Sun StorEdge™ Fast Write Cache 2.0 Installation Guide

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Sun StorEdge Fast Write Cache 2.0 Installation Guide

Introduction

The Sun StorEdge™ Fast Write Cache 2.0 Installation Guide describes installation procedures and product considerations for the Sun StorEdge Fast Write Cache software. The Fast Write Cache software is an application host-based write accelerator of disk I/O. It improves performance for transaction processing and delivers faster response times to user requests for data by reducing the frequency of disk I/O accesses. Writes are cached in non-volatile memory and then the cached data is destaged to disk at a later time. Fast Write Cache is installed on Solaris™ servers and consists of NVRAM (non-volatile memory) boards used as cache memory and storage cache management software.

Sun StorEdge Fast Write Cache is implemented as a UNIX device driver, using nonvolatile memory to cache write requests. As the cache fills, older data is written asynchronously to the real disk. Fast Write Cache works as a layer between other single disk drivers and the rest of the UNIX kernel. Stubs replace the original driver's entry points in the device switch tables. Whenever Fast Write Cache performs actual I/O (for example, when its cache must be destaged), it uses the real device driver routines.

Note – Fast Write Cache is implemented using a pair of SBus or PCI NVRAM cards installed on your system.

Document Structure

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Related Documentation

TABLE P-1   Related Documentation

Application	Title	Part Number

`man` Pages	`fwcadm(1FWC)`
	`cache_control`
	`cache_config`
	`cache_health`
	`svadm(1SV)`
		N/A

User	*Sun StorEdge Fast Write Cache 2.0 System Administrator's Guide*	806-2064
User	*Sun StorEdge Fast Write Cache 2.0 Release Notes*	806-3165
Configuration	*Sun StorEdge Fast Write Cache 2.0 Configuration Guide*	806-4383
Installation	*Solaris 2.6 Handbook for SMCC Peripherals*	802-7295
Installation	*Solaris Handbook for SMCC Peripherals*	805-7404
Installation	*Solaris 2.x Handbook for SMCC Peripherals*	801-5488
Options	*OpenBoot 3.x Command Reference Manual*	802-3242
Diagnostics (Solaris 2.6)	*SunVTS 2.1 User's Guide*	802-7299
Diagnostics (Solaris 2.6)	*SunVTS 2.1.3 Test Reference Manual*	805-4163
Diagnostics (Solaris 2.6)	*SunVTS 2.1 Quick Reference*	802-7301
Diagnostics (Solaris 7)	*SunVTS 3.0 User's Guide*	805-4442
Diagnostics (Solaris 7)	*SunVTS 3.0 Test Reference Manual*	805-4443
Diagnostics (Solaris 7)	*SunVTS 3.0 Programmer's Guide*	805-7338
Diagnostics (Solaris 7)	*SunVTS 3.0 Quick Reference*	805-4444
Diagnostics (Solaris 7)	*SunVTS 3.1 User's Guide*	805-7406
Diagnostics (Solaris 7)	*SunVTS 3.1 Test Reference Manual*	805-7407
Diagnostics (Solaris 7)	*SunVTS 3.1 Quick Reference*	805-7408
User	*Dynamic Reconfiguration User's Guide For Sun Enterprise 3x00/4x00/5x00/6x00 Systems*	805-3530
User	*Sun Enterprise 6x00, 5x00, 4x00, and 3x00 Systems Dynamic Reconfiguration Guide*	806-0280
User	*Sun Enterprise 10000 Dynamic Reconfiguration User's Guide*	805-7985

Reading Fast Write Cache `man` Pages

● **Set the `MANPATH` environment variable to include** `/usr/opt/SUNWesm/man`: **for example:**

```
# MANPATH=$MANPATH:/usr/opt/SUNWesm/man
# export MANPATH
```

After the commands have been executed, you do not have to type the path to the `man` pages.

Qualified Platforms

The following platforms are qualified for Fast Write Cache:

- Sun Enterprise™ Ultra 60
- Sun Enterprise 420r
- Sun Enterprise 220r
- Sun Enterprise 250
- Sun Enterprise 450
- Sun Enterprise 3000
- Sun Enterprise 3500
- Sun Enterprise 4000
- Sun Enterprise 4500
- Sun Enterprise 5000
- Sun Enterprise 5500
- Sun Enterprise 6000
- Sun Enterprise 6500
- Sun Enterprise 10000

Limitations

Fast Write Cache 2.0 does not support the following:

- Single NVRAM cards
- Multiple NVRAM card pairs
- Sun Cluster

Product Considerations

- Do not cache underlying volume manager devices (for example, VxVM log devices), as this can result in unpredictable behavior.

- The volume manager must always be below the Fast Write Cache:

  - To allow coalescing stripe width size writes for RAID 5

  - The volume manager partitioning of disks does not necessarily map to the Solaris partitions

- Fast Write Cache can cache Volume Manager volumes. The example for configuring the `/etc/opt/SUNWspsv/sv.cf` file that is shown in the *Sun StorEdge Fast Write Cache 2.0 System Administrator's Guide* lists linear disks, only. The following example adds a volume manager volume for the Sun Enterprise Volume Manager by including the entry in the `/etc/opt/SUNWspsv/sv.cf` file:

```
/dev/vx/rdsk/vol01     cache
```

- Install Fast Write Cache only on systems with clean NVRAM cards. If an unclean shutdown of the system occurred, recover or purge the data before installing Fast Write Cache. Please see the *Sun StorEdge Fast Write Cache 2.0 System Administrator's Guide.*

- Do not cache the root (`/`) and `/usr` file systems (or any file systems that mount before Fast Write Cache) is initialized because to recover disk data stored in an NVRAM card after a system crash, the data must be restored to disk before file systems are mounted or applications are written to raw volumes.

- Do not cache the swap partition.

- Avoid multiple paths to data. The following are examples of operations that can access data using alternate cached or non-cached paths:
  - caching overlapping slices
  - commands that write to a device using `ioctl(2)`, such as `format(1M)`

- In general, devices must be Storage Volume (SV) disabled using the `fwcadm volume -d` command before doing any operations requiring a device to be quiescent. Some procedures (for example, an A5000 firmware download) will not complete successfully unless the appropriate devices are SV disabled.

- Limit any changes in the default `/etc/opt/SUNWscm/sd.cf` file to the following two parameters:
    - `cache_mem` – The `size_in_megabytes` for the `cache_mem` parameter must be greater than 0 and must be at least equal to the amount of memory (in Mbytes) that is available on one board (PCI NVRAM card 64Mbytes or SBus 32Mbytes).
    - `threads` – This parameter must be at least equal to the number of cached volumes.

- If the NVRAM card contains dirty data, do not reconfigure your disks or move the card to another system until the dirty data is destaged to disk or purged.

- If even one of the batteries on an NVRAM card is low, the cache is destaged and a warning message is sent to the console and the message log.

- If you need to run the verification test suite on the Fast Write Cache cards, install the appropriate SunVTS version. You must also install the nvtest module for your version of Solaris according to the following proceedures:
    - Solaris 2.6 (SunVTS 2.1.3) Users:

    Start the Volume Manager daemon and install nvtest patch number 110528 located in the /fwc/Solaris_2.6/nvtest directory on the CD-ROM.

```
# /etc/init.d/volmgt start
# cd /cdrom/cdrom0/fwc/Solaris_2.6/nvtest
# patchadd 110528
```

The Solaris 2.6 operating environment version of the SUNWvtsnp patch contains a 32-bit nvtest.

■ Solaris 7 (SunVTS 3.2, 3.3, & 3.4) Users:

Start the Volume Manager daemon and install the SUNWvtsnp package located in the /fwc/Solaris_7/nvtest directory on the CD-ROM.

```
# /etc/init.d/volmgt start
# cd /cdrom/cdrom0/fwc/Solaris_7/nvtest
# pkgadd -d . SUNWvtsnp
```

The Solaris 7 operating environment version of the SUNWvtsnp package contains both 32-bit and 64-bit nvtest binaries. Package dependency is checked during installation, and the nvtest binaries are installed in the appropriate directories. The 64-bit nvtest is not installed unless the SUNWvtsx (64-bit SunVTS) package is already installed.

■ Solaris 8 (All Solaris 8 SunVTS Versions) Users:

Start the Volume Manager daemon and install the SUNWvtsnp package located in the /fwc/Solaris_8/nvtest directory on the CD-ROM.

```
# /etc/init.d/volmgt start
# cd /cdrom/cdrom0/fwc/Solaris_8/nvtest
# pkgadd -d . SUNWvtsnp
```

The Solaris 8 operating environment of the SunWvtsnp package contains both 32-bit and 64-bit nvtest binaries. Package dependency is checked during installation, and the nvtest binaries are installed in the appropriate directories. The 64-bit nvtest is not installed unless the SUNWvtsx (64-bit SunVTS) package is already installed.

To test the NVRAM, first install the SUNWwvts packages. The packages include SUNWvts, SUNWvtsx, and SUNWvtstk. Also install the SunVTS patch.

▼ To Run NVRAM Diagnostics

Note – Before you test the NVRAM, make sure the NVRAM board is disabled.

1. **Launch the SunVTS diagnostic tool graphical user interface:**

```
# cd /opt/SUNWvts/bin
# sunvts
```

2. **Select None and Intervention under Select Devices on the left panel of the GUI.**

3. **Expand the Other Devices tree on the right panel of the GUI.**

   The tree shows all the NVRAM devices on your system that you can test.

4. **Check the box next to the NVRAM device you want to test from the tree.**

5. **Click Start on the Start menu to run the test.**

   The test might take 10 to 12 minutes to run.

6. **If the NVRAM device you selected on the device tree turns green, it passed the test.**

   If the device turns red, read the error message in the test messages pane at the bottom of the GUI. If you have a battery jumper cable error, refer to the *Sun StorEdge Fast Write Cache 2.0 System Administrator's Guide* or contact your service representative. For all other errors, contact your representative.

7. **You can continue testing or quit out of the GUI.**

Installation Requirements

- The minimum requirements for installing Fast Write Cache are:
  - Solaris™ 2.6, 7 8/99 or compatible versions, or 8 operating environment or a subsequent compatible version
  - Pair of SBus or PCI NVRAM cards
  - CD-ROM drive connected to the host server where Fast Write Cache is to be installed
  - Approximately 40 Mbytes of disk drive space to install the data services.
- `SUNWvtsnp` is the enhanced SunVTS that verifies the SBus or PCI NVRAM card for Fast Write Cache. `SUNWvtsnp` is not a stand-alone package. It does not run without the corresponding `SUNWvts` package being installed.
- Java version 1.2.1_04b or compatible versions is required. To update your version of java, go to `http://java.sun.com`. To verify your version of java:

  ```
  # java -version
  ```

  If you are loading Fast Write Cache for the French, Japanese, or Chinese locales, load the appropriate localized version of Java.
- The latest Solaris Recommended Patch Cluster is to be installed before loading Data Services software. The following patches, which are available at `http://www.sunsolve.sun.com` when you have a service contract, are the minimum revisions required:

TABLE P-2   Solaris Operating Environment Patches for FWC

Solaris Environment Version	Patch	Description
2.6	105181-23	Kernel Update patch is to be installed before loading data services software. This patch is included with the Solaris Recommended Patch Cluster.
	108091-03	Sun OS 5.6: ss JDK 1.2.1_04b
7	106541-14	Kernel Jumbo patch is to be installed before loading data services software. This patch is included in the Solaris Recommended Patch Cluster.
	106924-06	5.7 isp driver
	106980-15	5.7 libthread
	107081-25	5.7 Motif 1.2.7 and 2.1.1 runtime library

TABLE P-2   Solaris Operating Environment Patches for FWC *(Continued)*

Solaris Environment Version	Patch	Description
8	108528-05	SunOS 5.8: Kernel Update patch is to be installed before loading data services software. This patch is included with the Solaris Recommended Patch Cluster.

So that the cache software can allocate host memory for optimum performance, set the OpenBoot PROM variable dr-max-mem to 2. As superuser, enter:

```
# eeprom dr-max-mem=2
```

Or, at the OK prompt, enter:

```
ok setenv dr-max-mem 2
```

Configuration Files

Fast Write Cache and its related packages include configuration files with a `.cf` suffix. For example, `sv.cf` is in the `/etc/opt/SUNWspsv` directory.

The Fast Write Cache CD contains sample configuration files that are installed in the `/etc/opt/`*SUNWpackage* directory; however, the packages do not overwrite existing configuration files in this directory.

Note – Install Fast Write Cache only on systems with clean NVRAM cards. If an unclean shutdown of the system occurred, recover or purge the data before installing Fast Write Cache. See the *Sun StorEdge Fast Write Cache 2.0 System Administrator's Guide* for more information.

Do the following before installing Fast Write Cache:

- Install the NVRAM cards. See the *Sun StorEdge Fast Write Cache 2.0 System Administrator's Guide* for the NVRAM installation instructions.
- Install the `SUNWvts` diagnostic package. Refer to the appropriate SunVTS documentation.

Installing the Fast Write Cache Software

These procedures describe how to perform a clean install of the Fast Write Cache software. The procedures assume you have not previously installed any versions of Fast Write Cache software. You may install Fast Write Cache automatically or manually.

▼ Install the Fast Write Cache Software Automatically

Note – This procedure assumes that the system is running Sun Enterprise Volume Manager[TM]. If you are not using Volume Manager to manage diskettes and CDs, see the *Solaris System Administration Guide, Volume I* for detailed information about managing removable media with Volume Manager. If you inserted a CD, Volume Manager automatically mounts it.

Note – You should load data services software in a single user state.

1. **Become superuser (root).**

2. **On a system running the Solaris 2.6 environment, add this line to the** `/etc/system` **file:**

   ```
   set kobj_map_space_len=0x200000
   ```

   If you have not set this, the system may hang on reboot.

3. **Reboot the system.**

   You only need to reboot for the Solaris 2.6 operating environment.

4. **If the Fast Write Cache CD is not already in the CD-ROM, insert it into the CD-ROM drive connected to your system.**

5. **Start the Volume Manager daemon (if needed) and start the Fast Write Cache automatic installation.**

   Where the value of the variable *Solaris_version* is either Solaris_2.6, Solaris_7 or Solaris_8, enter:

```
# cd /etc/init.d/volmgt start
# cd /cdrom/cdrom0/fwc/Solaris_version
# ./install_fwc.ksh
```

   install_fwc installs the data services and the Fast Write Cache Management service.

   Caution – If you have previously installed any versions of Fast Write Cache software and you have failed to bring down the system cleanly prior to the install of this software with the shutdown or init commands (halt, reboot, and power button all constitute an unclean shutdown), then you might run into problems due to data structures still remaining on the NVRAM cards being incompatible with the newly installed software. If you have problems as a result of dirty data from a previous installation of FWC, Step 6 and Step 7outline a method for discarding this data by forcing initialization of the board before it is accessed by the FWC software.

6. **Add the following line to the /etc/system file:**

   Note – Adding this line to /etc/system causes the board to be cleared on every boot. Failure to remove the line as described in Step 7 would result in the cache losing data on any crash or unexpected shutdown.

```
# set nvmem:nvram_force_init=1
```

   Reboot the system.

7. **Delete the line from Step 6 when the system is running after the first reboot.**

▼ Install the Fast Write Cache Software Manually

> **Note –** This procedure assumes that the system is running Sun Enterprise Volume Manager. If you are not using Volume Manager to manage diskettes and CDs, see the *Solaris System Administration Guide, Volume I* for detailed information about managing removable media with Volume Manager. If you inserted a CD, Volume Manager automatically mounts it.

> **Note –** You should load data services software in a single user state.

1. **Become superuser (root).**

2. **On a system running the Solaris 2.6 environment, add this line to the** `/etc/system` **file:**

   ```
   set kobj_map_space_len=0x200000
   ```

   If you have not set this, the system may hang on reboot.

3. **Reboot the system.**

   You only need to reboot if you are using the Solaris 2.6 operating environment.

4. **If the Fast Write Cache CD is not already in the CD-ROM, insert it into the CD-ROM drive connected to your system.**

5. **Start the Volume Manager daemon (if needed) and start the Fast Write Cache manual installation.**

   Follow the order of installation when you add packages manually for a successful installation. If you are installing for a non-English locale, add the French, Japanese or Chinese packages after you add the English packages.

   a. **For the English locale, where the value of the variable** *Solaris_version* **is either Solaris_2.6, Solaris_7 or Solaris_8, enter:**

   ```
   # /etc/init.d/volmgt start
   # cd /cdrom/cdrom0/fwc/Solaris_version
   # pkgadd -d . SUNWspuni SUNWscm SUNWspsv SUNWnvm
   # pkgadd -d . SUNWesm SUNWspcsl SUNWdaert SUNWesmrt SUNWesmru
   # pkgadd -d . SUNWmscmu SUNWmscmr
   # pkgadd -d . SUNWmjhlp SUNWmjacf SUNWmjmai
   ```

b. For the French locale, enter:

```
# pkgadd -d . SUNWfrdae SUNWfresm SUNWfmscm
```

c. For the Japanese locale, enter:

```
# pkgadd -d . SUNWjadae SUNWjeesm SUNWjmscm
```

d. For the Chinese locale, enter:

```
# pkgadd -d . SUNWcdae SUNWcesm SUNWcmscm
```

Caution – If you have previously installed any versions of Fast Write Cache software and you have failed to bring down the system cleanly prior to the install of this software with the shutdown or init commands (halt, reboot, and power button all constitute an unclean shutdown), then you might run into problems due to data structures still remaining on the NVRAM cards being incompatible with the newly installed software. If you have problems as a result of dirty data from a previous installation of FWC, Step 6 and Step 7outline a method for discarding this data by forcing initialization of the board before it is accessed by the FWC software.

6. Add the following line to the /etc/system **file:**

Note – Adding this line to /etc/system causes the board to be cleared on every boot. Failure to remove the line as described in Step 7 would result in the cache losing data on any crash or unexpected shutdown.

```
# set nvmem:nvram_force_init=1
```

Reboot the system.

7. Delete the line from Step 6 when the system is running after the first reboot.

Post-Installation Patches

After installing the Fast Write Cache packages, install the appropriate patches.

▼ Complete the Post-Installation

1. If you are installing other Data Services, eject the Fast Write Cache CD and continue.

IOtherwise, eject the CD and reboot the system:

```
# cd
# eject cdrom
# /etc/shutdown -y -g 0 -i 6
```

2. Install the appropriate patches.

The patches listed here are required. Patches are included on the software CD, but you should check `http://www.sunsolve.sun.com` to make sure you have the latest revision of the patches.

Solaris Environment	Patch	Description
2.6	109967[1]	data services core patch
	109971[1]	Sun StorEdge Fast Write Cache patch
7	109969[2]	data services core patch
	109973[2]	Sun StorEdge Fast Write Cache patch
8	109970[3]	data services core patch
	109974[3]	Sun StorEdge Fast Write Cache patch

[1]Load patch 109967 before you load 109971.

[2] Load patch 109969 before you load 109973.

[3]Load patch 109970 before you load 109974.

3. **If you are installing other Data Services, eject the Fast Write Cache CD and continue.**

Otherwise, eject the CD and reboot the system:

```
# cd /
# eject cdrom
# /etc/shutdown -y -g 0 -i 6
```

Removing Fast Write Cache Software

▼ Remove Fast Write Cache

1. **Stop Fast Write Cache:**

```
# esm_orderly stop
```

2. Back out Fast Write Cache and data services patches.

If patch 109628 (all Solaris environments), 109971 (Solaris 2.6 operating environment) 109973 (Solaris 7 operating environment) or patch 109974 (Solaris 8 environment) is installed, remove it. For example:

```
# showrev -p | grep 109973
Patch: 109973-05 Obsoletes: Requires: 109969-05 Incompatibles: \
Packages: SUNWmscmu, SUNWmscmr
# patchrm 109973-05
```

If there are no other data services (Network Data Replication, Storage Target Emulation or Instant Image) on the system, remove patch 109967 (Solaris 2.6 operating environment) 109969 (Solaris 7 environments) or patch 109970 (Solaris 8 environment). Also remove any other revisions. For example:

```
# showrev -p | grep 109969
Patch: 109969-05 Obsoletes: Requires: 106541-06 Incompatibles: \
Packages: SUNWspuni,SUNWscm, SUNWspsv, SUNWspcsl
# patchrm 109969-05
```

3. Remove the Fast Write Cache Management Services packages.

When uninstalling, the order in which you remove packages does matter.

```
# pkgrm SUNWmscmr SUNWmscmu
```

4. Remove the Fast Write Cache Data Service package:

```
# pkgrm SUNWnvm
```

5. If there are no other data services (Storage Target Emulation, Solstice Network Data Replicator or Instant Image) on the system, uninstall the core data services packages:

```
# pkgrm SUNWspcsl SUNWspsv SUNWscm SUNWspuni
```

If you are not going to reinstall SUNWscm and SUNWspsv, and you wish to completely remove them, remove the /etc/opt/SUNWspsv/sv.cf, /etc/opt/SUNWscm/sd.cf and /etc/opt/SUNWscm/bitmapfs.cf files if they exist.

6. **If Instant Image is not installed, remove the Management Services supporting packages:**

```
# pkgrm SUNWesmru SUNWmjhlp SUNWmjmai SUNWmjacf SUNWesmrt \
SUNWdaert SUNWesm
```

If you are not going to reinstall SUNWesm, also remove the Data Services persistence files:

```
# rm /var/opt/SUNWesm/m*/persistence/*
```

7. **If you have other data services to remove, continue to do so. If this is the last data service that you are removing, reboot the system now:**

```
# /etc/shutdown -y -i 6 -g 0
```

Note – If you are going to reinstall any data services software, reboot the system into a single user state before you load the new data services software.

Adding Fast Write Cache Volumes to the Storage Volume Driver Configuration File

Before you can enable and use the Fast Write Cache software, you must add the Fast Write Cache volumes to the Storage Volume (SV) driver configuration file and reconfigure the driver.

You cannot enable and use the Fast Write Cache software on volumes that are not in the SV driver configuration file and enabled by the SV driver. The SV driver provides a simple layer of volume management for the Fast Write Cache software.

Tip – If you want to add devices later, repeat the steps in "To Add Fast Write Cache Volumes" on page 20".

▼ To Add Fast Write Cache Volumes

1. **Decide which devices you are going to use with the Fast Write Cache software.**

2. **Using a text editor, add the volumes to the Storage Volume (SV) driver configuration file** `/etc/opt/SUNWspsv/sv.cf`.

   This file includes two fields per line for each volume: the resource name field and access mode field. Separate the fields in the file with spaces.

   The resource name field contains the name of a raw device for which the SV driver is to be enabled. *It must be the full path to the raw device node and cannot be the block device node.*

   The access mode field can be `cache` or `raw`. This field specifies how this device volume is accessed: through the Storage Cache Management module cache. The raw mode causes IO to be uncached, and the cache mode enables read and write caching.