Oracle Flash Storage System

Statistics Tools User's Guide

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Preface

Oracle Resources

Important: For the latest version of this document, visit the *SAN Storage – Oracle Flash Storage Systems* section at the Oracle Help Center (http://www.oracle.com/goto/fssystems/docs).

Table 1: Oracle resources

For help with...	Contact...
Support	*http://www.oracle.com/support* (www.oracle.com/support)
Training	*https://education.oracle.com* (https://education.oracle.com)
Documentation	• *SAN Storage – Oracle Flash Storage Systems*: (http://www.oracle.com/goto/fssystems/docs) • From Oracle FS System Manager (GUI): Help > Documentation • From Oracle FS System HTTP access: (http://system-name-ip/documentation.php where system-name-ip is the name or the public IP address of your system)
Documentation feedback	*http://www.oracle.com/goto/docfeedback* (http://www.oracle.com/goto/docfeedback)
Contact Oracle	*http://www.oracle.com/us/corporate/contact/index.html* (http://www.oracle.com/us/corporate/contact/index.html)

Typographical Conventions

Table 2: Typography to mark certain content

Convention	Meaning
italics	Within normal text, words in italics indicate one of the following items: - Hypertext, as in a URL - A reference to a book title - New terms and emphasized words - Command variables
`monospace`	Indicates one of the following, depending on the context: - The name of a file or the path to the file *Output* displayed by the system on the command line
`monospace` (bold)	*Input* provided by an administrator on the command line.
>	Indicates a menu item or a navigation path in Oracle FS System Manager (GUI). For example, "Click SAN > Storage > LUNS > Action > Clone" means to click the Clone link on the SAN page in the GUI.
...	Indicates that one or more steps have been omitted from the path or menu structure. The ellipsis is used within an expression of a navigation path or within a cascading menu structure. For example, in the SAN > **Storage** > LUNS > ... > Clone menu structure, the ... implies that one or more menu items have been omitted.

Command Syntax Conventions

Table 3: Typography to mark command syntax

Typographic symbol	Meaning
`[  ]`	Square brackets. Delimits an optional command parameter or a set of optional command parameters.
`{  }`	Braces. Delimits a set of command parameters, one of which must be selected.
`|`	Vertical bar. Separates mutually exclusive parameters.
`. . .`	Ellipsis. Indicates that the immediately preceding parameter or group of parameters can be repeated.
`monospace`	Indicates the name of a command or the name of a command option (sometimes called a *flag* or *switch*).
italic	Indicates a variable for which you need to supply a value.

Command parameters that are not enclosed within square brackets ([ ]) are required.

Important: The above symbols (and font styling) are based on the POSIX.1-2008 specification. These symbols are used in the command syntax only to clarify how to use the command parameters. *Do not enter these symbols on the command line.*

Introduction to the Statistics Tools

Statistics Tools Overview

The Oracle FS System collects statistics data on many system operations. Each component of the Oracle FS System periodically collects key statistics covering such areas as read and write performance, block-level read and write performance, and error counts. You can download these system operation statistics from the Oracle FS System Manager (GUI) for analysis. The Oracle Flash Storage System Statistics Tools make it possible to process these statistics, which are in binary format, for analysis in statistical applications and spreadsheets.

The system operation statistics are historical compared to real-time statistics. These system operations are collected over intervals for a period of time, up to the point when you generated and downloaded the statistics. The corresponding time and duration are included in the statistics file for each system component.

When analyzing statistics, the real-time statistics on the GUI provide an instance of performance data, whereas the system operation statistics represent a longer period of time and include a system-wide collection of statistics. These statistics can help determine both whether the system is being fully utilized and the sizing for future system expansion

Statistical data captured in a binary format on the Oracle FS System is downloaded from the GUI Systems Logs page for processing on a client machine.

The Statistics Tools provided with the Oracle FS System make it possible to process this data into a format usable by statistical applications or spreadsheets. In that format, the statistical data can be used to perform the following tasks:

- Analyze the Oracle FS System to determine bottlenecks and determine what needs to be tuned in order to optimize performance.
- Track Oracle FS System load and capacity.
- Produce reports and graphs for presentation.
- Integrate with existing performance monitoring and reporting applications.

Note: Additional information on other statistics, including real-time statistics, is provided in the *Oracle Flash Storage System Administrator's Guide.*

Related Links
Statistics Tools Terminology and Definitions

Supported Platforms

`fsstatsparser` and `fsstatsformatter` are supported on the following platforms:

- CentOS 5.x or higher (32-bit platforms only)
- Microsoft Windows Server 2008 or higher
- Microsoft Windows XP or 7.0 or higher
- Oracle Linux 5.x or higher
- Oracle Solaris 10.x or higher on SPARC systems
- Oracle Solaris 10.x or higher on x86 systems
- Red Hat Enterprise Linux (RHEL) 5.x or higher (32-bit platforms only)

`fsstatsdigest` is supported on the following Linux platforms:

- 64-bit Oracle Linux 5.x or higher
- 64-bit Red Hat Enterprise Linux (RHEL) 5.x or higher
- 64-bit CentOS 5.x or higher

Audience

This guide is intended for system administrators and storage administrators who analyze Oracle FS System statistics. The results can be used to make system configuration and performance improvements.

Oracle recommends that you have the following skills and experience:

- Understand storage management
- Perform system administration tasks including gathering storage system statistics from the Oracle FS System
- Analyze storage system statistics
- Use Linux, Solaris, or Windows storage management tools to improve system and storage performance

Statistics Tools Descriptions

The Oracle FS System provides two application tools to prepare and format statistical data used for storage management analysis. A third tool converts statistics downloaded from an Oracle FS System into a set of multi-tabbed Excel spreadsheets.

You can download these tools from the Oracle FS System and use them on your client workstation to perform tasks. The following table provides the tool name,

the executable name, and a brief description of the tasks you can complete with the tool.

Table 4: Statistics tools descriptions

Tool	Executable name	Description
Statistics Parser	`fsstatsparser`	A command line utility that runs on the client machine and translates the raw Oracle FS System statistics into an intermediate format.
		The intermediate format data is stored in a file on the client machine to provide quick access to the data in the subsequent analysis phase. The intermediate format cannot be read by applications, such as a spreadsheet, until the data is formatted with `fsstatsformatter`.
Statistics Formatter	`fsstatsformatter`	A command line utility that runs on the client machine and reads Oracle FS System statistics from the intermediate format created by `fsstatsparser`. `fsstatsformatter` exports statistical data to comma-separated value (CSV) files that can be imported into spreadsheets and other applications for analysis.
Statistics Digest	`fsstatsdigest`	A command line utility that converts statistics downloaded from an Oracle FS System into a set of multi-tabbed Excel spreadsheets. Each spreadsheet charts the metrics from the system (for example, SAN LUN I/O and Drive Group I/O).

Run the Oracle FS System `fsstatsparser` tool to parse the binary statistics bundle into an intermediate statistics file whenever you download a new statistics bundle from the Oracle FS System . After you parse the data, you run the Oracle FS System `fsstatsformatter` tool to generate one or more subsets of the data which can be read by applications like a spreadsheet. To help you with your analysis, the statistical data can be sorted by Oracle FS System component, time range, and other categories. Information is provided in this document on how to organize and sort the statistical data.

Statistics Tools Terminology and Definitions

Oracle FS System statistics are organized by component, subcomponent, and statistics type.

The statistics are grouped by component (such as Drive Groups, any subcomponent, and statistic type, such as user interface. The statistics presented vary by component (for example, the statistics generated for Drive Groups are different than the statistics generated for the SAN LUN). The following table provides terminology and definitions of the component, subcomponents,

statistics type, and how the statistics are organized. For a detailed description of the component and subcomponent statistics, refer to the `fsstatsdefinitions.html` file that is part of the statistics tool package.

Table 5: Statistics terms definitions

Term	Description
Component	An Oracle FS System software module. The following software module components provide data that is included in the statistics file: **BS** — Block Services. Supply all read and write cache management, including mirroring **CIFS** — Common Internet File System. Provides Windows and other CIFS clients access to the Oracle FS System filesystems from network shares. **DMS** — Diagnostic and Monitoring Services. Run diagnostics and monitors various components of the system **DPS** — Data Protection Services. Provide the functions necessary for backup services **MQFS** — Meta File System. Provides a protocol neutral file system that supports files, directories, and other filesystem objects **NFS** — Network File System. Provides UNIX, Linux, and other NFS clients access to the Oracle FS System file system by means of mount points **RAID** — Redundant array of independent disks (RAID). Provides a disk subsystem that consists of a set of drives and a controller that operate as a single logical drive **SAN** — Storage Area Network. Provides the host network with a SCSI interface to the Oracle Flash Storage System on a SAN Controller to LUNs **VS** — Virtual Server. The Virtual Server manages NAS-only File Servers that are used to assign security, network, and protocol access attributes. These attributes apply to all filesystems associated with the File Server. Includes virtual interfaces (VIFs).
Duration	The amount of time in seconds that data was collected
Statistics bundle	The portion of the system information collection that contains statistical data

Table 5: Statistics terms definitions (continued)

Term	Description
Statistics column	A column heading in the statistics output that identifies a discrete statistic, such as `Write_through_Ops` (the number of write-through operations). These column headings are listed and described in the HTML file `fsstatsdefinitions.html`. The `fsstatsdefinitions.html` is downloaded with the statistics tools.
Stats time	The time the system began collecting data for the software module component statistics typeStatistics type
Statistics Type	The type of statistical data. Each component can contain different types of data: Error Error statistics count operations that have failed. UI User interface statistics are user-visible statistics normally shown on the GUI. General General statistics contain any detailed statistics that a component collects that cannot be classified as error or user visible statistics.
Subcomponent	A constituent part of a primary component. Subcomponents are also known as *resource types*. The value of *none* is displayed if there is no subcomponent.

For a detailed description of the component and subcomponent statistics, refer to the `fsstatsdefinitions.html` file that is part of the statistics tools package. The statistics tools package includes the Oracle FS System `fsstatsparser` tool and the Oracle FS System `fsstatsformatter` tool. The statistics tools package is available for downloading from the Oracle FS System.

Related Links
Statistics Tools Overview

Display Help for the Statistics Tools

To display help for the `fsstatsparser` tool, the `fsstatsformatter` tool, or the `fsstatsdigest` tool, use the `-h` option.

1   Log on to the client machine where you installed the statistics tools.

2   From a command line, choose one of the following tasks:

- Run `fsstatsparser -h` to display a procedure for using the statistics tools, as well as the syntax, command options, and examples for using the fsstatsparser tool.

- Run `fsstatsformatter -h` to display a procedure for using the statistics tools, as well as the syntax, command options, and examples for using the fsstatsformatter tool.

- Run `fsstatsdigest -S -i log-bundle` to process the statistics log bundle and create graphs for individual system components.

Download, Format, and Prepare System Statistics

Prepare System Statistics

To obtain Oracle FS System statistics for use with your analysis tools, you will need to collect, download, extract, process, and format the statistics. The following provides an overview of the process.

1   Download the Oracle Flash Storage System Statistics Tools from the Oracle FS System using the Oracle FS System Manager (GUI).

    Note: You only need to download the tools once unless the Oracle FS System is updated or upgraded. After an update or an upgrade, Oracle recommends that you download the tools.

2   Collect and download system statistics from the Oracle FS System.

3   Extract system statistics from the compressed file you downloaded.

4   Run the `fsstatsparser` tool to create a file that can be formatted in preparation for use with applications such as spreadsheets.

5   Run the `fsstatsformatter` tool to convert the statistics into a format that can be read by applications such as a spreadsheet.

After you have processed and formatted the statistics, you can import them into a tool such as Microsoft Excel for statistical analysis.

Related Links
Download the Statistics Tools
Extract System Statistics
Collect and Download System Statistics
Run fsstatsparser
Run the fsstatsformatter Tool

Download the Statistics Tools

To run the Oracle Flash Storage System Statistics Tools, download the `fsstatsparser` and `fsstatsformatter` software (contained in single,

compressed file). The compressed file also contains the `fsstatsdefinitions.html` file.

Prerequisite: You need network access to the Oracle FS System to download the statistics tool package from the Oracle Flash Storage Portal.

Oracle recommends that you perform this task on the workstation from where you manage the Oracle FS System. You can download the tools to any client that has network access to the Oracle FS System.

Note: The statistics tools run on Linux operating systems, Oracle Solaris operating systems, and Microsoft Windows operating systems. Review the list of supported operating systems provided in this document.

1   Start a web browser on your workstation to access the Oracle Flash Storage Portal.

2   In the address field, enter the Oracle FS System address:
     Valid address options:

     - The IP address of the Pilot (for example, `10.0.0.2`).

     - The Name of the Oracle FS System, if DNS name resolution is available (for example, `myFS.picwa.com`).

     `myFS.picwa.com`

3   Click Utility Software.

4   Select the version for your operating system from Downloads:

     - Oracle FS Statistics Tool for Linux

     - Oracle FS Statistics Tool for Solaris 10/11 SPARC

     - Oracle FS Statistics Tool for Solaris 10/11 x86

     - Oracle FS Statistics Tool for Windows

5   Save the selected file to your client workstation.

6   Extract the file contents to a directory in which you expect to be working with the statistics data files.

     Oracle recommends that you download the tools to the same directory into which you downloaded the statistics data files.

     Tip: Statistical data files can be large and can consume significant resources when being processed. Oracle recommends you select a file directory on locally attached storage with a minimum of 200 MB of storage space available.

     - For Linux or Solaris operating systems, use `tar` to extract the files from the downloaded `*.tgz` archive file.

     - For Windows, use a utility to extract the files from the downloaded `*.zip` archive file.

Before you can use the Oracle Flash Storage System Statistics Tools, you need to collect and download the Oracle FS System statistics.

Related Links

Supported Platforms

Collect and Download System Statistics

Collect and Download System Statistics

System statistics are collected and downloaded from the Oracle FS System Manager (GUI) from Support > System Logs.

Collect and download the system statistics from the Oracle Flash Storage System.

1   Navigate to Support > System Logs.

2   Select Actions > Create.
    The Create Log Bundle dialog is displayed with all of the components selected for data collection.

3   Click Deselect All.

4   From the Component or Item table, select the Statistics option.

5   (Optional) To specify a collection period of the last hours or last days, select Most Recent Logs.

6   (Optional) Enter the desired value, and then select the units in Hours or Days.

7   (Optional) To select a collection period from the last log collection to the present, select All Logs Since Last Log Collection.

8   (Optional) To collect logs from the SAN hosts that are running Oracle FS Path Manager (FSPM), click Select Host and then select the hosts from the list.

    Note: The SAN host must have FSPM installed and the host must be in a communicating state.

    When you are finished selecting the hosts, click OK.

9   (Optional) Enter a short description for the log collection in the Notes field (for example, you can enter a service request (SR) number).

    Note: If you use an SR number, it must be the first entry in the Notes field, but can be followed by additional information about the log bundle.

10 (Optional) To download the log bundle to your workstation, select the Download to option, and then specify the file path for the log bundle.

11 Click OK.

After downloading the statistics bundle, extract the statistics.

Related Links

Extract System Statistics

Extract System Statistics

The statistics bundle downloaded from the Oracle FS System is a compressed `.tar` file containing multiple `.tar` and `.gz` archive files. You must extract these files before you can use the Oracle Flash Storage System Statistics Tools to process and format the statistics.

For Linux and Solaris, use the `tar` command to extract the files. For Windows, you need a `.tar` and `.gz` utility to extract the files.

1   For Linux and Solaris, use the following command to extract the statistics `gz` files from the system information collection tar file:

    ```
    tar -xf Log_Bundle_Name.tar
    ```

    where *Log_Bundle_Name* `.tar` is the name of the system information collection you downloaded.

2   To extract the individual data files from the unzip utility tool, file, use the following commands:

    ```
    tar -x ID_number.stats.tar.gz
    tar -x ID_number.chsh.xml.tar.gz
    ```
    where *ID_number* is the system-generated ID number of the data file.

    Note: The `ID_number.stats.tar.gz` file contains the raw statistical data from the statistics bundle. The `ID_number.chsh.xml.tar.gz` file identifies the statistics gathered from your Oracle FS System and displays these statistics using the names you have defined.

    The `ID_number.chsh.xml.tar.gz` file is extracted to the current directory, and a new `PillarStatistics` directory is created in the current directory. The contents of the `ID_number.stats.tar.gz` file are extracted to the new `PillarStatistics` directory.

3   For Windows, extract the files in the same directory in which you downloaded the statistics file from the Oracle FS System.

Once the `chsh` and `stats` files have been extracted, process the files with the Statistics Parser tool.

Related Links
Run fsstatsparser

System Statistics Data Processing Overview

The data from the statistics bundle needs to be processed before the data can be formatted for use by applications such as a spreadsheet.

The `fsstatsparser` tool translates the data from the statistics bundle to an intermediate format. This intermediate format is then processed into a format that can be read by applications such as a spreadsheet.

Related Links
Run the fsstatsformatter Tool

Statistics Parser Syntax

The `fsstatsparser` tool translates raw statistics from the individual statistics files that were extracted from the statistics bundle into an intermediate format for the Statistics Formatter.

Syntax

Use the `fsstatsparser` tool to process a statistics bundle into an intermediate format to provide quick access to the statistics data in the subsequent analysis phase. You can then format this intermediate file using the `fsstatsformatter` tool.

```
fsstatsparser [-h | -i | -o]
```

Options

`-h`	Displays the help page.
`-i` *input_file_path*	Specifies the path to the input files.

- Default = `PillarStatistics`.
- Use the default path unless you extracted the statistics files to a different location.

`-o` *output_file_name* Specifies the name of the output file.

- Default = `fsstats.sps` in the current working directory.
- If not specified, the output defaults to the `fsstats.sps` file.

Examples

Use the following command to create the `fsstats.sps` file from the statistics files that are located in the default `PillarStatistics` directory:

fsstatsparser

Use the following command to create a `mystats.sps` file from the statistics files that are located in the `/tmp/stats` directory:

fsstatsparser -i=/tmp/stats -o=mystats.sps

Related Links

Run the fsstatsformatter Tool

Statistics Formatter Syntax

The `fsstatsformatter` tool processes files generated by the `fsstatsparser` tool to create formatted output suitable for import into a spreadsheet or other analysis tools.

Syntax

To format a statistics file generated by the Statistics Parser too, use the `fsstatsformatter` tool: `fsstatsformatter[-c | -C | -f | -h | -H | -i | -l | -m | -n | -o | -r | -s | -t | -T | -v | -V]`

Options

-c = *COMPONENT*	Specifies the name of the component for which statistics are collected. If a subcomponent or statistics type is not specified, the statistics for all subcomponents and statistics types for this component are collected.
-C = *COLUMNS*	Specifies the column names to include in the collected statistics. *COLUMNS* is a comma separated list of the column names to retrieve. If column names contain a space, the *COLUMNS* list must be double-quoted: `fsstatsformatter -C = "first name,second name,third name"` The `statsTime` and `duration` columns are always included, so you do not need to specify them. When listing Controller components statistics for named columns, the nodename is an optional column that is not included by default. Oracle recommends that you include the nodename on the list of named columns so that the data can be sorted and easily identified by node.
-f = *FORMAT*	Specifies the output format. CSV (comma-separated value) is the default format and currently the only option that can be specified, but a `.csv` extension is not automatically added to the output file name. To specify the `.csv` extension, specify an output file name using the `-o` option. If you are using a spreadsheet application, Oracle recommends that you use `.csv` as the file name extension.
-h	Displays this help page.
-H = *HEADERTYPE*	Header rows specify the component, subcomponent, type, and column names in the output file by default. Specify **NONE** to hide the headers and display only data rows.
-i = *FILENAME*	Specifies the name of the file from which to read the statistics data that was processed by `fsstatsparser`. If no file name is specified, the input defaults to the `fsstats.sps` file in the current working directory.

-l	Lists the available statistics in the statistics file. Statistics are listed by component, subcomponent, and statistics type.
-m	Specify this option to have a separate data file written for each component, subcomponent, and statistics type. This option applies only if the -o option is also used. The data files names include the component, subcomponent, and statistics type concatenated to the specified output file name. An output file name extension (such as .csv) can be specified with the file name. Oracle recommends that you specify a file name extension with the output file name. If you are using a spreadsheet application, Oracle recommends that you use .csv as the file name extension.
-n = *NODENAME*	Specifies that only data records from this Oracle FS System Controller or Drive Enclosure are collected. Specify the World-Wide Name (WWN) of the Controller or Drive Enclosure that generated the statistical data you want to obtain.
-o = *FILENAME*	Specifies the name of the file to which to write the formatted output. If not specified, the output defaults to stdout. File name extensions are not automatically added to the output file name. See also the -m option, which can be used in conjunction with the -o option to separate the output by component, subcomponent, and statistics type. Note that errors are printed to stderr.
-r	Specifies that all data is displayed from the data file without any processing applied. Without the -r option, counter data is normalized to turn it into rates, and ID values are translated into Fully Qualified Names (FQNs) where possible. With the -r option, counter data is expressed as accumulated values rather than rates, and ID values will not be translated into FQNs.
-s = *NAME*	Specifies that statistics collected are limited to those that match the specified subcomponent.
-t = *STATISTICSTYPE*	Must be used with the -c option. Specifies that statistics collected are limited to those that match the specified *STATISTICSTYPE* for the specified component. *STATISTICSTYPE* must be expressed as one of the following values: • ERROR • GENERAL • UI
-T = *TIME*	Specifies a time range within which to retrieve the statistics. *TIME* is specified in the following format: *START,END*. *START* and *END* are formatted as follows:

`MMDDYY:HH:MM:SS`

The time is the local time of the client machine on which `fsstatsformatter` is running.

-v	Prints the `fsstatsformatter` version number.
-V	Specifies verbose output. While the statistics formatting process is running, status progress is printed to standard output (`stdout`). If you use verbose output, you should also use the `-o` option to send program output to a file to avoid mixing program output with progress output in `stdout`.

Examples

Run the following command to send CSV-formatted data from the default `fsstatsparser` output file `fsstats.sps` to your standard output (`stdout`) device:

```
fssstatsformatter
```

Run the following command to list the names and definitions of all the statistical values in the default `fsstats.sps` file:

```
fsstatsformatter -l
```

Run the following command to list the names and definitions of the statistical values for the Block Services component:

```
fsstatsformatter -l -c=BS
```

Run the following command to send CSV-formatted data from an `fsstatsparser` output file named `my_stats.sps` to your standard output (`stdout`) device:

```
fsstatsformatter -i=my_stats.sps
```

Run the following command to send CSV-formatted port errors to a file named `porterrors.csv`:

```
fsstatsformatter -c=VS -s=Port -o=porterrors.csv
```

Run the following command to send CSV-formatted data from the default `fsstats.sps` file to a series of files, one for each component, subcomponent, and statistic type, while sending verbose progress output to your standard output (`stdout`) device:

```
fsstatsformatter -m -o=mystats.csv -V
```
The files will be named `mystats_component_subcomponent_type.csv`.

Run the following command to send CSV-formatted port error information for the time range 10:00 to 10:05 local client time on December 1, 2014 to your standard output (`stdout`) device:

```
fsstatsformatter -c=VS -s=Port -T=120114:10:00:00,120114:10:05:00
```

Formatting System Statistics Overview

To obtain data that spreadsheets and other applications can read directly, you need to format the processed statistical data with the `fsstatsformatter` tool.

The `fsstatsformatter` tool uses the output of the `fsstatsparser` tool and converts the output to comma-separated value (CSV) data.

Run the fsstatsformatter Tool

Use the `fsstatsformatter` tool to convert the statistics data into a format that can be read by an application such as a spreadsheet.

Prerequisites:

- Collect statistics

- Extract the statistics files

- Run the `fsstatsparser` tool to convert the statistics into a format that the `fsstatsformatter` tool can read.

1 Verify that the intermediate format file (default = `fsstats.sps`) has been created.

2 At a command prompt, run the `fsstatsformatter` command with any appropriate options.

Related Links

Statistics Formatter Syntax
Run the fsstatsformatter Tool

fsstatsdigest Utility

Statistics Digest Utility

The `fsstatsdigest` utility complements the `fsstatsparser` and the `fsstatsformatter` tools.

Run only in a Linux environments, the `fsstatsdigest` utility automatically executes the `fsstatsparser` tool and the `fsstatsformatter` tool and then graphs the data into spreadsheets. You can then use the spreadsheets to analyze Oracle FS System system performance and to troubleshoot your system.

The `fsstatsdigest` utility converts the statistics that are downloaded from an Oracle FS System into a set of multi-tabbed spreadsheets in Microsoft XLSX format. You can view the spreadsheets using Microsoft Excel or Microsoft Excel Viewer. The viewer is free and anyone can download it from the following URL: *http://www.microsoft.com/en-us/download/office.aspx* .

The data that is presented in the spreadsheets represent the most recent 20 hours of operation that precedes the log collection. Each metric that is displayed is averaged across a two-minute interval, which is the most granular duration.

Each spreadsheet charts the metrics for a system component (for example, for a LUN or for a Drive Group).

Statistics Digest Requirements

The following minimum components are required for the `fsstatsdigest` utility to execute successfully in your environment.

- Hardware
  - Dual-core CPU
  - 4 GB RAM
  - 1 Gbps Ethernet
- Supported operating systems
  - 64-bit Oracle Linux 5.x or higher
  - 64-bit Red Hat Enterprise Linux (RHEL) 5.x or higher
  - 64-bit CentOS 5.x or higher
- Perl programming language, version 5.10.1 or higher

Prerequisites for 32-bit OEL and CentOS

The Oracle Enterprise Linux (OEL) and the Community ENTerprise (CentOS) 32-bit Linux operating systems require two binary packages before you execute the `fsstatsdigest` tools. 64-bit Linux operating systems do not require the binary packages.

Prerequisites:

- Access to the network or to a CD / DVD drive
- `sudo` privileges to execute the installation syntax
- Access to the Yellowdog Updater, Modified (YUM) management utility for Linux

1   Using the YUM package manager, install the following packages on the OEL 32-bit host operating system:

   - `yum install glibc.i686`
   - `yum install libstdc++.i686`

2   Execute the same packages on the CentOS 32-bit host operating system.

Prerequisites for 32-bit RHEL

The Red Hat Enterprise Linux (RHEL) 32-bit operating system requires two binary packages before you execute the `fsstatsdigest` tools. 64-bit Linux operating systems do not require the binary packages.

Prerequisites:

- Access to the network or to a CD / DVD drive
- `sudo` privileges to execute the installation syntax
- Access to the Yellowdog Updater, Modified (YUM) package utility for Linux

There are two methods of installing the binary packages, depending on the RHEL support registration.

1   With support registration, use the YUM package manager to install the following packages:

   - `yum install glibc.i686`
   - `yum install libstdc++.i686`

2   Without support registration, perform the following steps to install the packages:

   a)   Mount the physical CD or DVD using the following commands:
   ```
   mkdir -p / mnt/RHEL
   mount /dev/cdrom /mnt/RHEL
   ```

   b)   Mount the ISO file using the following commands:

```
mkdir -p / mnt/RHEL

mount -o loop /path/to/RHEL.iso /mnt/RHEL
```

c) Create a YUM repository that will use the DVD as a repository using the following command:

```
vi /etc/yum.repos.d/rhel-dvd.rep

[rhel-dvd] name=Red Hat Enterprise Linux $releasever -
$basearch - DVD baseurl=file:///mnt/RHEL/Server/
enabled=1 gpgcheck=0
```

d) Clean the YUM cache:

```
yum clean all
```

e) Execute the following commands to install the 32-bit C library:

  - `yum install glibc.i686`

  - `yum install libstdc++.i686`

Install the fsstatsdigest Tools

Prerequisites

- Network access to your Oracle FS System

- A host that is running a Linux operating system

Oracle recommends that you perform this task on the workstation from where you manage the Oracle FS System. You can download the tools to any client that has network access to your Oracle FS System.

1   Start a web browser on your workstation.

2   In the address field, enter the Oracle FS System address.
    Valid address options:

  - The IP address of the Pilot. An example is the default address: `10.0.0.2`.

  - The name of the Oracle FS System, if DNS name resolution is available. An example is: `myFS.picwa.com`.

3   Click Utility Software.

4   Under Downloads, select Oracle FS Statistics Tool for Linux.

5   Save the `fsstatstool-linux.tgz` file to your Linux-based workstation.

6   Extract the contents of a saved file to a directory where you expect to be working with the statistics data files.

Oracle recommends that you download the tools to the same directory into which you downloaded the statistics data files.

Tip: Statistical data files can be large and can consume significant resources when being processed. Oracle recommends that you select a file directory

on locally attached storage with a minimum of 200 MB of storage space available.

7   To extract the `.tgz` file, execute the following command: `tar xvf fsstatstool -linux.tgz`.
The following files are extracted to the current directory:

```
fsstatsformatter
fsstatsparser
fsstatsdefinitions.html
fsstatsdigest
```

After installation completes, run the `fsstatsdigest` executable file.

Run the fsstatsdigest Executable

The `fsstatsdigest` executable uses the `fsstatsparser` and the `fsstatsformatter` files that were extracted during the `fsstatstool` installation. Running the `fsstatsdigest` utility is supported only on Linux operating systems and can take several minutes to run.

Run the Statistics Digest utility.

Example: **./fsstatsdigest -S -i *log -bundle***

where *log -bundle* is is the file either downloaded from the Oracle FS System or delivered to Oracle by means of the Call-Home feature.

fsstatsdigest Utility Operations

After the `fsstatsdigest` utility completes, the utility generates the following files:

- Controller-combined metrics:

  - `Raid_DriveGroup_Ui.xlsx`

  - `San_Lun_Ui.xlsx`

  - `San_Lun_General.xlsx`

  - `Bs_None_Ui.xlsx`

  Individual metrics:

  - `Dms_None_Ui.xlsx`

  - `San_SanFc_Ui.xlsx`

  - `San_SanFc_General.xlsx`

  - `San_SanFc_Error.xlsx`

  - `Dms_None-General.xlsx`

fsstatsdigest Output Metrics

Drive Group UI Metrics

Drive Group metrics provide statistics about the disk subsystem, which consists of a set of drives and a controller that operate as a single logical drive. User interface (UI) statistics are visible to users.

The following table identifies the drive group UI metrics provided by the `fsstatsdigest` output.

Table 6: Metrics collected for the Drive Group UI

Category	Description
Read Second	The number of read commands that are performed per second for all QoS levels, averaged across the duration interval. The duration interval is the amount of time between statistics collection, which is 120 seconds (two minutes).
Read MB Second	The number of megabytes read per second across all QoS levels. A megabyte is defined as 2^{20}(1,048,576 bytes).
Read Millisecond	The time to complete the read commands, which is averaged across all QoS levels for the interval
Write Second	The number of write commands performed per second, which is averaged across all QoS levels for the interval
Write MB Second	The number of megabytes written per second across all QoS levels. A megabyte is defined as 2^{20} (1,048,576 bytes).
Write Millisecond	The time to complete the write commands, which is averaged across all QoS levels for the interval
Read Queue	The number of outstanding read commands that are averaged across the interval
Write Queue	The number of outstanding write commands that are averaged across the interval

SAN LUN Access UI Metrics

SAN LUN Access metrics relate to the request actually being serviced through read operations or write operations. User interface (UI) statistics are visible to users.

The following table identifies the SAN LUN UI metrics provided by the `fsstatsdigest` output.

Table 7: Metrics collected for the SAN LUN UI

Category	Description
Optimized Access	The percentage of optimized access commands for all LUNs that are configured on the storage system
Read Second	The number of read commands performed per second that are averaged over the sampling interval. The interval is the amount of time between statistics collection, which is 120 seconds (two minutes).
Read MB Second	The number of megabytes read per second that are averaged over the sampling interval. A megabyte is defined as 2^{20} (1,048,576 bytes).
Read Millisecond	Read response times in milliseconds that are averaged over the sampling interval
Read Block Counts	The average number of bytes per read command for each individual LUN
Write Second	The number of write commands performed per second that are averaged over the sampling interval
Write MB Second	The number of write megabytes per second that are averaged over the sampling interval. A megabyte is defined as 2^{20} (1,048,576 bytes).
Write Millisecond	The write response times in milliseconds that are averaged over the sampling interval
Write Block Count	The average number of bytes per write command for each individual LUN
Read Queue	The number of outstanding read commands for each LUN that are averaged over the sampling interval
Write Queue	The number of outstanding write commands for each LUN that are averaged over the sampling interval

BS None Metrics

Block Services (BS) metrics supply all read and write cache management, including mirroring. `None` indicates that the statistics for the subcomponent are not included in the output.

The following table identifies the internal BS module metrics provided by the `fsstatsdigest` output.

Table 8: Metrics collected for the BS None UI

Category	Description
Extent Lock Miss	The count of extent lock misses
Read Operations	The count of all read operations
Read Time	The time of all reads in clock cycles
Bytes Read	The total number of bytes read. This does not include the 8 bytes of CRC when T10 DIF.
Read Cache Hits	The number of complete hit operations
Read Aheads	The count of all read ahead operations
Read Ahead Bytes	The count of all bytes read ahead. This is valid only if the VLUN type is not `bs_vlun_ui_statistics_type_pm`.
Transport Count	The count of all SLAT transports. This is valid only if the VLUN type is `bs_vlun_ui_statistics_type_pm`.
Write Operations	The count of all write operations
Write Through Operations	The count of write through operations
Write Time	The time of all writes in clock cycles
Bytes Written	The total number of bytes written. This does not include the 8 bytes of CRC when T10 DIF.
Destage Operations	The count of all destage operations
Destage Time	The time of all destage operations in clock cycles
Bytes Destaged	The total number of bytes destaged. This does not include the 8 bytes of CRC when T10 DIF.

DMS None General Metrics

Diagnostic and Monitoring Services (DMS) runs diagnostics and monitors various components of the system. `None` indicates that the statistics for the subcomponent are not included in the output. General metrics contain any detailed statistics that a component collects which cannot be classified as error statistics or user-visible statistics.

The following table identifies the DMS metrics provided by the `fsstatsdigest` output.

Table 9: Metrics collected for DMS None General

Category	Description
Port	The Private Management Interface (PMI) Ethernet port identifier
MAC Addr	The PMI Ethernet MAC address
Root ID	The PMI Ethernet root ID
Bridge ID	The PMI Ethernet bridge ID
Port Status 0	The PMI Ethernet Marvel 6052 port status bits
Port State 0	The PMI Ethernet port state: disabled, listening, learning, forwarding, or blocking
Port Status 1	The PMI Ethernet Marvel 6052 port status bits
Port State 1	The PMI Ethernet port state: disabled, listening, learning, forwarding, or blocking
Port Status 2	The PMI Ethernet Marvel 6052 port status bits
Port State 2	The PMI Ethernet port state: disabled, listening, learning, forwarding, or blocking
Various Fan RPM	The Fan RPM
Various Sensor Temp	The Sensor temperature
ESM 0 Slot	The Energy Storage Module (ESM) Slot 0
ESM 1 Slot	The Energy Storage Module (ESM) Slot 1
ESM 2 Slot	The Energy Storage Module (ESM) Slot 2
ESM 3 Slot	The Energy Storage Module (ESM) Slot 3
Various Volt milli Volts	The Volt milli-Volts
Various PS Input power	The power supply input volts
Various PS Output power	The power supply output volts
Various PS V in	The power supply volts
Various PS V 12	The power supply V_12
Various PS Temperature	The power supply temperature
Various PS Fan RPM	The power supply fan RPM

DMS None UI Metrics

Diagnostic and Monitoring Services (DMS) run diagnostics and monitors various components of the system. `None` indicates that the statistics for the subcomponent are not included in the output. User interface (UI) statistics are visible to users.

The following table identifies the internal DMS metrics collected.

Table 10: Metrics collected for the DMS None UI

Category	Description
CPU Utilization	The percentage of the central processing unit (CPU) utilization

SAN LUN Access General Metrics

SAN LUN metrics relate to the request actually being serviced through read operations or write operations. General statistics contain any detailed statistics that a component collects that cannot be classified as error statistics or user-visible statistics.

The following table identifies the SAN LUN general metrics provided by the `fsstatsdigest` output.

Table 11: Metrics collected for the SAN LUN UI

Category	Description
Total Cmds	The total number of read/write commands that are sent from any SAN host on the fabric
BS Requests	Any block command sent from any of the SAN hosts on the fabric
Non Data Xfer	Any non-block command received such as Reservation, Mode Page request, or a LUN Query
Non Data Xfer Response Time nS	The amount of time for the non-block command received to respond to the request. These should not hold up I/O. However, in reservation requests, I/O can be impacted because a lock could not be obtained.
OrderedQ	The specification from the host to send commands in a particular order
HeadOfQ	The specification from the host to send commands in a particular order
AcaQ	This is sent via IBM hosts that changes the task set with an Auto Contingent Alligence (ACA) condition
ACA Active	The status message that indicates whether ACA is active or not. The status message appears for IBM hosts only.
Busy	The Busy status is returned from the internal Block Services module in the Controller.
Reservation Conflict	Attempted to obtain a reservation and it was not allowed because a different host has a lock
Task Set Full	If the I/O request has not received a response from the internal Block Services module in the Controller within 9 seconds, the system expires and the host sends a retry command.

Table 11: Metrics collected for the SAN LUN UI (continued)

Category	Description
Read Before Write	Check to see if there is a Task Set Full instance, as that instance can show Read Before Write instances. If all LUNs have Disable Reference Tag Checking selected, then the Read Before Write metric is not present in the output.
Untagged	Queue tagging for these instances does not exist
SimpleQ	I/O is tagged with a simple reference
Check Condition Medium Error	Indicates that the system is being overloaded, or a physical error exists on the Fabric/SFP (GBIC)
'Remaining' Check_Condition*	Check Conditions (SCSI STATUS) in general can cause a performance issue. So, document these instances and report the conditions to development.

SAN FC Protocol Error Metrics

SAN Fibre Channel (FC) Protocol metrics relate to a request coming in through an HBA port, being queued by priority, and eventually making its way to the software layers that service the request. The request is routed back through the HBA port and on to the SAN Host. Error metrics count operations that have failed.

The following table identifies the SAN FC Error metrics provided by the fsstatsdigest output.

Table 12: Metrics collected for SAN FC Errors

Category	Description
Port_Logout	The number of port logouts detected
Port_Config_Change	The number of port configuration changes detected
Threshold Exceeded	The number of threshold exceeded events detected
QoS Wakeups Level 0	The number of QoS wakeups for commands at priority level 0
QoS Wakeups Level 1	The number of QoS wakeups for commands at priority level 1 (archive)
QoS Wakeups Level 2	The number of QoS wakeups for commands at priority level 2 (low)
QoS Wakeups Level 3	The number of QoS wakeups for commands at priority level 3 (medium)
QoS Wakeups Level 4	The number of QoS wakeups for commands at priority level 4 (high)
QoS Wakeups Level 5	The number of QoS wakeups for commands at priority level 5 (internal)

Table 12: Metrics collected for SAN FC Errors (continued)

Category	Description
QoS Wakeups Level 6	The number of QoS wakeups for commands at priority level 6 (premium)
QoS Wakeups Level 7	The number of QoS wakeups for commands at priority level 7 (highest)

SAN FC Protocol General Metrics

SAN Fibre Channel (FC) Protocol metrics relate to a request coming in through an HBA port, being queued by priority, and eventually making its way to the software layers that service the request. The request is routed back through the HBA port and on to the SAN Host. General statistics contain any detailed statistics that a component collects which cannot be classified as error statistics or user statistics.

The following table identifies the SAN FC Protocol General metrics provided by the `fsstatsdigest` output.

Table 13: Metrics collected for SAN FC General

Category	Description
UnAcked Host	The number of unacknowledged host events detected
No Exchange Buffer	The number of no exchange buffer errors detected

SAN FC Protocol UI Metrics

SAN Fibre Channel (FC) Protocol metrics relate to a request coming in through an HBA port, being queued by priority, and eventually making its way to the software layers that service the request. The request is routed back through the HBA port and on to the SAN Host. User interface (UI) statistics are visible to users.

The following table identifies the SAN FC UI metrics collected.

Table 14: Metrics collected for the SAN UI

Category	Definition
Abort Task	The number of abort task commands processed on the specified port
Abort Task Set	The number of commands to abort a task set processed on the specified port
Clear ACA	The number of Clear ACA (Auto Contingent Allegiance) commands processed on the specified port
Clear Task Set	The number of commands to clear a task set processed on the specified port

Table 14: Metrics collected for the SAN UI (continued)

Category	Definition
LUN Reset	The number of commands to reset a logical unit processed on the specified port
Target Reset	The number of commands to reset a target processed on the specified port
Reselect Timeout	The number of reselection timeout errors that have occurred on the channel associated with this port
Invalid RXID	The number of invalid receiver exchange identifier (RXID) errors that have occurred on the channel associated with this port
Link Down	The number of link down events
Link Up	The number of link up events
Link Init	The number of initializations that have occurred on the channel associated with this port
Link Init Error	The number of initialization errors that have occurred on the channel associated with this port
RND Error	The number of RND errors that have occurred on the channel associated with this port. A faulty SPF or FC cable might cause these errors.
Data Xfer Error	The number of data transfer errors that have occurred on the channel associated with this port
Underrun	The number of underrun errors that have occurred on the channel associated with this port
Overrun	The number of overrun errors that have occurred on the channel associated with this port
DMA Error	The number of Direct Memory Access (DMA) errors that have occurred on the channel associated with this port
System Error	The number of system errors that have occurred on the channel associated with this port
PCI Error	The number of Peripheral Component Interconnect (PCI) errors that have occurred on the channel associated with this port
Port Unavailable	The number of port unavailable errors that have occurred on the channel associated with this port
Command Timeout	The number of command timeout errors that have occurred on the channel associated with this port
FW Dumps	The number of firmware (FW) dump errors

Troubleshooting

fsstatsdigest Data Presentation

The `fsstatsdigest` statistics are presented in charts. The following table describes the charts along with some tips for obtaining more finely-grained details.

Table 15: Data presentation of fsstatsdigest worksheets

Area of worksheet	Detail of worksheet area
Worksheet Overview	• Top Column The first column in each sheet provides the timestamp of the statistics sample. • Top Row The top row in each sheet provides the names of the data series information for lookup when reviewing cell data.
Chart Overview	• X-axis The X-axis (horizontal) provides the data and timestamp for each data point. The timestamps on the X-axis are derived from the fsstatsparser, which automatically converts GMT to the local time zone in which fsstatsparser was executed. • Y-axis The Y-axis (vertical) provides the data values (for example, megabytes per second or latency in milliseconds). • Data Markers Each chart has data markers that allow you to mouse over the chart to see data point values.
Additional Information	• Y-axis details may show multiple values for the same number. This is due to the statistical value not being available as the object, as in the example where a LUN was deleted within the timeframe of the statistics collection period. • Some workbooks have an additional column at the right end and also an additional row at the bottom. The additional row and column provide the summary, minimum, and maximum values of the data set collected to aid in looking for I/O spikes within the data series. • In some instances, the `fsstatsparser` and `fsstatsformatter` tools cannot find all the components in the statistics bundle. When these instances are encountered, remove all the non-required files and directories where you executed `fsstatsdigest` and re-execute the command syntax.

Log File

Use the contents of the `fsstatsdigest.log` file to troubleshoot potential issues during processing.

Table 16: Contents of the fsstatsdigest.log file

Log File Section	Description
TAR Extraction	This section provides the results of tar extraction of the `*.stats.tar.gz` file.
Parser and Formatter	• This section provides the results of executing `fsstatsparser` which will combine the `*.dat` files from the `.tar` extraction to the `*.sps dbase` file. • This section provides the results of any errors executing `fsstatsformatter`. If there are no errors for `fsstatsformatter`, the execution was successful.
CSV Stat Sum	This section provides any errors pertaining to the statistics summary execution. The statistics summary is the combined statistics for the following components: • San_Lun_Ui • Raid_DriveGroup_Ui • Raid_Drive_Ui Included in this component is the XOR Summary data. Specific analysis of this information requires development interaction upon processing failure only. • San_Lun_General • Bs_None_Ui • Raid_Port_General
CSV Individual	This section provides the results of any errors encountered during the execution of individual statistics for the following components: • Dms_None_Ui • San_SanFc_Ui • San_SanFc_General • San_SanFc_Error • Dms_None_General
CSV-ID to FQN-NAME	This section provides the results to any issues encountered during translation of the ID to the fully qualified name.

Table 16: Contents of the fsstatsdigest.log file (continued)

Log File Section	Description
CSV to XLS	This section provides the results of creating the result XLSX files for the following components: • SAN/Lun/UI • Raid/DriveGroup/UI • SAN/Lun/General • BS/None/UI • DMS/None/UI • SAN/SANFC/UI • SAN/SANFC/General • SAN/SANFC/Error • DMS/None/General
Cleanup	This section provides any errors encountered when generating the report file or when moving data to the `./PillarStatisticsProcessedFiles` directory.

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