacity is calculated.

NOTE: Deleting files and directories in an SDNAS file system is asynchronous. While the response to the Delete request is received immediately, the ultimate release of storage resources takes longer to complete. The asynchronous deletion is reflected in the file system capacity metrics. When files are deleted in the file system, the update in capacity metrics may appear gradually.

Historical capacity usage and recommendations

You can use the historical chart to evaluate space utilization trends for the cluster, and review recommendations for your future capacity storage requirements. You can view the historical data for the last 24 hours, month, or year. Also, print charts for presentation, or export the data into a .CSV format for further analysis using your tool of choice.

Top consumers

The cluster capacity dashboard also presents which of the cluster resources are the top capacity consumers in the cluster. The **Top Consumer** area provides a high-level summary of the capacity statistics for each resource. Once you have identified the top consumers, you can further analyze to the resource level to review the capacity of a specific Volume, Volume group, Virtual Machine, or File system.

Data savings

Finally, the capacity dashboard shows you the Data Savings as a result of automated data efficiency features such as deduplication, compression, and thin provisioning. See Data Savings features for details.

Data savings features

Data savings metrics are based on the automated inline data services that are provided with PowerStore.

The automated inline data services occur in the system before the data is written to the storage drives. The automated inline data services include:

- Data reduction, which consists of deduplication and compression.
- Thin provisioning, which enables multiple storage resources to subscribe to a common storage capacity.

The drive usage that is saved by these data services results in cost savings and consistent, predictable high performance, regardless of workload.

Data reduction

The system achieves data reduction by using the following techniques:

- Data deduplication
- Data compression

There is no performance impact from the use of data deduplication or compression.

Data deduplication

Deduplication is the process of consolidating redundancies that are contained within data to reduce storage overhead. With deduplication, only one copy of data is stored on drives. Duplicates are replaced with a reference that points back to the original copy. Deduplication is always enabled and cannot be disabled. Deduplication occurs before the data is written to storage drives.

Deduplication provides the following benefits:

- Deduplication enables high capacity growth without requiring a drastic increase in space, power, or cooling.
- Fewer writes to the drive results in Improved drive endurance.
- The system reads the deduplicated data from the cache (instead of the drives) which results in Improved performance.

Compression

Compression is the process of reducing the number of bits that are required to store and transmit data. Compression is always enabled, and cannot be disabled. Compression occurs before data it is written to storage drives.

Inline compression provides the following benefits:

- Efficient storage of data blocks saves storage capacity.
- Fewer writes to the drive improve drive endurance.

There is no performance impact from compression.

Reporting the capacity savings

The system provides capacity accounting by reporting the capacity savings that are gained from data reduction, using the Unique Data metric.

Capacity accounting enables you to make informed decisions about data placement, and helps to forecast growth trends and plan future capacity expansions accordingly.

The Unique Data metric is calculated for:

- A volume and its associated clones and snapshots (volume family)
- A file system and its associated clones and snapshots (file system family).
- A NAS server - the calculated data is an aggregate of all file systems that are defined for the server.

The system provides the following capacity savings properties:

- Overall DRR - Indicates the ratio of logical used space to physical used space for the resource family.
- Reducible DRR - Indicates the Data Reduction Ratio that is based only on reducible data.
- Unreducible Data - The amount of data (GB) written to the storage object (or objects across an appliance or cluster) that is considered as not applicable for deduplication or compression.

Capacity accounting metrics are collected at intervals of 5 minutes, 1 hour, and 1 day. The data is included in the SupportAssist bundles and is displayed in APEX AIOps Observability.

To view capacity saving metrics:

- Clusters - Select **Dashboard** > **Capacity** and hover over the Data Reduction section of the **Data Savings** chart.
- Appliances - Select **Hardware** > **Appliances** > **[appliance]** > **Capacity** and hover over the Data Reduction section of the **Data Savings** chart or see the Appliances table.
- Volumes and volume groups - The properties are displayed in the respective tables and in the volume family capacity view (as Family Overall DRR, Family Reducible DRR, and Family Unreducible Data).
- File systems - The properties are displayed in the **File Systems** table and in **Storage** > **File Systems** > **[file system]** > **More Actions** > **View Topology** > **Capacity** (Family Overall DRR, Family Reducible DRR, and Family Unreducible Data).

  NOTE: You can zoom in and out of the topology view by pressing the Ctrl key and scrolling up and down respectively, using the mouse wheel.

- NAS servers - The properties are displayed in the **NAS Servers** table.
- VMs and storage containers - See the respective tables.

NOTE: The columns displaying capacity savings are not visible by default. To view these columns select **Show/Hide Table Columns** and check the relevant columns.

Thin provisioning

Storage provisioning is the process of allocating available drive capacity to meet the capacity, performance, and availability requirements of hosts and applications. In PowerStore, volumes and file systems are thin provisioned to optimize the use of available storage.

Thin provisioning works as follows:

- When you create a volume or file system, the system allocates an initial quantity of storage to the storage resource. This provisioned size represents the maximum capacity to which the storage resource can grow without being increased. The system reserves only a portion of the requested size, called the initial allocation. The requested size of the storage resource is called the subscribed quantity.
- The system will only allocate physical space when data is written. A storage resource appears full when data written to the storage resource reaches the provisioned size of the storage resource. Since provisioned space is not physically allocated multiple storage resources could subscribe to the common storage capacity.

Thin provisioning allows multiple storage resources to subscribe to a common storage capacity. Therefore, it allows organizations to purchase less storage capacity up front, and increase available drive capacity on an on-demand basis, according to actual storage usage. While the system allocates only a portion of the physical capacity requested by each storage resource, it leaves the remaining storage available for other storage resources to use.

The system reports the capacity savings gained from thin provisioning using the Thin Savings metric, which is calculated for volume families and file systems. A volume family consists of a volume and its associated thin clones and snapshots.

Thin provisioning is always enabled.

4

Monitoring performance

This chapter includes:

Topics:

- About monitoring system performance
- Performance metrics collection and retention periods
- Performance data locations in PowerStore Manager
- Monitoring user virtual machines performance
- Comparing object performance
- Performance policies
- Working with performance charts
- Generating performance metrics archives

About monitoring system performance

PowerStore provides you with various metrics that can help you monitor the health of your system, anticipate problems before they occur, and reduce troubleshooting times.

You can use the PowerStore Manager, REST API, or CLI to monitor the performance of a cluster, and for individual storage resources such as volumes, file systems, volume groups, appliances, and ports.

You can print performance charts and download metrics data as a PNG, PDF, JPG, or .csv file for further analysis. For example, you can graph downloaded CSV data using Microsoft Excel, and then view the data from an offline location or pass the data through a script.

Performance metrics collection and retention periods

Collection of performance metrics is always enabled in PowerStore.

All system performance metrics are collected every five seconds except for volumes, virtual volumes, and file systems, for which performance metrics are collected by default every 20 seconds.

All storage resources that are configured to collect performance metrics every five seconds are listed in the **Metric Collection Configuration** window (**Settings** > **Support** > **Metric Collection Configuration**.

You can change the granularity of performance data collection for volumes, virtual volumes, and file system:

1. Select the relevant storage resource (or resources).
2. Select **More Actions** > **Change Metric Granularity**.
3. From the **Change Metric Collection Granularity** slide-out panel, select the granularity level.
4. Click **Apply**.

The collected data is retained as follows:

- Five seconds data is retained for one hour.
- 20 seconds data is retained for one hour.
- Five minute data is retained for one day.
- One hour data is retained for 30 days.
- One day data is retained for Two years.

The performance charts refresh interval is set according to the selected Timeline as follows:

Table 7. Performance charts refresh intervals

Timeline	Refresh Interval
Last hour	Five minutes
Last 24 hours	Five minutes
Last month	One hour
Last two years	One day

Performance data locations in PowerStore Manager

You can view performance charts for PowerStore systems, and system resources from the PowerStore Manager **Performance** card, views, and details as follows:

Performance data is available from the PowerStore CLI, REST API, and PowerStore Manager user interface. This document describes how to access performance data and charts from PowerStore Manager.

See the PowerStore Online Help for specific performance metric definitions and calculations.

Table 8. Location of Performance Charts in PowerStore Manager

For	Access Path
Cluster	**Dashboard** > **Performance**
Virtual Machine	• **Compute** > **Virtual Machines** > **[virtual machine]** > **Compute Performance** displayed for the virtual machine. • **Compute** > **Virtual Machines** > **[virtual machine]** > **Storage Performance**
Virtual Volume (vVol)	**Compute** > **Virtual Machines** > **[virtual machine]** > **Virtual Volumes** > **[virtual volume]** > **Performance**
Volume	**Storage** > **Volumes** > **[volume]** > **Performance**
Volume Group	**Storage** > **Volume Groups** > **[volume group]** > **Performance**
Volume Group member (volume)	**Storage** > **Volume Groups** > **[volume group]** > **Members** > **[member]** > **Performance**
File System	**Storage** > **File Systems** > **[file system]** > **Performance**
NAS Server	**Storage** > **NAS Servers** > **[NAS server]** > **Performance**
Host	**Compute** > **Host Information** > **Hosts &Hosts Groups** > **[host]** > **Performance**
Host Group	**Compute** > **Host Information** > **Hosts &Hosts Groups** > **[host group]** > **Performance**
Initiator	**Compute** > **Host Information** > **Initiators** > **[initiator]** > **Performance**
Appliance	**Hardware** > **Appliances** > **[appliance]** > **Performance**
Node	**Hardware** > **Appliances** > **[appliance]** > **Performance** > **[node]**
Ports	• To view performance metrics of all configured ports **Hardware** > **Ports** > **Performance**. • To view network performance of a selected port, **Hardware** > **Ports** > **Performance** > **[port]** > **Network Performance** opens the **Network Performance**. • To view the I/O performance of a selected port **Hardware** > **Ports** > **Performance** > **[port]** > **IO Performance**.

Monitoring user virtual machines performance

Use PowerStore Manager to monitor CPU and memory usage of all user-configured VMs or per VM.

You can monitor the percentage of CPU and memory usage of user VMs in PowerStore Manager and use this information to improve resource management.

Select **Hardware** > **[appliance]** and select **AppsON CPU Utilization** from the Category menu to view historical CPU utilization of user VMs per appliance. To view CPU utilization of user VMs per node, use the Show/Hide menu.

Select **Hardware** > **[appliance]** and select **AppsON Mem Utilization** from the Category menu to view historical memory utilization of user VMs per appliance. To view CPU utilization of user VMs per node, use the Show/Hide menu.

You can view the CPU and memory usage per virtual machine in the Virtual Machines list (**Compute** > **Virtual Machines**).

NOTE: If you cannot see the CPU Usage (%) and Memory Usage (%) columns, add them using the **Show/Hide Table Columns**.

Comparing object performance

Use the PowerStore Manager to compare performance metrics of objects of the same type.

You can compare performance metrics to help troubleshoot system performance-related issues.

You can select two or more objects from the respective lists of the following objects:

- Volumes
- Volume groups
- File systems
- Hosts
- Host groups
- Virtual machines
- Appliances
- Ports

Selecting **More Actions** > **Compare Performance Metrics** displays the performance charts of the selected objects.

For ports, select **Hardware** > **Ports** > **Performance**, then select two or more ports and select **Compare IO Performance**.

See Working with performance charts for details on how to use the different menus of the performance charts to display the relevant data.

Comparing object performance can help in identifying potential misconfiguration or resource allocation issues.

Performance policies

You can choose to change the performance policy set on a volume, or a virtual volume (vVol).

The performance policies are provided with PowerStore. You cannot create or customize performance policies.

By default, volumes and vVols are created with a medium performance policy. The performance policies are relative to the performance of the volumes. For example, if you set a High-performance policy on a volume, the usage of the volume will take priority over volumes set with a medium, or low policy.

You can change the performance policy from medium to low or high, when a volume is created or after the volume has been created.

Setting a performance policy for a volume group applies the same policy on all members of the volume group. You can also set different performance policies for volume group members by assigning a policy to selected volumes.

Change performance policy set for a volume

About this task

You can change the performance policy set for a volume.

Steps

1. Select **Storage** > **Volumes**.
2. Check the checkbox next to the volume and select **More Actions** > **Change Performance Policy**.
3. In the **Change Performance Policy** slide-out, select the performance policy.
4. Select **Apply**.

Change performance policy for multiple volumes

About this task

You can set the same performance policy for all members of a volume group or for multiple volumes in a volume group simultaneously.

Steps

1. Select **Storage** > **Volume Groups**.
2. To change the performance policy for all members of the group, select the checkbox next to the group.
3. To change the performance policy for multiple members within the volume group:
   a. Select a volume group.
   b. Select the **Members** tab.
   c. Select the relevant volumes.
4. Select **More Actions** > **Change Performance Policy**.
5. Select a performance policy, and select **Apply**.

Working with performance charts

You can work with the performance charts to customize the display. Print performance charts, or export the performance data to display in an alternative application.

A performance summary for the current time period is always displayed at the top of the Performance card.

Performance charts are displayed for the following objects:

- Cluster
- Appliance
- Node
- Volume
- Volume group
- Virtual volume (vVol)
- NAS server
- File system
- Host
- Initiator

Common features of performance charts:

- Select whether to view the **Overall** or **File** performance of a storage object.

  NOTE: The **File** tab displays a summary of file protocols (SMB and NFS) operations for all NAS file systems. The **Overall** tab displays the summary of all block-level operations across volumes, virtual volumes, and NAS file systems internal volumes, but does not include the file protocols operations that are displayed in the **File** tab.

- Select the type of chart to display. You can choose whether to display the performance summary in the chart, or display the details of a specific metric in the chart.
- To show or hide a metric from the chart, select or clear the type of metric listed above the chart.
- Select the type of chart to display. You can choose whether to display the performance summary in the chart, or display the details of a specific metric in the chart.
- Select the time range to display.
- View the historical data in the chart area, and hover over any point on the line graph to get display the metric values at that point-in-time.

  NOTE: You can zoom into an area of the chart by selecting the area with the mouse. To reset the zoom setting, click **Reset zoom**.

- Download the charts as a .png, .jpg, .pdf file or export the data to a .csv file.

Asynchronous replication performance metrics

For storage objects that are part of an asynchronous replication session (volumes, volume groups, NAS servers, file systems), you can select additional metrics from the **Replication** list:

- Replication Remaining Data - The amount of data (MB) left to be replicated to the remote system.
- Replication Bandwidth - The replication rate (MB/s)
- Replication Transfer Time - The amount of time (seconds) required for copying the data.

For NAS servers and file systems that are part of a replication session, additional charts can be displayed for IOPS, bandwidth, and latency that allow you to monitor the impact of replication on latency and track data that is replicated to the destination system, separately from the data that is written to the local system. You can select to view the following charts:

- For block performance 20s metrics:
  - Block Write IOPS
  - Block Write Latency
  - Block Write Bandwidth
- For replicated data performance 20s metrics
  - Mirror Write IOPS
  - Mirror Write Latency
  - Mirror Overhead Write Latency
  - Mirror Write Bandwidth

For each of these metrics, you can select to view charts displaying average and maximum performance data.

Synchronous replication and metro performance metrics

For volumes and volume groups that are configured as metro, and for storage resources that are part of a synchronous replication session (volumes, volume groups, NAS servers, file systems), you can select additional metrics from the **Metro/ Synchronous Replication** list:

- Session Bandwidth
- Remaining Data

Remote backup performance metrics

For volumes and volume groups that are the sources of remote backup, you can select additional metrics from the **Remote Snapshot** list:

- Remote Snapshot Remaining Data
- Remote Snapshot Transfer Time

Offload performance metrics

XCopy, Unmap, and WriteSame offload commands may have an impact on the cluster performance. PowerStore allows you to monitor offload commands and their impact on performance.

You can view offload command metrics for the system, node, initiator, and target. The following metrics are collected for each command:

- IOPs - I/O commands per second
- Bandwidth - Bytes per second
- Latency - Time in seconds to run a command

When the cluster is slow, the displayed metrics enable you to determine which command creates a load on the cluster and identify the host or hosts that are creating the load.

To view offload command metrics, select the relevant object, and on the **Performance** tab, select the metric you want to view to display the performance chart. The offload metric options are displayed above the chart. You can select or clear a metric to add or remove it from the chart.

Monitor system utilization

The utilization tab enables you to gain a view of current resource utilization by the system components.

The utilization tab displays metrics that provide a way to measure the appliance performance utilization in a specific configuration and workload and anticipate potential performance bottlenecks.

To monitor system utilization, select **Hardware** > **Appliances** > **[appliance]** > **Performance** > **Utilization**.

The **Utilization** tab displays two charts:

- Appliance Utilization - Displays appliance utilization (percentage) and latency (ms) by default. You can select to add the following additional components utilization graphs:
  - CPU
  - Caching Media
  - Front-end ports
  - Back-end
- IOPS - Displays IOPS latency (ms), Max Sustainable IOPS, and Average total IOPS.

The system utilization metrics can help you to evaluate the system current and future performance needs and decide on steps such as adding appliances to the cluster, or upgrading the cluster to account for these needs.

Generating performance metrics archives

You can collect and download performance metrics to help troubleshoot performance-related issues.

About this task

You can use the PowerStore Manager, REST API, or CLI to collect performance data and download the generated archives. You can use the gathered information to analyze and troubleshoot performance-related issues.

Steps

1. Select the **Settings** icon and then select **Metrics Archives** in the **Support** section.
2. Select **Generate Metrics Archive** and confirm to initiate the process.
   A progress bar indicates when the archive is generated and the new archive is added to the **Metrics Archives** list.
3. Select the generated archive and then select **Download** and confirm to initiate the download.
   When download is complete, the download date and time is displayed in the Downloaded column.

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Collecting system data

This chapter includes:

Topics:

- Support materials collection
- Collect support materials

Support materials collection

You can collect support materials to help troubleshoot the appliances in your system.

Depending on the option you choose, support materials can include system logs, configuration details, and other diagnostic information. Use this information to analyze performance issues, or send it to your service provider so they can diagnose and help you resolve the issues. This process does not collect user data.

You can collect support materials for one or more appliances. When you start a collection, data is always collected at the appliance level. For example, if you request a collection for a volume, the system collects support materials for the appliance that contains the volume. If you request a collection for multiple volumes, the system collects support materials for all appliances that contain the volumes.

You can set a timeframe for collecting support materials. Setting a timeframe can result in smaller and more relevant data collection which is easier to analyze . You can either set a predefined timeframe or set a custom timeframe that suits your needs.

You can also include additional information in the support materials collection from **Advanced collection options**. Collecting additional information can take longer than the default support materials collection, and the size of the resulting data collection is larger. Select this option if your service provider requests it. By default the support materials collection uses the *essentials* profile. Use the `svc_dc` service script to collect support materials for other profiles. See the PowerStore Service Scripts Guide for more information about the `svc_dc` service script and the available profiles.

NOTE: The system can run only one collection job at a time.

You can perform the following actions on a collection of support materials:

- View information about existing collections.
- Upload a collection to support, if remote support through Secure Remote Services is enabled.
- Download a collection to a local client.
- Delete a collection.

NOTE: Some of these operations might not be available if the cluster is operating in a degraded state.

Collect support materials

Steps

1. Select the **Settings** icon, and then select **Gather Support Materials** in the **Support** section.
2. Click **Gather Support Materials**.
3. Type a description of the collection in the **Description** field.
4. Select the timeframe for the data collection.

   You can select one of the available options from the **Collection Timeframe** drop-down menu, or select **Custom** and set a timeframe.

   NOTE: If you select **Custom** as the timeframe for the data collection, the estimated finish time for the data collection is displayed in the **Collection Timeframe Finish** column of the **Support Materials Library** table.

5. Select the type of support data to collect from the **Object type** drop-down menu.
6. In the **Objects to collect data for:** area, select the check boxes of the appliances from which to collect support data.
7. To send the data collection to support when the job completes, select the **Send materials to Support when finished** check box.

   NOTE: This option is available only when Support Connectivity is enabled on the system. You can also send the data collection to support from the **Gather Support Materials** page after the job is completed.

8. Click **Start**.
   The data collection is initiated, and the new job appears in the **Support Materials Library** table. You can click the job entry to view its details and progress.

Results

When the job is completed, the job information is updated in the **Support Materials Library** table.

Next steps

After the job is finished, you can download the data collection, send the data collection to support, or delete the data collection.