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Preface

As part of an effort to improve and enhance the performance and capabilities of its product lines, EMC periodically releases revisions of its hardware and software. Therefore, some functions described in this document may not be supported by all versions of the software or hardware currently in use. For the most up-to-date information on product features, refer to your product release notes.

If a product does not function properly or does not function as described in this document, please contact your EMC representative.

Audience

This document is intended for use by storage managers who are installing and using the Symmetrix Performance Analyzer.

Readers of this document are expected to be familiar with the following topics:

- SYMCLI commands
- Solutions Enabler options, environment variables, daemons, and events.
- Symmetrix Management Console

Related documentation

Other Symmetrix publications of related interest are:

- EMC Solutions Enabler Symmetrix CLI Command Reference
- EMC Solutions Enabler Symmetrix Array Management CLI Product Guide
- EMC Solutions Enabler Symmetrix Array Controls CLI Product Guide
Conventions used in this manual

The following conventions are used in this manual:

CAUTION

A caution contains information essential to avoid data loss or damage to the system or equipment. The caution may apply to hardware or software.

Note: A note presents information that is important, but not hazard-related.

Typographical conventions

EMC uses the following type style conventions in this document:

Normal font

In running text:
- Interface elements (for example, button names, dialog box names) outside of procedures
- Items that user selects outside of procedures
- Java classes and interface names
- Names of resources, attributes, pools, Boolean expressions, buttons, DQL statements, keywords, clauses, environment variables, filenames, functions, menu names, utilities
- Pathnames, URLs, filenames, directory names, computer names, links, groups, service keys, file systems, environment variables (for example, command line and text), notifications

Bold

In procedures:
- Names of dialog boxes, buttons, icons, menus, fields
- Selections from the user interface, including menu items and field entries
- Key names
- Window names

In running text:
- Command names, daemons, options, programs, processes, notifications, system calls, man pages, services, applications, utilities, kernels

Italic

Used for:
- Full publications titles referenced in text
- Unique word usage in text

Bold Italic

Anything requiring extra emphasis
Where to get help

EMC support, product, and licensing information can be obtained as follows.

**Product information** — For documentation, release notes, software updates, or for information about EMC products, licensing, and service, go to the EMC Powerlink website (registration required) at:

http://Powerlink.EMC.com

**Technical support** — For technical support, go to EMC Customer Service on Powerlink. To open a service request through Powerlink, you must have a valid support agreement. Please contact your EMC Sales Representative for details about obtaining a valid support agreement or to answer any questions about your account.

Your comments

Your suggestions will help us continue to improve the accuracy, organization, and overall quality of the user publications. Please send your opinion of this document to:

techpub_comments@EMC.com
This chapter provides information you need to know prior to installing Symmetrix Performance Analyzer, and explains how to install Symmetrix Performance Analyzer.

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- Database maintenance....................................................................... 20
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Symmetrix Performance Analyzer overview

EMC® Symmetrix® Performance Analyzer (SPA) is a simple, intuitive, browser-based user interface for the purpose of historical trending and analysis of performance data. It was developed to overlay the Symmetrix Management Console (SMC). From SMC, the SPA interface opens in its own separate web window.

SPA adds an optional layer of data collection, analysis, and presentation tools to the SMC implementation. You can use SPA to:

- Set retention policies, threshold values, and interval collections
- View graphs detailing system performance
- Drill-down through data to investigate issues
- Monitor performance over time

This document

This installation guide explains how to install the Symmetrix Performance Analyzer. It also provides a high-level introduction to the SPA interface and views. Its purpose is to familiarize the new user with the software before its use.

Finding help

To find help while using Symmetrix Performance Analyzer, you can:

- Click Help on the SPA menu bar
- Click Help on the dialog box
- Click the question mark (?) in the View display

The EMC Solutions Enabler Symmetrix CLI product guides can provide more information about Symmetrix arrays or SYMCLI functionality. They are listed in “Related documentation” of the Preface.
Preinstallation information

This section provides the preinstallation information for the Symmetrix Performance Analyzer, V1.0.

Installation prerequisites

Before installing SPA V1.0 software, the following prerequisites must be met:

- Symmetrix Management Console V6.1.1.3 or later must be installed to use the SPA Link and Launch from SMC.

  **Note:** The secure port must not be disabled during the SMC installation to use the SPA Link and Launch from SMC.

- Solutions Enabler V6.5.1.3 or later must be installed, and the `storstpd` daemon must be running (for SPA data collection).

- Use SMC to enter your Symmetrix Performance Analyzer license key, or use the SYMCLI command, as follows:

  `symlmf SPAKey`

- Symmetrix Performance Analyzer can be installed on the same system as the SYMAPI server, or on a system connected to the SYMAPI server. Refer to Figure 1 and Figure 2 on page 12.

  **Note:** Do not install SPA on a network drive.

- Javascript must be enabled on your client browser.

- The minimum SPA client screen resolution is 1024 x 768.

  **Note:** Refer to the *EMC Symmetrix Performance Analyzer Release Notes* for additional environment requirements and product updates.

Installing client/server license keys

To run SPA in client/server mode, install the SPA license key on the SMC server, and the SYMAPI server and Base license keys on the SYMAPI server. Refer to Figure 2 on page 12.
Figure 1 and Figure 2 show the local and remote installation locations for the Symmetrix Performance Analyzer software:

- **Local**: SMC and SPA software are installed on the same system as the SYMAPI server.

- **Remote**: SMC and SPA software are installed on a system connected to the SYMAPI server.

**Figure 1** Local installation: SMC and SPA on SYMAPI server

**Figure 2** Remote installation: SMC and SPA on system connected to SYMAPI server
installing SPA

Symmetrix Performance Analyzer can be installed through a graphical user interface (GUI), as described in this section.

Note: Enter your SPA license key using SMC before this installation.

1. Click the SPA executable file, as follows:
   Windows: spaV1.0.0.1_win32.exe
   The Welcome window may take up to a minute to appear.

2. Click Next.
The **SPA Ports** window appears.
These are the default ports of the SPA web server.

**Note:** Make sure these ports are available before accepting them.

3. Click **Next** to review the installation summary.
The **Installation Summary** window appears.

4. Review the installation summary; if correct, click **Install**. Click **Back** to change any installation values.

**Note:** The SPA installation location defaults to the SMC installation location.
The Installation Complete window appears.

5. Click Finish.
Uninstalling SPA

You can uninstall SPA using the GUI, as described in this section.
To uninstall SPA, complete the following steps:

1. From the Windows Control Panel, select Add/Remove Programs.
2. Select EMC Symmetrix Performance Analyzer and click Change/Remove.

   The EMC InstallShield Wizard Welcome page appears.
   This may take a minute to appear.

   ! CAUTION!
   This uninstall operation terminates all client sessions to the SPA server in progress.

3. Click Next.
The **Uninstall Summary** window appears.

4. Review the summary information; if correct, click **Uninstall**. It may take a few minutes to remove all of the files.
The **Uninstall Complete** window appears.

![Uninstall Complete Window]

5. Click **Finish**.
Database maintenance

This section explains how to backup and restore the SPA database.

Backing up the SPA database

Follow these steps to manually backup the SPA database:

1. Open a DOS window.
2. Change directory to the scripts folder, as shown in the following example:

   cd C:\Program Files\EMC\SPA\litewave\webapps\spm\WEB-INF\classes\com\emc\ecc\datasource\spm\database\scripts

   Note: Substitute your SPA installation path if you changed the default location.

3. Select the file dbManager.bat.
4. Select Backup and provide a filename.

Backup files are placed in the EMC\SPA\data\backup folder.

Restoring the SPA database

Follow these steps to restore a database backup to the SPA database:

1. Open a DOS window.
2. Change directory to the scripts folder, as shown in the following example:

   cd C:\Program Files\EMC\SPA\litewave\webapps\spm\WEB-INF\classes\com\emc\ecc\datasource\spm\database\scripts

   Note: Substitute your SPA installation path if you changed the default location.

3. Select the file dbManager.bat.
4. Select Restore and provide a filename.

The database is restored.
Importing data

The SPA Metric Import Tool (SMIT) is a Symmetrix Performance Analyzer CLI application used to extract metric data from ECC Performance Manager daily files, convert them to Key Performance Indicators (KPIs) and store them in the SPA database.

The SMIT application is intended as a resource to jump start a new SPA installation by using pre-existing customer performance data in BTP format to populate the SPA database using the existing SPA server functionality.

CLI interface specifications

The command line for the SMIT application will have two modes of operation: export and import.

◆ export — Reads Performance Manager (or other BTP data) and extracts all available SPA data, exporting it into SPA message file format. Table 1 on page 22 lists the export command options.

Note: This command is performed on the ECC Performance Manager server. If the SPA server and the ECC Performance Manager server are not on the same network, export the files from the Archive directory to a zip drive.

◆ import — Sends previously generated SPA message files to the SPA server. Table 2 on page 22 lists the import command options.

Note: This command is performed on the SPA server. If you are using files on a zip drive, copy the files to the SPA server first, then issue the import command.

Examples

The following are some examples of running from the command line:

"java -jar smit.jar EXPORT -dir "C:\MyArchive" -symmids 000190108732

"java -jar smit.jar EXPORT -file "20080630d.btp"

"java -jar smit.jar IMPORT -symmids 000190108732 -dir "C:\MyFiles\8732" \ -address 192.186.23.10

Note: If there is insufficient memory, use the -Xms and -Xmx java options:

"java -Xms256M -Xmx768M -jar smit.jar EXPORT -dir "C:\MyArchive" \ -symmids 000190108732
## Command line options

Table 1 contains the options that can be used with the `export` command.

**Table 1**  
**SMAIT export command line options**

<table>
<thead>
<tr>
<th>Option</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>-file</code></td>
<td>Imports a single BTP file.</td>
</tr>
</tbody>
</table>
| `-dir Path` | Imports a directory of files. Defaults to the current directory.  
  **Note:** Each Symmetrix ID should have a directory, and each Symmetrix ID directory should have a daily subdirectory. |
| `-out Path` | Specifies an output file destination path. A separate directory will be created for each Symmetrix ID and the message files will be written there. |
| `-start Date` | Specifies the beginning date for a window of data to be imported. The date format is `mm/dd/yyyy`. |
| `-end Date` | Specifies the end date for a window of data to be imported. The date format is `mm/dd/yyyy`. |
| `symmids SymmID List` | Lists Symmetrix IDs to import. Imports none if not specified. The `symmids` format is 12 digits with a leading 0. |

Table 2 contains the options that can be used with the `import` command.

**Table 2**  
**SMAIT import command line options**

<table>
<thead>
<tr>
<th>Option</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>-dir Path</code></td>
<td>Specifies the directory of message files to be sent. Defaults to the current directory.</td>
</tr>
<tr>
<td><code>-address Address</code></td>
<td>Indicates the IP address of the SPA DMF. Defaults to the local host.</td>
</tr>
<tr>
<td><code>-port Port</code></td>
<td>Indicates the TCP port of the SPA server. Defaults to the SPA default port.</td>
</tr>
<tr>
<td><code>symmids SymmID List</code></td>
<td>Specifies Symmetrix IDs to import. Imports none if not specified. The <code>symmids</code> format is 12 digits with a leading 0.</td>
</tr>
</tbody>
</table>
This chapter introduces the Symmetrix Performance Analyzer and explains where to find objects in the menus and navigation tree.

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- Snapshot view performance data .................................................... 27
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Opening Symmetrix Performance Analyzer

The SPA installation is layered over the SMC software, therefore the most common gateway to SPA is through SMC, however, SPA can also be opened independently of SMC.

From SMC

Select an object from the SMC navigation tree, such as a Symmetrix array. Table 3 on page 27 contains the complete list of SPA-supported objects.

From a web browser

Open the web browser and enter:

http://localhost:7071

The EMC Symmetrix Performance Analyzer login window (Figure 3) appears.

Figure 3 Symmetrix Performance Analyzer login window

Type your SMC Username and Password. When using SPA, you have the same access controls and privileges as you have in SMC.

Register arrays for data collection

For SPA to display data, you need to register the Symmetrix arrays on which to collect data. SPA supports data collection for up to six
arrays. The `daemon_options` file must contain the Symmetrix IDs of the arrays that the `storstpd` daemon will monitor. Refer to the *EMC Solutions Enabler Installation Guide* or the *EMC Symmetrix Performance Analyzer Release Notes* for information about editing the `daemon_options` file.

To register Symmetrix arrays in SPA:

1. Select **Data Collection Registration** from the **Administration** menu. Select the Symmetrix arrays from the **Unregistered Symmetrix** list and click **Add** to move the arrays to the **Registered Symmetrix** list.

2. Click **OK**.

   Allow the data to collect for a period of time (minimum 24 hours).

3. Select an array and select **Snapshot** or **Trend** from the view menu.

   ![Symmetrix Array Snapshot view](image)

   **Figure 4**  
   
   **Symmetrix Array Snapshot view**

   **Figure 4** shows array data that has been collecting for one month.
The following figure describes the components of the SPA interface.

**Menu Bar**
- **File**: Provides controls for seldom performed tasks.
- **Administration**: Provides dialogs for administrative tasks.
- **Help**: Provides online help for the Console.
- **Refresh View**: Refreshes the view from the Symmetrix database.
- **Export**: Saves the tree or view to a file or graphic.
- **Logout**: Closes the SPA application.

**Snapshot** Displays graphs containing performance data for the selected object.
**Trend**: Displays performance trends for the selected object.

**View Bar**

**Navigation Tree**
The navigation tree is the roadmap to your storage array and devices. It contains folders and objects. Each folder contains a collection of objects, such as disks, directors, device groups, and so on. Use the navigation tree to find objects.

**Performance Details**
The graphs in this view display performance data organized by physical hardware (top), logical software (middle), and time (bottom).
### Snapshot view performance data

Table 3 lists the performance data that is available for each monitored object.

**Table 3  Supported performance metrics in SnapShot view (page 1 of 4)**

<table>
<thead>
<tr>
<th>Object supported</th>
<th>Performance metrics available</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Symmetrix arrays</td>
<td>• I/O and throughput&lt;br&gt;• RDF link throughput&lt;br&gt;• I/Os per second and Response time distribution&lt;br&gt;• Total I/Os - all arrays</td>
</tr>
<tr>
<td>Single Symmetrix array</td>
<td>• Resource utilization or workload distribution for:&lt;br&gt;  - Front-end ports&lt;br&gt;  - Front-end directors&lt;br&gt;  - Cache partition&lt;br&gt;  - Back-end disk adapters&lt;br&gt;  - Disks&lt;br&gt;  - RDF directors&lt;br&gt;  - RDF director ports&lt;br&gt;• I/Os and response times&lt;br&gt;• I/Os for array</td>
</tr>
<tr>
<td>All front-end directors</td>
<td>• I/Os per second and utilization&lt;sup&gt;a&lt;/sup&gt;&lt;br&gt;• MBs per second&lt;br&gt;• Total I/Os per second - all front-end directors</td>
</tr>
<tr>
<td>Single front-end director</td>
<td>• I/O contribution&lt;br&gt;• Read/Write distribution&lt;br&gt;• Utilization&lt;sup&gt;a&lt;/sup&gt;&lt;br&gt;• Throughput contribution&lt;br&gt;• I/Os per second&lt;br&gt;• MBs per second&lt;br&gt;• Total I/Os per second</td>
</tr>
<tr>
<td>All back-end directors</td>
<td>• I/Os per second and utilization&lt;sup&gt;a&lt;/sup&gt;&lt;br&gt;• Disk utilization distribution&lt;sup&gt;a&lt;/sup&gt;&lt;br&gt;• Total I/Os per second - all back-end directors</td>
</tr>
</tbody>
</table>
### Supported performance metrics in SnapShot view (page 2 of 4)

<table>
<thead>
<tr>
<th>Object supported</th>
<th>Performance metrics available</th>
</tr>
</thead>
</table>
| Single back-end director | • I/O contribution  
|                       | • Read & Write distribution  
|                       | • Throughput Contribution  
|                       | • Disk I/Os per second by utilization buckets  
|                       | • Total I/Os per second  |
| All RDF directors      | • I/Os per second  
|                       | • Write Pending (WP) counts  
|                       | • RDF group cache usage  
|                       | • RDF/A group cycle times (sec.)  
|                       | • Total MBs per second  |
| Single RDF director    | • I/Os per second  
|                       | • Write Pending (WP) counts  
|                       | • RDF group cache usage  
|                       | • RDF/A group cycle times (sec.)  
|                       | • MBs per second  |
| All disks              | • Free/used capacity by group  
|                       | • Utilization by group<sup>a</sup>  
|                       | • Response time by group  
|                       | • Device group back-end I/O rate per second  
|                       | • Total back-end I/Os per second - all groups  |
| Single disk group      | • Profile  
|                       | • I/O contribution  
|                       | • Utilization<sup>a</sup>  
|                       | • Disk I/Os by utilization buckets  
|                       | • I/Os per second  |
### Table 3  
**Supported performance metrics in SnapShot view (page 3 of 4)**

<table>
<thead>
<tr>
<th>Object supported</th>
<th>Performance metrics available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single disk</td>
<td>• Disk profile</td>
</tr>
<tr>
<td></td>
<td>- Model</td>
</tr>
<tr>
<td></td>
<td>- Capacity</td>
</tr>
<tr>
<td></td>
<td>- Used capacity</td>
</tr>
<tr>
<td></td>
<td>- RPM</td>
</tr>
<tr>
<td></td>
<td>- Disk group</td>
</tr>
<tr>
<td></td>
<td>- Number of devices</td>
</tr>
<tr>
<td></td>
<td>- I/Os per second</td>
</tr>
<tr>
<td></td>
<td>- MBs per second</td>
</tr>
<tr>
<td></td>
<td>• Reads and Writes distribution</td>
</tr>
<tr>
<td></td>
<td>• Reads and Writes throughput distribution</td>
</tr>
<tr>
<td></td>
<td>• Reads and Writes response time (ms)</td>
</tr>
<tr>
<td></td>
<td>• Utilization %</td>
</tr>
<tr>
<td>All thin device pools</td>
<td>• Activity profile:</td>
</tr>
<tr>
<td></td>
<td>- Host I/Os per second</td>
</tr>
<tr>
<td></td>
<td>- Back-end I/Os</td>
</tr>
<tr>
<td></td>
<td>• Capacity allocation (total, allocated, used)</td>
</tr>
<tr>
<td></td>
<td>• Host activity vs. pool back-end activity</td>
</tr>
<tr>
<td>Single thin pool</td>
<td>• Profile</td>
</tr>
<tr>
<td></td>
<td>• I/O contribution</td>
</tr>
<tr>
<td></td>
<td>• Hit ratios</td>
</tr>
<tr>
<td></td>
<td>• Host &amp; back-end I/Os per second</td>
</tr>
<tr>
<td></td>
<td>• Host &amp; back-end MBs per second</td>
</tr>
<tr>
<td></td>
<td>• Host &amp; back-end response time (ms)</td>
</tr>
<tr>
<td></td>
<td>• Capacity Allocation</td>
</tr>
<tr>
<td>All cache partitions</td>
<td>• Write Pending (WP) usage by cache partition</td>
</tr>
<tr>
<td></td>
<td>• Hit Ratio by cache partition</td>
</tr>
<tr>
<td></td>
<td>• System write pending count</td>
</tr>
<tr>
<td>Single cache partition</td>
<td>• Cache partition profile</td>
</tr>
<tr>
<td></td>
<td>• Write Pending (WP) counts</td>
</tr>
<tr>
<td></td>
<td>• Hit ratio (%) by device group</td>
</tr>
<tr>
<td></td>
<td>• Write pending distribution by device group</td>
</tr>
<tr>
<td></td>
<td>• Write Pending count</td>
</tr>
</tbody>
</table>
Using the Symmetrix Performance Analyzer

Table 3  Supported performance metrics in SnapShot view (page 4 of 4)

<table>
<thead>
<tr>
<th>Object supported</th>
<th>Performance metrics available</th>
</tr>
</thead>
<tbody>
<tr>
<td>All RDF/A groups</td>
<td>• I/Os per second</td>
</tr>
<tr>
<td></td>
<td>• Write Pending (WP) counts</td>
</tr>
<tr>
<td></td>
<td>• Write Pending usage</td>
</tr>
<tr>
<td></td>
<td>• Cycle time (sec.)</td>
</tr>
<tr>
<td></td>
<td>• Total MBs per second</td>
</tr>
<tr>
<td>Single RDF/A group</td>
<td>• Host writes &amp; MBs written per second</td>
</tr>
<tr>
<td></td>
<td>• Write Pending (WP) counts</td>
</tr>
<tr>
<td></td>
<td>• RDF/A write pending usage</td>
</tr>
<tr>
<td></td>
<td>• RDF/A group cycle times (sec.)</td>
</tr>
<tr>
<td></td>
<td>• MBs per second</td>
</tr>
<tr>
<td>Single RDF/S group</td>
<td>• Host writes &amp; MBs written per second</td>
</tr>
<tr>
<td></td>
<td>• Write Pending (WP) counts</td>
</tr>
<tr>
<td></td>
<td>• Response time (Msec)</td>
</tr>
<tr>
<td></td>
<td>• MBs per second</td>
</tr>
<tr>
<td>All device groups</td>
<td>• I/Os per second and response time distribution</td>
</tr>
<tr>
<td>(each DG shown)</td>
<td>• Read (hit/miss) and write (hit/miss) distribution</td>
</tr>
<tr>
<td></td>
<td>• I/Os over time</td>
</tr>
<tr>
<td>Single device group</td>
<td>• Device group profile:</td>
</tr>
<tr>
<td></td>
<td>- Reads per second</td>
</tr>
<tr>
<td></td>
<td>- Writes per second</td>
</tr>
<tr>
<td></td>
<td>- Read size (KB)</td>
</tr>
<tr>
<td></td>
<td>- Write size (KB)</td>
</tr>
<tr>
<td></td>
<td>- Read response time (ms)</td>
</tr>
<tr>
<td></td>
<td>- Write response time (ms)</td>
</tr>
<tr>
<td></td>
<td>- Read hit %</td>
</tr>
<tr>
<td></td>
<td>- Write hit %</td>
</tr>
<tr>
<td></td>
<td>- Sequential reads %</td>
</tr>
<tr>
<td></td>
<td>- Sequential writes %</td>
</tr>
<tr>
<td></td>
<td>- Random reads %</td>
</tr>
<tr>
<td></td>
<td>- Random writes %</td>
</tr>
<tr>
<td></td>
<td>- Number of devices</td>
</tr>
<tr>
<td></td>
<td>• Response time distribution</td>
</tr>
<tr>
<td></td>
<td>• Hit/miss distribution</td>
</tr>
<tr>
<td></td>
<td>• Sequential/random distribution</td>
</tr>
<tr>
<td></td>
<td>• Total I/Os per second</td>
</tr>
</tbody>
</table>

a. Utilization data availability is dependent on the Enginuity version running on the Symmetrix array.
Table 4 lists the raw data that appears in the Trend view.

### Table 4: Supported performance metrics in Trend view (page 1 of 2)

<table>
<thead>
<tr>
<th>Object supported</th>
<th>Trend metrics available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Symmetrix array</td>
<td>• I/O and throughput&lt;br&gt;• Write pending usage and hit ratio&lt;br&gt;• RDF/A I/O and throughput&lt;br&gt;• Number of devices and Number of device groups</td>
</tr>
<tr>
<td>All front-end directors</td>
<td>• Total I/Os per second&lt;br&gt;• Total MBs per second</td>
</tr>
<tr>
<td>Single front-end director</td>
<td>• I/O and utilization&lt;br&gt;• Throughput</td>
</tr>
<tr>
<td>All back-end directors</td>
<td>• Total I/Os per second - all back-end directors&lt;br&gt;• Total I/Os per second - all disks&lt;br&gt;• Number of disks</td>
</tr>
<tr>
<td>Single back-end director</td>
<td>• I/O and utilization&lt;br&gt;• Throughput</td>
</tr>
<tr>
<td>All RDF directors</td>
<td>• Total MBs per second - all RDF directors&lt;br&gt;• RDF/A groups write pending count&lt;br&gt;• Max cycle time&lt;br&gt;• Number of RDF/A groups</td>
</tr>
<tr>
<td>Single RDF director</td>
<td>• MBs per second&lt;br&gt;• RDF/A write pending count&lt;br&gt;• Cycle time (sec.)</td>
</tr>
<tr>
<td>All disks</td>
<td>• Total I/Os per second - all disks&lt;br&gt;• Total MBs per second - all disks&lt;br&gt;• Average disk utilization&lt;br&gt;• Number of disks</td>
</tr>
<tr>
<td>Single disk</td>
<td>• I/O and throughput&lt;br&gt;• Utilization&lt;br&gt;• Response time&lt;br&gt;• Used capacity</td>
</tr>
</tbody>
</table>
### Table 4  Supported performance metrics in Trend view (page 2 of 2)

<table>
<thead>
<tr>
<th>Object supported</th>
<th>Trend metrics available</th>
</tr>
</thead>
</table>
| All thin pools     | • Total I/Os per second - all thin pools  
                     • Total allocated capacity (GB) - all thin pools  
                     • Number of pools and number of thin devices |
| Single thin pool   | • I/Os per second  
                     • Allocated capacity |
| All cache partitions | • Total write pending counts  
                          • Average hit ratio (%) |
| Single cache partition | • Write pending usage  
                         • Write pending count  
                         • Hit ratio %  
                         • I/Os per second |
| Single RDF/A group | • Host writes per second  
                         • MBs per second  
                         • Write pending count  
                         • Max cycle time (sec.) |
| Single device group | • I/Os per second  
                         • MBs per second  
                         • Response time (ms)  
                         • Read hit and write miss % |
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