Sun StorEdge™ T3 and T3+ Array Configuration Guide

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Preface

The *Sun StorEdge T3 and T3+ Array Configuration Guide* describes the recommended configurations for Sun StorEdge T3 and T3+ arrays for high availability, maximum performance, and maximum storage capability. This guide is intended for Sun™ field sales and technical support personnel.

Before You Read This Book

Read the *Sun StorEdge T3 and T3+ Array Installation, Operation, and Service Manual* for product overview information.

How This Book Is Organized

Chapter 1 describes the connection ports and Fibre Channel loops for the Sun StorEdge T3 and T3+ array. It also describes basic rules and recommendations for configuring the array.

Chapter 2 describes how to configure the array's global parameters.

Chapter 3 describes how to configure arrays into partner groups to form redundant storage systems.

Chapter 4 provides reference configuration examples.

Chapter 5 describes host connections for the array.

Chapter 6 describes array cabling.

Using UNIX Commands

This document contains some information on basic UNIX® commands and procedures such as booting the devices. For further information, see one or more of the following:

- AnswerBook2™ online documentation for the Solaris™ software environment
- Other software documentation that you received with your system

Typographic Conventions

Typeface	Meaning	Examples
`AaBbCc123`	The names of commands, files, and directories; on-screen computer output	Edit your `.login` file. Use `ls -a` to list all files. `% You have mail.`
`AaBbCc123`	What you type, when contrasted with on-screen computer output	`%` **`su`** `Password:`
AaBbCc123	Book titles, new words or terms, words to be emphasized	Read Chapter 6 in the *User's Guide*. These are called *class* options. You *must* be superuser to do this.
	Command-line variable; replace with a real name or value	To delete a file, type `rm` *filename*.

Shell Prompts

Shell	Prompt
C shell	*machine_name*%
C shell superuser	*machine_name*#
Bourne shell and Korn shell	$
Bourne shell and Korn shell superuser	#
Sun StorEdge T3 and T3+ array	:/:

Related Documentation

Application	Title	Part Number
Latest array updates	*Sun StorEdge T3 and T3+ Array Release Notes*	816-1983
Installation overview	*Sun StorEdge T3 and T3+ Array Start Here*	816-0772
Safety procedures	*Sun StorEdge T3 and T3+ Array Regulatory and Safety Compliance Manual*	816-0774
Site preparation	*Sun StorEdge T3 and T3+ Array Site Preparation Guide*	816-0778
Installation and Service	*Sun StorEdge T3 and T3+ Array Installation, Operation, and Service Manual*	816-0773
Administration	*Sun StorEdge T3 and T3+ Array Administrator's Guide*	816-0776
Cabinet installation	*Sun StorEdge T3 Array Cabinet Installation Guide*	806-7979
Disk drive specifications	*18 Gbyte, 1-inch, 10K rpm Disk Drive Specifications*	806-1493
	36 Gbyte, 10K rpm Disk Drive Specifications	806-6383
	73 Gbyte, 10K rpm, 1.6 Inch Disk Drive Specifications	806-4800

Application	Title	Part Number
Sun StorEdge Component Manager installation	*Sun StorEdge Component Manager Installation Guide - Solaris*	806-6645
	Sun StorEdge Component Manager Installation Guide - Windows NT	806-6646
Using Sun StorEdge Component Manager software	*Sun StorEdge Component Manager User's Guide*	806-6647
Latest Sun StorEdge Component Manager Updates	*Sun StorEdge Component Manager Release Notes*	806-6648

Accessing Sun Documentation Online

You can find the Sun StorEdge T3 and T3+ array documentation and other select product documentation for Network Storage Solutions at:

```
http://www.sun.com/products-n-solutions/hardware/docs/
Network_Storage_Solutions
```

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Array Configuration Overview

This chapter describes the Sun StorEdge T3 and T3+ arrays, the connection ports, and Fibre Channel connections. It also describes basic rules and recommendations for configuring the array, and it lists supported hardware and software platforms.

Note – For installation and cabling information, refer to the *Sun StorEdge T3 and T3+ Array Installation, Operation, and Service Manual*. For software configuration information, refer to the *Sun StorEdge T3 and T3+ Array Administrator's Guide*.

This chapter is organized as follows:

- "Product Description" on page 1
- "Configuration Guidelines and Restrictions" on page 8
- "Configuration Recommendations" on page 9
- "Supported Platforms" on page 9
- "Sun Cluster Support" on page 10.

Product Description

The Sun StorEdge T3 array is a high-performance, modular, scalable storage device that contains an internal RAID controller and nine disk drives with Fibre Channel connectivity to the data host. Extensive *reliability, availability, and serviceability* (RAS) features include redundant components, notification of failed components, and the ability to replace components while the unit is online. The Sun StorEdge T3+ array provides the same features as the Sun StorEdge T3 array, and includes an updated controller card with direct fiber-optic connectivity and additional memory for data cache. The controller cards of both array models are described in more detail later in this chapter.

The array can be used either as a standalone storage unit or as a building block, interconnected with other arrays of the same type and configured in various ways to provide a storage solution optimized to the host application. The array can be placed on a table top or rackmounted in a server cabinet or expansion cabinet.

The array is sometimes called a *controller unit*, which refers to the internal RAID controller on the controller card. Arrays without the controller card are called *expansion units.* When connected to a controller unit, the expansion unit enables you to increase your storage capacity without the cost of an additional controller. An expansion unit must be connected to a controller unit to operate because it does not have its own controller.

In this document, the Sun StorEdge T3 array and Sun StorEdge T3+ array are referred to as the *array*, except when necessary to distinguish between models.

Note – The Sun StorEdge T3 and T3+ arrays are similar in appearance. In this document, all illustrations labeled Sun StorEdge T3 array also apply to the Sun StorEdge T3+ array, except when necessary to distinguish specific model features. In these instances, the array model is specified.

Refer to the *Sun StorEdge T3 and T3+ Array Installation, Operation, and Service Manual* for an illustrated breakdown of the array and its component parts.

Controller Card

There are two controller card versions that are specific to the array model. Both controller cards provide the connection ports to cable the array to data and management hosts, but the type of connectors vary between models.

The Sun StorEdge T3 array controller card contains:

- One Fibre Channel-Arbitrated Loop (FC-AL) port, which provides data path connectivity to the application host system. This connector on the Sun StorEdge T3 array requires a media interface adapter (MIA) to connect a fiber-optic cable.

- One 10BASE-T Ethernet host interface port (RJ-45). This port provides the interface between the controller card and the management host system. An unshielded twisted-pair Ethernet cable (category 3) connects the controller to the site's network hub. This interface enables the administration and management of the array via the Sun StorEdge Component Manager software or the *command-line interface* (CLI).

- One RJ-11 serial port. This serial port is reserved for diagnostic procedures that can only be performed by qualified service personnel.

FIGURE 1-1 shows the location of the controller card and the connector ports on the Sun StorEdge T3 array.

Serial port (RJ-11)

10BASE-T Ethernet port (RJ-45)

FC-AL data connection port

Note: FC-AL port requires an MIA for cable connection.
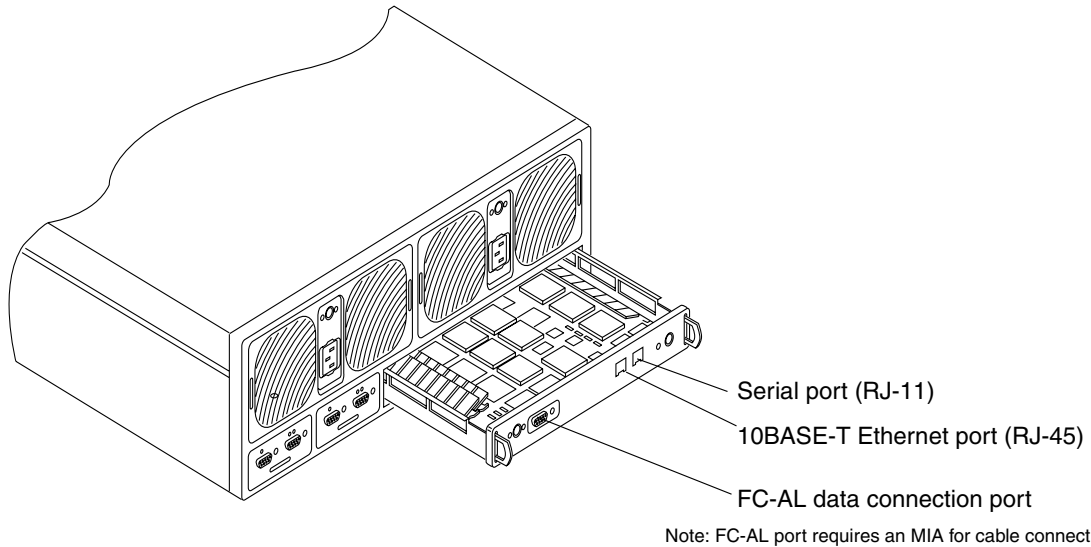
FIGURE 1-1 Sun StorEdge T3 Array Controller Card and Ports

The Sun StorEdge T3+ array controller card contains:

- One Fibre Channel-Arbitrated Loop (FC-AL) port using an LC small-form factor (SFF) connector. The fiber-optic cable that provides data channel connectivity to the array has an LC-SFF connector that attaches directly to the port on the controller card. The other end of the fiber-optic cable has a standard connector (SC) that attaches a host bust adapter (HBA), hub, or switch.

- One 10/100BASE-T Ethernet host interface port (RJ-45). This port provides the interface between the controller card and the management host system. A shielded Ethernet cable (category 5) connects the controller to the site's network hub. This interface enables the administration and management of the array via the Sun StorEdge Component Manager software or the *command-line interface* (CLI).

- One RJ-45 serial port. This serial port is reserved for diagnostic procedures that can only be performed by qualified service personnel.

FIGURE 1-2 shows the Sun StorEdge T3+ array controller card and connector ports.

Serial port (RJ-45)

10/100BASE-T Ethernet port (RJ-45)

FC-AL data connection port
(LC-SFF)
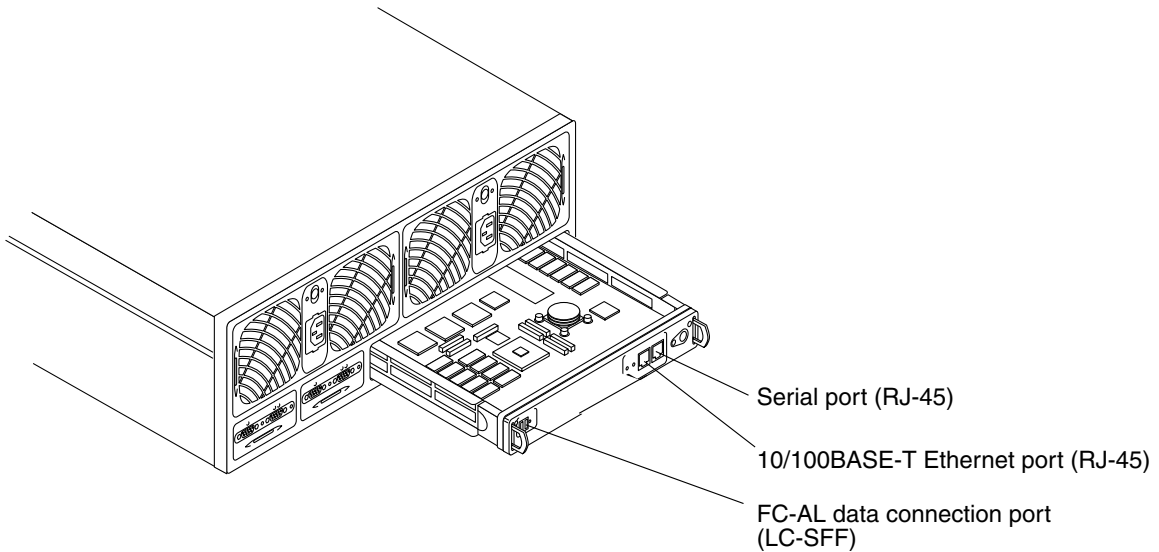
FIGURE 1-2 Sun StorEdge T3+ Array Controller Card and Ports

Interconnect Cards

The interconnect cards are alike on both array models. There are two interconnect ports on each card: one input and one output for interconnecting multiple arrays.

The interconnect card provides switch and failover capabilities, as well as an environmental monitor for the array. Each array contains two interconnect cards for redundancy (thus providing a total of four interconnect ports).

FIGURE 1-3 shows the interconnect cards in a Sun StorEdge T3+ array.

Interconnect cards

Output

Input
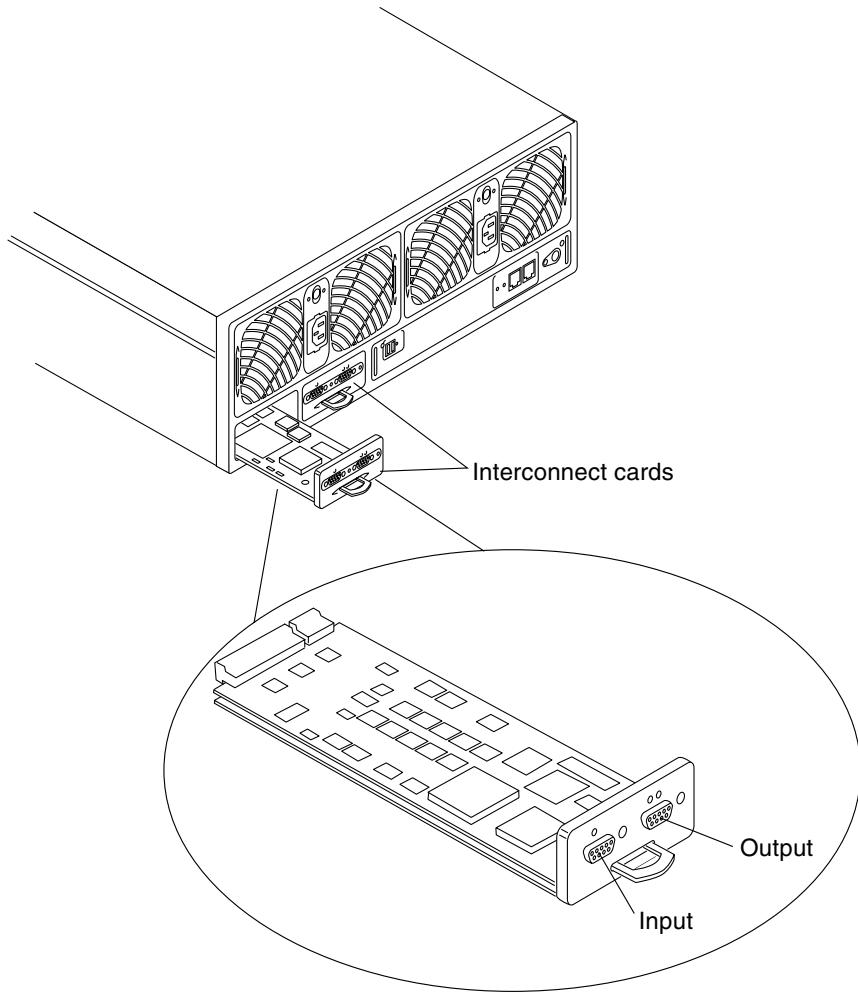
FIGURE 1-3   Interconnect Card and Ports

Array Configurations

Each array uses Fibre Channel-Arbitrated Loop (FC-AL) connections to connect to the application host. An FC-AL connection is a 100-Mbyte/second serial channel that enables multiple devices, such as disk drives and controllers, to be connected.

Two array configurations are supported:

- **Workgroup**. This standalone array is a high-performance, high-RAS configuration with a single hardware RAID cached controller. The unit is fully populated with redundant *hot-swap* components and nine disk drives (FIGURE 1-4).
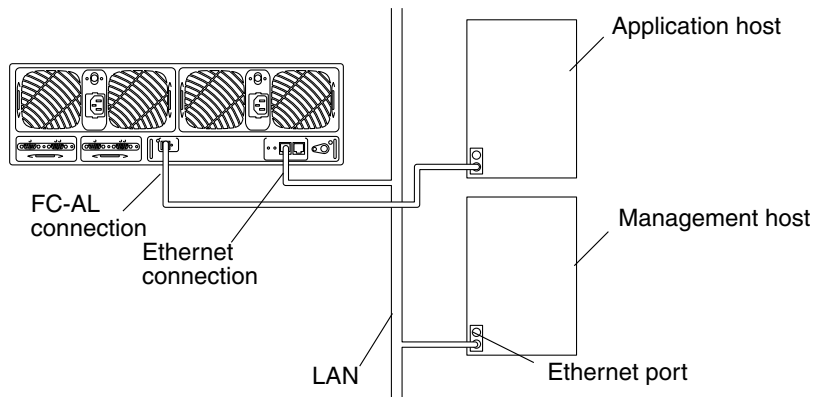
FIGURE 1-4   Workgroup Configuration

⚠ **Caution –** In a workgroup configuration, use a host-based mirroring solution to protect data. This configuration does not offer the redundancy to provide cache mirroring, and operating without a host-based mirroring solution could lead to data loss in the event of a controller failure.

- **Enterprise**. Also called a *partner group*, this is a configuration of two controller units paired using interconnect cables for back-end data and administrative connections. The *enterprise* configuration provides all the RAS of single controller units, plus redundant hardware RAID controllers with mirrored caches, and redundant host channels for continuous data availability for host applications.

  In this document, the terms *enterprise configuration* and *partner group* are used interchangeably, but apply to the same type of configuration shown in FIGURE 1-5.
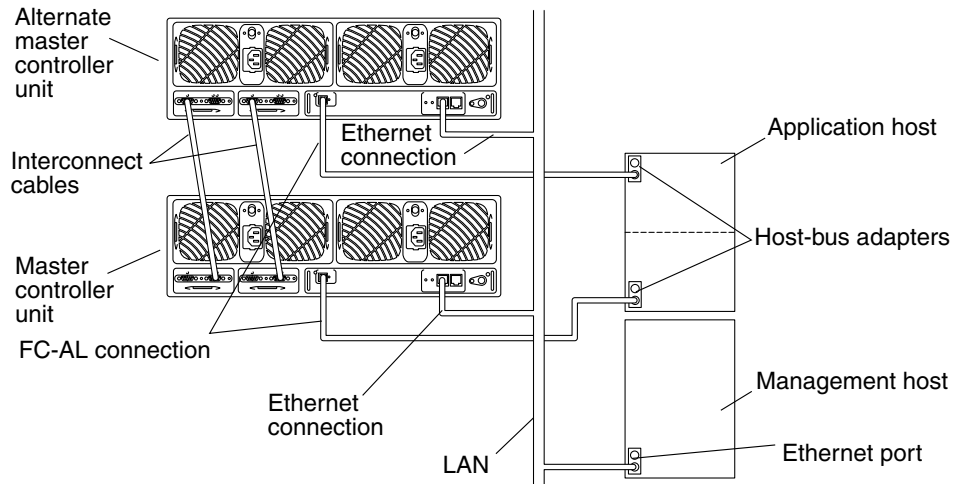
FIGURE 1-5   Enterprise Configuration

Note – Sun StorEdge T3 array workgroup and enterprise configurations require a *media-interface adapter* (MIA) connected to the Fibre Channel port to connect the fiber-optic cable. Sun StorEdge T3+ array configurations support direct FC-AL connections. Refer to the *Sun StorEdge T3 and T3+ Array Installation, Operation, and Service Manual* for specific information on cabling the arrays.

In an enterprise configuration, there is a *master controller unit* and an *alternate master controller unit*. In all default enterprise configurations, the master controller unit is the array positioned at the bottom of an array stack in either a rackmounted or tabletop installation. The alternate master controller unit is positioned on top of the master controller unit. The positioning of the master and alternate master controller units is important for cabling the units together correctly, understanding IP address assignments, interpreting array command-line screen output, and determining controller failover and failback conditions.

Note – In an enterprise configuration, you can only interconnect array models of the same type. For example, you can connect a Sun StorEdge T3+ array to another Sun StorEdge T3+ array, but you cannot connect it to a Sun StorEdge T3 array.

Configuration Guidelines and Restrictions

Workgroup Configurations:

- The media access control (MAC) address is required to assign an IP address to the controller unit. The MAC address uniquely identifies each node of a network. The MAC address is available on the pull-out tab on the front left side of the array.

- A host-based mirroring solution is necessary to protect data in cache.

- Sun StorEdge T3 array workgroup configurations are supported in Sun Cluster 2.2 environments. Sun StorEdge T3 and T3+ array workgroup configurations are supported in Sun Cluster 3.0 environments.

Enterprise Configurations

- Partner groups can be connected to more than one host only if the following conditions exist:

  - The partner group must be connected to the hosts through a hub.

  - The configuration must be using Sun StorEdge Traffic Manager software for multipathing support.

  - The configuration must be a cluster configuration using Sun Cluster 3.0 software.

- You cannot use a daisy-chain configuration to link more than two controller units together.

- You can only connect arrays of the same type model in a partner group.

- In a cluster configuration, partner groups are supported using only Sun Cluster 3.0 software. They are not supported with Sun Cluster 2.2 software.

Caution – In an enterprise configuration, make sure you to use the MAC address of the *master* controller unit.

Configuration Recommendations

- Use enterprise configurations for controller redundancy.
- Use host-based software such as VERITAS Volume Manager (VxVM), Sun Enterprise™ Server Alternate Pathing (AP) software, or Sun StorEdge Traffic Manager for multipathing support.
- Connect redundant paths to separate host adapters, I/O cards, and system buses.
- Configure active paths over separate system buses to maximize bandwidth.

Caution – The array and its global parameters must be tailored to match the I/O workload for optimum performance. Within a partner group, both units will share the same *volume* configuration, block size, and cache mode. That is, all cache parameter settings are common to both units within a partner group.

Supported Platforms

Sun StorEdge T3 and T3+ arrays are supported on the following host platforms:

- Sun Ultra™ 60 and Ultra 80 workstations
- Sun Blade™ 1000 workstation
- Sun Enterprise 10000, 6*x*00, 5x00, 4*x*00, and 3*x*00 servers
- Sun Workgroup 450, 420R, 250, and 220R servers
- Sun Fire™ F6*x*00, F4*x*10, F4*x*00, F3*x*00, and F280R servers
- Netra™ t 1405 server

Tip – For the latest information on supported platforms, refer to the storage solutions web site at `http://www.sun.com/storage` and look for details on the Sun StorEdge T3 array product family.

Supported Software

The following software is supported on Sun StorEdge T3 and T3+ arrays:

- Solaris 2.6, Solaris 7, and Solaris 8 operating environments
- VERITAS Volume Manager 3.04 and later with DMP
- Sun Enterprise Server Alternate Pathing (AP) 2.3.1
- Sun StorEdge Component Manager 2.1 and later
- StorTools™ 3.3 Diagnostics
- Sun Cluster 2.2 and 3.0 software (see "Sun Cluster Support" on page 10)
- Sun StorEdge Data Management Center 3.0
- Sun StorEdge Instant Image 2.0
- Sun StorEdge Network Data Replicator (SNDR) 2.0
- Solstice Backup™ 5.5.1
- Solstice DiskSuite™ 4.2 and 4.2.1

Tip – For the latest information on supported software, refer to the storage solutions web site at `http://www.sun.com/storage` and look for details on the Sun StorEdge T3 array product family.

Sun Cluster Support

Sun StorEdge T3 and T3+ arrays are supported in Sun Cluster configurations with the following restrictions:

- Array controller firmware version 1.17b or later is required on each Sun StorEdge T3 array.
- Array controller firmware version 2.0 or later is required on each Sun StorEdge T3+ array.
- Workgroup configurations are supported in Sun Cluster 2.2 for the Sun StorEdge T3 array only. Sun Cluster 3.0 environments support both Sun StorEdge T3 and T3+ array models.
- Enterprise configurations are supported only in Sun Cluster 3.0 environments.
- Partner groups in a Sun Cluster environment must use Sun StorEdge Traffic Manager software for multipathing support.

- Switches are *not* supported.

- Hubs *must* be used.

- The Sun StorEdge SBus FC-100 (SOC+) HBA and the onboard SOC+ interface in Sun Fire™ systems are supported.

- On Sun Enterprise 6*x*00/5*x*00/4*x*00/3*x*00 systems, a maximum of 64 arrays are supported per cluster.

- On Sun Enterprise 10000 systems, a maximum of 256 arrays are supported per cluster.

- To ensure full redundancy, host-based mirroring software such as Solstice DiskSuite (SDS) 4.2 or SDS 4.2.1 *must* be used.

- Solaris 2.6 and Solaris 8 are the only supported operating systems.

Note – Refer to the latest Sun Cluster documentation for more information on Sun Cluster supported array configurations and restrictions.

Configuring Global Parameters

When an array is shipped, the global parameters are set to default values. This chapter describes how to reconfigure your array by changing these default values.

Caution – If you are planning an enterprise configuration using new factory units, be sure to install and set up the units as a partner group before you power on, and change any parameters or create/change any logical volumes. Refer to the *Sun StorEdge T3 and T3+ Array Installation, Operation, and Service Manual* for more information.

Note – For more information on changing array global parameters, refer to the *Sun StorEdge T3 and T3+ Array Administrator's Guide*.

The following parameters are described in this chapter:

- "Cache" on page 13
- "Logical Volumes" on page 16
- "Using RAID Levels to Configure Redundancy" on page 20

Cache

Each Sun StorEdge T3 array controller unit has 256 Mbytes of data cache; each Sun StorEdge T3+ array controller unit has 1 GByte of data cache. Writing to cache improves write performance by staging data in cache, assembling the data into data stripes, and then destaging the data from cache to disk, when appropriate. This method frees the data host for other operations while cache data is being destaged, and it eliminates the read-modify-write delays seen in non-cache systems. *Read cache* improves performance by determining which data will be requested for the next read operation and prestaging this data into cache. RAID 5 performance is also improved by coalescing writes.

Configuring Cache for Performance and Redundancy

Cache mode can be set to the following values:

- **Auto**. The cache mode is determined as either write-behind or write-through, based on the I/O profile. If the array has full redundancy available, then caching operates in write-behind mode. If any array component is non-redundant, the caching mode is set to write-through. Read caching is always performed. Auto caching mode provides the best performance while retaining full redundancy protection.

  Auto is the default cache mode for Sun StorEdge T3 and T3+ arrays.

- **Write-behind**. All read and write operations are written to cache. An algorithm determines when the data is destaged or moved from cache to disk. Write-behind cache improves performance, because a write to a high-speed cache is faster than a write to a normal disk.

  Use write-behind cache mode with a workgroup configuration when you want to force write-behind caching to be used.

⚠ **Caution –** In a workgroup configuration, use a host-based mirroring solution to protect data. This configuration does not offer the redundancy to provide cache mirroring, and operating without a host-based mirroring solution could lead to data loss in the event of a controller failure.

- **Write-through**. This cache mode forces write-through caching to be used. In write-through cache mode, data is written through cache in a serial manner and is then written to the disk. Write-through caching does not improve write performance. However, if a subsequent read operation needs the same data, the read performance is improved, because the data is already in cache.

- **None**. No reads or writes are cached.

Note – For full redundancy in an enterprise configuration, set the cache mode and the mirror variable to Auto. This ensures that the cache is mirrored between controllers and that write-behind cache mode is in effect. If a failure occurs, the data is synchronized to disk, and then write-through mode takes effect. Once the problem has been corrected and all internal components are again optimal, the system will revert to operating in write-behind cache mode.

Configuring Data Block Size

The data block size is the amount of data written to each drive when striping data across drives. (The block size is also known as the stripe unit size.) The block size can be changed only when there are no volumes defined. The block size can be configured as 16 Kbytes, 32 Kbytes, or 64 Kbytes. The default block size is 64 Kbytes.

A cache segment is the amount of data being read into cache. A cache segment is 1/8 of a data block. Therefore, cache segments can be 2 Kbytes, 4 Kbytes, or 8 Kbytes. Because the default block size is 64 Kbytes, the default cache segment size is 8 Kbytes.

Note – The array data block size is independent of I/O block size. Alignment of the two is not required.

Selecting a Data Block Size

If the I/O initiated from the host is 4 Kbytes, a data block size of 64 Kbytes would force 8 Kbytes of internal disk I/O, wasting 4 Kbytes of the cache segment. Therefore, it would be best to configure 32-Kbyte block sizes, causing 4-Kbyte physical I/O from the disk. If sequential activity occurs, full block writes (32 Kbytes) will take place. For 8-Kbyte I/O or greater from the host, use 64-Kbyte blocks.

Applications benefit from the following data block or stripe unit sizes:

- 16-Kbyte data block size
    - Online Transaction Processing (OLTP)
    - Internet service provider (ISP)
    - Enterprise Resource Planning (ERP)
- 32-Kbyte data block size
    - NFS™ file system, version 2
    - Attribute-intensive NFS file system, version 3
- 64-Kbyte data block size
    - Data-intensive NFS file system, version 3
    - Decision Support Systems (DSS)
    - Data Warehouse (DW)
    - High Performance Computing (HPC)

> **Note –** The data block size must be configured before any logical volumes are created on the units. Remember, this block size is used for every logical volume created on the unit. Therefore it is important to have similar application data configured per unit.

Data block size is universal throughout a partner group. Therefore, you cannot change it after you have created a volume. To change the data block size, you must first delete the volume(s), change the data block size, and then create new volume(s).

> **Caution –** Unless you back up and restore the data on these volumes, it will be lost.

Enabling Mirrored Cache

By enabling mirrored cache, you can safeguard cached data if a controller fails.

> **Note –** Mirrored cache is possible only in a redundant enterprise configuration.

Configuring Cache Allocation

Cache is allocated based on the read/write mix and it is dynamically adjusted by the controller firmware, based on the I/O profile of the application. If the application profile is configured for a 100% read environment, then 100% of the cache is used for reads. If the application profile has a high number of writes, then the upper limit for writes is set to 80%.

Logical Volumes

Also called a *logical unit number* (LUN), a logical volume is one or more disk drives that are grouped together to form a single unit. Each logical volume is represented to the host as a logical unit number. Using the format utility on the application host, you can view the logical volumes presented by the array. You can use this disk space as you would any physical disk, for example, to perform the following operations:

- Install a file system
- Use the device as a raw device (without any file system structure)
- Partition the device

Note – Individual physical disk drives are not visible from the application host. Refer to the *Sun StorEdge T3 and T3+ Array Administrator's Guide* for more information on creating logical volumes.

Guidelines for Configuring Logical Volumes

Use the following guidelines when configuring logical volumes:

- The array's native volume management can support a maximum of two volumes per array unit.
- The minimum number of drives is based on the RAID level, as follows:
  - RAID 0 and RAID 1 require a minimum of two drives.
  - RAID 5 requires a minimum of three drives.
- Drive number 9 can be designated as a *hot spare*. If designated, drive number 9 will be the hot spare for all volumes in the array.
- A partial drive configuration is not allowed.
- Volumes cannot span array units.

Consider the following questions when configuring logical volumes:

- How many logical volumes do you need (one or two)?
- What RAID level do you require?
- Do you need a hot spare?

Determining How Many Logical Volumes You Need

You can configure a volume into seven partitions (also known as *slices*) using the format(1M) utility. Alternatively, you can configure virtually a large number of partitions (also known as *subdisks*) using VERITAS Volume Manager. Therefore, arrays are best configured as one large volume.

Applications benefit from the following logical volume or LUN configurations:

- Two LUNs per array
  - OLTP
  - ISP
  - ERP
  - NFS, version 2
  - Attribute-intensive NFS, version 3
- One LUN per array

- Data-intensive NFS, version 3
- DSS
- DW
- HPC

Note – If you are creating new volumes or changing the volume configuration, you must first manually rewrite the label of the previous volume using the autoconfigure option of the format(1M) UNIX host command. For more information on this procedure, refer to the *Sun StorEdge T3 and T3+ Array Administrator's Guide*.

Caution – Removing and reconfiguring the volume will destroy all data previously stored there.

Determining Which RAID Level You Need

For a new array installation, the default configuration is 8+1 RAID 5, without a hot spare.

In general, RAID 5 is efficiently managed by the RAID controller hardware. This efficiency is apparent when compared to RAID 5 software solutions such as VERITAS Volume Manager.

The following applications benefit most from the RAID controller hardware of the array:

- Data-intensive NFS file system, version 3
- DSS
- DW
- HPC

Note – For more information about RAID levels, see "Using RAID Levels to Configure Redundancy" later in this chapter.

Determining Whether You Need a Hot Spare

If you choose to include a hot-spare disk drive in your configuration, you must specify it when you create the first volume in the array. If you want to add a hot spare at a later date, you must remove the existing volume(s) and recreate the configuration.

Note – Only one hot spare is allowed per array and it is only usable for the array in which it is configured. The hot spare must be configured as drive 9.

Drive 9 will be the hot spare in the unit. So, for example, should a drive failure occur on drive 7, drive 9 is synchronized automatically with the entire LUN to reflect the data on drive 7. Once the failed drive (7) is replaced, the controller unit will automatically copy the data from drive 9 to the new drive, and drive 9 will become a hot spare again.

Tip – Although they are not required, hot spares are always recommended for mission-critical configurations because they allow the controller unit to reconstruct the data from the RAID group and only take a performance hit while the reconstruction is taking place. If a hot spare is not used, the controller unit remains in write-through cache mode until the failed drive is replaced and reconstruction is complete (which could take an extended period of time). During this time, the array is operating in degraded mode.

If there is no hot spare, the reconstruction of the data will begin when the failed drive is replaced, provided RAID 1 or RAID 5 is used.

Creating and Labeling a Logical Volume

You must set the RAID level and the hot-spare disk when creating a logical volume. For the Solaris operating system to recognize a volume, it must be labeled with the `format` or `fmthard` command.

Caution – Removing and reconfiguring a logical volume will destroy all data previously stored there.

Setting the LUN Reconstruction Rate

Note – When a failed drive is disabled, the volume is operating without further redundancy protection, so the failed drive needs to be replaced as soon as possible.

If the volume has a hot spare configured and that drive is available, the data on the disabled drive is reconstructed on the hot-spare drive. When this operation is complete, the volume is operating with full redundancy protection, so another drive in the volume may fail without loss of data.

After a drive has been replaced, the original data is automatically reconstructed on the new drive. If no hot spare was used, the data is regenerated using the RAID redundancy data in the volume. If the failed drive data has been reconstructed onto a hot spare, once the reconstruction has completed, a copy-back operation begins where the hot spare data is copied to the newly replaced drive.

You can also configure the rate at which data is reconstructed, so as not to interfere with application performance. Reconstruction rate values are low, medium, and high as follows:

■ Low is the slowest and has the lowest impact on performance

■ Medium is the default

■ High is the fastest and has the highest impact on performance

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Note – Reconstruction rates can be changed while a reconstruction operation is in process. However, the changes don't take effect until the current reconstruction has completed.

Using RAID Levels to Configure Redundancy

The RAID level determines how the controller reads and writes data and *parity* on the drives. The Sun StorEdge T3 and T3+ arrays can be configured with RAID level 0, RAID level 1 (1+0) or RAID level 5. The factory-configured LUN is a RAID 5 LUN.

Note – The default RAID level (5) can result in very large volumes; for example, 128 Gbytes in a configuration of single 7+1 RAID 5 LUN plus hot spare, with 18 Gbyte drives. Some applications cannot use such large volumes effectively. The following two solutions can be used separately or in combination:

■ First, use the partitioning utility available on the data host's operating system. In the Solaris environment, use the `format` utility, which can create up to seven distinct partitions per volume. Note that in the case of the configuration described above, if each partition is equal in size, this will result in 18-Gbyte partitions, which still may be too large to be used efficiently by legacy applications.

■ Second, you can use third-party software on the host system to create as many partitions as desired from a given volume. In the Solaris environment, you can use VERITAS Volume Manager or Solaris Logical Volume Management (SLVM) formerly known as Solstice DiskSuite (SDS) for this purpose.

Note – For information on using the `format` utility, refer to the `format` (1M) man page. For more information on third-party software or VERITAS Volume Manager, refer to the documentation for that product.

RAID 0

Data blocks in a RAID 0 volume are striped across all the drives in the volume in order. There is no parity data, so RAID 0 uses the full capacity of the drives. There is, however, no redundancy. If a single drive fails, all data on the volume is lost.

RAID 1

Each data block in a RAID 1 volume is mirrored on two drives. If one of the mirrored pair fails, the data from the other drive is used. Because the data is mirrored in a RAID 1 configuration, the volume has only half the capacity of the assigned drives. For example, if you create a 4-drive RAID 1+0 volume with 18-Gbyte drives, the resulting data capacity is 4 x 18 / 2 = 36 Gbytes.

RAID 5

In a RAID 5 configuration, data is striped across the drives in the volumes in segments, with parity information being striped across the drives, as well. Because of this parity, if a single drive fails, data can be recovered from the remaining drives. Two drive failures cause all data to be lost. A RAID 5 volume has the data capacity of all the drives in the logical unit, less one. For example, a 5-drive RAID 5 volume with 18-Gbyte drives has a capacity of (5 - 1) x 18 = 72 Gbytes.

Configuring RAID Levels

The Sun StorEdge T3 and T3+ arrays are preconfigured at the factory with a single LUN, RAID level 5 redundancy and no hot spare. Once a volume has been configured, you cannot reconfigure it to change its size, RAID level, or hot spare configuration. You must first delete the volume and create a new one with the configuration values you want.

Configuring Partner Groups

Sun StorEdge T3 and T3+ arrays can be interconnected in *partner groups* to form a redundant and larger storage system.

Note – The terms *partner group* and *enterprise configuration* refer to the same type of configuration and are used interchangeably in this document.

Note – Partner groups are *not* supported in Sun Cluster 2.2 configurations.

This chapter describes how to configure array partner groups, and it includes the following sections:

- "Understanding Partner Groups" on page 23
- "How Partner Groups Work" on page 25
- "Creating Partner Groups" on page 26

Understanding Partner Groups

In a partner group, there is a *master controller unit* and an *alternate master controller unit*. The master controller unit is the array positioned at the bottom of an array stack in either a rackmounted or tabletop installation. The alternate master controller unit is positioned on top of the master controller unit. Array units are connected using the interconnect cards and interconnect cables. A partner group is shown in FIGURE 3-1.
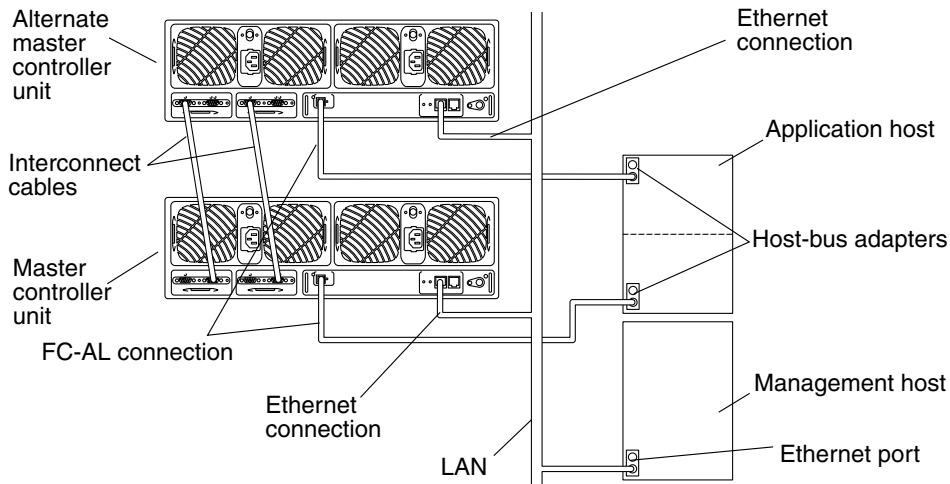
FIGURE 3-1   Sun StorEdge T3 Array Partner Group

Note – Sun StorEdge T3 arrays require a media-interface adapter (MIA) connected to the Fibre Channel port on the controller card to connect the fiber-optic cable. Sun StorEdge T3+ array configurations support direct FC-AL connections.

When two units are connected together, they form a redundant partner group. This group provides controller redundancy. Because the controller is a single point of failure in a standalone configuration, this redundancy allows an application host to access data even if a controller fails. This configuration offers multipath and LUN failover features.

The partner group connection also allows for a single point of control. The bottom unit will assume the role of the master, and from its Ethernet connections, it will be used to monitor and administer the unit installed above it.

The master controller unit will set the global variables within this storage system, including cache block size, cache mode, and cache mirroring.

Note – For information about setting or changing these parameters, refer to the *Sun StorEdge T3 and T3+ Array Administrator's Guide*.

Any controller unit will boot from the master controller unit's drives. All configuration data, including `syslog` information, is located on the master controller unit's drives.

How Partner Groups Work

If the master controller unit fails and the "heartbeat" between it and the alternate master stops, this failure causes a controller failover, where the alternate master assumes the role of the master controller unit. The new master (formerly the alternate master) takes the IP address and the MAC address from the old master and begins to function as the administrator of the storage system. It will also be able to access the former master controller unit's drives. The former master controller unit's drives will still be used to store `syslog` information, system configuration information, and bootcode. Should it become necessary to reboot the storage system while the master controller unit is inactive, the alternate master will use the former master controller unit's drives to boot.

Note – After the failed master controller is back online, it remains the alternate master controller and, as a result, the original configuration has been modified from its original state.

In a redundant partner group configuration, the units can be set to do a path failover operation. Normally the volumes or LUNs that are controlled by one unit are not accessible to the controller of the other. The units can be set so that if a failure in one controller occurs, the remaining one will accept I/O for the devices that were running on the failed controller. To enable this controller failover operation, multipathing software, such as VERITAS Volume Manager, Sun StorEdge Traffic Manager software, or Solaris Alternate Pathing (AP) software must be installed on the data application host.

Note – In order for a feature such VERITAS DMP to access a LUN through both controllers in a redundant partner group, the `mp_support` parameter must be set to `rw` to enable this feature. If you are using Sun StorEdge Traffic Manager, the `mp_support` parameter must be set to `mpxio`. For information on setting the `mp_support` parameter and options, refer to the *Sun StorEdge T3 and T3+ Array Administrator's Guide*.

Creating Partner Groups

Partner groups can be created in two ways:

■ From new units

■ From existing standalone units

Instructions for installing new array units and connecting them to create partner groups can be found in the *Sun StorEdge T3 and T3+ Array Installation, Operation, and Service Manual*.

To configure existing standalone arrays with data into a partner group, you must go through a qualified service provider. Contact your SunService representative for more information.

Caution – The procedure to reconfigure the arrays into a partner group involves deleting all data from array disks and restoring the data after the completing the reconfiguration. There is the potential risk of data loss or data corruption if the procedure is not performed properly.

Configuration Examples

This chapter includes sample reference configurations for Sun StorEdge T3 and T3+ arrays. Although there are many supported configurations, these reference configurations provide the best solution for many installations.:

Direct Host Connection

This section contains examples of the following configurations:

Single Host With One Controller Unit

FIGURE 4-1 shows one application host connected through an FC-AL cable to one array controller unit. The Ethernet cable connects the controller to a management host via a LAN on a public or separate network, and requires an IP address.

Note – This configuration is not recommended for RAS functionality because the controller is a single point of failure. In this type of configuration, use a host-based mirroring solution to protect data in cache.
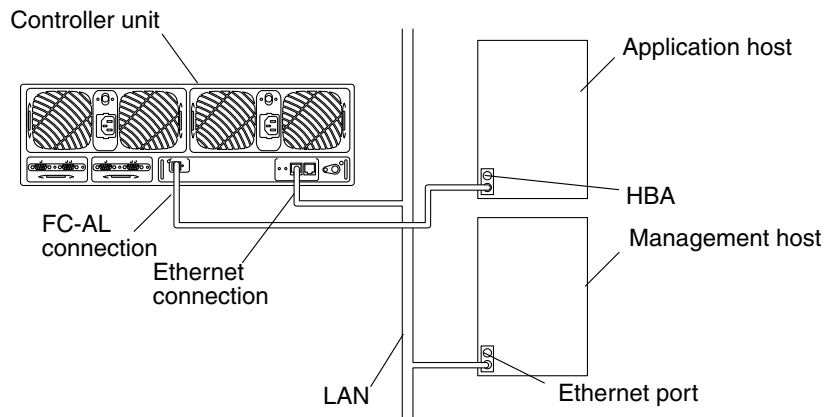
FIGURE 4-1   Single Host Connected to One Controller Unit

Note – For the Sun StorEdge T3 array, you must insert a media interface adapter (MIA) into the FC-AL connection port on the array controller card to connect the fiber-optic cable. This is detailed in the *Sun StorEdge T3 and T3+ Array Installation, Operation, and Service Manual*.
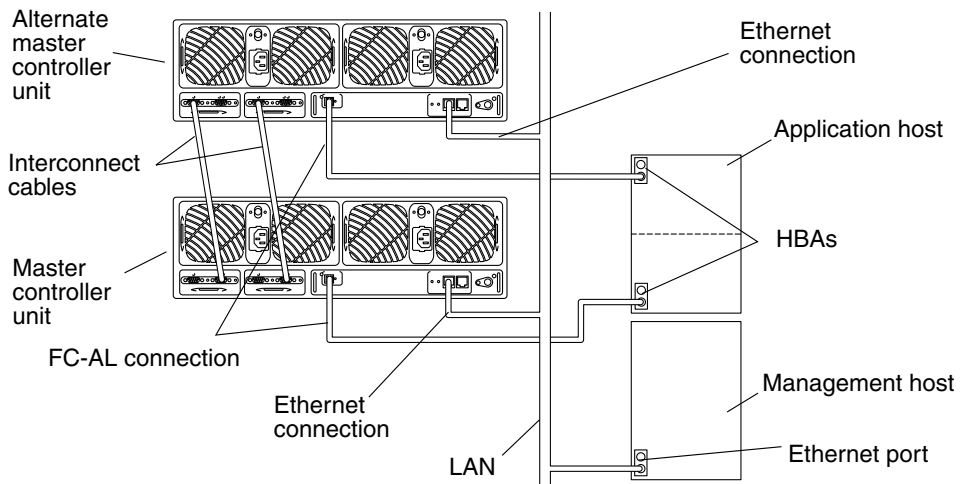
Single Host With Two Controller Units Configured as a Partner Group

FIGURE 4-2 shows one application host connected through FC-AL cables to one array partner group, which consists of two Sun StorEdge T3+ arrays. The Ethernet connection from the master controller unit is on a public or separate network and requires an IP address for the partner group. In the event of a failover, the alternate master controller unit will use the master controller unit's IP address and MAC address.

FIGURE 4-2   Single Host With Two Controller Units Configured as a Partner Group

This configuration is a recommended enterprise configuration for RAS functionality because there is no single point of failure. This configuration supports Dynamic Multi-Pathing (DMP) by VERITAS Volume Manager, the Alternate Pathing (AP) software in the Solaris operating environment, or Sun StorEdge Traffic Manager software for failover only.

The following three global parameters must be set on the master controller unit, as follows:

- `mp_support` = rw *or* `mpxio`
- `cache mode` = auto
- `cache mirroring` = auto

For information on setting these parameters, refer to the *Sun StorEdge T3 and T3+ Array Administrator's Guide*.

Host Multipathing Management Software

While Sun StorEdge T3 and T3+ arrays are redundant devices that automatically reconfigure whenever a failure occurs on any internal component, a host-based solution is needed for a redundant data path. Supported multipathing solutions include:

- The DMP feature in VERITAS Volume Manager
- Sun Enterprise Server Alternate Pathing software
- Sun StorEdge Traffic Manager software

During normal operation, I/O moves on the host channel connected to the controller that owns the LUNs. This path is a *primary path*. During failover operation, the multipathing software directs all I/O to the alternate channel's controller. This path is the *failover path*.

When a controller in the master controller unit fails, the alternate master controller unit becomes the master. When the failed controller is repaired, the new controller immediately boots, goes online and becomes the alternate master controller unit. The former alternate master controller unit remains the master controller unit.

Note – The multipathing software solution must be installed on the application host to achieve a fully redundant configuration.

FIGURE 4-3 shows a failover configuration.

FIGURE 4-3   Failover Configuration

Single Host With Four Controller Units Configured as Two Partner Groups

FIGURE 4-4 shows one application host connected through FC-AL cables to four arrays configured as two separate partner groups. This configuration can be used for capacity and I/O throughput requirements. Host-based Alternate Pathing software is required for this configuration.
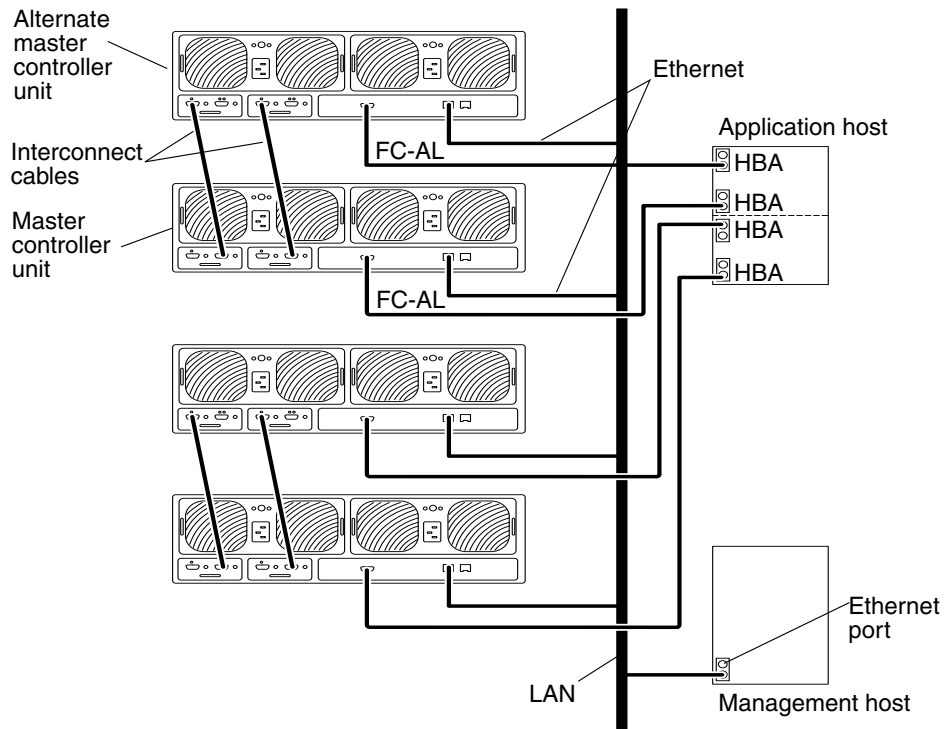

Note – This configuration is a recommended enterprise configuration for RAS functionality because the controller is not a single point of failure.

The following three parameters must be set on the master controller unit, as follows:
- mp_support = rw *or* mpxio
- cache mode = auto
- cache mirroring = auto

For information on setting these parameters, refer to the *Sun StorEdge T3 and T3+ Array Administrator's Guide*.

FIGURE 4-4   Single Host With Four Controller Units Configured as Two Partner Groups

Single Host With Eight Controller Units Configured as Four Partner Groups

FIGURE 4-5 shows one application host connected through FC-AL cables to eight Sun StorEdge T3+ arrays, forming four partner groups. This configuration is the maximum allowed in a 72-inch cabinet. This configuration can be used for footprint and I/O throughput.

Note – This configuration is a recommended enterprise configuration for RAS functionality because the controller is not a single point of failure.

The following three parameters must be set on the master controller unit, as follows:

- `mp_support = rw` *or* `mpxio`
- `cache mode = auto`
- `cache mirroring = auto`

Note – For information on setting these parameters, refer to the *Sun StorEdge T3 and T3+ Array Administrator's Guide*.

Host-based multipathing software is required for this configuration.

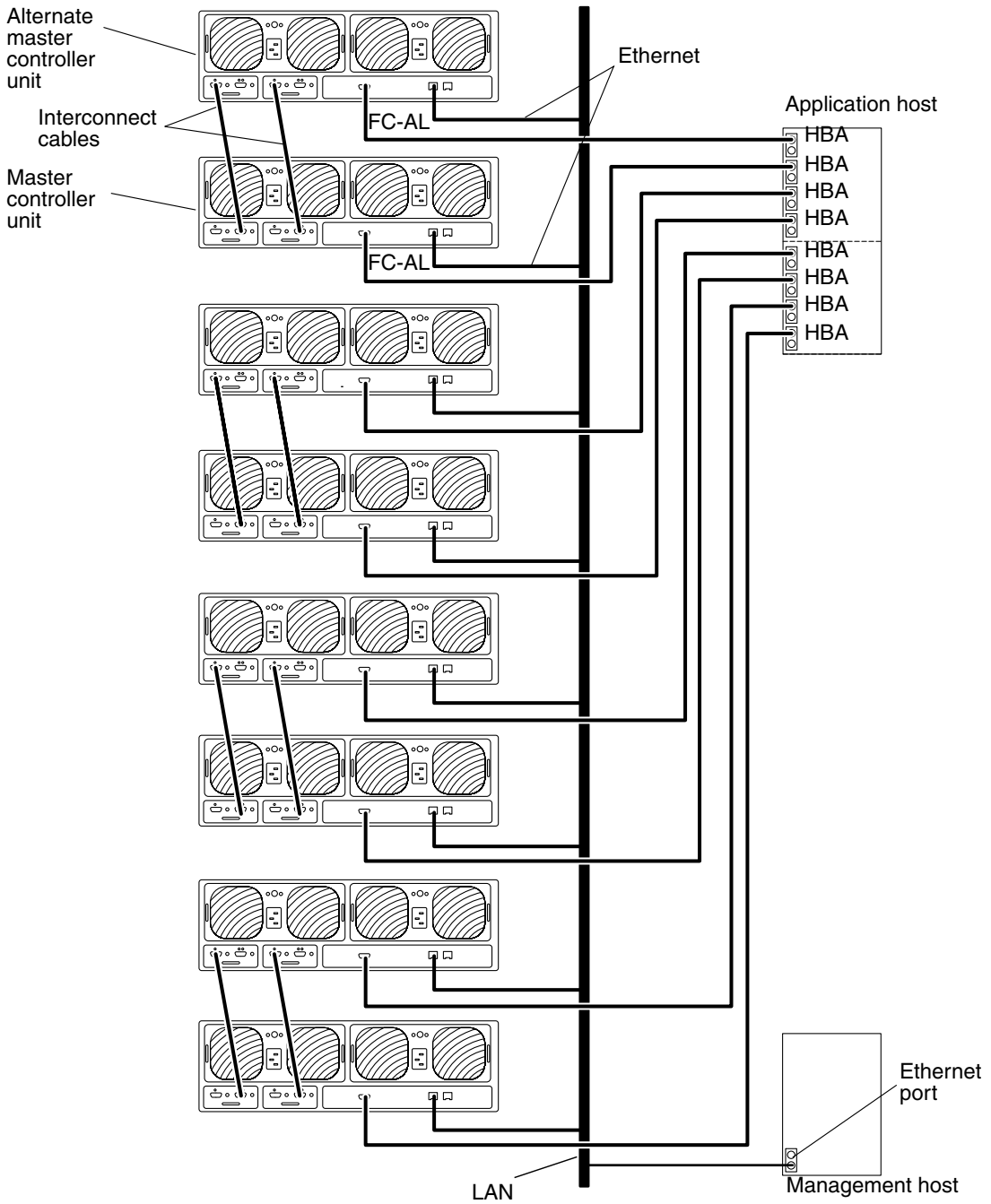**FIGURE 4-5** Single Host With Eight Controller Units Configured as Four Partner Groups

Hub Host Connection

The following sample configurations are included in this section:

- "Single Host With Two Hubs and Four Controller Units Configured as Two Partner Groups" on page 34
- "Single Host With Two Hubs and Eight Controller Units Configured as Four Partner Groups" on page 36
- "Dual Hosts With Two Hubs and Four Controller Units" on page 38
- "Dual Hosts With Two Hubs and Eight Controller Units" on page 40
- "Dual Hosts With Two Hubs and Four Controller Units Configured as Two Partner Groups" on page 42
- "Dual Hosts With Two Hubs and Eight Controller Units Configured as Four Partner Groups" on page 44

Single Host With Two Hubs and Four Controller Units Configured as Two Partner Groups

FIGURE 4-6 shows one application host connected through FC-AL cables to two hubs and two array partner groups. The Ethernet connection on the master controller unit is on a public or separate network and requires an IP address for the partner group. In the event of a failover, the alternate master controller unit will use the master controller unit's IP address and *MAC address.*

Note – This configuration is a recommended enterprise configuration for RAS functionality because the controller is not a single point of failure.

Note – There are no hub port position dependencies when connecting arrays to a hub. Arrays can be connected to any available port on the hub.

Each array needs to be assigned a unique target address using the `port set` command. These target addresses can be any number between 1 and 125. At the factory, the array target addresses are set starting with target address 1 for the bottom array and continuing to the top array. Use the `port list` command to verify that all arrays have a unique target address. Refer to Appendix A of the *Sun StorEdge T3 and T3+ Array Administrator's Guide* for further details.

The following three parameters must be set on the master controller unit, as follows:
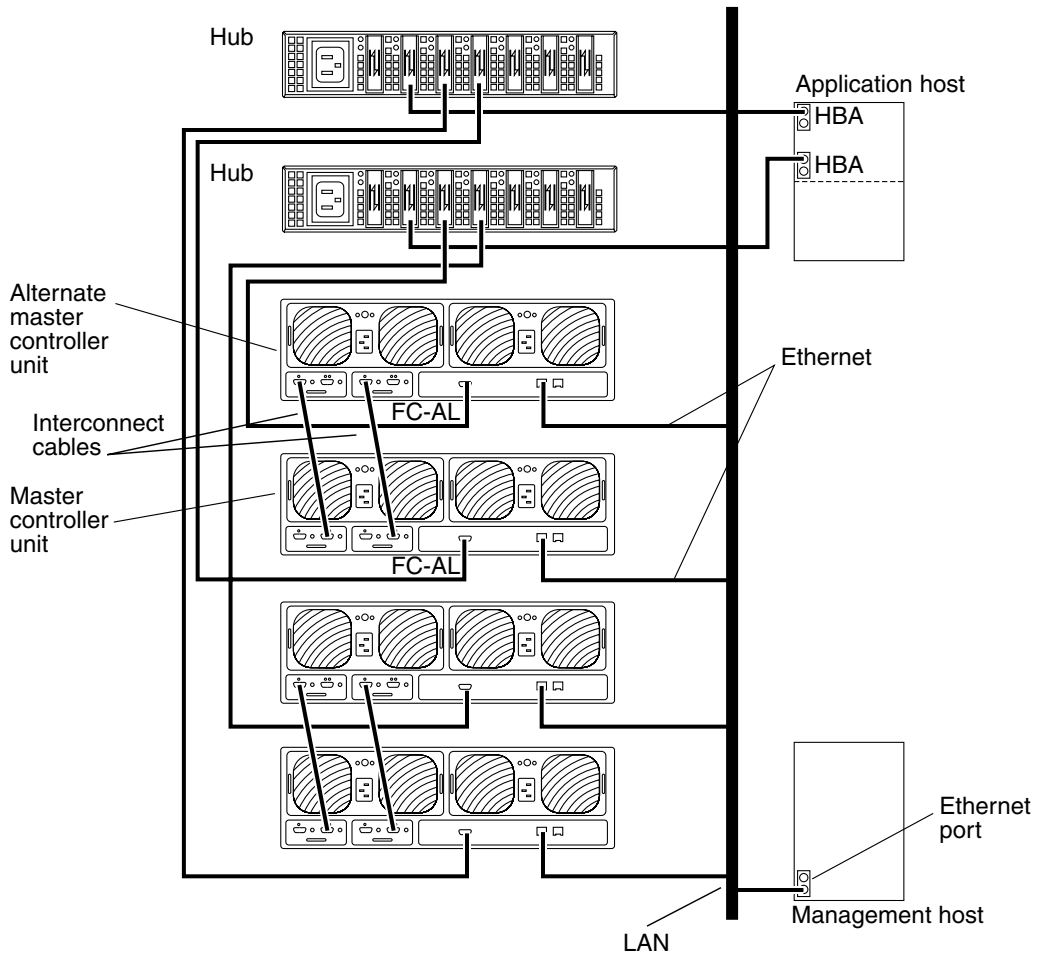
- `mp_support = rw` *or* `mpxio`
- `cache mode = auto`
- `cache mirroring = auto`

Note – For information on setting these parameters, refer to the *Sun StorEdge T3 and T3+ Array Administrator's Guide*

Host-based multipathing software is required for this configuration.

FIGURE 4-6   Single Host With Two Hubs and Four Controller Units Configured as Two Partner Groups

Single Host With Two Hubs and Eight Controller Units Configured as Four Partner Groups

FIGURE 4-7 shows one application host connected through FC-AL cables to two hubs and to eight Sun StorEdge T3+ arrays, forming four partner groups. This configuration is the maximum allowed in a 72-inch cabinet. This configuration can be used for footprint and I/O throughput.

Note – This configuration is a recommended enterprise configuration for RAS functionality because the controller is not a single point of failure.

Note – There are no hub port position dependencies when connecting arrays to a hub. An array can be connected to any available port on the hub.

Each array needs to be assigned a unique target address using the `port set` command. These target addresses can be any number between 1 and 125. At the factory, the array target addresses are set starting with target address 1 for the bottom array and continuing to the top array. Use the `port list` command to verify that all arrays have a unique target address. Refer to Appendix A of the *Sun StorEdge T3 and T3+ Array Administrator's Guide* for further details.

The following three parameters must be set on the master controller unit, as follows:

- `mp_support = rw` *or* `mpxio`
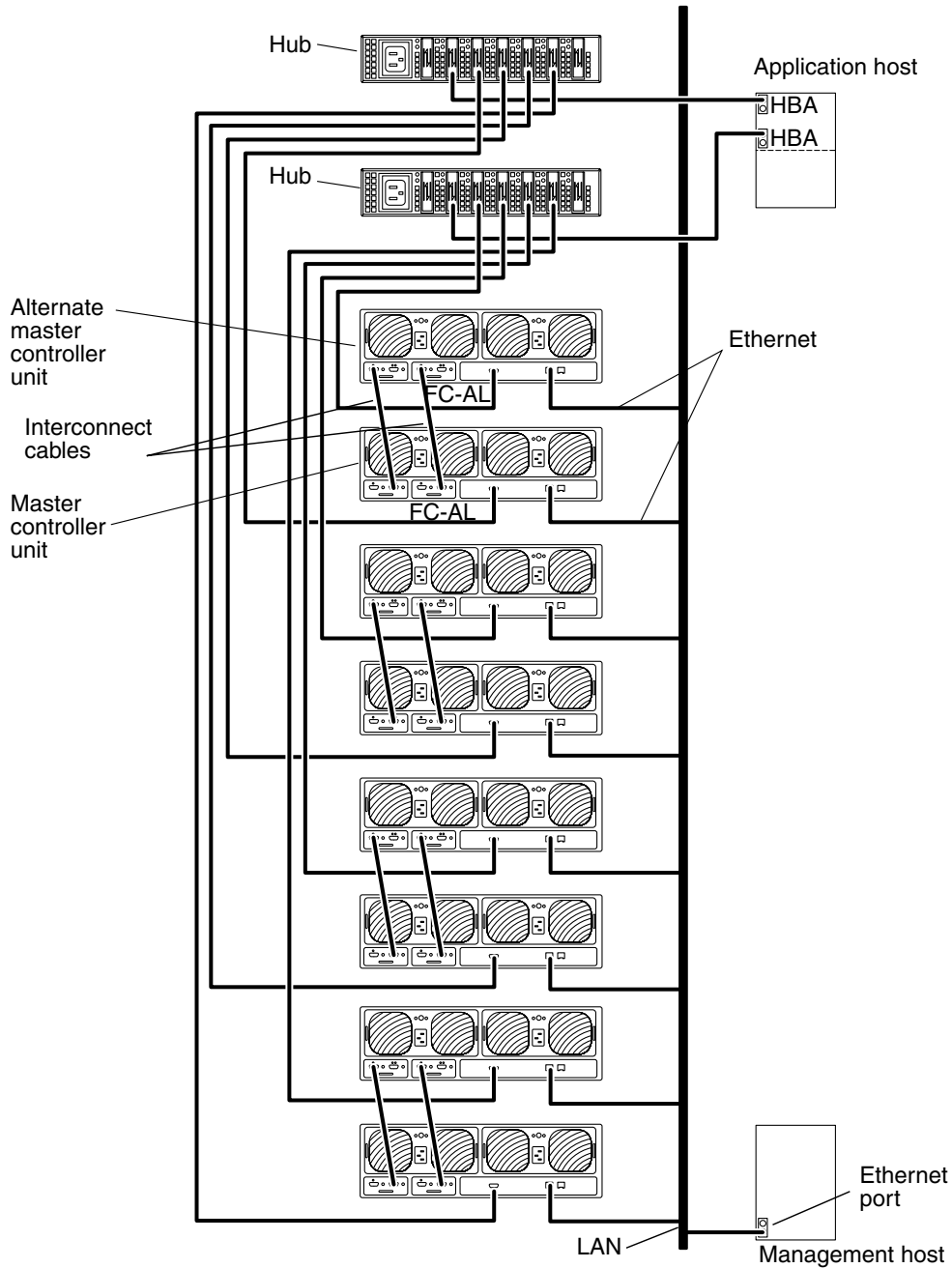- `cache mode = auto`
- `cache mirroring = auto`

Note – For information on setting these parameters, refer to the *Sun StorEdge T3 and T3+ Array Administrator's Guide*

Host-based multipathing software is required for this configuration.

FIGURE 4-7 Single Host With Two Hubs Configured and Eight Controller Units as Four
Partner Groups

Dual Hosts With Two Hubs and Four Controller Units

FIGURE 4-8 shows two application hosts connected through FC-AL cables to two hubs and four Sun StorEdge T3+ arrays. This configuration, also known as a *multi-initiator configuration*, can be used for footprint and I/O throughput. The following limitations should be evaluated when proceeding with this configuration:

- Avoid the risk caused by any array or data path single point of failure using host-based mirroring software such as VERITAS Volume Manager or Solaris Volume Manager.
- When configuring more than a single array to share a single FC-AL loop, as with a hub, array target addresses need to be set to unique values.

This configuration is not a recommended for RAS functionality because the controller is a single point of failure.

Note – There are no hub port position dependencies when connecting arrays to a hub. An array can be connected to any available port on the hub.

Each array needs to be assigned a unique target address using the `port set` command. These target addresses can be any number between 1 and 125. At the factory, the array target addresses are set starting with target address 1 for the bottom array and continuing to the top array. Use the `port list` command to verify that all arrays have a unique target address. Refer to Appendix A of the *Sun StorEdge T3 and T3+ Array Administrator's Guide* for further details.
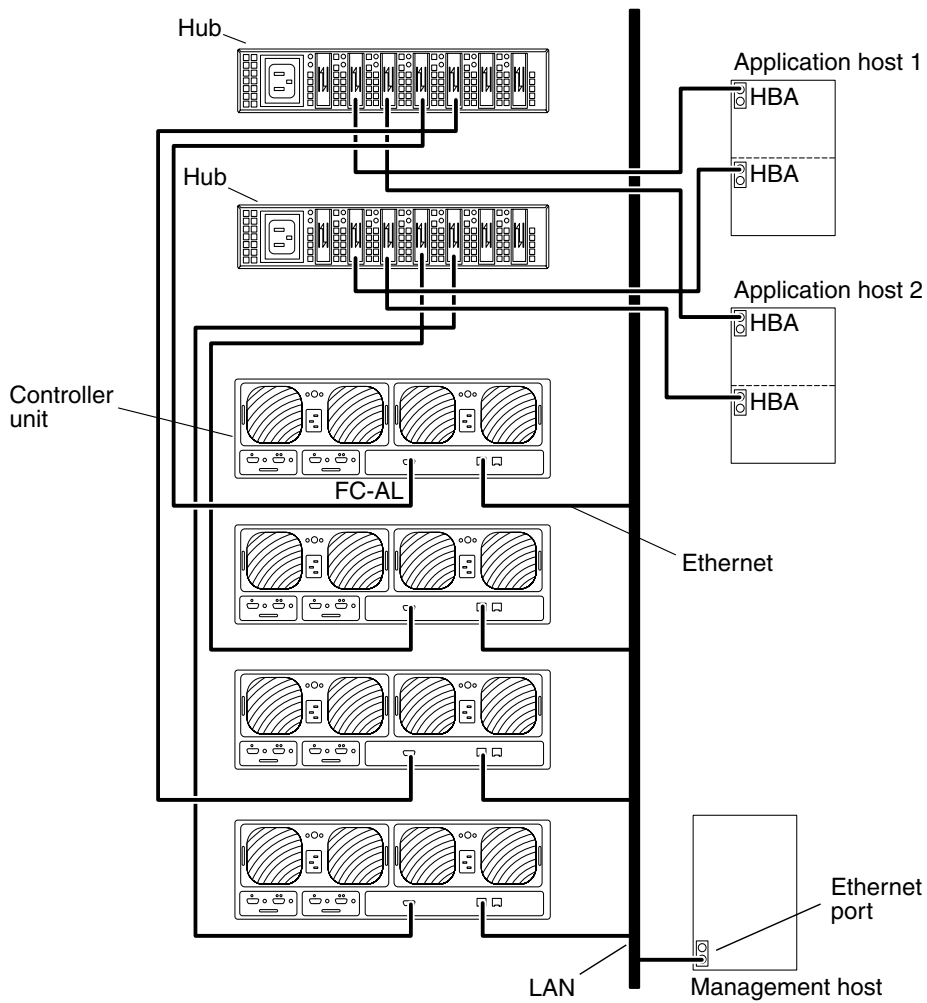
The following two parameters must be set on the master controller unit, as follows:

- `cache mode = auto`
- `cache mirroring = auto`

Note – For information on setting these parameters, refer to the *Sun StorEdge T3 and T3+ Array Administrator's Guide*.

FIGURE 4-8   Dual Hosts With Two Hubs and Four Controller Units

Dual Hosts With Two Hubs and Eight Controller Units

FIGURE 4-9 shows two application hosts connected through FC-AL cables to two hubs and eight Sun StorEdge T3+ arrays. This configuration, also known as a *multi-initiator configuration*, can be used for footprint and I/O throughput. The following limitations should be evaluated when proceeding with this configuration

- Avoid the risk caused by any array or data path single point of failure using host-based mirroring software such as VERITAS Volume Manager or Solaris Volume Manager.

Note – This configuration, running host-based mirroring features from VERITAS Volume Manager or Solaris Logical Volume Manager, represents four arrays of data mirrored to the other four trays using host-based mirroring.

- When configuring more than a single array to share a single FC-AL loop, as with a hub, array target addresses need to be set to unique values.

This configuration is not a recommended for RAS functionality because the controller is a single point of failure.

Note – There are no hub port position dependencies when connecting arrays to a hub. An array can be connected to any available port on the hub.

Each array needs to be assigned a unique target address using the `port set` command. These target addresses can be any number between 1 and 125. At the factory, the array target addresses are set starting with target address 1 for the bottom array and continuing to the top array. Use the `port list` command to verify that all arrays have a unique target address. Refer to Appendix A of the *Sun StorEdge T3 and T3+ Array Administrator's Guide* for further details.
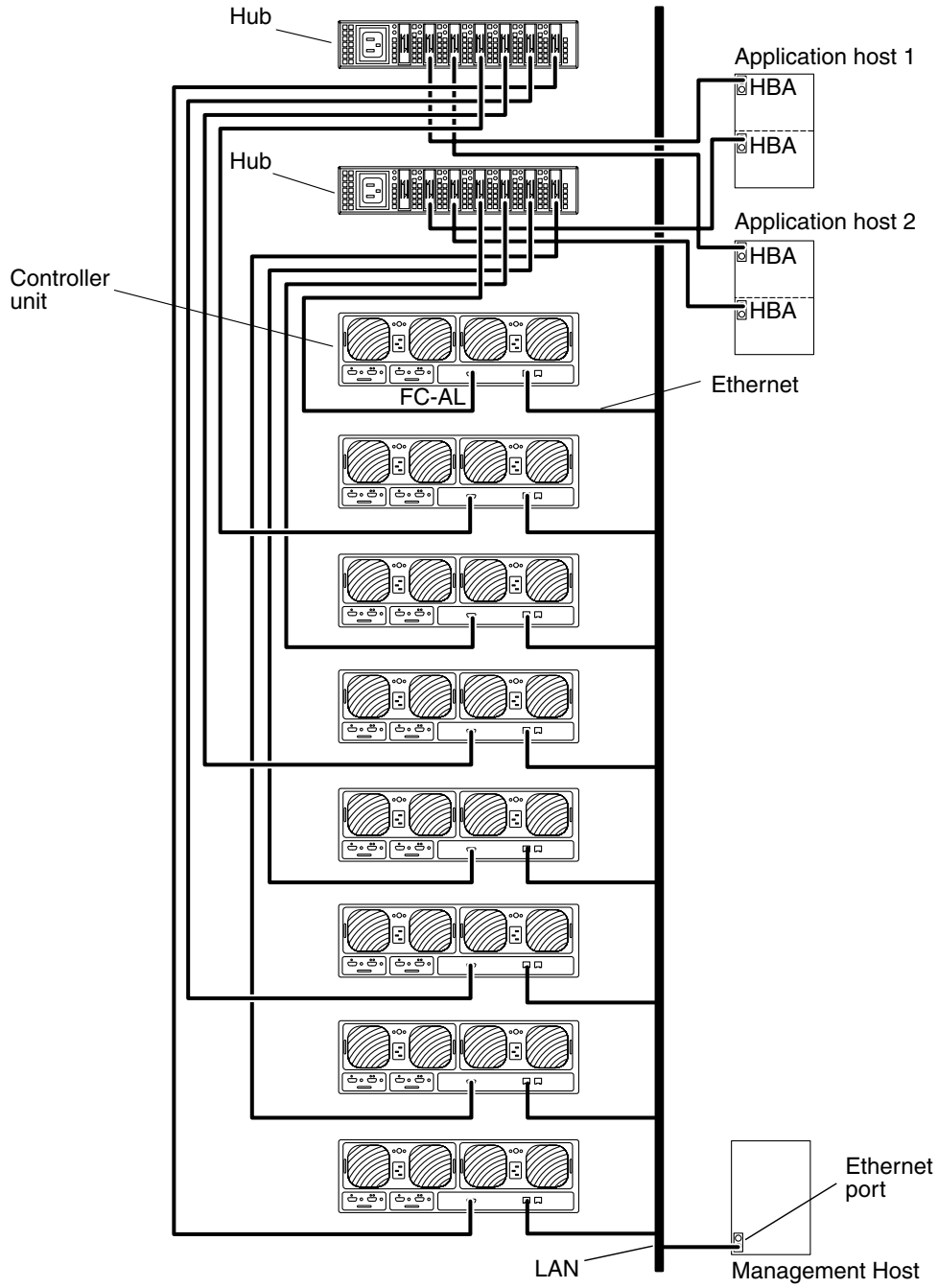
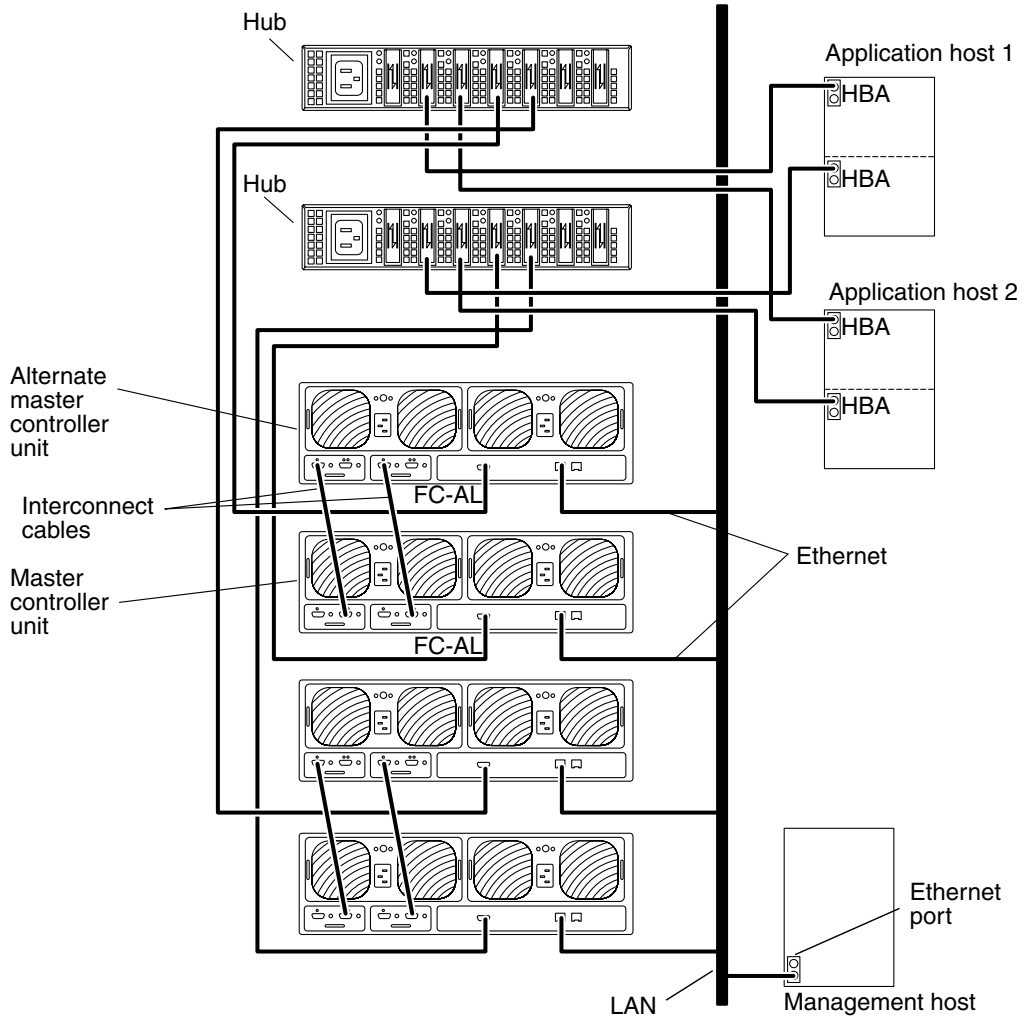The following two parameters must be set on the master controller unit, as follows:

- `cache mode = auto`
- `cache mirroring = auto`

Note – For information on setting these parameters, refer to the *Sun StorEdge T3 and T3+ Array Administrator's Guide*.

FIGURE 4-9 Dual Hosts With Two Hubs and Eight Controller Units

Dual Hosts With Two Hubs and Four Controller Units Configured as Two Partner Groups

FIGURE 4-8 shows two application hosts connected through FC-AL cables to two hubs and four Sun StorEdge T3+ arrays forming two partner groups. This *multi-initiator configuration* can be used for footprint and I/O throughput.

Note – This configuration is a recommended enterprise configuration for RAS functionality because the controller is not a single point of failure.

Note – There are no hub port position dependencies when connecting arrays to a hub. An array can be connected to any available port on the hub.

Each array needs to be assigned a unique target address using the `port set` command. These target addresses can be any number between 1 and 125. At the factory, the array target addresses are set starting with target address 1 for the bottom array and continuing to the top array. Use the `port list` command to verify that all arrays have a unique target address. Refer to Appendix A of the *Sun StorEdge T3 and T3+ Array Administrator's Guide* for further details.

The following three parameters must be set on the master controller unit, as follows:

- `mp_support = rw` *or* `mpxio`
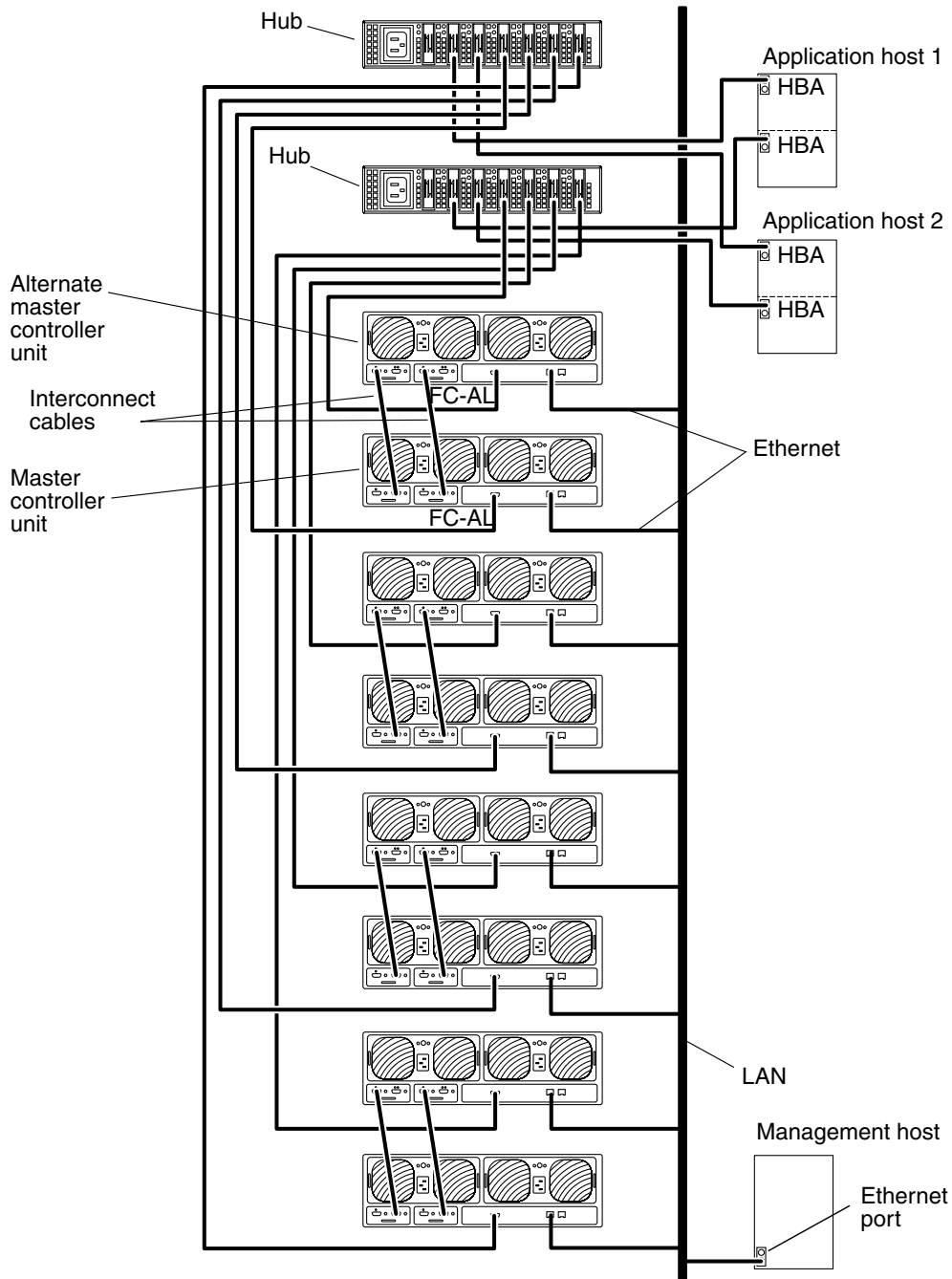- `cache mode = auto`
- `cache mirroring = auto`

Note – For information on setting these parameters, refer to the *Sun StorEdge T3 and T3+ Array Administrator's Guide*

Host-based multipathing software is required for this configuration.

FIGURE 4-10 Dual Hosts With Two Hubs and Four Controller Units Configured as Two Partner Groups

Dual Hosts With Two Hubs and Eight Controller Units Configured as Four Partner Groups

FIGURE 4-9 shows two application hosts connected through FC-AL cables to two hubs and eight Sun StorEdge T3+ arrays forming four partner groups. This multi-initiator configuration can be used for footprint and I/O throughput.

This configuration is a recommended enterprise configuration for RAS functionality because the controller is not a single point of failure.

Note – There are no hub port position dependencies when connecting Sun StorEdge T3 and T3+ arrays to a hub. An array can be connected to any available port on the hub.

When configuring more than one partner group or a single array to share a single FC-AL loop, as with a hub, array target addresses need to be set to unique values. Assign the array target address using the `port set` command. These target addresses can be any number between 1 and 125. At the factory, the array target addresses are set starting with target address 1 for the bottom array and continuing to the top array. Use the `port list` command to verify that all arrays have a unique target address. Refer to Appendix A of the *Sun StorEdge T3 and T3+ Array Administrator's Guide* for further details.

The following two parameters must be set on the master controller unit, as follows:

■ `mp_support = rw` *or* `mpxio`
■ `cache mode = auto`
■ `cache mirroring = auto`

Note – For information on setting these parameters, refer to the *Sun StorEdge T3 and T3+ Array Administrator's Guide*

Host-based multipathing software is required for this configuration.

FIGURE 4-11 Dual Hosts With Two Hubs and Eight Controller Units Configured as Four Partner Groups

Switch Host Connection

This section contains the following example configurations:

- "Dual Hosts With Two Switches and Two Controller Units" on page 46
- "Dual Hosts With Two Switches and Eight Controller Units" on page 48

Dual Hosts With Two Switches and Two Controller Units

FIGURE 4-12 shows two application hosts connected through FC-AL cables to two switches and two Sun StorEdge T3+ arrays. This multi-initiator configuration can be used for footprint and I/O throughput.

Note – This configuration is not a recommended for RAS functionality because the controller is a single point of failure.

Evaluate the following limitations before proceeding with this configuration:

- Avoid the risk caused by any array or data path single point of failure using host-based mirroring software such as VERITAS Volume Manager or Solaris Volume Manager.
- When configuring more than a single array to share a single FC-AL loop, as with a hub, array target addresses need to be set to unique values.

Each array needs to be assigned a unique target address using the `port set` command. These target addresses can be any number between 1 and 125. At the factory, the array target addresses are set starting with target address 1 for the bottom array and continuing to the top array. Use the `port list` command to verify that all arrays have a unique target address. Refer to Appendix A of the *Sun StorEdge T3 and T3+ Array Administrator's Guide* for further details.

The following two parameters must be set on the master controller unit, as follows:

- `cache mode = auto`
- `cache mirroring = auto`

Note – For information on setting these parameters, refer to the *Sun StorEdge T3 and T3+ Array Administrator's Guide*.
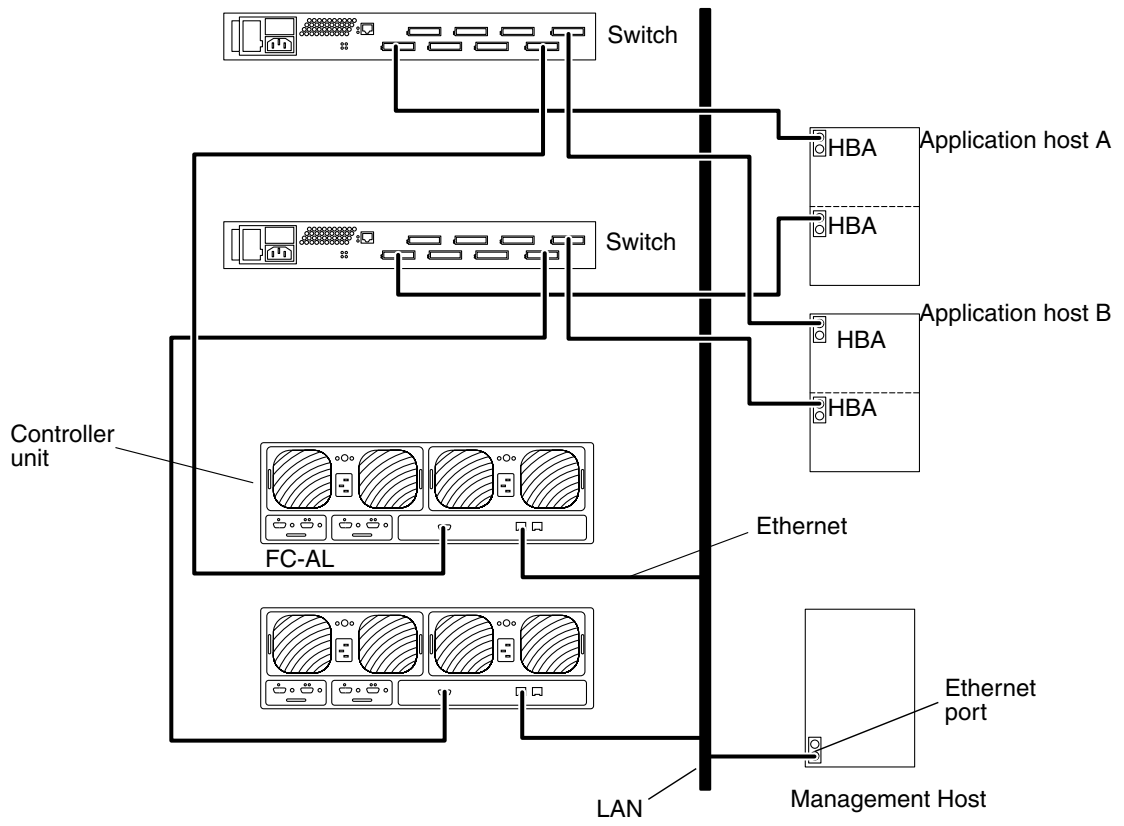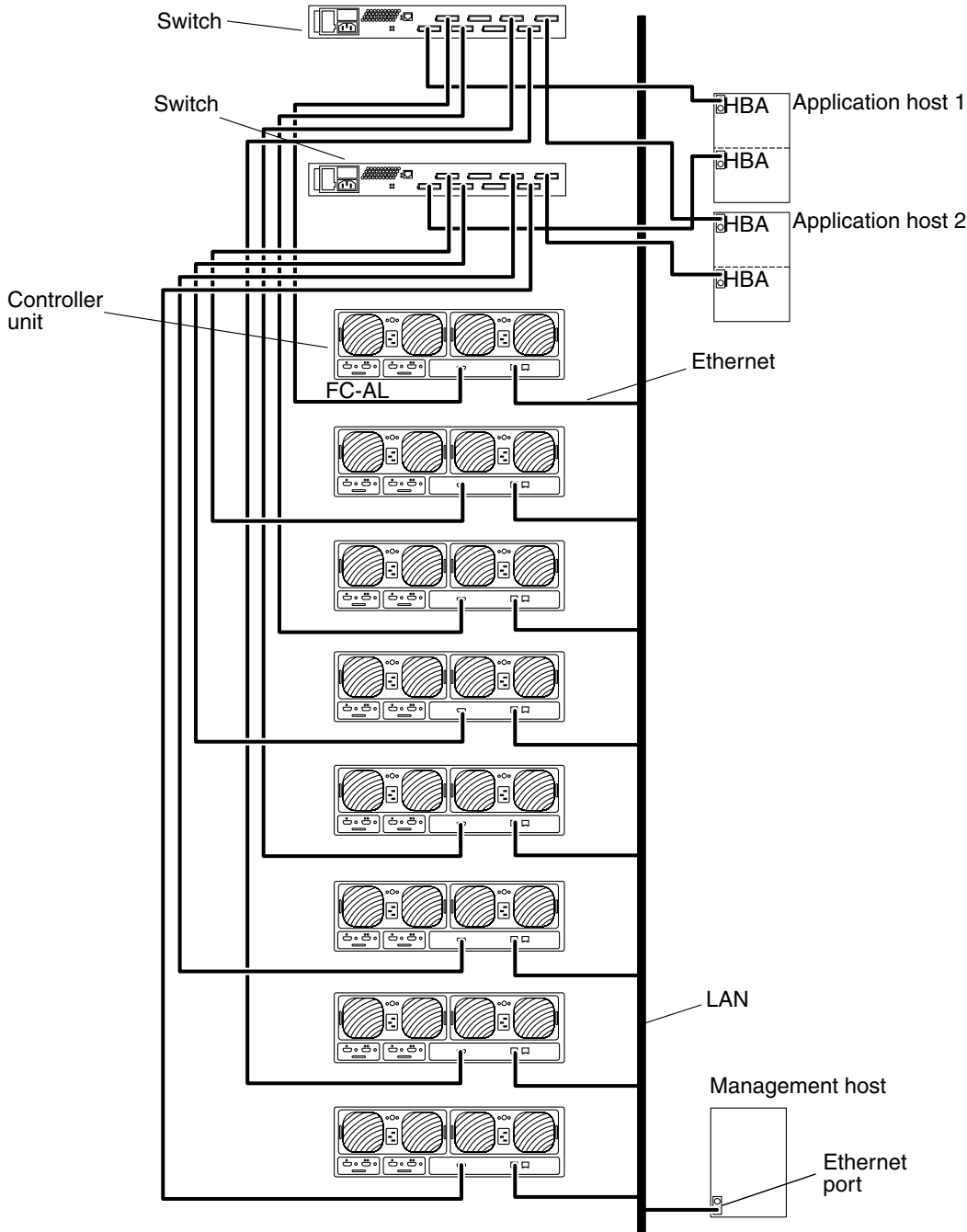

**FIGURE 4-12** Dual Hosts With Two Switches and Two Controller Units

Dual Hosts With Two Switches and Eight Controller Units

FIGURE 4-13 shows two application hosts connected through FC-AL cables to two switches and eight Sun StorEdge T3+ arrays. This multi-initiator configuration, can be used for footprint and I/O throughput.

Note – This configuration is not a recommended for RAS functionality because the controller is a single point of failure.

The following limitations should be evaluated when proceeding with this configuration:

- Avoid the risk caused by any array or data path single point of failure using host-based mirroring software such as VERITAS Volume Manager or Solaris Logical Volume Manager.
- When configuring more than a single array to share a single FC-AL loop, as with a hub, array target addresses need to be set to unique values.

Each array needs to be assigned a unique target address using the `port set` command. These target addresses can be any number between 1 and 125. At the factory, the array target addresses are set starting with target address 1 for the bottom array and continuing to the top array. Use the `port list` command to verify that all arrays have a unique target address. Refer to Appendix A of the *Sun StorEdge T3 and T3+ Array Administrator's Guide* for further details.

The following two parameters must be set on the master controller unit, as follows:

- `cache mode = auto`
- `cache mirroring = auto`

Note – For information on setting these parameters, refer to the *Sun StorEdge T3 and T3+ Array Administrator's Guide*.

FIGURE 4-13 Dual Hosts With Two Switches and Eight Controller Units

Host Connections

This chapter describes the host bus adapters (HBAs) that are supported by Sun StorEdge T3 and T3+ arrays:

Sun Enterprise SBus+ and Graphics+ I/O Boards

The SBus+ and Graphics+ I/O boards each provide mounting for two *Gigabit Interface Converters* (GBICs). For more detailed information about these I/O boards, refer to the *Sun Enterprise 6x00/5x00/4x00/3x00 Systems SBus+ and Graphics+ I/O Boards Installation Guide*, part number 805-2704. FIGURE 5-1 shows an Enterprise 6x00/5x00/4x00/3x00 SBus+ I/O board.
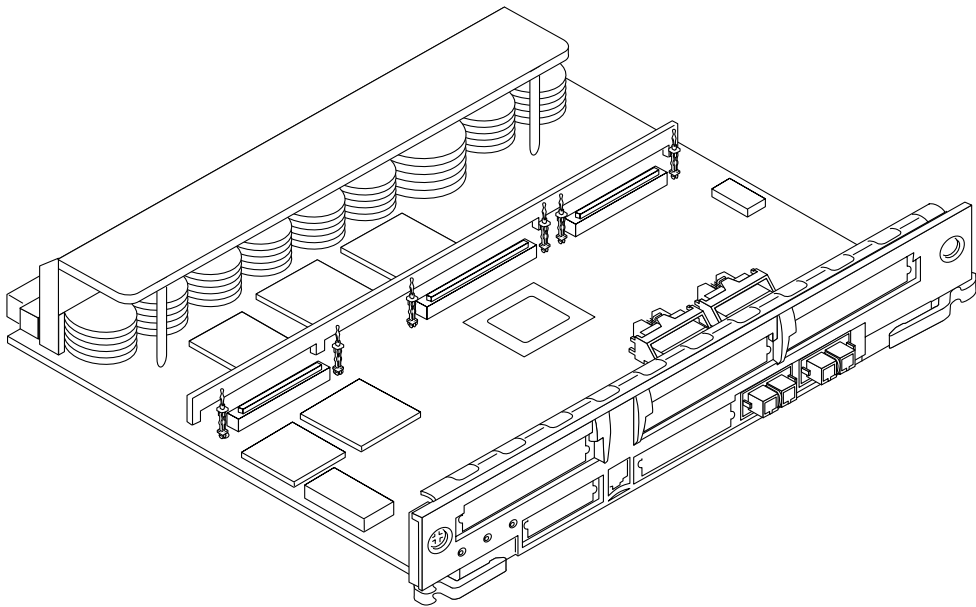
FIGURE 5-1   Sun Enterprise 6x00/5x00/4x00/3x00 SBus+ I/O Board

System Requirements

Your system must meet the following hardware and software requirements:

- Sun Enterprise 6x00/5x00/4x00/3x00 system
- An available I/O board slot
- OpenBoot™ PROM, version 3.2.10 or later
- A release of the Solaris operating environment that supports this board. The first release that supports this board is the Solaris 2.6 operating environment.

Sun StorEdge PCI FC-100 Host Bus Adapter

The Sun StorEdge PCI FC-100 host bus adapter is a 33-MHz, 100 Mbytes/second, single-loop Fibre Channel PCI host bus adapter with an onboard GBIC. This host bus adapter is PCI Version 2.1-compliant. For more detailed information about this product, refer to the *Sun StorEdge PCI FC-100 Host Adapter Installation Manual*, part number 805-3682. FIGURE 5-2 shows a Sun StorEdge PCI FC-100 host bus adapter.
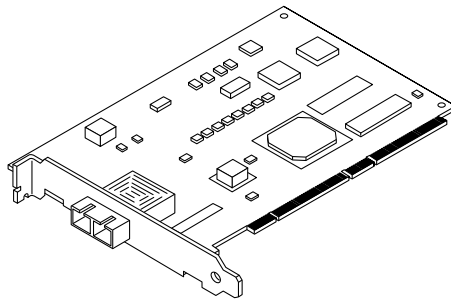
FIGURE 5-2   Sun StorEdge PCI FC-100 Host Bus Adapter
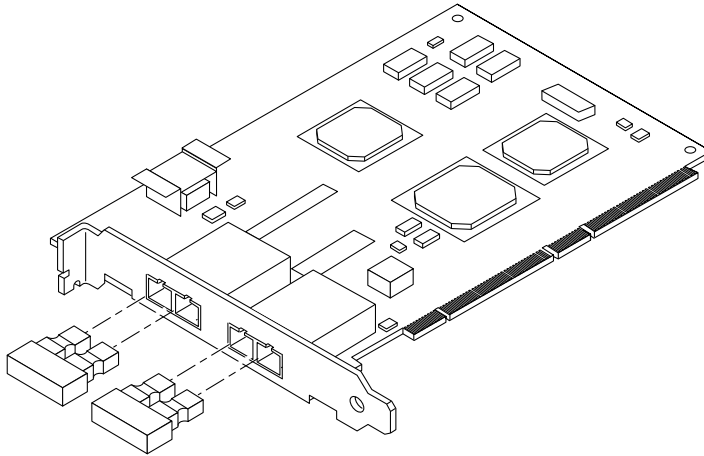
System Requirements

Your system must meet the following hardware and software requirements:

- An available PCI port
- A release of the Solaris operating environment that supports this board. The first release that supports this board is the Solaris 2.6 operating environment

Sun StorEdge SBus FC-100 Host Bus Adapter

The Sun StorEdge SBus FC-100 host bus adapter is a single-width Fibre Channel SBus card with a Sun Serial Optical Channel (SOC+) ASIC (application-specific integrated circuit). You can connect up to two loops to each card, using hot-pluggable GBICs. For more detailed information about this product, refer to the *Sun StorEdge SBus FC-100 Host Adapter Installation and Service Manual*, part number 802-7572. FIGURE 5-3 shows a Sun StorEdge SBus FC-100 host bus adapter.
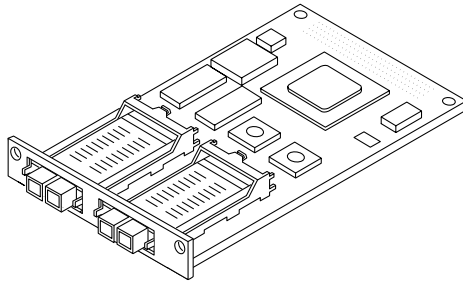
FIGURE 5-3   Sun StorEdge SBus FC-100 Host Bus Adapter
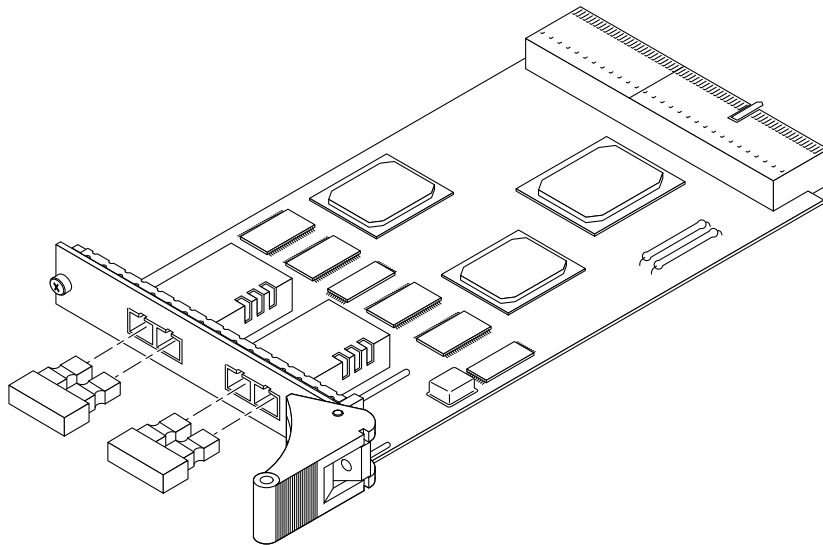
System Requirements

Your system must meet the following hardware and software requirements:

- An available SBus port
- A release of the Solaris operating environment that supports this board. The first release that supports this board is the Solaris 2.6 operating environment.

Sun StorEdge PCI Single Fibre Channel Network Adapter

The Sun StorEdge PCI Single Fibre Channel network adapter is a Fibre Channel PCI card with one onboard optical receiver. This network adapter is PCI Version 2.1-compliant. For more detailed information about this product, refer to the *Sun StorEdge PCI Single Fibre Channel Network Adapter Installation Guide*, part number 806-7532-*xx*. FIGURE 5-4 shows a Sun StorEdge PCI Single Fibre Channel network adapter.
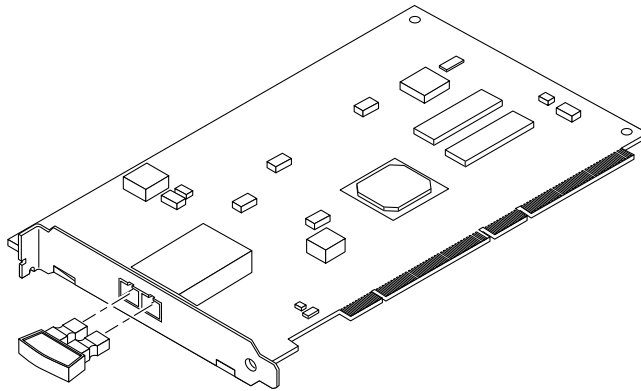
FIGURE 5-4   Sun StorEdge PCI Single Fibre Channel Network Adapter

System Requirements

Your system must meet the following hardware and software requirements:

- An available PCI port
- A release of the Solaris operating environment that supports this board. The first release that supports this board is the Solaris 7 11/99 operating environment.

Sun StorEdge PCI Dual Fibre Channel Network Adapter

The Sun StorEdge PCI Dual Fibre Channel network adapter is a Fibre Channel PCI card with two onboard optical transceivers. This network adapter is PCI Version 2.1-compliant. For more detailed information about this product, refer to the *Sun StorEdge PCI Dual Fibre Channel Network Adapter Installation Guide*, part number 806-4199-*xx*. FIGURE 5-6 shows a Sun StorEdge PCI Dual Fibre Channel network adapter.

FIGURE 5-5 Sun StorEdge PCI Dual Fibre Channel Network Adapter

System Requirements

Your system must meet the following hardware and software requirements:

- An available PCI slot
- A release of the Solaris operating environment that supports this board. The first release that supports this board is the Solaris 7 11/99 operating environment.

Sun StorEdge CompactPCI Dual Fibre Channel Network Adapter

The Sun StorEdge CompactPCI Dual Fibre Channel network adapter has two 1-Gbit Fibre Channel ports on a cPCI card. For more detailed information about this product, refer to the *Sun StorEdge CompactPCI Dual Fibre Channel Network Adapter Installation Guide*, part number 816-0241-*xx*. FIGURE 5-6 shows a Sun StorEdge CompactPCI Dual Fibre Channel network adapter.

FIGURE 5-6   Sun StorEdge CompactPCI Dual Fibre Channel Network Adapter

System Requirements

Your system must meet the following hardware and software requirements:

- An available cPCI port
- OpenBoot PROM version 5.1 or later
- Solaris 8 operating environment

Array Cabling

This chapter describes the array configurations supported by the Sun StorEdge T3 and T3+ arrays, and it includes the following sections:

- "Overview of Array Cabling" on page 59
- "Workgroup Configurations" on page 62
- "Enterprise Configurations" on page 63

Overview of Array Cabling

Sun StorEdge T3 and T3+ arrays have the following connections:

- One FC-AL interface to the application host
- One Ethernet interface to the management host (via a LAN) for administration purposes
- One serial interface to be used for service tasks by qualified service personnel only
- Interconnect ports for configuring arrays into partner groups

Data Path

For the data path (FC-AL) connection, there are three ways that the array can connect to the host:

- Direct attached mode to the data host
- Hub connection, where the FC-AL from the array is connected to a hub on the same network as the data host

- Switch connection where the FC-AL from the array is connected to a switch on the same network as the data host.

Administration Path

For the administration path, each controller unit has an Ethernet connector. For each installed controller, an Ethernet connection and IP address are required. The administration server uses this link to set up and manage the arrays using Sun StorEdge Component Manager software.

Note – In a partner group, only one of the two Ethernet connections is active at any time. The second Ethernet connection is used for redundancy.

Connecting Partner Groups

The array also has two interconnect cards that are used to connect the array in a partner group. These interconnect cards have two ports (in and out).

Note – Partner groups are *not* supported in Sun Cluster 2.2.

Note – In a workgroup (standalone) configuration, these interconnect cards cannot be used to connect to the administrative console or to the application host. These interconnect cards are used solely for ensuring redundancy and failover mechanisms in partner groups.

FIGURE 6-1 and FIGURE 6-2 show a Sun StorEdge T3 and T3+ array with a controller card and interconnect cards.

Controller card

Serial port (RJ-11)

10BASE-T Ethernet port (RJ-45)

Interconnect
cards

FC-AL data connection port

Note: FC-AL port requires an MIA for cable connection.
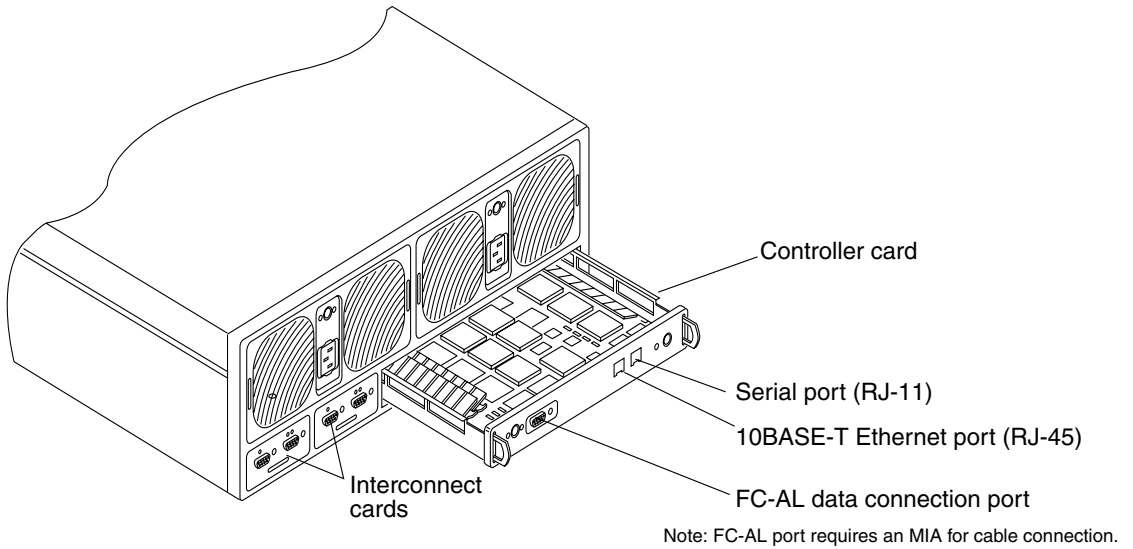
FIGURE 6-1   Sun StorEdge T3 Array Controller Card and Interconnect Cards

Controller card

Serial port (RJ-45)

10/100BASE-T Ethernet port (RJ-45)

Interconnect
cards

FC-AL data connection port
(LC-SFF)
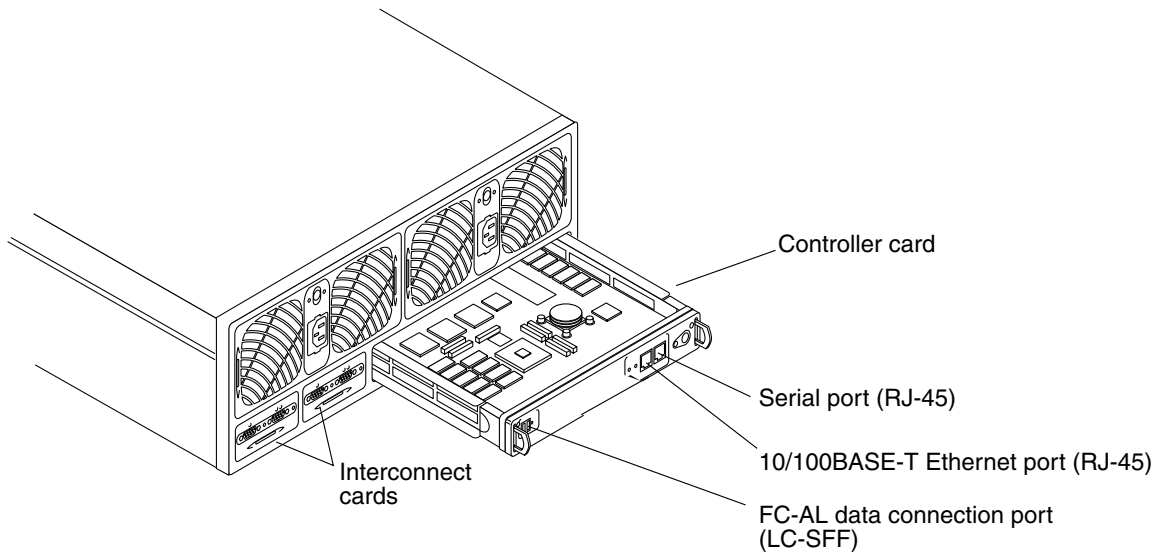
FIGURE 6-2   Sun StorEdge T3+ Array Controller Card and Interconnect Cards

Workgroup Configurations

The following configuration rules apply to array workgroup configurations (FIGURE 6-3):

- The interconnect ports, which are used only in partner group configurations, cannot be used for host connections.
- The FC-AL connection provides a data path to the application host.
- The Ethernet connection provides a link to the management host.
- The serial port is used solely for diagnostics and service by qualified service personnel only.
- Fiber-optic cable lengths between 2 and 500 meters, using short-wave laser and 50-micron fiber-optic cable, are supported.
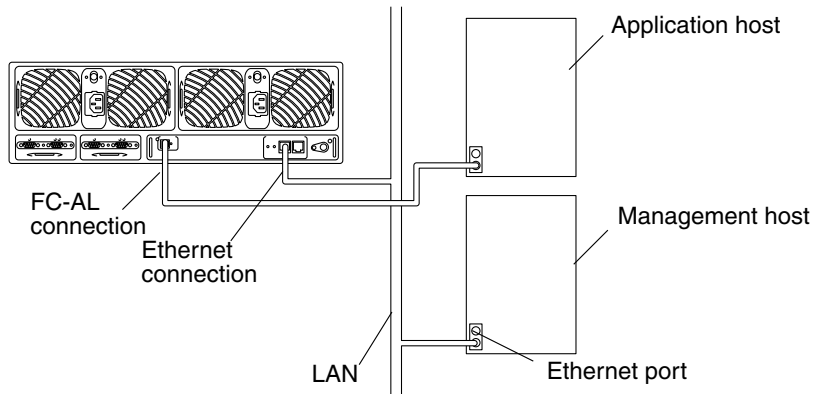
FIGURE 6-3   Array Workgroup Configuration

Enterprise Configurations

The following rules configuration rules apply to enterprise (partner group) configurations (FIGURE 6-4):

- The interconnect ports, which are used only in enterprise configurations, cannot be used for host connections.

- The FC-AL connection provides a data path to the application host.

- The Ethernet connection provides a link to the management host.

- The serial port is used solely for diagnostics and service by qualified service personnel only.

- Fiber-optic cable lengths between 2 and 500 meters, using short-wave laser and 50-micron fiber-optic cable, are supported.

This configuration is optimal because it provides full redundancy to the application hosts. Failover mechanisms are provided within the arrays, but the application host has to provide data-path failover mechanisms, such as Dynamic Multi-Pathing from VERITAS Volume Manager or Alternate Pathing from Sun Enterprise Server Alternate Pathing.
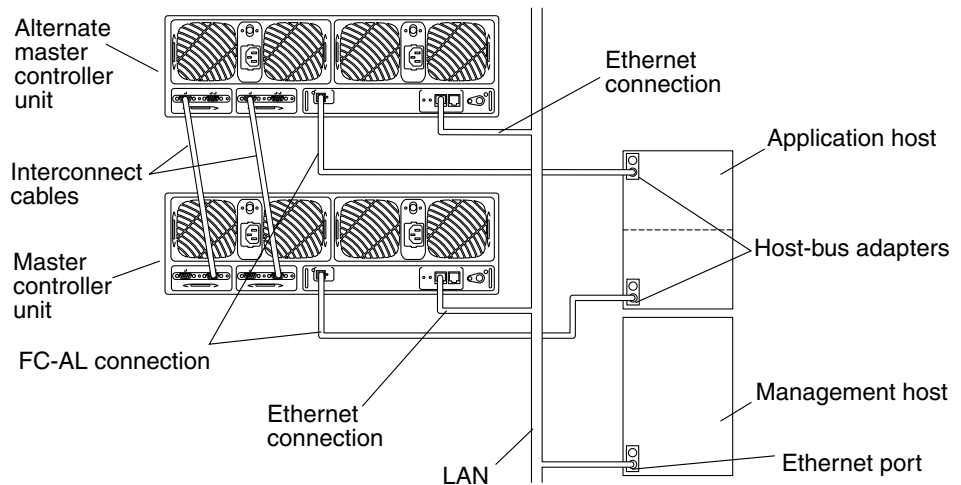
FIGURE 6-4   Enterprise Configuration

Glossary

A

administrative domain Partner groups (interconnected controller units) that share common administration through a master controller.

alternate master controller unit Also called "alternate master unit," the secondary array unit in a partner group that provides failover capability from the master controller unit.

Alternate Pathing (AP) A mechanism that reroutes data to the other array controller in a partner group upon failure in the host data path. Alternate Pathing requires special software to perform this function.

auto cache mode The default cache mode for the Sun StorEdge T3 and T3+ array. In a fully redundant configuration, cache is set to write-behind mode. In a nonredundant configuration, cache is set to write-through mode. Read caching is always performed.

auto disable The Sun StorEdge T3 and T3+ array default that automatically disables a disk drive that has failed.

B

buffering Data that is being transferred between the host and the drives.

C

command-line interface (CLI) The interface between the Sun StorEdge T3 and T3+ array's pSOS operating system and the user in which the user types commands to administer the array.

controller unit A Sun StorEdge T3 and T3+ array that includes a controller card. It can be use as a standalone unit or configured with other Sun StorEdge T3 and T3+ arrays.

G

Dynamic Multi-Pathing (DMP) A VERITAS Volume Manager feature that provides an Alternate Pathing mechanism for rerouting data in the event of a controller failover.

E

enterprise configuration One or more partner groups (pair of interconnected controller units) in a system configuration.

erasable programmable read-only memory (EPROM) Memory stored on the controller card; useful for stable storage for long periods without electricity while still allowing reprogramming.

expansion unit A Sun StorEdge T3 and T3+ array without a controller card. It must be connected to a controller unit to be operational.

F

**Fibre Channel
Arbitrated Loop
(FC-AL)** A 100 Mbyte/s serial channel that enables connection of multiple devices (disk drives and controllers).

**field-replaceable unit
(FRU)** A component that is easily removed and replaced by a field service engineer or a system administrator.

**FLASH memory device
(FMD)** A device on the controller card that stores EPROM firmware.

G

**Gigabit Interface
Converter (GBIC)** An adapter used on an SBus card to convert fiber-optic signal to copper.

**gigabyte (GB or
Gbyte)** One gigabyte is equal to one billion bytes (1X109).

**graphical user interface
(GUI)** A software interface that enables configuration and administration of the Sun StorEdge T3 and T3+ array using a graphic application.

H

**host bus adapter
(HBA)** An adapter that resides on the host.

hot spare A drive in a RAID 1 or RAID 5 configuration that contains no data and acts as a standby in case another drive fails.

hot-swappable The characteristic of a field-replaceable unit (FRU) to be removed and replaced while the system remains powered on and operational.

I

input/output operations per second (IOPS) A performance measurement of the transaction rate.

interconnect cable An FC-AL cable with a unique switched-loop architecture that is used to interconnect multiple Sun StorEdge T3 and T3+ arrays.

interconnect card An array component that contains the interface circuitry and two connectors for interconnecting multiple Sun StorEdge T3 and T3+ arrays.

L

LC An industry standard name used to describe a connector standard. The Sun StorEdge T3+ array uses an LC-SFF connector for the host FC-AL connection.

light-emitting diode (LED) A device that converts electrical energy into light that is used to display activity.

logical unit number (LUN) One or more drives that can be grouped into a unit; also called a volume.

M

master controller unit Also called a "master unit," the main controller unit in a partner-group configuration.

media access control (MAC) address A unique address that identifies a storage location or a device.

media interface adapter (MIA) An adapter that converts fiber-optic light signals to copper.

megabyte (MB or Mbyte) One megabyte is equal to one million bytes (1X106).

megabytes per second (MB/s) A performance measurement of the sustained data transfer rate.

multi-initiator configuration	A supported array configuration that connects two hosts to one or more array administrative domains through hub or switch connections.

P

parity	Additional information stored with data on a disk that enables the controller to rebuild data after a drive failure.
partner group	A pair of interconnected controller units. Expansion units interconnected to the pair of controller units can also be part of the partner group.
power and cooling unit (PCU)	A FRU component in the Sun StorEdge T3 and T3+ array. It contains a power supply, cooling fans, and an integrated UPS battery. There are two power and cooling units in a Sun StorEdge T3 and T3+ array.
pSOS	An operating system built into the Sun StorEdge T3 and T3+ array RAID Controller firmware, which provides interfaces between the mounted RAID volumes and the database environment.

Q

quiesce	To halt all drive activity.

R

read caching	Data for future retrieval, to reduce disk I/O as much as possible.
redundant array of independent disks (RAID)	A configuration in which multiple drives are combined into a single virtual drive to improve performance and reliability.
reliability, availability, serviceability (RAS)	A term to describe product features that include high availability, easily serviced components, and very dependable.

reverse address resolution protocol (RARP)	A utility in the Solaris operating environment that enables automatic assignment of the array IP address from the host.

S

SC	An industry standard name used to describe a connector standard.
Simple Network Management Protocol (SNMP)	A network management protocol designed to give a user the capability to remotely manage a computer network.
small form factor (SFF)	An industry standard describing a type of connector. An LC-SFF connector is used for the host FC-AL connection to the Sun StorEdge T3+ array.
synchronous dynamic random access memory (SDRAM)	A form of dynamic random access memory (DRAM) that can run at higher clock speeds than conventional DRAM.
system area	Located on the disk drive label, the space that contains configuration data, boot firmware, and file-system information.

U

uninterruptable power source (UPS)	A component within the power and cooling unit. It supplies power from a battery in the case of an AC power failure.

V

volume	Also called a logical unit or LUN, a volume is one or more drives that can be grouped into a unit for data storage.

W

workgroup configuration   A standalone array connected to a host system.

world wide name (WWN)   A number used to identify array volumes in both the array system and Solaris environment.

write caching   Data used to build up stripes of data, eliminating the read-modify-write overhead. Write caching improves performance for applications that are writing to disk.

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