



# Sun StorageTek™ 5800 System Overview

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Sun Microsystems, Inc.  
[www.sun.com](http://www.sun.com)

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# Preface

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The *Sun StorageTek 5800 System Overview* provides information about the features and functionality of the Sun StorageTek 5800™ System. It discusses the possible cell configurations, the hardware components that make up the 5800 system, and the various user interfaces available to access and manage the system.

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## Typographic Conventions

Typeface	Meaning	Examples
AaBbCc123	The names of commands, files, and directories; on-screen computer output	Edit your <code>.login</code> file. Use <code>ls -a</code> to list all files. % You have mail.
<b>AaBbCc123</b>	What you type, when contrasted with on-screen computer output	% <b>su</b> password:
<i>AaBbCc123</i>	Book titles, new words or terms, words to be emphasized. Replace command-line variables with real names or values.	Read Chapter 6 in the <i>User's Guide</i> . These are called <i>class</i> options. You <i>must</i> be superuser to do this. To delete a file, type <code>rm filename</code> .

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**Note** – Characters display differently depending on browser settings. If characters do not display correctly, change the character encoding in your browser to Unicode UTF-8.

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## Related Documentation

The following table lists the documentation for this product. The online documentation is available at:

<http://docs.sun.com/app/docs/prod/stortek.5800>

<b>Title</b>	<b>Part Number</b>	<b>Format</b>	<b>Location</b>
<i>Sun StorageTek 5800 System 1.1.1 Release Notes</i>	820-4120-xx	PDF HTML	Online
<i>Sun StorageTek 5800 System Regulatory and Safety Compliance Manual</i>	819-3809-xx	PDF HTML	Online
<i>Sun StorageTek 5800 System Site Preparation Guide</i>	820-1635-xx	PDF HTML	Online
<i>Sun StorageTek 5800 System Administration Guide</i>	820-4118-xx	PDF HTML	Online
<i>Sun StorageTek 5800 System API Reference Manual</i>	820-4796-xx	PDF HTML	Online
<i>Sun StorageTek 5800 System SDK Reference Manual</i>	820-4797-xx	PDF HTML	Online

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# Product Overview

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This document provides an overview of the Sun StorageTek™ 5800 System. It includes the following sections:

- [“About the 5800 System” on page 1](#)
- [“5800 System Hardware” on page 3](#)
- [“5800 System Software” on page 16](#)

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## About the 5800 System

The 5800 system is a self-contained storage unit that attaches directly to a network. It does not use typical data and file structures: there are no pools, volumes, logical unit numbers (LUNs), or redundant arrays of independent disks (RAID) to set up or manage.

Instead, the 5800 system uses an object-oriented methodology to store fixed-content data files (files that will never be modified) as if they were individual objects. The storage system assigns each of these *data objects* a unique identifier called an Object ID (OID) based on the attributes of the data object. Applications use the OIDs to query and retrieve the data objects.

The 5800 system employs a cluster of *storage nodes*. Each storage node is an individual server with CPU processing power, RAM, and four Serial Advanced Technology Attachment (Serial ATA) disk drives for storage. Each storage node has hardware and software that is identical to that of the other storage nodes, but each storage node operates independently. This configuration allows for all storage processing and data path operations to be distributed across the available processing power of the system and enhances both system reliability and performance.

Each 5800 system includes a single *service node* with preconfigured software and firmware. The system uses the service node for initial configuration, for troubleshooting, and to upgrade the system software.

The basic 5800 system is a *full-cell configuration* that includes 16 storage nodes, 1 service node, 2 gigabit Ethernet switches, a network patch panel, and preinstalled operating system and software. A *half-cell configuration*, which includes only 8 storage nodes, is also allowed. You can expand (scale) a half-cell configuration to a full-cell configuration. You can also expand a full-cell configuration to create *multicell configurations*, also referred to as *hives*. Only full-cells are allowed in multicell configurations.

Features of the 5800 system include:

- Both a command-line interface (CLI) and a graphical user interface (GUI) to monitor system performance and status and perform administration tasks.
- Metadata associated with each data object that you can customize to:
  - Emulate a database query. An application programming interface (API) allows developers to write applications for storing, retrieving, querying, and deleting data.
  - Present a simulated hierarchical directory structure with the Web-based Distributed Authoring and Versioning (WebDAV) tool. (WebDAV is not supported for multi-cell configurations.)
- Two virtual IP addresses per half- or full-cell: one for data processing and one for management operations. An integrated Domain Name Service (DNS) establishes the host name.
- Self-healing operations that increase system reliability. When a disk drive fails, the system rebuilds the data on other disks in the system.
- Hot-swappable disks that can be removed and replaced easily while the system is in operation.
- A distributed data storage model that utilizes the Reed Solomon algorithm commonly used in RAID systems to increase system reliability.
- An integrated Sun Solaris 10 Operating System (Solaris OS).

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# 5800 System Hardware

The 5800 system ships from the factory fully installed in a rack and with the software loaded in the default configuration.

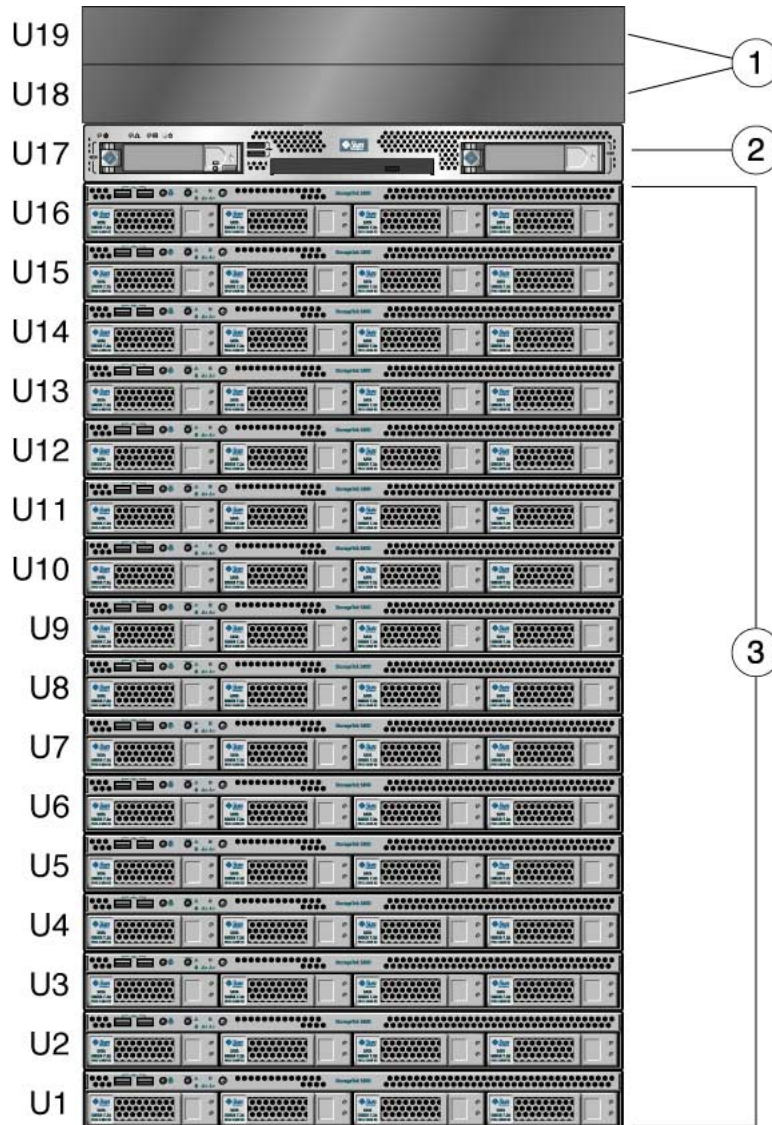
This section includes the following topics:

- [“Full-Cell and Half-Cell Configurations” on page 3](#)
- [“Storage Nodes” on page 9](#)
- [“Service Node” on page 12](#)
- [“Gigabit Ethernet Switches” on page 14](#)
- [“Network Patch Panel” on page 15](#)

## Full-Cell and Half-Cell Configurations

The full-cell is the basic building block of the 5800 system. A full-cell includes a service node, 16 storage nodes, 2 gigabit Ethernet switches, and a network patch panel. The front view of a single full-cell is shown in [FIGURE 1](#). Additional full-cells in a multicell system (referred to as a *hive*) are identical.

**FIGURE 1** 5800 System Full-Cell Front View



**Figure Legend**

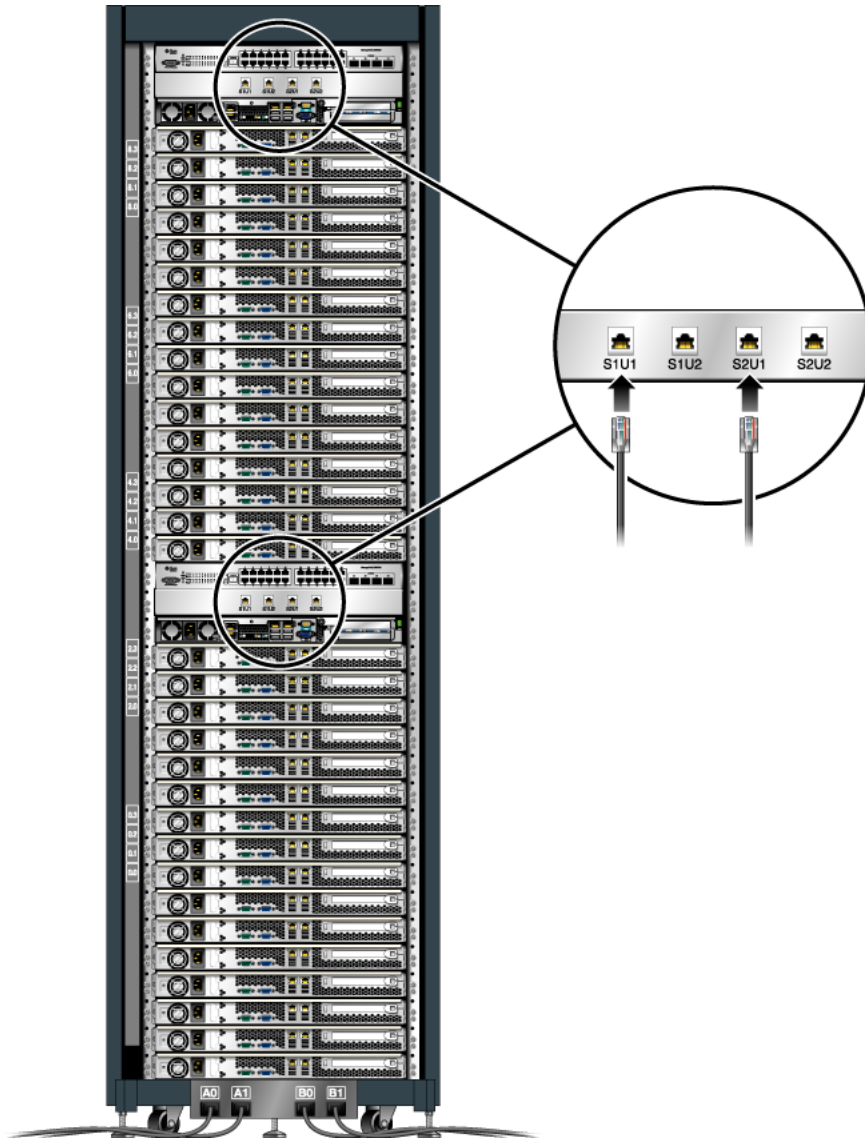
- 
- 1 Filler panels hiding two rear-facing gigabit Ethernet switches and a rear-facing network patch panel located behind the lower switch
  - 2 Service node
  - 3 16 storage nodes
-



The gigabit Ethernet switches are installed with their ports facing towards the back of the cabinet. Filler panels are installed in the front of the cabinet at the same elevation as the two switches. The network patch panel is mounted behind the lower switch on the back of the cabinet (see [FIGURE 2](#)). Both of the gigabit Ethernet switches are connected to the service node, to all the storage nodes, and to the network patch panel.

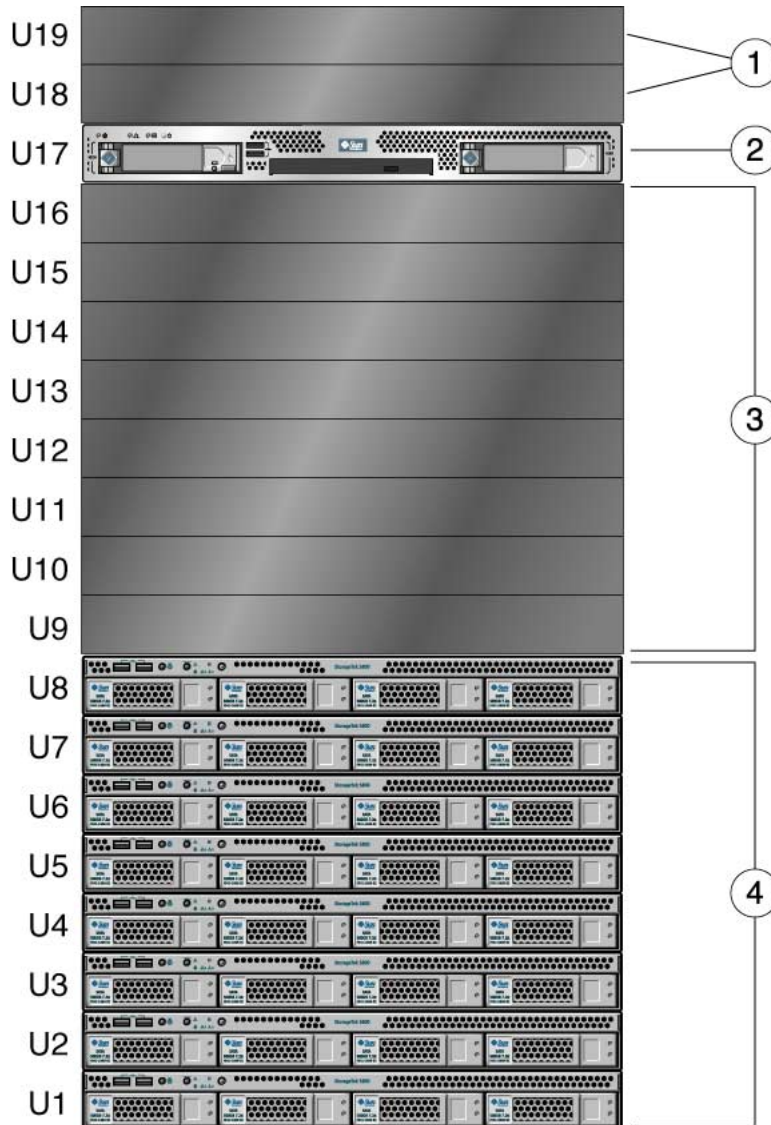
Storage node number 101 is on the bottom of the cell; the numbering of the storage nodes gets higher as you go up the cell, with node 102 above node 101, followed by node 103 above that and so on.

**FIGURE 2** Rear View of a Two-Cell System, Showing Network Patch Panel Connections



If you chose to populate the cabinet with only a half-cell (eight storage nodes), slots U9 through U16 have filler panels on the front, as shown in [FIGURE 3](#). A half-cell configuration is stand-alone and cannot be combined with another full-cell. To add another full-cell to the hive, you must first add additional storage nodes to expand the half-cell to a full-cell configuration. Because a half-cell has a reduced number of storage nodes, it does not have the same inherent reliability as that of a full-cell with 16 storage nodes.

**FIGURE 3** 5800 System Half-Cell Front View



**Figure Legend**

- 
- 1 Filler panels hiding two rear-facing gigabit Ethernet switches and a rear-facing network patch panel located behind the lower switch
  - 2 Service node
  - 3 8 filler panels
  - 4 8 storage nodes
-

Three configurations of the 5800 system can be housed in a single cabinet:

- A full-cell with 16 storage nodes
- A half-cell with eight storage nodes
- Two full-cells for a total of 32 storage nodes

Systems having more than two full-cells must be accommodated with additional cabinets.

## Storage Nodes

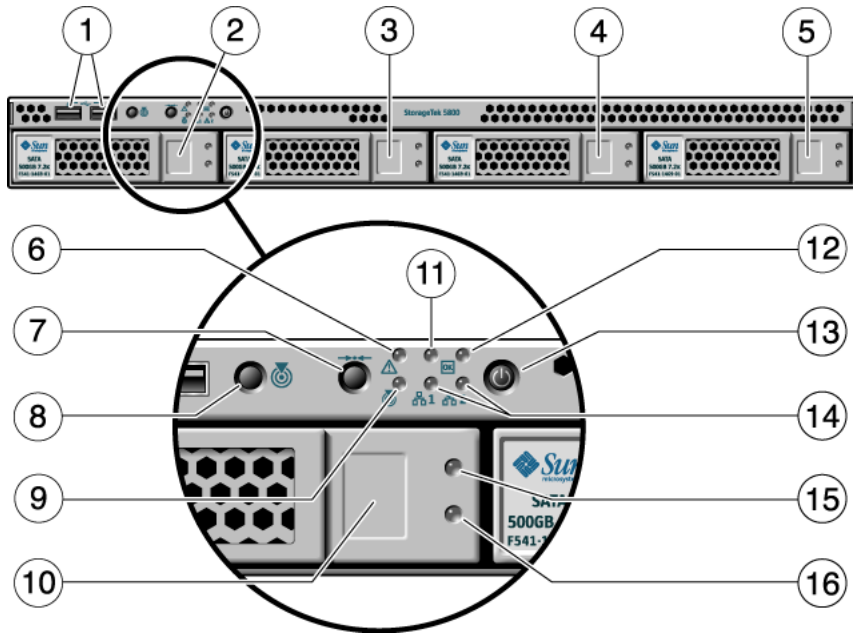
The key features of the 5800 system storage node are listed in [TABLE 1](#).

**TABLE 1** Storage Node Features

Component	Description
CPU	<ul style="list-style-type: none"><li>• One single-core AMD Opteron processor</li><li>• Processor frequency: 2.2 GHz</li><li>• 1 MB level 2 cache</li></ul>
Memory	Three GB using two 1-GB ECC DIMMs and two 512-MB ECC DIMMs
Hard disk drives	Four 500-GB Serial ATA disk drives
Power supply	350W
Network I/O	Two 10/100/1000BASE-T gigabit Ethernet ports
System management	Intelligent Platform Management Interface (IPMI) 1.5-compliant service processor module

[FIGURE 4](#) shows the front panel components of a 5800 system storage node. Pressing the locator switch on the front of the storage node causes the Locator LEDs on both the front and the back of the node to blink so that you can easily identify a particular node from the front and back of the cabinet. [TABLE 2](#) explains the functions and characteristics of the storage node switches and LEDs.

**FIGURE 4** Storage Node Front Panel Components



**Figure Legend**

1	USB ports (not used)	9	Locator LED
2	Drive 0	10	Unlatch level button
3	Drive 1	11	Not used
4	Drive 2	12	Power LED
5	Drive 3	13	Power switch
6	Storage node fault LED	14	Not used
7	Reset switch	15	Drive fault LED
8	Locator switch	16	Drive activity LED

**TABLE 2** Storage Node Front Panel LED and Switch Descriptions

LED/Switch	Description
Storage node fault LED	Yellow/amber when a fault exists in the system.
Reset switch	Reboots the storage node.
Power LED	Green when the power is on.

**TABLE 2** Storage Node Front Panel LED and Switch Descriptions (*Continued*)

LED/Switch	Description
Locator LED	White and blinks when you press the locator switch. It also blinks when the service node receives the chassis indicator command to light the LED. <b>Note:</b> There is a corresponding Locator LED on the back of the system.
Drive fault LED	Amber when a drive fault exists. <b>Note:</b> The drive fault LED is activated by the 5800 system software to indicate components in the cell that must be serviced.
Drive activity LED	Solid green when no activity is taking place. When disk access occurs, it momentarily turns off. When access is non-stop, it blinks continuously. When there is no drive present in the bay, it turns off.
Power switch	Provides power to the system.
Locator switch	Causes the Locator LEDs on the front and back to blink, enabling you to locate a storage node in the rear of a fully equipped cabinet.

FIGURE 5 shows the back panel components of a 5800 system storage node.

FIGURE 5 Storage Node Back Panel Components

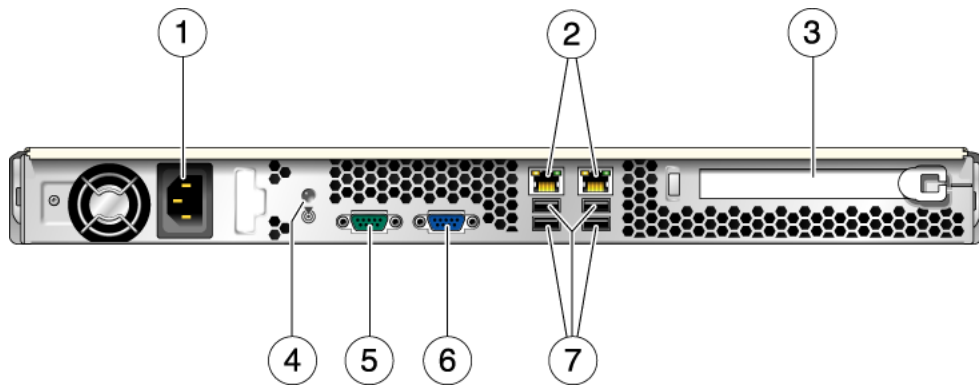


Figure Legend

1	Power connector	5	Serial port
2	Gigabit Ethernet ports	6	VGA port
3	Blank plate	7	USB ports
4	Locator LED		

## Service Node

The service node is a Sun Microsystems Sun Fire™ X2100 M2 server with one 250-gigabyte Serial ATA disk drive. The 5800 system uses the service node for initial configuration and troubleshooting, and to upgrade the system software. The system does not use the service node to access the data objects. The key components of a service node are listed in TABLE 3.

TABLE 3 Service Node Features

Component	Description
CPU	<ul style="list-style-type: none"> <li>• One dual-core AMD Opteron processor</li> <li>• Processor frequency: 1.8 GHz</li> <li>• Two 1-MB level 2 cache</li> </ul>
Memory	2 GB using four 512MB ECC DIMMs
Media storage	DVD-ROM drive
Hard disk drive	One 250-GB Serial ATA

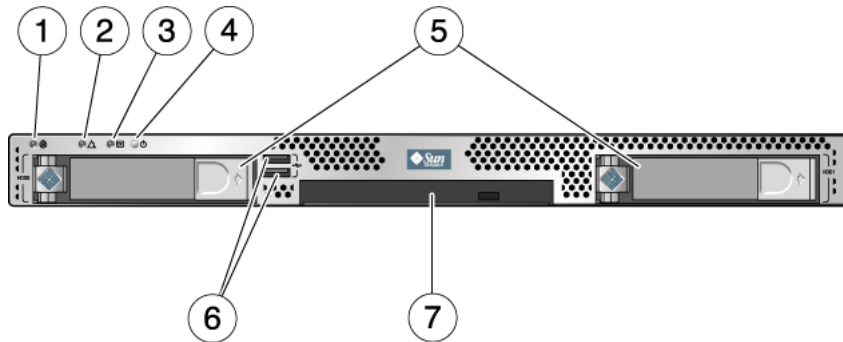


**TABLE 3** Service Node Features

Component	Description
Power supply	345W PSU
Network I/O	Four 10/100/1000BASE-T GB Ethernet ports, two Broadcom and two NVidia. (The 5800 system uses the two Broadcom ports.)
System management	IPMI 2.0-compliant service processor module

FIGURE 6 shows the front panel of the service node.

**FIGURE 6** Service Node Front Panel Components

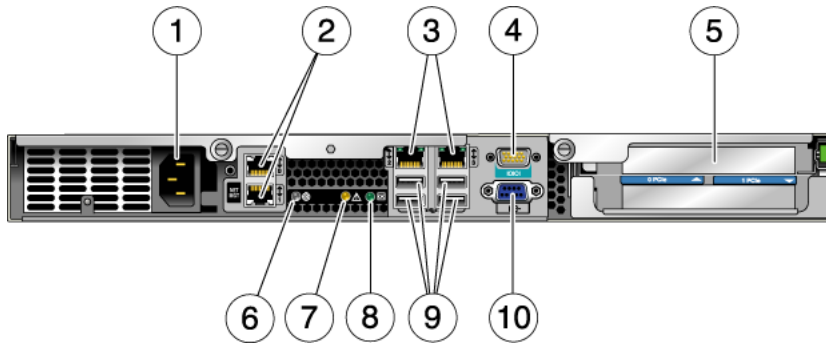


**Figure Legend**

1	Locator button/LED	5	Hard disk drive bays. The single disk drive is located behind the left drive bay latch.
2	Service indicator LED	6	USB ports
3	Power LED	7	DVD drive
4	Power switch		

FIGURE 7 shows the back panel of the service node.

**FIGURE 7** Service Node Back Panel Components



**Figure Legend**

1	Power connector	6	Locator LED
2	Broadcom Ethernet ports	7	Service indicator LED
3	NVIDIA Ethernet ports	8	Power LED
4	serial port	9	USB ports
5	Not used	10	VGA port

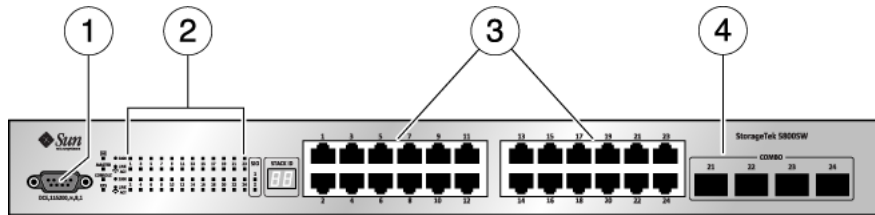
## Gigabit Ethernet Switches

A half- or full-cell 5800 system includes two gigabit Ethernet switches. The switches allow the system to be addressable from a single physical Ethernet connection (with a redundant backup) as two virtual IP (VIP) addresses: one for data and one for administration. The switches also enable load-balancing capabilities for store and retrieve data flows to and from the storage nodes by making use of chipsets that support basic packet header analysis of hash-table based routing information.

**FIGURE 8** shows the components of the switches. One of the switches is designated as primary and the other as standby. By default, the bottom switch is the active, primary switch, and the top switch is the secondary switch in standby mode. If the primary switch fails, the secondary switch takes control automatically and becomes the primary switch. If the primary switch comes back online, it resumes control.

Storage nodes 1 through 16 are connected to Ethernet ports 1 through 16 of each switch. The service node is connected to port 17 of each switch. The switches are connected to each other for heartbeat communication by ports 23 and 24 of each switch. See **TABLE 4** for an explanation of how the primary and secondary switches are connected to the network patch panel.

**FIGURE 8** Gigabit Ethernet Switch



**Figure Legend**

- 1 Serial port
- 2 Port connection status LEDs
- 3 Ethernet ports
- 4 Not used

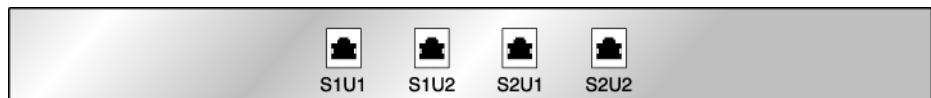
**TABLE 4** Gigabit Ethernet Switch Connections to the Network Patch Panel

Switch and Ethernet Port	Network Patch Panel Port
Primary - port 21	S1U2 - For Sun service personnel only
Primary - port 22	S1U1
Secondary - port 21	S2U2 - For Sun service personnel only
Secondary - port 22	S2U1

## Network Patch Panel

A single network patch panel on the back of the 5800 system provides all the attachment points for the network. [FIGURE 9](#) shows the port configuration of the network patch panel.

**FIGURE 9** Network Patch Panel



The Ethernet ports are designated SxUy, where:

S = Switch

x = Switch number

U = Uplink

y = Port number

S1 is the primary switch and S2 is the secondary. The secondary switch becomes operational when the primary fails. The S1U2 and S2U2 connections are for Sun service personnel only.

---

## 5800 System Software

This section describes the 5800 system software. It includes the following topics:

- [“Bundled Software” on page 16](#)
- [“Metadata” on page 17](#)
- [“The Placement Algorithm” on page 17](#)
- [“User Interfaces” on page 18](#)

## Bundled Software

You manage and upgrade the 5800 system software as a combined *bundle* rather than as individual components. The software components of the bundle include:

- 5800 system software
- Sun Solaris 10 Operating System (x86 version)
- All Sun Solaris 10 patches
- Basic Input Output System (BIOS)
- Server Management Daughter Card (SMDC) firmware

Even though there are many components, each with their own unique software, BIOS, and firmware, they are upgraded as a whole unit. Even if only one component needs upgrading, the version number of the bundle changes, and you must upgrade the entire bundle.

# Metadata

Metadata is information that describes a data object. The 5800 system stores metadata about all data objects in a distributed database. Users can issue queries to search the database and find objects based on the metadata assigned to them. The 5800 system allows two types of metadata: *system* and *extended*.

## System Metadata

The 5800 system automatically assigns system metadata to every data object when it is stored on the 5800 system. System metadata includes a unique identifier for each object, called the Object ID or OID. The application programming interface (API) included with the 5800 system can retrieve the object using this OID. System metadata also includes creation time, data length, and data hash.

## Extended Metadata

Extended metadata goes beyond the system metadata to further describe each data object. For example, if the data stored on the 5800 system includes medical records, extended metadata attributes might include patient name, date of visit, doctor name, medical record number, and insurance company. Users can issue queries to retrieve data objects using these attributes. For example, a query could retrieve all records (data objects) for a given doctor and a particular insurance company.

# The Placement Algorithm

The 5800 system stores data objects across multiple storage nodes and disks using 5+2 encoding. The system can tolerate up to two missing data or parity fragments. After a failure of a disk or a storage node, the system distributes the data and/or parity to other storage nodes and disks. After a rebuild cycle, the system can tolerate another two missing data or parity fragments.

When a data object comes into the system, the gigabit Ethernet switch directs the store request to a storage node, and that node fragments the object and distributes the fragments to different disks in the system. The 5800 system breaks up the data into data and parity chunks. A placement algorithm then decides out of thousands of different layout possibilities where to put the chunks.

# User Interfaces

The 5800 system exports two virtual IP (VIP) addresses: one for data processing and one for administrative functions. Your interaction with the system does not require a knowledge of the underlying hardware. Instead, you access it as a single large system.

The 5800 system provides a number of different user interfaces for data processing and management functions, as shown in [TABLE 5](#).

**TABLE 5** 5800 Storage System User Interface Functional Capabilities

Interface	Data Processing Capabilities	Administration / Management Capabilities
API	Can perform all store, retrieve, query, and delete functions	None
WebDAV	<ul style="list-style-type: none"><li>• Same capabilities as API except no query function</li><li>• Can present a virtual directory structure view of data objects according to a defined schema of metadata attributes</li><li>• Not supported for multi-cell configurations</li></ul>	None
CLI	None, except capability to delete all data and metadata on a full-cell	Can perform most system administration tasks
GUI	None, except capability to delete all data and metadata on a full-cell	Can perform most system administration tasks

## Application Program Interface (API)

A Java™ and C language-based application program interface (API) provides the basic store and retrieve commands with additional query semantics.

You perform data processing tasks on the 5800 system using the API or WebDAV, both of which are available through the data VIP address.

The Java and C language APIs enable you to store, retrieve, query, and delete data and metadata through Java and C client libraries. Sample applications and command-line routines that demonstrate the 5800 system's capabilities as well as provide good programming examples are provided in the client software developer's kit (SDK).

The SDK also provides an emulator that can run on the Sun Solaris, Red Hat Enterprise Linux, and Microsoft Windows operating systems. The emulator imitates the behavior of a 5800 system, allowing you to test your software or applications.

For more information on the SDK, see the *Sun StorageTek 5800 System SDK Reference Manual*. For more information on the Java and C client APIs, see the *Sun StorageTek 5800 System API Reference Manual*.

## WebDAV

The Web-based Distributed Authoring and Versioning (WebDAV) protocol is a set of extensions to the HTTP/1.1 protocol that allows you to read, add, and delete files on remote web servers. You can set up virtual file system views in the 5800 system that allow you to use WebDAV to browse through data files on the system as though they were stored in a hierarchical path structure.

For example, you could set up a virtual file system view that included medical records as a folder, and included subfolders for a number of different doctors or hospitals. You could then use a web browser to view those files and add and delete new files to the folder and subfolders.

WebDAV is not supported for multi-cell configurations.

## CLI and GUI

You perform administrative tasks using either the command-line interface (CLI) or the graphical-user interface (GUI). Refer to the *Sun StorageTek 5800 System Administration Guide* for information about completing administrative tasks using either of these interfaces.





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