Quantum

User's Guide

StorNext Advanced Reporting
StorNext MDC

6-67352-02 Rev A

Quantum StorNext Advanced Reporting User's Guide, 6-67352-02 Rev A, October 2011, Product of USA.

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Preface

Quantum® StorNext™ Advanced Reporting provides performance data logging and visual reporting and graphing features for Quantum StorNext-Series systems.

This guide introduces StorNext Advanced Reporting and discusses the following topics:

- Installation
- Navigation
- Reports

Audience

This guide is written for StorNext MDC operators and system administrators.

Document Organization

This guide contains the following chapters:

- Chapter 1, StorNext Advanced Reporting Introduction provides an overview of the features of StorNext Advanced Reporting.
- Chapter 2, StorNext Advanced Reporting Installation provides step-by-step instructions for installing and running Advanced Reporting on a StorNext MDC.

- Chapter 3, StorNext Advanced Reporting Navigation describes how to access and work with the Web-based user interface of StorNext Advanced Reporting.
- Chapter 4, Advanced Reports describes how to view and interpret the available performance reports.
- Glossary provides definitions of technical terms used in this document.

Notational Conventions

This manual uses the following conventions:

Convention	Example
User input is shown in bold font.	**./DARTinstall**
Computer output and command line examples are shown in monospace font.	`./DARTinstall`
User input variables are enclosed in angle brackets.	**http://<ip_address>/reports/**

For UNIX and Linux commands, the command prompt is implied.	`./DARTinstall`
	`is the same as`
	`# ./DARTinstall`

File and directory names, menu commands, button names, and window names are shown in bold font.	**/data/upload**
Menu names separated by arrows indicate a sequence of menus to be navigated.	**Utilities > Software**

The following formats indicate important information:

Note: Note emphasizes important information related to the main topic.

Caution: Caution indicates potential hazards to equipment or data.

WARNING: Warning indicates potential hazards to personal safety.

Related Documents

The following Quantum documents are also available for StorNext Advanced Reporting and StorNext systems:

Document No.	Document Title	Document Description
6-67355	*Quantum StorNext Advanced Reporting Release Notes*	Describes late-breaking information about StorNext Advanced Reporting.
6-67370	*Quantum StorNext User's Guide*	Describes the StorNext operation and administration.

For the most up to date information on StorNext Advanced Reporting, see:

http://www.quantum.com/ServiceandSupport/Index.aspx

Contacts

Quantum company contacts are listed below.

Quantum Corporate Headquarters

To order documentation on StorNext Advanced Reporting or other products contact:

Quantum Corporation *(Corporate Headquarters)*
1650 Technology Drive, Suite 700
San Jose, CA 95110-1382

Technical Publications

To comment on existing documentation send e-mail to:

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Chapter 1

StorNext Advanced Reporting Introduction

This chapter introduces Quantum StorNext Advanced Reporting and contains the following sections:

About StorNext Advanced Reporting

Quantum StorNext Advanced Reporting is a visual reporting tool that is available for installation on all StorNext MDCs.

This tool combines comprehensive performance data logging with powerful visual reporting and analysis tools to help you identify potential problems and optimize system operation.

See the following sections for more information about StorNext Advanced Reporting:

Extension to StorNext Remote Management

StorNext Advanced Reporting is an extension to the StorNext GUI. With StorNext Advanced Reporting, you can view an array of performance statistics for a StorNext MDC and see how those statistics change over time. This lets you identify trends or determine when a problem began.

By showing you how various operations affect performance, StorNext Advanced Reporting also helps you optimize the network ecosystem and business procedures for data management policies, file system disk usage, and replication.

On Demand Reports

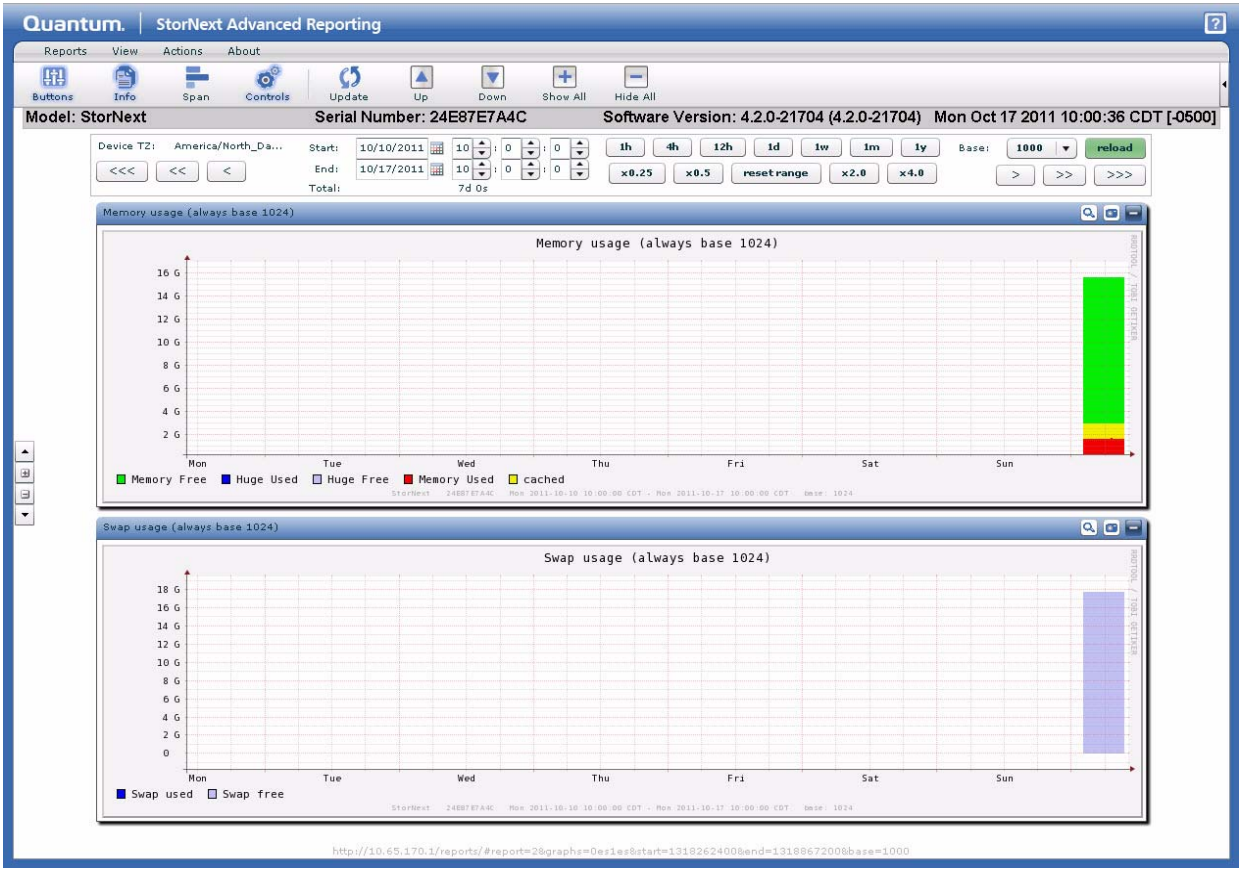
StorNext Advanced Reporting runs on the StorNext MDC and continually works in the background to log performance data. To view logged data, use StorNext Advanced Reporting's graphical reports. Reports are available on demand through a Web-based interface. You can check up-to-the-minute system status or view data for any time period since data logging began.

StorNext Advanced Reporting reports let you view and work with a wealth of performance and system statistics, such as Ethernet I/O, Fibre Channel I/O, CPU load, File System (FS), and Memory. Each report includes two or more graphs. Use the report tools to zoom in on a graph to see just the time period you want to see, or zoom out to see data for a longer time period.

No matter what time period you select, all of the graphs in the report stay in sync. In addition, StorNext Advanced Reporting maintains the current time period when you select a new report. This lets you compare performance data between graphs in the same report or between different reports. For example, you can see how CPU load is affected during deduplication or space reclamation activities.

Figure 1 shows an example of the **Memory** report.

Figure 1 StorNext Advanced Reporting Memory Report



Historical Data

StorNext Advanced Reporting maintains a maximum of six years of logged data, so you can view historical reports for previous time periods.

StorNext Advanced Reporting's historical record lets you compare current performance to past performance. It also lets you see the effect of any recent changes to system and network configuration or business processes.

Logging Database

StorNext Advanced Reporting records performance data in the logging database. The database resides on the StorNext MDC where StorNext Advanced Reporting is running.

See the following sections for more information about the logging database:

- Round Robin Database
- Database Resolution
- Performance Impact

Round Robin Database

The StorNext Advanced Reporting logging database is a round robin style database with a small, fixed size. The database never grows larger than the fixed size. As new logging data is added to the database, older data is overwritten as necessary, thereby maintaining the fixed size. As a result, the logging database has a negligible impact on storage capacity on the StorNext MDC.

Database Resolution

The logging database records performance data at two second intervals. StorNext Advanced Reporting aggregates this data over time to maintain different resolutions for different time periods. The database resolution is finer (more granular) for recent events and becomes coarser (less granular) as you go back in time.

Table 1 lists the database resolutions that are maintained in the logging database for each time period.

Table 1 Logging Database Resolution

Database Resolution	Maintained For
2 seconds	Data up to 7 days old
60 seconds	Data older than 7 days

Performance Impact

StorNext Advanced Reporting logging has a negligible impact on the operation and performance of a StorNext MDC.

- Most data is captured once every two seconds with a typical loop time of only 2ms per capture.
- Total disk capacity used is limited to 2GB for the logging database.
- Disk contention is rare, and if it occurs StorNext Advanced Reporting logging has lower priority compared to system needs.

Chapter 2

StorNext Advanced Reporting Installation

This chapter describes how to install Advanced Reporting on a StorNext MDC and contains the following sections:

Setting the Date and Time

Because data in the StorNext Advanced Reporting database is time sensitive, it is important that the date and time are correctly set on the StorNext MDC before using StorNext Advanced Reporting.

Caution: When changing the date and time on a StorNext MDC, make sure not to change to a date in the future. For example, if the current date is July 30, 2011 and you accidentally change the date on the StorNext MDC to July 30, 2012 (a year ahead), and then change the date back to the correct date of July 30, 2011, the StorNext MDC will not collect Advanced Reporting logging data until July 30, 2012, even though you restored the correct date. This means that you would not be able to use StorNext Advanced Reporting until July 31, 2012.

If the date and time are not correct on the StorNext MDC, it will be difficult to associate StorNext Advanced Reporting data with events in the customer's ecosystem.

To make sure the time and date are always correct, configure the StorNext MDC to use a Network Time Protocol (NTP) server. For help with this task, see the *StorNext User's Guide*.

Obtaining StorNext Advanced Reporting

StorNext Advanced Reporting is available for download and installation on all StorNext MDCs. For more information, see the following section, Downloading StorNext Advanced Reporting.

Downloading StorNext Advanced Reporting

To obtain StorNext Advanced Reporting, download the StorNext Advanced Reporting software from the Quantum Service and Support site:

http://www.quantum.com/ServiceandSupport/Index.aspx

Following is a list of the file names for the available installation programs:

- `RHEL-5-DART-<version and build number>-bundle-64bit.bin`
- `RHEL-6-DART-<version and build number>-bundle-64bit.bin`
- `SuSE-10-DART-<version and build number>-bundle-64bit.bin`
- `SuSE-11-DART-<version and build number>-bundle-64bit.bin`

Installing or Upgrading StorNext Advanced Reporting

This section describes how to install or upgrade StorNext Advanced Reporting on a StorNext MDC.

Caution: Before you begin, *Apache* must be installed prior to the StorNext Advanced Reporting installation or upgrade, and **mod_ssl**, if installed, so that it does not conflict with port 443. If *Apache* is not installed or does not work properly, the installation will fail.

To install Apache on RedHat, run `yum install httpd`

To install Apache on SuSE, run `yast2 -i apache2`

Required Packages

The following packages are required for StorNext Advanced Reporting. If they are not already installed, a version of the package is installed by the StorNext Advanced Reporting installation process. You may choose to install these packages from your OS vendor CD or by download.

For RedHat 5:

- dejavu-lgc-fonts
- libart_lgpl
- perl-Filesys-Df
- perl-HTML-Parser
- perl-HTML-Tagset
- perl-libwww-perl
- perl-Time-HiRes
- perl-URI
- perl-XML-Parser
- perl-XML-Simple

For RedHat 6:

- dejavu-lgc-fonts
- libart_lgpl

For RedHat 6 (continued):

- perl-CGI
- perl-Filesys-Df
- perl-HTML-Parser
- perl-HTML-Tagset
- perl-libwww-perl
- perl-Time-HiRes
- perl-URI
- perl-XML-Parser
- perl-XML-Simple

For SLES 10:

- dejavu-lgc-fonts
- libart_lgpl
- libpng12
- perl-Filesys-Df
- perl-HTML-Parser
- perl-HTML-Tagset
- perl-libwww-perl
- perl-Time-HiRes
- perl-URI
- perl-XML-Parser
- perl-XML-Simple

For SLES 11:

- dejavu
- dejavu-lgc-fonts
- libart_lgpl
- perl-Filesys-Df
- perl-HTML-Tagset
- perl-libwww-perl
- perl-Time-HiRes
- perl-URI
- perl-XML-Parser
- perl-XML-Simple

Note: If the packages are not installed, the StorNext Advanced Reporting installer will install a compatible open source version during the installation. Before the packages are installed, the StorNext Advanced Reporting end user license agreement (EULA) displays.

Beginning the Installation

Follow these steps to install StorNext Advanced Reporting:

Note: On HA systems the following steps must be performed on BOTH the primary and secondary nodes.

1. If you have not already done so, download to the directory of your choice the StorNext Advanced Reporting installer as described in Downloading StorNext Advanced Reporting on page 8.
2. Log in via ssh as root, using your system password.
3. `chmod 755` the downloaded file.
4. `rm -rf` the `/tmp/stornext` directory.

   Note: The `/tmp/stornext` directory must be empty when you extract the files to install. If the directory is not empty, extraction will fail with an error message.

5. Execute the installation file.
6. When the StorNext End User License Agreement (EULA) appears, read and accept the agreement. (You can display the next and subsequent pages by pressing the space bar.)
7. `cd /tmp/stornext` and cd to the subdirectory created.
8. Execute the command `./install`.

   During installation you will see a series of messages. Look for the following message which indicates that the software was correctly installed:

   0: loggerd -u (running [loggerd process number])
9. To monitor a particular system using StorNext Advanced Reporting, enter the IP address of that system in the following format: **http://<ip_address>/reports/#**

Note: You must include the pound sign (#) on StorNext MDC servers.

On DXi systems, be sure to include the forward slash (/) at the far right.

Chapter 3

StorNext Advanced Reporting Navigation

This chapter describes how to navigate in StorNext Advanced Reporting and contains the following sections:

Accessing StorNext Advanced Reporting

To access StorNext Advanced Reporting, you must use a Web browser on a workstation that is on the same network as the StorNext MDC for which you want to view reports.

See the following sections for more information about accessing StorNext Advanced Reporting:

Supported Web Browsers

StorNext Advanced Reporting is designed to run in any modern Web browser that supports the Adobe Flash Player plug-in version 10.x and higher. Web browser software is not included with StorNext Advanced Reporting. You must obtain and install it separately.

You must also install the correct version of the Adobe Flash Player plug-in for your operating system and browser. StorNext Advanced Reporting requires Adobe Flash Player version 10.x or higher. To download and install Flash Player, go to: http://www.adobe.com

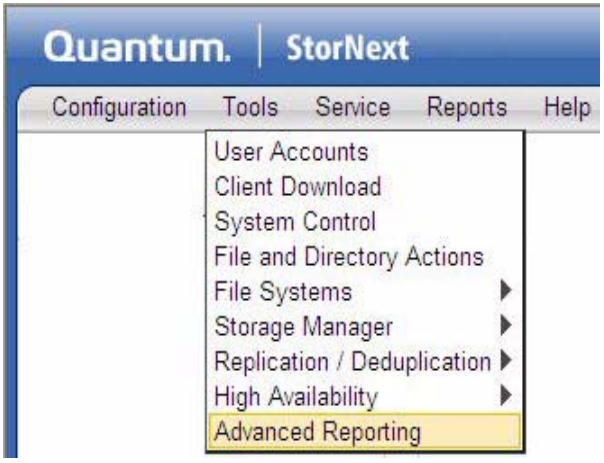
Caution: StorNext Advanced Reporting does not support the 64-bit version of the Flash Player plug-in on Linux. Instead, use the 32-bit Flash Player plug-in and a 32-bit browser.

Accessing the StorNext Advanced Reporting User Interface

Follow these steps to access the StorNext Advanced Reporting user interface:

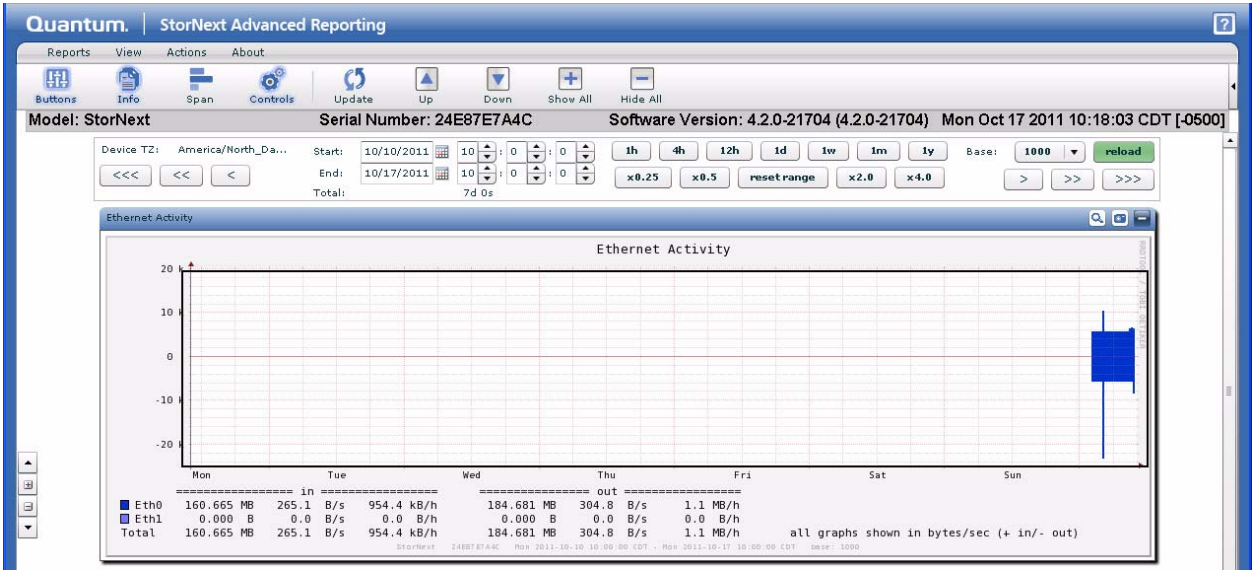
1. Log on to the StorNext MDC.
2. From the StorNext MDC GUI, click the **Tools** menu, and then select **Advanced Reporting** (see Figure 2).

Figure 2 Accessing StorNext Advanced Reporting



The StorNext Advanced Reporting user interface displays. The user interface is also referred to as the report window (see Figure 3).

Figure 3 StorNext Advanced Reporting User Interface



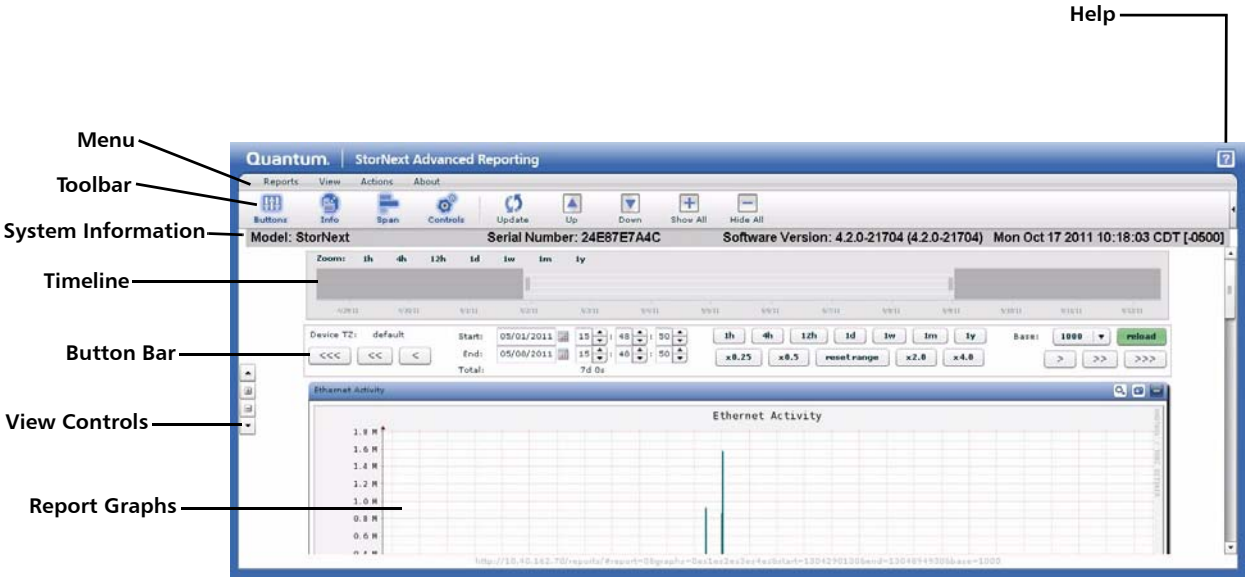
Using the Report Window

The report window displays the performance graphs for the currently selected report (see Figure 4). When you first access StorNext Advanced Reporting, the **Ethernet I/O** report displays.

The report window includes the following features:

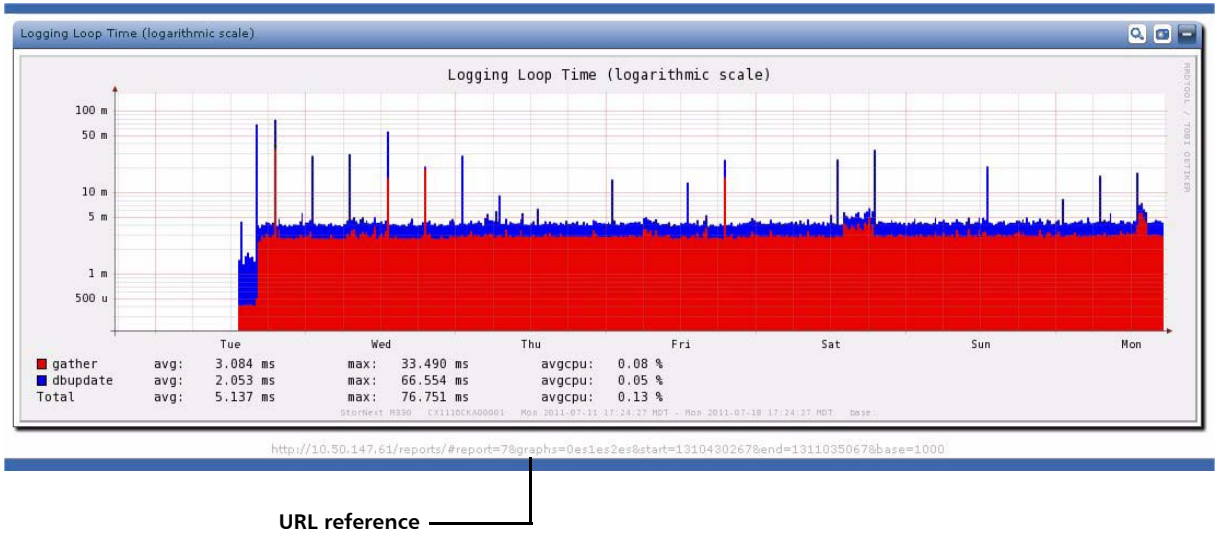
- StorNext Advanced Reporting Menus
- Toolbar
- View Controls
- Graphs

Figure 4 Report Window



Note that at the bottom of every report window is a link that provides a URL reference to the current report (see Figure 5). The URL can be copied and sent to a third party, such as a coworker, and then viewed in a different browser.

Figure 5 URL Reference



StorNext Advanced Reporting Menus

The following menu options display at the top of the StorNext Advanced Reporting window:

- **Reports** – Use the **Reports** menu to select a report to display (see Figure 6).

Figure 6 Reports Menu

StorNext Advanced Reporting maintains the currently selected time range when you choose a new report. For example, if you are currently viewing the most recent day of logging for the Overview report, StorNext Advanced Reporting displays data for that same time range when you select a new report. This makes it easy to compare different performance statistics for the same time range.

Note: For more information about time ranges, see Working With Time Ranges on page 21. For a description of the available reports, see Advanced Reports on page 35.

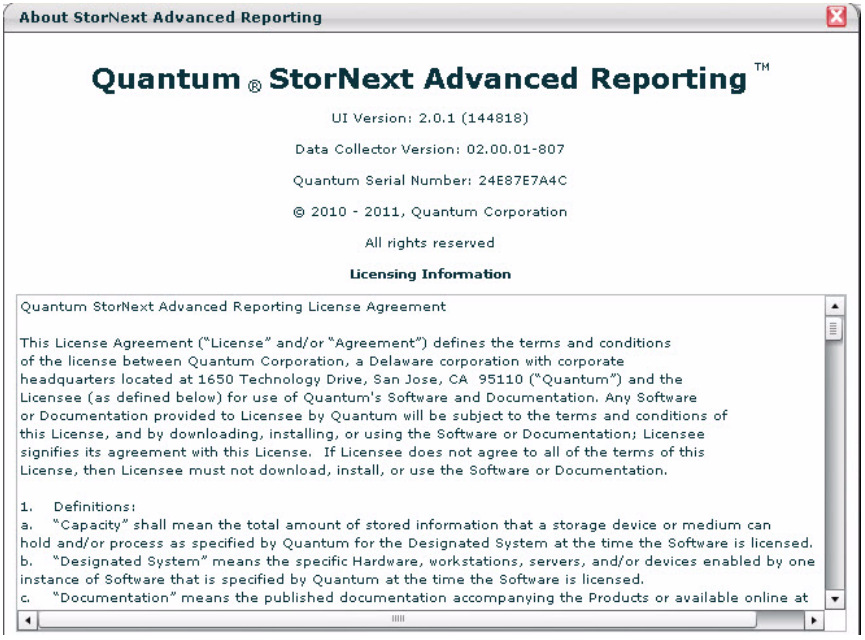
- **View** – Use the **View** menu to show or hide the button bar (**Buttons**), system information (**Info**), the timeline (**Span**), the toolbar (**Toolbar**), or the view controls (**View Controls**).

  By default, all of these items are enabled except for **Span**.

- **Actions** – Use the **Actions** menu to perform graph actions.
  - **Update** - Updates the graphs in the currently displayed report with the latest logging information.
  - **Scroll Up** - Scrolls the graph order up by one graph.
  - **Scroll Down** - Scrolls the graph order down by one graph.
  - **Show All Legends** - Shows the title and legend on all graphs in the report.
  - **Hide All Legends** - Hides the title and legend on all graphs in the report.

- **About** – Use the **About** menu to display version and license information for StorNext Advanced Reporting (see Figure 7).

Figure 7 About Menu



Toolbar

The toolbar displays below the menu and includes the following options:

- **Buttons** - Shows hides the button bar. (By default, the button bar is hidden.)
- **Info** - Shows or hides the system information. (By default, the system information is visible.)

  The system information includes the StorNext model, serial number, software version, and the current date, time, and time zone.
- **Span** - Shows or hides the timeline. (By default, the timeline is not visible.)
- **Controls** - Shows or hides the view controls. (By default, the view controls are visible.)

- **Update** - Updates the graphs in the currently displayed report with the latest logging information.
- **Up** - Scrolls the graph order up by one graph.
- **Down** - Scrolls the graph order down by one graph.
- **Show All** - Shows the title and legend on all graphs in the report.
- **Hide All** - Hides the title and legend on all graphs in the report.
- **User Menu** - Displays the user that is currently logged on to StorNext Advanced Reporting.

Note: To hide the toolbar, click the arrow on the right edge of the toolbar. Click the arrow again to show the toolbar.

View Controls

The view controls display on the left edge of the report window and include the following options:

- **Scroll Up** - Scrolls the graph order up by one graph.
- **Show All Legends** - Shows the title and legend on all graphs in the report.
- **Hide All Legends** - Hides the title and legend on all graphs in the report.
- **Scroll Down** - Scrolls the graph order down by one graph.

Graphs

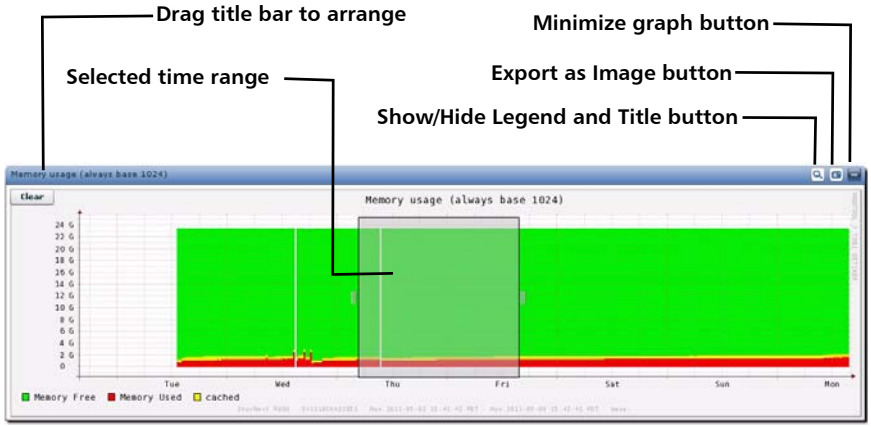
Each report is made up of one or more graphs that show performance data for the selected time range (see Figure 8). Customize the appearance of a report by arranging the graphs in a different order.

- To change the order of the graphs, drag a graph by its title bar and move it before or after another graph.
- To minimize a graph, click the **Minimize** (–) graph button on the right side of the graph title bar. To restore the graph to full size, click the minimized title bar, located towards the bottom of the window.
- To export a screen capture (.JPG or .PNG image) of the graph, click the **Export as Image** button on the right side of the graph title bar, located next to the **Minimize** button.

- To display or hide the graph title and legend, click the **Show/Hide Legend and Title** button (magnifying glass) on the right side of the graph title bar.

Note: If you log off of StorNext Advanced Reporting, the graphs are restored to their default appearance the next time you log on.

Figure 8 Arranging Graphs



Working With Time Ranges

A time range is like a window through which you view performance data. Each report displays performance data for the time range you choose. All graphs in a report display data for the same time range.

By default, StorNext Advanced Reporting displays data for the most recent seven days of logging. To view logged data for a different time range, use the tools at the top of the report window. You can move the time range backward and forward in time, and you can make the time range longer or shorter.

When you change the time range, StorNext Advanced Reporting automatically adjusts the resolution of performance data. For example, the resolution is finer (more granular) for shorter time ranges and is coarser (less granular) for longer time ranges.

Note: No matter how long the time range is, StorNext Advanced Reporting scales all graphs in the report so that the time range uses the entire width of each graph.

Changing the Time Range

To view performance data for a different time range, use one of the following methods:

- Using the Timeline
- Selecting a Preset Time Range
- Moving Forward and Backward
- Zooming With the Dynamic Zoom Feature
- Zooming With the Preset Zoom Buttons
- Specifying Start and End Times
- Resetting the Time Range

Note: The button bar displays the starting date and time and the ending date and time of the current time range, as well as the total length of the time range. It also displays the time zone of the StorNext. If the button bar is not visible, select **View > Buttons**.

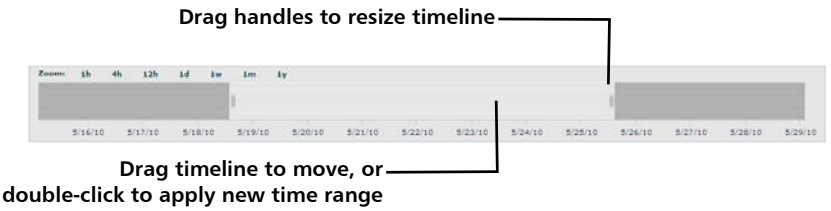
Using the Timeline

To move the time range forward or backward in time, use the timeline at the top of the report window (see Figure 9). The timeline displays the current time range used for the report.

Note: If the timeline is not visible, select **View** > **Span**.

- To move the time range backward or forward in time, drag the timeline to the left or right. Then double-click the timeline to apply the new time range to the report.
- To make the time range longer or shorter, drag the left and right selection handles. Then double-click the timeline to apply the new time range to the report.

Figure 9 Using the Timeline



Selecting a Preset Time Range

To quickly display performance data for a different time range, use the time range presets on the timeline (see Figure 10). Click a preset to display data for 1 hour (**1h**), 4 hours (**4h**), 12 hours (**12h**), 1 day (**1d**), 1 week (**1w**), 1 month (**1m**), or 1 year (**1y**). After you click a preset, double-click the timeline to apply the new time range to the report.

Note: If the timeline is not visible, select **View > Span**.

When you apply a preset, StorNext Advanced Reporting resizes the time range while maintaining the center of the time range. For example, if you are currently viewing a one week time range that goes from Sunday to Saturday, applying the **1d** preset displays performance data for Wednesday.

Note: You can also use the button bar to apply time range presets. If the button bar is not visible, select **View > Buttons**.

Figure 10 Selecting a Preset Time Range

Moving Forward and Backward

Move the time range forward or backward in time using the navigation buttons on the left or right of the button bar (see Figure 11). StorNext Advanced Reporting shifts the time range while maintaining the length of the time range.

Note: If the button bar is not visible, select **View > Buttons**.

Table 2 describes the functions of the navigation buttons.

Figure 11 Using the Navigation Buttons

Table 2 Navigation Button Functions

Button	Description
<<< or >>>	Moves the time range back or forward an amount equal to the current time range.
<< or >>	Moves the time range back or forward an amount equal to one half of the current time range.
< or >	Moves the time range back or forward an amount equal to one quarter of the current time range.

Zooming With the Dynamic Zoom Feature

Use the dynamic zoom feature to select the part of a graph you want to zoom in on and see in more detail (see Figure 12).

To zoom in on part of a graph:

1. Click and drag over the part of the graph you want to zoom in on.

   StorNext Advanced Reporting highlights the selected part of the graph.

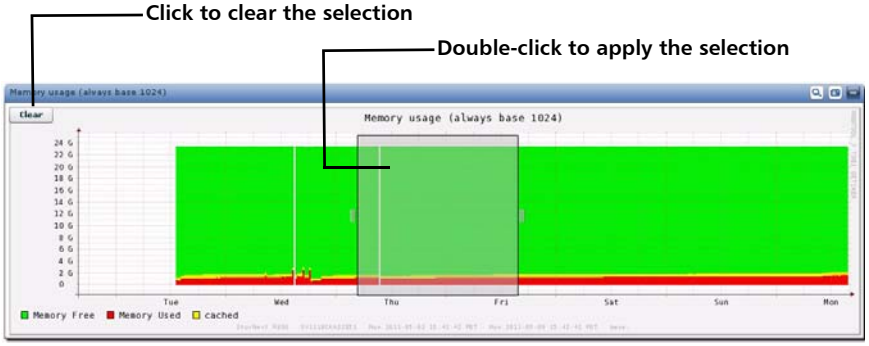
2. (Optional) Drag the left and right selection handles to adjust the size of the selection, or drag the selection area to move it.

3. Double-click the selection area.

   StorNext Advanced Reporting zooms in on the time range so that the selected area takes up the entire width of the graph.

   To cancel the action and start over, click **Clear** on the upper left of the graph.

Figure 12 Click and Drag to Zoom

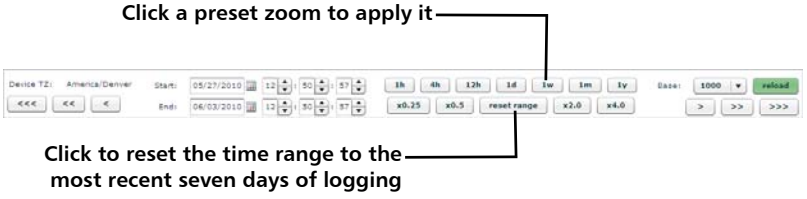


Zooming With the Preset Zoom Buttons

Use the preset zoom buttons on the button bar to zoom in or zoom out on a report by a fixed factor (see Figure 13). Click a preset zoom button to specify a zoom factor of **x0.25**, **x0.5**, **x2.0**, or **x4.0**. When you zoom in, StorNext Advanced Reporting displays a shorter time range. When you zoom out, StorNext Advanced Reporting displays a longer time range. StorNext Advanced Reporting maintains the current center of the time range when you zoom.

Note: If the button bar is not visible, select **View > Buttons**.

Figure 13 Using the Preset Zoom Buttons



Specifying Start and End Times

The **Start** and **End** boxes on the button bar display the starting date and time and the ending date and time for the current time range.

To change the time range using exact values, specify a new date and time in the **Start** and **End** boxes, and then click **reload**. StorNext

Advanced Reporting adjusts the time range to reflect the start and end times you entered.

Note: Specify the starting or ending time in hours, minutes, and seconds using a twenty four hour clock.

Note: If the button bar is not visible, select **View > Buttons**.

Resetting the Time Range

To reset the time range back to its original position, click **reset range** on the button bar (see Figure 13). StorNext Advanced Reporting adjusts the time range to display the most recent seven day of logging.

Note: If the button bar is not visible, select **View > Buttons**.

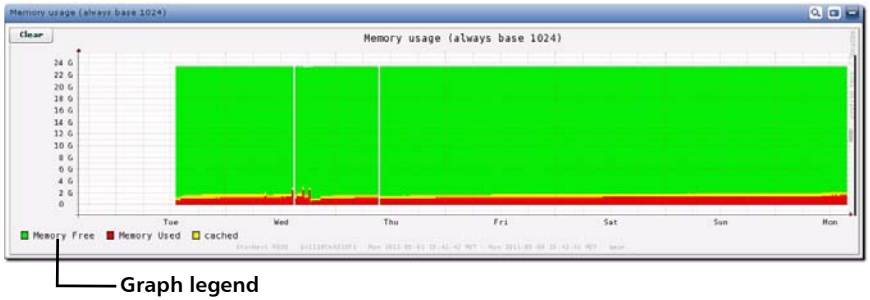
Working With Graphs

In StorNext Advanced Reporting, each report is made up of one or more graphs. Each graph shows a particular type of performance data for the current time range. For example, the **Self** report includes the following graphs: **CPU Load Average**, **CPU Stats in %**, and **Logging Loop Time**.

The horizontal axis of each graph represents time and displays the current time range. The vertical axis varies depending on the graph. It is often a capacity or data amount, but can also be a calculated value such as a ratio, average, or percentage.

Below each graph is a color-coded legend. Use the legend to help read and interpret the graph. For example, according to the legend for the **Memory Usage** graph, bright green represents free memory, red represents used memory, and yellow represents cached memory on the StorNext MDC (see Figure 14).

Figure 14 The Graph Legend



See the following sections for more information about graphs:

- Selecting the Base
- Gaps in Graphs
- Stacked and Layered Graphs
- The Zero Line

Selecting the Base

Different StorNext models report data usage in different ways.

- Data can be reported using a base of 1000 bytes per kilobyte, or in TB. (Similar to disk and tape drives.)
- Data can be reported at 1024 bytes per kilobyte, or in TiB. (Similar to most backup applications.)

This difference results in a disparity of over 10% in reported data sizes at the terabyte level. For example, 27.3TiB reported at base 1024 becomes 30.0TB when reported at base 1000. Backup applications typically report summaries in units of 1024. Tape drives, tape cartridges, and disk drives report capacities in units of 1000.

StorNext Advanced Reporting is flexible and allows you to select whichever base quantity you want. To display data using a different base, select it in the **Base** list on the button bar (see Figure 15). StorNext Advanced Reporting adjusts all report data to reflect the selected base.

Note: If the button bar is not visible, select **View > Buttons**.

Figure 15 Selecting a Base

Gaps in Graphs

A white gap in a graph indicates an absence of logging data for a period of time. This can occur for the following reasons:

- A system reboot occurred.
- No StorNext Advanced Reporting logging took place because the system was busy.
- StorNext Advanced Reporting logging was turned off.

Stacked and Layered Graphs

StorNext Advanced Reporting often displays data for multiple variables on the same graph. This lets you see the interaction between different variables.

StorNext Advanced Reporting uses two different methods for placing multiple variables on the same graph:

- Layered Graphs
- Stacked Graphs

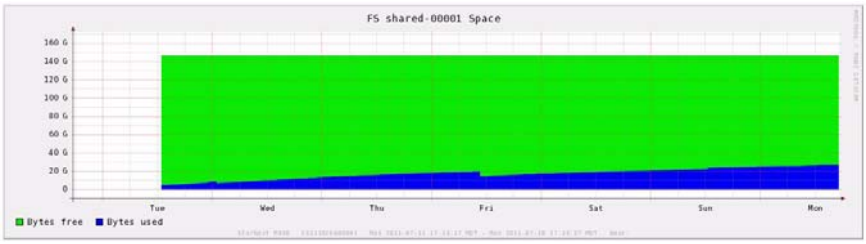
Layered Graphs

StorNext Advanced Reporting uses layered graphs to compare related variables. A layered graph superimposes data for two or more variables on top of one another. StorNext Advanced Reporting assigns a different color to each variable, so you can see how the values for each variable differ over time.

For example, in the **FS Space** graph, StorNext Advanced Reporting displays a separate value line for the variables Bytes used and Bytes free.

Note: StorNext Advanced Reporting always displays the smaller variable in front of the larger variable. Because of this, shifts in the color pattern in a graph can occur if the variable that was smaller becomes larger at some point in time.

Figure 16 Layered Graph

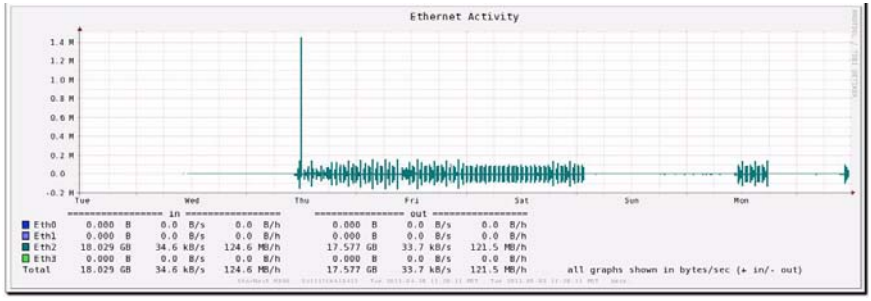


Stacked Graphs

StorNext Advanced Reporting uses stacked graphs to display aggregate performance. A stacked graph adds together values for two or more variables to arrive at a total value. StorNext Advanced Reporting assigns a different color to each variable, so you can see the contribution that each variable makes to the total.

For example, in the **Ethernet Activity** graph, values for each Ethernet port are added together to reach a total value for each point in the time range.

Figure 17 Stacked Graph



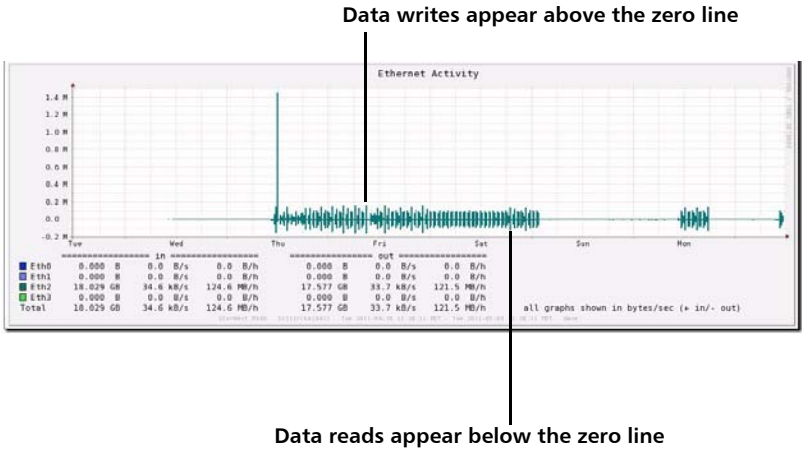
The Zero Line

StorNext Advanced Reporting uses graphs with a zero line to show when the StorNext MDC is being written to or being read from.

- Positive values (above the line) represent data being written to the StorNext MDC.
- Negative values (below the line) represent data being read from the StorNext MDC.

By using a zero line, StorNext Advanced Reporting can show data reads and writes on the same graph, for example, on the **Ethernet Activity** graph (see Figure 18).

Figure 18 Graph With a Zero Line



Interpreting Performance Data

The power of StorNext Advanced Reporting is that it lets you compare different types of performance data for the same time range. This lets you see patterns and trends and helps you identify relationships between events.

Keep in mind the following general concepts as you work with graphs in StorNext Advanced Reporting:

- Correlating Information Across Graphs
- Looking For Interactions Between Events
- Understanding the Effects of Time Resolution

Correlating Information Across Graphs

When you view a report, try to correlate information in one graph with information in the other graphs.

Remember that all graphs in a report display the same time range and always remain in sync. That means an event that happens in the center of one graph can be correlated with an event that happens in the center of another graph in the same (or in a different) report.

In other words, if you can draw a straight vertical line between events in two graphs, then the events happened at the same time.

Looking For Interactions Between Events

As you work in StorNext Advanced Reporting, look for interactions between events in different graphs.

While correlation is not the same as causation, if you consistently see that events in one graph happen at the same time as events in another graph, there is a strong possibility that the two types of events are related.

Understanding the Effects of Time Resolution

StorNext Advanced Reporting displays graphs with 960 data points (pixels) along the horizontal axis. However, the logging database usually contains more than 960 data points for the currently selected time range (depending on the length of the time range).

StorNext Advanced Reporting uses aggregation to convert the resolution of the database to the resolution of the graph. This means that, in many cases, each pixel in the graph is an aggregate of multiple data points in the database. Depending on how many data points are aggregated to create each pixel in the graph, the resulting value can change.

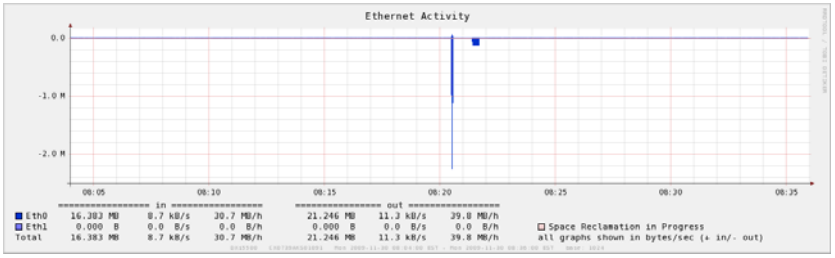
For example, consider a transfer on the **Ethernet Activity** graph that lasts for 6 seconds. First it is displayed in a 32 minute time range, and then in a 128 minute time range (see Figure 19).

- In the first example, the graph shows the transfer within a time range of 32 minutes or 1,920 seconds. In this case, each pixel in the graph represents 2 seconds of time. As a result, the transfer takes

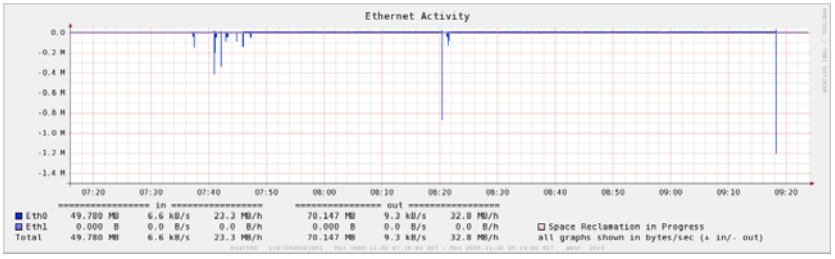
up 3 pixels in the graph and displays a peak amplitude of 2.1MB/second.

- In the second example, the graph shows the transfer within a time range of 128 minutes, or 7,680 seconds. In this case, each pixel in the graph represents 8 seconds of time. Even though the transfer is only 6 seconds long, it cannot take up less than 1 pixel in the graph. As a result, the transfer amount is averaged over 8 seconds, resulting in a lower peak amplitude of 0.9MB/second.

Figure 19 Amplitude Changes With Resolution



32 Minute time range: Peak amplitude is 2.1MB/second



128 Minute rime range: Peak amplitude is 0.9MB/second

The only difference between the two examples is the time resolution. The underlying data did not change. The difference in amplitude is due to the different number of data points StorNext Advanced Reporting aggregates when calculating the value for each pixel in the graph. Be aware of this effect as you work with graphs and time ranges in StorNext Advanced Reporting.

Note: StorNext Advanced Reporting always uses the finest resolution of data available in the database. Finer-grained data is available for more recent time ranges as opposed to time ranges further in the past. This affects the number of data points StorNext Advanced Reporting aggregates when displaying a graph, and in turn can affect amplitude.

Chapter 4

Advanced Reports

This chapter provides information to help you interpret the reports available in StorNext Advanced Reporting and contains the following sections:

Reports and Graphs

To access the StorNext Advanced Reporting reports, click the **Reports** menu on the StorNext Advanced Reporting user interface (see Figure 20).

Figure 20 Reports Menu

Each report available in StorNext Advanced Reporting is made up of two or more graphs. Some graphs appear in more than one report. Table 3 lists the graphs included in each report. For information about interpreting each report, see Report Descriptions on page 37. For information about viewing reports, see Using the Report Window on page 15.

In Table 3, reports are designated as (L) for layered graphs or (S) for stacked graphs. This distinction does not apply to graphs that report only a single variable.

Table 3 StorNext Advanced Reporting Reports and Graphs

Report	Graphs
Ethernet I/O Report	• Ethernet Activity (S) • eth*n* Activity
CPU load Report	• CPU Load Average • CPU stats in % (S)
Memory Report	Memory usage (always base 1024) (S) Swap usage (always base 1024) (S)

Report	Graphs
FS Reports	• Space (S) • inodes (S) • Connections (L) • CPU usage in % (L) • Size (L)
Self Report	• CPU Load Average • CPU stats in % (S) • Logging Loop Time (S)

Report Descriptions

This section describes the graphs included in the following reports available in StorNext Advanced Reporting:

- Ethernet I/O Report on page 37
- CPU load Report on page 39
- Memory Report on page 41
- FS Reports on page 43
- Self Report on page 47

Ethernet I/O Report

The **Ethernet I/O** report displays detailed information about the amount of data passing through the Ethernet ports in the system. The report contains the following graphs:

- Ethernet Activity
- ethn Activity

View the Ethernet I/O report when you need to monitor writes to and reads from the system using the Ethernet ports. For example, if you have replication configured on the system, you should view this report daily to make sure you see replication traffic occurring at the correct times.

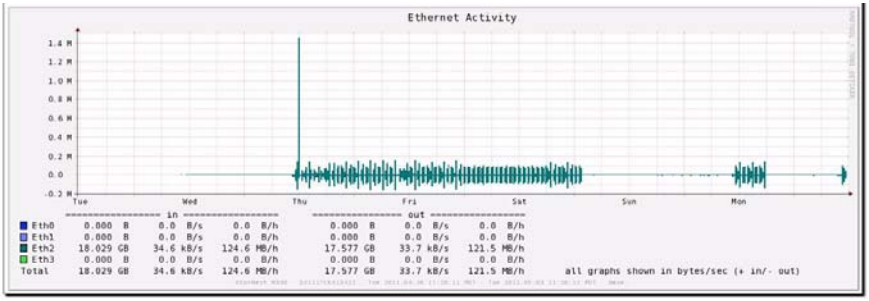
If you don't have replication configured, you will see minor heartbeat and web management traffic and then occasional spikes for metadata requests, allocations, and deletes.

To access the **Ethernet I/O** report, select **Reports > Ethernet I/O**.

Ethernet Activity

The **Ethernet Activity** graph (see Figure 21) displays the amount of data passing through all of the Ethernet ports in the system.

Figure 21 Ethernet Activity Graph



Use the **Ethernet Activity** graph to monitor writes to and reads from the system using the Ethernet ports.

- The graph shows each port in a different color.

  In the example above, the symmetry between the four ports indicate the Ethernet ports are bonded (not segmented) and traffic is balanced across the ports.

- Write activity (above the zero line) indicates target replication to the system (if configured), web management activity, heartbeat traffic, and metadata traffic.

- Read activity (below the zero line) indicates source replication from the system (if configured), web management activity, heartbeat traffic, or metadata traffic.

eth*n* Activity

The **ethn Activity** graph (see Figure 22) displays the amount of data passing through Ethernet port *n*. A graph appears for each Ethernet port in the system, for example, eth0, eth1, eth2, and eth3.

Figure 22 eth*n* Activity Graph

Use the **ethn Activity** graph to monitor writes to and reads from the system using Ethernet port *n*.

- Write activity (above the zero line) indicates target replication to the system (if configured), web management activity, heartbeat traffic, and metadata traffic.
- Read activity (below the zero line) indicates source replication from the system (if configured), web management activity, heartbeat traffic, or metadata traffic.

CPU load Report

The **CPU Load** report displays information about the usage of CPU resources in the system. The report contains the following graphs:

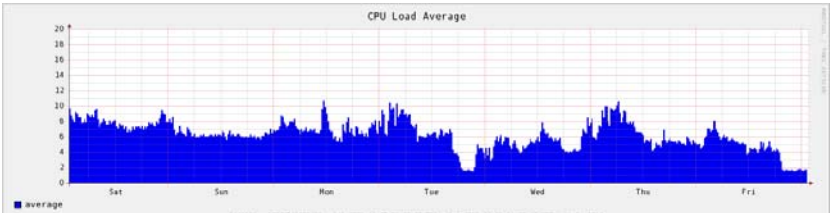
- CPU Load Average
- CPU stats in %

To access the **CPU load** report, select **Reports > CPU load**.

CPU Load Average

The **CPU Load Average** graph (see Figure 23) displays the one minute load average for the system.

Figure 23 CPU Load Average Graph



Use the **CPU Load Average** graph to determine if the system has adequate CPU resources.

- The load average represents the average number of processes, in a one minute time period, that were running on a CPU or that were waiting to run on a CPU.
- A load average higher than the number of CPU cores in the system indicates that the system is CPU limited.

  For example, a typical StorNext MDC has four CPUs. In this case, a load average of greater than four means that some processes had to wait for an available CPU before running. In contrast, a load average of less than four means no processes had to wait for a CPU.

CPU stats in %

The **CPU stats in %** graph (see Figure 24) displays the relative CPU usage for seven categories of processes (see Table 4).

Figure 24 CPU stats in % Graph

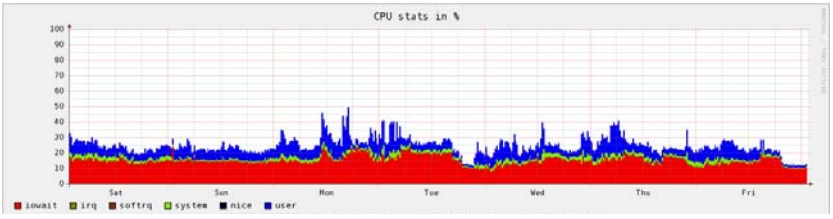


Table 4 Categories of Processes in the CPU stats in % Graph

Process Category	Description
iowait (red)	The CPU is waiting for an I/O device to respond (for example, the system is waiting on a disk).
irq (gold)	The CPU is handling an interrupt request related to I/O (for example, network, Fibre Channel, disk, keyboard, or serial port activity).
softirq (brown)	The CPU is handling a high level I/O task (for example, timer interrupts or packets in the TCP/IP stack).

Process Category	Description
system (green)	The CPU is handling a kernel process (for example, filesystem operations related to the StorNext or blocklet filesystems).
nice (black)	The CPU is handling processes that have lower priority (for example, background processes).
user (blue)	The CPU is handling processes that are not owned by the kernel (for example, deduplication as well as some space management and replication activities).
idle (not shown)	The CPU is not handling one of the other process categories.

Use the **CPU stats in %** graph to see how CPU resources are allocated among different categories of processes. The amount of CPU activity consumed by each category of process is expressed as a percentage. The percentages (including the value for **idle**, which is not shown in the graph) total to 100%.

If a system has a high CPU load average (see CPU Load Average on page 39), then consider the following guidelines:

- A high percentage of **system** (green) and **user** (blue) activity indicates the system is CPU limited. Add more CPUs to improve system performance.
- A high percentage of **iowait** (red) activity indicates the system is I/O limited. Add more disks or arrays to improve system performance.

Memory Report

The **Memory** report displays information about StorNext MDC memory usage. You can view this report to make sure the cache settings are configured to maximize system performance.

The report contains the following graphs:

- Memory usage
- Swap usage

Note: In the following examples, some of the data in the **Memory** graphs may not be accurate.

To access the **Memory** report, select **Reports > Memory**.

Memory usage

The **Memory usage** graph (see Figure 25) monitors the amount of physical memory (RAM) used during system operation.

Note: For newly configured systems, you will see mostly free memory (light green). As the system increases the number of file systems and clients, monitor this graph often to make sure that there is as little free memory available as possible. This means the cache settings are configured to maximize performance.

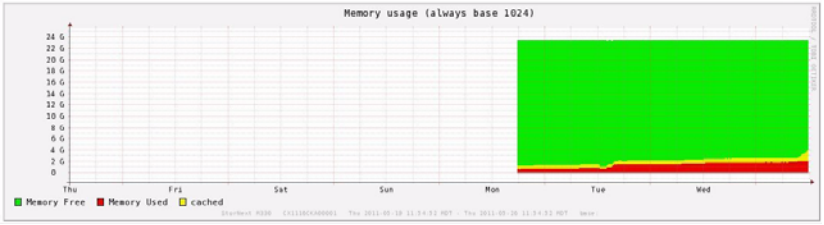


Figure 25 Memory usage Graph

In the **Memory usage** graph:

- Values are in GB. The graph always displays values in base 1024, no matter what base is selected in the **Base** list (see Selecting the Base on page 27).
- For standard memory (4 KB) pages, the graph displays the amount of memory that is free (green) and used (red). The graph also displays the amount of memory used for caching (yellow). Memory

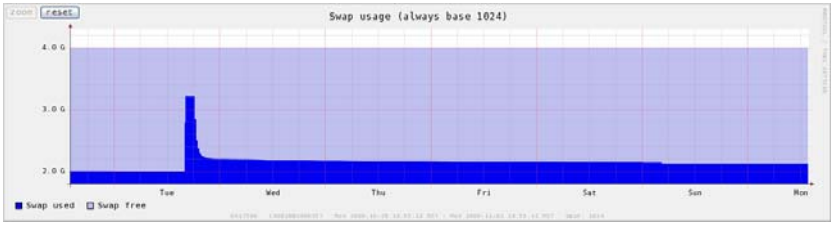
used for caching can be easily freed up, therefore it usually can be treated as available even though it is not free.

- For huge memory (2 MB) pages, the graph displays the amount of memory that is free (light blue) and used (dark blue).

Swap usage

The **Swap usage** graph (see Figure 26) monitors the amount of virtual memory used during system operation.

Figure 26 Swap usage Graph



In the **Swap usage** graph:

- Values are in GB. The graph always displays values in base 1024, no matter what base is selected in the **Base** list (see Selecting the Base on page 27).
- The graph displays the amount of the disk swap file that is free (light blue) and used (dark blue).

FS Reports

The File System (FS) reports provide file system statistics pertaining to the primary and secondary system nodes. Statistics on the primary and secondary nodes are monitored independently and they differ since the passive node doesn't run the FS processes for the user file systems and the one process (FS1) that runs on both nodes has a larger footprint on the active node.

Each FS report shows a single file system server process running on the StorNext System Node. The StorNext MDC can have up to four of these processes running. These processes will have unique FS names.

Note: The FS names depend on the names that users give their file systems. The name would follow the *FS_file system* name convention. For example, if the StorNext MDC has two configured file systems named *filesystem1* and *filesystem2*, two reports will display from the Reports menu named *FS_filesystem1* and *FS_filesystem2*. StorNext Advanced Reporting displays reports for up to 10 file systems.

The FS reports display detailed statistics about the configured file systems in the StorNext MDC. Each FS report contains the following five graphs:

- FS Space
- FS inodes
- FS Connections
- FS CPU usage in %
- FS Size

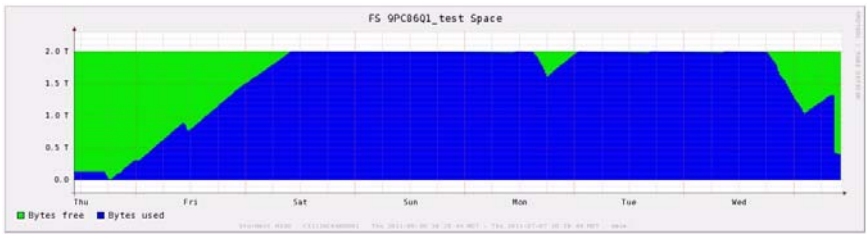
To access the **FS** reports, select **Reports > FS_Name**, where *Name* is the name of the file system.

FS Space

The **FS Space** graph displays the number of bytes of data space currently in use or available for use by file system clients. This graph shows you exactly when file system clients started to quickly fill space in the file system.

This graph is a stacked graph, meaning the graph superimposes data for two or more variables on top of each another. A different color is assigned to each variable, so you can see how the values for each variable differ over time.

Figure 27 FS Space Graph



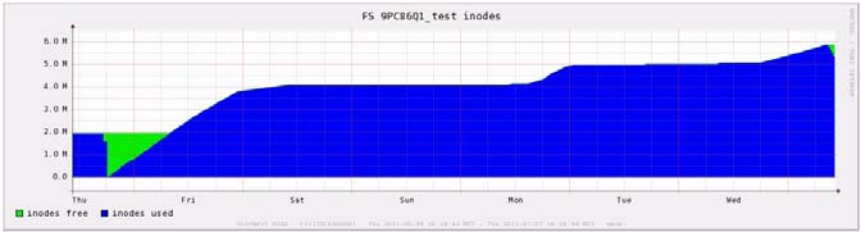
- Bytes Free (light green) — Displays the number of bytes of data space available for use by StorNext file system clients. As the level of free data space gets low, expanding the data space for the given file system should be considered.
- Bytes Used (blue) — Displays the number of bytes of data space currently in use by StorNext file system clients.

FS inodes

The **FS inodes** graph displays the number of inodes that are currently available or are in use by the selected file system.

A large number of inodes in use in the file system indicates that either the file system contains a lot of files or that it contains a lot of fragmented files.

Figure 28 FS inodes Graph



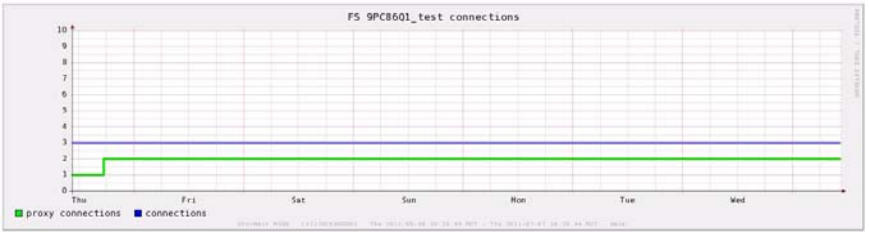
- inodes free (light green) — Displays the number of free inodes available. These inodes are available for use in allocating files in the selected StorNext file system. This value should not reach zero unless all of the StorNext metadata space has been consumed. Inodes are allocated dynamically.
- inodes used (blue) — Displays the number of inodes allocated. These inodes are in use by the StorNext file system. This graph will show the growth in the number of files used in the StorNext file system.

FS Connections

The **FS connections** graph displays the number of StorNext DLC and SAN clients that are connected to the selected file system.

Use this graph to view the history of your client connections. The number of connections will remain steady if the client computers are left running all the time.

Figure 29 FS Connections Graph

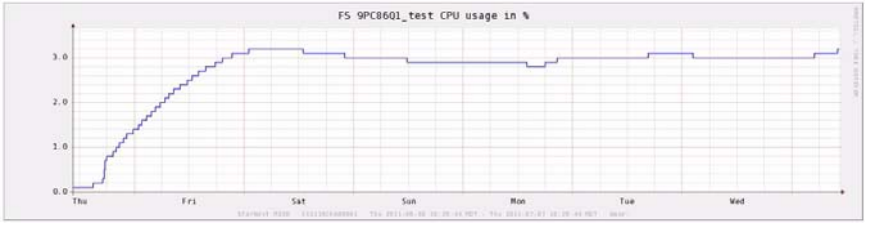


- Proxy Connections (light green) — Displays the number of StorNext DLC clients connected to this StorNext file system.
- Connections (blue) — Displays the number of StorNext SAN clients connected to this StorNext file system.

FS CPU usage in %

The **FS CPU usage in %** graph displays the percentage of CPU resources consumed by the FS process for the selected file system.

Figure 30 FS CPU Usage in % Graph



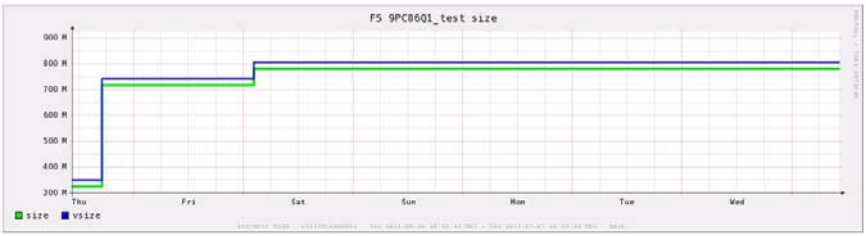
FS Size

The **FS size** graph displays the total amount of physical and virtual memory in use by the selected file system.

If the file system's performance degrades, then check this graph for an increase of physical memory (size) in use. This could indicate that runaway processes are doing lots of busy work (thrashing) or that caching is set too high.

A rapid increase in physical memory usage (for example, the file system was using around 200 MB of memory suddenly shot up to 2 GB) may indicate a client or caching issue. If this occurs, you should check the cvlogs to see what happened at the time of the increase.

Figure 31 FS Size Graph



- Size (light green) — Indicates the total amount of physical memory in use by the by the file system. High levels of memory consumption by the StorNext FS process could lead to performance if virtual memory swapping once contention for memory resources is seen.
- Vsize (blue) — Indicates the total amount of virtual memory in use by the file system. The virtual memory size will display the total process footprint for the file system.

Self Report

The **Self** report displays information about the CPU resources used by the system and by the StorNext Advanced Reporting for Service logging database. The report contains the following graphs:

- CPU Load Average
- CPU stats in %
- Logging Loop Time (logarithmic scale)

CPU Load Average

See CPU Load Average on page 39.

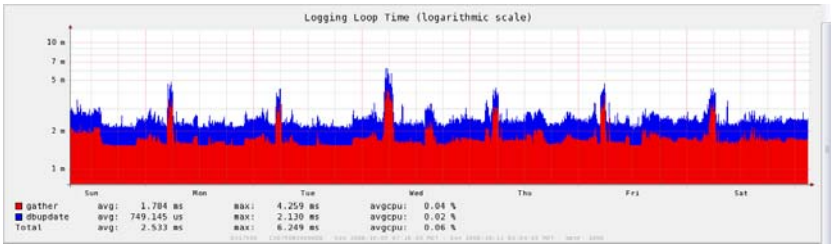
CPU stats in %

See CPU stats in % on page 40.

Logging Loop Time (logarithmic scale)

The **Logging Loop Time** graph (see Figure 23) displays how long it takes StorNext Advanced Reporting for Service to gather performance data and write it to the logging database.

Figure 32 Logging Loop Time Graph



Use the **Logging Loop Time** graph to determine the impact of StorNext Advanced Reporting for Service logging on system performance.

- The graph displays loop times in milliseconds on a logarithmic scale.
- The time to gather data (red) and update the database (blue) is typically about 2 milliseconds.
- Loop time can increase during periods of high CPU usage.

Glossary

A

Adaptive Deduplication The mode of deduplication which allows data deduplication to run concurrent with the backup being ingested. The deduplication process will adapt to the speed of the ingest.

B

Bit The basic unit of data in a binary numbering system (*bi*nary digi*t*), represented by a 0 or a 1. Eight bits equals one byte.

Block During deduplication, data is divided into variable length blocks (also called blocklets). Redundant blocks are removed and replaced with pointers to the original copy of the block.

Blockpool See **Deduplication Pool**.

Byte The basic unit of computer memory which is large enough to hold one character.

C

Compress A process of removing fine-grained redundancy from data prior to storing or transmitting it. The granularity may vary, but generally compression deals with redundancy in grains of a few bytes.

Continuous Replication Data replication is the process of creating and managing duplicate versions of your data. Once a data set

has been deduplicated, it may be replicated (nonredundant data is transmitted from a source system to a target). Deduplication tags representing files with a high probability of being replicated (for example, NAS share marked for replication) are queued for replication after deduplication is complete without regard to the replication schedule. This continuous transmission of data is an optimization allowing replication to be used with low bandwidth networks.

D

Deduplicate A process of removing coarse-grained redundancy from data prior to storing or transmitting it. The granularity may vary, but generally deduplication deals with redundancy in grains of several kilobytes.

Deduplication Pool The term used to refer to the collection of unique data stored in a StorNext deduplication MDC. The size of the deduplication pool is reported as the After Reduction statistic on the StorNext GUI and is a measure of the disk space occupied by all data backed up to the StorNext after the data has been deduplicated and compressed.

Deferred Deduplication The mode of deduplication which begins only after the **deferred deduplication window**. Typically, deferred deduplication begins after the backup ingest is complete.

Deferred Deduplication Window A defined window during which no deduplication will take place. This allows maximum system resources to be devoted to data ingest thus allowing a faster backup. The deferred deduplication window applies only to the share/partition for which it is defined. It is possible to define a second share/partition and perform backups that overlap the same time period. The data written to the share without a defined deferred deduplication window will be subjected to adaptive deduplication.

F

File or Cartridge Replication File or cartridge replication (FCR) extends continuous and namespace replication from operating at a share/partition level and zooms in to the file-directory/ virtual cartridge level. FCR can be used to synchronize the

content of a share or partition that is concurrently accessible at both source and target StorNext.

I

Ingest The process of writing data from an external system or application to disk in a StorNext MDC.

Inline deduplication The removal of redundancies from data before or as it is being written to a backup device.

L

LUN Logical Unit Number. A logical storage unit that corresponds to a storage volume. A storage array can be partitioned into multiple LUNs.

N

Namespace The term that applies to metadata required to reconstruct deduplicated data back into its native application format. It is used in phrase combinations such as “namespace replication” or “synchronize the namespace.”

Namespace Replication When a replication set is scheduled for transmission, the system scans the files comprising the replication set and a **namespace** file is created. A **namespace** file contains the complete set of deduplication tags for the replication set. Data that is active (a NAS file that is open) or data that is not yet deduplicated is not included in the namespace file. The **namespace** file is then deduplicated and transmitted to the target system after the data transmission of the replication set is complete. Once both the replication set and **namespace** file have been transmitted to the target system, the replication can be recovered.

NTP Network Time Protocol. A protocol used to synchronize time between devices over a network.

P

Partition A StorNext storage destination for data transferred by FC or iSCSI where the structure is considered to be a virtual tape library (VTL) and the content is written to virtual tape cartridges.

R

Recover The StorNext procedure to make replicated and namespace data accessible on the StorNext to which it had been replicated. If a share was replicated, then a share is recovered. If a partition is replicated, then a partition is recovered. It is not possible to convert a share to a partition (or vice-versa) during the recovery procedure.

S

Share A StorNext storage destination for data transferred by NAS where the content is treated as files and directories.

Source The term often applied to the StorNext that is sending a copy of deduplicated data to a second StorNext.

Space Reclamation A multi phase process used to recover disk space on a StorNext MDC. During space reclamation, the system searches for redundant blocks that were not captured during deduplication. The system also deletes blocks associated with expired virtual tape cartridges (VTCs) and files that have been deleted from NAS shares.

T

Tag A united of ingested data. During deduplication, a tag is divided into variable length blocks (also called blocklets).

Target The label often applied to the StorNext that is receiving a copy of deduplicated data.

Truncation A process used to recover disk space on a StorNext MDC. When deduplicated data is truncated, only the metadata is available on the filesystem. This reduces the amount of capacity required in the filesystem. Once truncated, the file must be reconstituted using its tag before you are able to access the file.

V

Virtual Tape Cartridge (VTC) An emulation of a real, physical tape cartridge, including a type, any nonvolatile memory associated with the case housing, and that recording medium. Also referred to as a virtual tape volume or a virtual volume.