



Sun StorEdge™ Instant Image 3.0 System Administrator's Guide

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Preface

The *Sun StorEdge™ Instant Image 3.0 System Administrator's Guide* describes the Sun StorEdge™ Instant Image 3.0 software and its use. Instant Image is a point-in-time snapshot application that enables you to quickly create a shadow volume of your database for use in backing up and restoring data, as a second copy for use by other applications, and as a set of test data. This guide is designed for use by an experienced system administrator of the Solaris™ operating environment and related disk storage systems.

Before You Read This Book

Before you perform the procedures in this document, make sure the Instant Image software is installed and configured according to the directions in the *Sun StorEdge Instant Image 3.0 Installation Guide*.

Note – This guide is designed for use by an experienced system administrator of the Solaris Operating Environment and related disk storage systems. To use the Instant Image software, you must be the root user.

How This Book Is Organized

Chapter 1 provides general information about Instant Image 3.0 software and defines its terminology.

Chapter 2 provides descriptions of Instant Image operations.

Chapter 3 describes the command-line interface (CLI).

The Glossary contains definitions of terms used in this document.

Using UNIX Commands

This document might not contain information on basic UNIX[®] commands and procedures such as shutting down the system, booting the system, and configuring devices.

Refer to the software documentation that you received with your system.

Documentation Conventions

Typeface or Symbol	Meaning	Examples
AaBbCc123	The names of commands, files, and directories; on-screen computer output.	Edit your <code>.login</code> file. Use <code>ls -a</code> to list all files. % You have mail.
AaBbCc123	What you type, when contrasted with on-screen computer output.	% su Password:
<i>AaBbCc123</i>	Book titles, new words or terms, words to be emphasized. Command-line variable; replace with a real name or value.	Read Chapter 6 in the <i>User's Guide</i> . These are called <i>class</i> options. You <i>must</i> be <i>root</i> to do this. To delete a file, type <code>rm filename</code> .
[]	In syntax, brackets indicate that an argument is optional.	<code>sd_stats [-d sec] [-r n[:n][,n]...] [-z]</code>
{ }	In syntax, braces indicate that one of the enclosed arguments must be chosen. The arguments are separated by a vertical line.	<code>iiadm [-g group] -u {s m}\ volumeset</code>
\	At the end of a command line, the slash indicates that the command continues on the next line.	<code>iiadm -e -I /dev/rdisk/c1t3d0s1 \ /dev/rdisk/c1t3d0s5 \ /dev/rdisk/bitmap01</code>

Shell Prompts

Shell	Prompt
C shell	<i>machine_name%</i>
C shell root user	<i>machine_name#</i>
Bourne shell and Korn shell	\$
Bourne shell and Korn shell root user	#

Related Documentation

Application	Title	Part Number
man pages	<i>iiadm(1M)</i> <i>ii(7D)</i>	N/A
Recent Updates	<i>Sun StorEdge Instant Image 3.0 Release Notes</i>	806-7678
Installation	<i>Sun StorEdge Instant Image 3.0 Installation Guide</i>	806-7675

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Overview

This chapter describes the Sun StorEdge Instant Image software's capabilities, terminology, and concepts. This chapter contains the following sections:

- “Sun StorEdge Instant Image Software” on page 2
- “Master Volume” on page 4
- “Shadow Volume” on page 4
- “Instant Image Volume Pair” on page 5
- “Bitmap Volume” on page 6
- “Instant Image Volume Set” on page 6
- “Overflow Volume” on page 6
- “Instant Image I/O Group” on page 7
- “Export Shadow Volumes” on page 7
- “Multiple Shadow Volumes” on page 8
- “System Requirements” on page 8
- “Operational Notes” on page 9
- “Uses for the Instant Image Software” on page 11
- “Task Summary: Getting Started” on page 12



Caution – *Do not* install the Sun StorEdge Version 3.0 core and data services software on servers in a Sun Cluster 3.0 environment.

- The Version 3.0 software is *not* coexistent with the Sun Cluster 3.0 environment
- The Version 3.0 software is coexistent in the Sun Cluster 2.2 environment
- The Version 3.0 core and data services software is cluster aware in the Sun Cluster 3.0 Update 1 environment and provides high availability for the Sun StorEdge data services.

Sun StorEdge Instant Image Software

Sun's StorEdge Instant Image 3.0 software is a *point-in-time snapshot* utility. Once installed and configured, the Instant Image software provides the system administrator with the ability to make and to maintain replicated data storage systems. Replicating system data with Instant Image is a fast process that is accomplished while the primary business application is running and that has minimal impact on ongoing data transactions.

The original copy of the data is maintained on a *master volume*, where the primary business application stores data. The master volume is replicated in what is called the *shadow volume*. The shadow volume can be read from and written to by another application and it can be used for system tests with a copy of real data without the danger of corrupting the original data.

As the data changes in the master volume and the shadow volume, a *bitmap volume* keeps track of the blocks that change so that to update the shadow or the master, only the blocks marked as changed by bitmap entries need be copied. This method provides quick updates that intrude minimally on the system's performance with normal business data requirements. You can also perform full copies instead of only updating changed blocks. Copying has more impact on data transactions, but is still minimally intrusive and does not require you to halt database operations.

The Instant Image software enables you to update the master volume from the shadow volume or the shadow volume from the master volume. You can also do a full copy, instead of an update, in both directions.

New with this release of Instant Image is the ability to create *compact shadow in dependent mode* volumes, which are smaller than their associated master volumes. These compact shadow volumes can be stored on a volume that can be much smaller than its associated master, which saves much storage space.

Also new in this release is an enhanced ability to export shadow volumes. Exported shadow volumes can be imported by other Instant Image hosts and can be rejoined to their original master volumes with or without the data changes that occurred in the shadow volume while exported.

Features

This table lists new features of the Instant Image software, version 3.0, and gives a brief explanation of the feature.

TABLE 1-1 Sun StorEdge Instant Image Software Features

Feature	Description
Multiple shadows of the same master	You can enable more than one volume set using a single master volume, which gives the master volume multiple shadow volumes. You can use each of these shadow volumes independently for software evaluation or data analysis.
Compact dependent shadow	By enabling a dependent volume set with a shadow volume that is smaller than the master volume, you create a compact dependent shadow volume. You can size the compact shadow so that it is large enough to accept the actual data transactions you expect, but no larger, which can make more efficient use of available storage space.
Overflow volume	You can now attach an optional overflow volume to any compact dependent shadow volume set to accept any data sent to the compact dependent shadow volume when it is full.
Export shadow	Shadow volumes on dual-ported devices can be exported. A second host can import the exported shadow and use it to continue business transactions in place of the first. Exporting a shadow volume to another host also enables you to conduct software evaluations on real data while having no impact on the first host's resources.
Grouping concept	You can organize volume sets in groups for ease of administration. Grouping allows atomic execution of commands across all group members. Grouping assures consistent point-in-time copies across all members of a group.
Sun Cluster 3.0 coexistent	The Sun StorEdge Version 3.0 data services software can be used in Sun Cluster 2.2 and Sun Cluster 3.0 Update 1 environments only.

Compatibility with Instant Image 2.0

The `esm_cli` and the Graphical User Interface (GUI) are no longer parts of Instant Image.

The Instant Image software, version 3.0, commands are closely compatible with the command-line interface, CLI, of version 2.0 with the exception of a number of features that have been added. See Chapter 2 for further information.

The Sun Instant Image software, Version 3.0, does not support the use of files for bitmaps. You must use a volume for a bitmap.

Master Volume

The master volume is the original volume of which a point-in-time snapshot is taken. The master volume needs only to be quiesced for the instant when the point-in-time snapshot is established, after which normal volume access (read and write) activity can be resumed. Differences between the master volume and the point-in-time shadow volume are tracked in the associated bitmap volume.

The master volume can be located on any volume manager supported by the Solaris operating environment and can be any size supported by its volume manager.

Shadow Volume

The shadow volume contains a point-in-time snapshot of the data stored on the master volume. You can read from and write to the shadow volume as you can to any other volume. The shadow volume can be located on any initially unmounted volume created with any volume manager that is supported by the Solaris operating environment. There are three types of shadow volumes: independent, dependent, and compact dependent.

Independent Shadow Volume

When you enable the Instant Image software for a *volume pair*, composed of a master volume and a shadow volume, and specify the shadow volume as independent, a full volume copy operation occurs from the master volume to the shadow volume. The independent shadow volume must be equal to or greater than the master volume in size; ideally, the volumes should be of the same size.

When the full copy completes, the shadow volume is identical to the master volume at the instant that the point-in-time copy was created, excluding any application writes that occurred to the shadow volume while the full copy was in progress. If you disable the Instant Image software for this volume set after the copy, the shadow volume, as an independent shadow volume, still contains valid point-in-time data. You can, of course, keep the volume set association indefinitely.

The instant after a point-in-time snapshot is taken, applications can read and write to either the master or shadow volume. The Instant Image software maintains a bitmap, or scoreboard, which tracks the differences between the master and shadow volumes.

Dependent Shadow Volume

When you enable the Instant Image software for a volume pair and specify the shadow volume as dependent, no copy operation occurs. Any reads directed to the shadow volume are answered with data from the master volume. When a write occurs to the master volume, the original data is written to the shadow volume first, then the new data is written to the master. The location of this changed data on the master volume is tracked in the bitmap volume. Any read to the shadow volume that requests data from a changed block of master data, as tracked in the bitmap, is answered from the shadow volume, which now contains the original point-in-time data. The shadow volume, when read, provides only original point-in-time data either from the master volume, if the master's data has not changed, or from the shadow volume, if the requested block has changed since the point-in-time snapshot was taken. The shadow volume does not contain new master volume data until you issue an update command or a copy command.

For dependent volume pairs, the shadow device must be the same size as the master volume or larger. For compact dependent shadow volumes, the shadow volume should be sized according to the total number of unique writes to both the master and shadow volumes expected over the time in which the shadow volume will be in use. A compact dependent shadow volume should be associated with a shared *overflow volume* to store writes to the shadow volume in case the shadow volume gets full.

If you disable the Instant Image software for a dependent volume pair after the point-in-time snapshot is taken, the shadow volume, which depends on the master volume for much of the data it returns on reads, does not contain valid point-in-time data. The shadow volume is partially erased to prevent accesses to invalid data.

Instant Image Volume Pair

The master volume and its associated shadow volume are referred to as a *volume pair*; the two are associated with one another. The name of the volume pair defaults to the name of the shadow volume for the Instant Image software's use. A volume pair does not stand alone, it must also have a bitmap volume associated with it to track changes between the master volume and the shadow volume. Optionally, an overflow volume can be associated with a compact dependent shadow volume group.

Instant Image Volume Set

An Instant Image volume pair and its associated bitmap together are called a *volume set*. The volume set is the minimum configuration for the Instant Image software to use. The volume set, like the volume pair, takes its name from the associated shadow volume. When you perform operations with the Instant Image software, you are performing them on volume sets.

Bitmap Volume

The bitmap, which must be a volume and not a file, is used to track differences between the master volume and the shadow volume. Writes to either volume are noted in the bitmap so that you can perform updates from either shadow volume to master volume or from master volume to shadow volume.

The bitmap can be located on any volume manager supported by the Solaris operating environment, except for a volume that contains a member of its associated volume pair (master or shadow). The size of the bitmap volume depends on the sizes of the volumes being tracked.

When you resynchronize the Instant Image volume pair, the Instant Image software only copies the changed blocks as noted in the appropriate bitmaps. This is true for both dependent shadow volumes and independent shadow volumes, and for both master-to-shadow and shadow-to-master resynchronization. Resynchronization usually occurs much faster than a full volume copy.

Overflow Volume

Compact dependent shadow volumes can potentially be completely filled with writes from the master volume. If this happens, additional writes to a full compact dependent shadow volume cause the writes to fail and the shadow volume to be taken offline and marked invalid. To prevent this, the Instant Image software enables you to attach an overflow volume to a compact dependent shadow volume set.

An overflow volume is a shared resource that can be used by one or more Instant Image dependent volume sets to handle overflow writes for a shadow volume that is full. This volume can be located on any volume manager supported by the Solaris

operating environment. This volume can be associated with one or more existing dependent volume sets, and can contain overflow writes that would have otherwise failed, if the dependent shadow volume was full.

Instant Image I/O Group

Instant Image volume sets, with or without associated overflow volumes, can be grouped together so the Instant Image software can perform the same operation on multiple volume sets at one time. The concept of grouping is new with this release of the Instant Image software.

A group, or collection, of volume sets is called an *I/O group*. These I/O groups, to which you can assign a name, can be composed of any number of volume sets. You can perform Instant Image commands, such as updates and copies, on all volume sets within an I/O group with a single command. This can result in a great time saving for the system administrator.

Volume sets can easily be moved into and out of I/O groups without first quiescing the volumes since no operation on the data is required. Volume sets can be moved out of an I/O group with the same ease. Restructuring the storage in this way has no impact on business operations.

Export Shadow Volumes

If the primary host needs to have some or all of the workload removed from it, you can *export* the shadow volumes of any or all volume sets so that a second host, also running the Instant Image software, can *import* them and continue the business transactions. Exporting can be used as a way to test new data methodology offline, using real data, before incorporating it in the online business. When desired, the shadow volume can be disabled at the second host and then rejoined to its master volume on the primary host, with or without any changes made by the second host.

Export a shadow volume with the `-E` option, which releases it for import by a second Instant Image host. The shadow volume must be an *independent* shadow and must reside on a dual-ported device. While exported, the shadow volume can not be updated by its master, but the master can continue to accept data and track the changes in its associated bitmap.

The second host imports the shadow volume with the `-I` command option, which requires that a bitmap volume be created to track changes to the shadow volume while imported. A volume set can be enabled on the second host with the imported shadow as the master volume. Business operations or technical evaluations can take place with the new volume set on the second host.

The second host disables the volume set that includes the imported shadow volume when it is finished with it. The primary host can now rejoin the shadow volume to its original master volume. If you do not specify a bitmap for the join, the primary host's bitmap and the secondary host's bitmap will be used to rejoin the shadow to the master. If you specify a bitmap, that bitmap is used in conjunction with the stored data to rejoin the volumes. Because several volume sets can include the same master, it is important to be able to specify which bitmap to use for the rejoin.

Multiple Shadow Volumes

An Instant Image master volume can now be the master volume in more than one volume set, effectively giving one master volume multiple shadow volumes. A new point-in-time snapshot can be taken onto any of the shadow volumes as needed. Each shadow volume is unrelated to the others and is not affected by updates or copies to any of the others. In the case of dependent shadows, writing to the master will cause master data to be copy-before-written to each of the dependent shadow volumes. The master can be updated from any of its shadow volumes without changing the contents of the other shadow volumes, subject to space being available on compact dependent shadow volumes.

System Requirements

Sun StorEdge Instant Image software is supported on server hosts using the Solaris operating environment and any Sun-supported network interface card. Hosts include but are not limited to:

- Sun Enterprise™ Server models 2x0 through 4x0
- Sun Enterprise Server models 3x00 through 10000

Operational Notes

Cautions: Enable, Copy, and Update

The Instant Image software, Version 3.0, does not support the use of files for bitmaps. You must use a volume for a bitmap.

Do not perform Instant Image enable, copy, or update operations on mounted shadow volumes. If mounted, you must unmount the Instant Image shadow volume before invoking an Instant Image enable, copy, or update operation to prevent a file system panic from occurring.

Either unmount or quiesce all applications using the Instant Image master volume, for only the instant when the point-in-time snapshot is enabled.

Immediately after the point-in-time is (re-)established, (either when the CLI prompt returns or the next shell script command is read), the master volume can be remounted or the applications using them can be resumed. Also the shadow volume can be mounted and immediately accessed.

If the master volume was suspended (not unmounted), validate the new point-in-time shadow volume's integrity using volume validation utilities, such as `fsck`, because Instant Image has made a point-in-time copy of a mounted master volume to an unmounted shadow volume. During the mounting of the shadow volume, the file system detects that it is in the mounted state. Typically, this state only occurs when a system crashes, so the file system will attempt to validate the integrity of the volume assuming a system failure occurred, not an Instant Image copy.

Using the CLI for Copy and Update Operations

Always specify the shadow volume name of the volume group when using the copy or update commands.

Length of Volume Names

Master, shadow, and bitmap volume names (including the path name) are currently limited to a maximum of 64 characters consisting of letters, numbers, and underscores.

Shadowing the Root File System

You cannot make a shadow volume copy of the root device `/` or `/usr`.

Shadowing Encapsulated Volumes

The Instant Image software does not support encapsulated volumes; you cannot create a shadow volume of an encapsulated volume.

Instant Image Interaction With `svadm`

Using the command option `iiadm -e` to enable a volume set automatically adds the volumes to the `sv` layer, but using the Instant Image `iiadm -d` command option to disable a volume set does not automatically remove volumes from the `sv` layer.

Also, there is no checking in the `sv` layer to prevent you from deleting volumes with `svadm` that are actively being used by Instant Image or other data services. If you remove volumes from the `sv` layer that are still in use by Instant Image or Sun SNDR, you will be able to continue operations on these volumes with no error messages, but the data in the volume set will become inconsistent.

After disabling volumes in Instant Image and Sun SNDR, they should be removed from the `sv` layer, but before removing volumes from the `sv` layer, verify with `iiadm -i` and `sndradm -i` that the volumes are not in use. Only if the volumes are not in use should you remove them from the `sv` layer.

reboot Command

Always use the `shutdown` command, not the `reboot` command.



Caution – Do not use the `reboot` command because it skips the necessary shutdown scripts for Instant Image.

Uses for the Instant Image Software

The Sun StorEdge Instant Image software, running in the Solaris operating environment, provides applications with continuous access to data and enables nonintrusive access to a point-in-time copy of the same data by secondary applications. Instant Image supports both full copy and fast resynchronization to reestablish a new point-in-time shadow copy as needed. The volume's data can be resynchronized from either master to shadow or from shadow to master.

Instant Image supports both Sun StorEdge and all Sun-supported storage. It works independently of the underlying data reliability software (for example: RAID-1, RAID-5, or volume manager). Additionally, it can be an integral part of the data migration to and from differing storage types.

Typical uses for the Sun StorEdge Instant Image software include:

- Backup of 24 x 7 application data.
- Data warehouse loading (and fast resynchronization) at predefined intervals.
- Application development and testing on a point-in-time snapshot of live data.
- Data migration across different types of storage platforms and volumes.
- Hot backup of application data from frequent point-in-time snapshots.
- Application data replication to secondary site.



Caution – *Do not* install the Sun StorEdge Version 3.0 core and data services software on servers in a Sun Cluster 3.0 environment.

- The Version 3.0 software is *not* coexistent with the Sun Cluster 3.0 environment
- The Version 3.0 software is coexistent in the Sun Cluster 2.2 environment
- The Version 3.0 core and data services software is cluster aware in the Sun Cluster 3.0 Update 1 environment and provides high availability for the Sun StorEdge data services.

Task Summary: Getting Started

This table briefly lists the steps and tasks for getting started with the Instant Image software.

TABLE 1-2 Getting Started Task Summary

Step	See This Section (Command-Line Interface)
1. Choosing volumes to use with Instant Image.	“Sizing Requirements for Volume Sets” on page 47
2. Enabling volume sets consisting of master volume, shadow volume, and bitmap volume.	“Enabling Volume Sets” on page 48
3. Initialize and attach overflow volumes to compact dependent shadow volume sets.	“Using Overflow Volumes” on page 50
4. Collect volume sets in I/O groups for ease of management.	“To Move Volume Sets into I/O Groups” on page 52
5. Perform Instant Image copy, update, and other operations on the volume sets.	Most of Chapter 3, including: “Updating, Copying, and Waiting” on page 54 “To Perform Full Copy Operations” on page 56 “To Update Volume Sets” on page 54
6. Check volume set status.	“To Display Volume Set Status” on page 59

The Command-Line Interface

This chapter describes the Instant Image CLI and provides the syntax of the CLI commands. The Instant Image CLI is designed to control a single Instant Image volume set, an I/O group consisting of more than one volume set, or selected volume sets or I/O groups within a specific Sun Cluster Resource Group. The CLI can be invoked interactively or incorporated into a shell script. This chapter includes:

- “Command-Line Interface” on page 14
- “Command Modifiers” on page 14
- “Help Information” on page 16
- “Command Options” on page 16
- “Option List” on page 18

Command-Line Interface

The primary user interface to the Instant Image software is the `/usr/opt/SUNWesm/sbin/iiadm` command.

The following usage applies to all examples and explanations in this chapter.

Name	Definition
<i>master</i>	The specific master volume referenced in the command
<i>shadow</i>	The specific volume set, whose name defaults to the name of its associated shadow volume
<i>shadowvol</i>	The name of a specific shadow volume
<i>bitmap</i>	The name of a specific bitmap volume
<i>cluster</i>	The name, or <i>tag</i> , of a specific Sun Cluster
<i>io-groupname</i>	The specific I/O group, whose name is given upon creation by naming it in a <code>move (to group)</code> command or an <code>enable</code> command
<i>overflow</i>	The specific overflow volume referenced in the command

Command Modifiers

The `iiadm` CLI performs only one action per command invocation, as such you cannot combine multiple options, except with the `-g` and `-C` command modifiers. The order in which command modifiers are entered is important: they must be entered after the `iiadm` command and before any other options or variables, such as names. Note also that the option is the last non-variable entry on a command line, which prevents confusion with volume names.

`iiadm -g`

This command modifier extends most, but not all, existing commands to act on I/O groups. No specific volume set names are needed because the command is carried out against all volume sets within the I/O group specified.

Syntax

`iiadm -g io-groupname -s`

This command line suspends (`-s`) all volume sets in the I/O group, *io-groupname*.

`iiadm -C`

This command modifier enhances all existing commands to act on all volume sets associated with the specified Sun Cluster tag. In a cluster environment, enabling a volume set causes it to be tagged with the current cluster tag. Enable volume sets so that master, shadow, bitmap, and overflow volumes are in the same disk group, physical and logical, so that failover will work correctly. Commands executed in a cluster environment are executed against all volume sets associated with the current cluster. If you need to execute commands against a cluster other than the current one, the `-C` option enables you to do that.

Syntax

```
iiadm -C cluster -s
```

This command line suspends (`-s`) all volume sets associated with the specified Sun Cluster whose tag is *cluster*.

```
iiadm -C cluster -g io-groupname -s
```

This command line suspends all volume sets in the specified I/O group in the cluster whose tag is *cluster*.



Caution – *Do not* install the Sun StorEdge Version 3.0 core and data services software on servers in a Sun Cluster 3.0 environment.

- The Version 3.0 software is *not* coexistent with the Sun Cluster 3.0 environment
- The Version 3.0 software is coexistent in the Sun Cluster 2.2 environment
- The Version 3.0 core and data services software is cluster aware in the Sun Cluster 3.0 Update 1 environment and provides high availability for the Sun StorEdge data services.

`iiadm -n`

This command modifier, when used with a copy or update command, skips the printing of a query to `stderr` that asks if you are sure you want to update the master volume.

Syntax

```
iiadm -n -c m shadow
```

```
iiadm -n -u m shadow
```

Command Options

When you enter an `iiadm` command, you must enter an option, telling the Instant Image software what to do, and usually one or more volume, set, and group names, telling the Instant Image software where to execute the command.

Only one option can be entered on a command line (except `-n` command option). Here are some examples of command lines illustrating the enable option, `-e`.

```
iiadm -e ind master shadowvol bitmap
iiadm -g io-groupname -e dep master shadowvol bitmap
iiadm -C cluster -e ind master shadowvol bitmap
```

Help Information

If an unsupported action item is entered, `iiadm` displays the entire help message text to `stderr`. The help message text can also be called up with the `iiadm -h` option.

If more than one action item or an incorrectly specified action item is entered, `iiadm` displays the specific error message to `stderr`. Here is an example of an incorrectly specified action.

```
# iiadm -d
iiadm: option requires an argument -- d
iiadm: unrecognized argument

Brief summary:
    -e {ind|dep} master_vol shadow_vol bitmap_vol
    -[cu {s|m}] volume_set
    -[irs] all
    -[adDEiloPRrsw] volume_set
    -g group_name [options]
    -f config_file [options]
    -C cluster_tag [options]
    -[hilLrsv]
    -[IJ] bitmap volume_set
    -[OQ] overflow_vol
    -P {delay} {units} volume_set
```

Configuration Parameters

There are three configuration parameters that directly influence the operation of the Instant Image software. You can use the `vi` editor to modify these parameters.

`II_Bitmap`

This parameter defaults to `1` upon installation of the Instant Image software. Possible settings are: `0`, `1`, and `2`. When you enable volume groups, they have this value associated with them. Edit `/usr/kernel/drv/ii.conf`.

If set to `0`, the bitmap is maintained in memory only. If the system crashes, there is a possibility of resulting inconsistent data. This is especially the case if the system crashes during a shadow-to-master update in a compact dependent shadow set.

If set to `1` and the system has Fast Write Cache (FWC) cards installed, the bitmap is maintained in FWC and stored upon suspension of the volume set in the bitmap volume given when the set was enabled. When the volume set is resumed, the bitmap is read into FWC. If no FWC cards are installed, the bitmap is maintained in the bitmap volume.

If set to `2`, the bitmap is maintained in the bitmap volume even if FWC cards are installed.

`II_Threshold`

The values stored in `II_Threshold` are the default values for *units* and *delay* in the copy parameter command, `-P`. You can change the default value for all newly enabled sets by modifying the `II_Threshold` settings. You can change the two parameters for any existing volume set with the `-P` command. Edit `/usr/kernel/drv/ii.conf` to set enable default values in `II_Threshold`.

These settings tune the copy process so that the copy does not swamp system resources. Set the maximum number of chunks of data (100 through 60000) to be sent before pausing and set the length of the pause, in system clock ticks (1 through 10000), before sending the next series of chunks of data. In this way, the copy proceeds to completion without preventing other processes from using the system.

`iidev_shorts`

This parameter determines the maximum number of `ii@0` devices created in `/devices/pseudo` to support compact dependent shadows volumes. The default value at installation is `iidev_shorts=100`. To change this parameter, edit `/usr/kernel/drv/iidev.conf`, then issue the `reboot -- -r` command. If you are increasing the number, you can also enter `drvconfig` instead of rebooting.

Option List

All the command options are listed in alphabetical order in the following pages of this chapter.

To Abort a Copy or Update

Use this option when you need to abort any copy or update before it executes to completion. Data remains valid, but the update or copy to the target volume is incomplete. The target volume is now a dependent copy of the source volume. At a later time, you can re-issue the update or copy option to resynchronize the volumes.

Note – See “Cautions: Enable, Copy, and Update” on page 9.

This option aborts any current copy or update operation on the specified volume set or on all volume sets within an I/O group.

`iiadm -a`

Syntax

`iiadm -a shadow`

`iiadm -g io-groupname -a`

To Attach an Overflow Volume

This option attaches an overflow volume to a volume set with a compact dependent shadow or to all volume sets within an I/O group that have compact dependent shadows.

Note – An overflow volume must be initialized before it is attached to a volume set. See “To Initialize an Overflow Volume” on page 33.

Use this option after you enable a volume set with a compact dependent shadow. You can also use this command to attach an overflow volume to an I/O group containing volume sets with compact dependent shadows.

```
iiadm -A
```

Syntax

```
iiadm -A overflow shadow
```

```
iiadm -g io-groupname -A overflow
```

To Copy Volumes

Note – See “Cautions: Enable, Copy, and Update” on page 9.

The copy option writes all the data from either the master volume of the volume set to the shadow volume or from the shadow volume to the master volume. You can also copy all masters to all shadows or all shadows to all masters within an I/O group.

If you do a shadow-to-master copy, the system prints a query that asks if a shadow-to-master copy is what you really want. You can stop this message from being printed with the `-n` command option.

Use this option to synchronize the master and shadow volumes with a full volume copy. If you do not need a full copy, use the update option instead.

`iiadm -c`

Syntax

```
iiadm -c { s | m } shadow  
iiadm -g io-groupname -c { s | m }
```

Options

<code>s</code>	update from master to shadow
<code>m</code>	update from shadow to master

To Disable Volume Sets

Note – See “Instant Image Interaction With svadm” on page 10.

The disable option disables a volume set or disables all volume sets in an I/O group. If you disable an independent volume set, the shadow volume contains valid data and remains accessible. If you disable a dependent volume set, the shadow does not contain valid data, the first 64Kbytes of the volume are erased, and the volume becomes inaccessible for data retrieval.

Use this option to disable the Instant Image software for specific volume sets or all volume sets in specific I/O groups so that it no longer maintains the shadow volumes’ point-in-time snapshots or the associated bitmaps.

Use this option to terminate the volume set association when the volume set is no longer needed, such as when you want an independent shadow copy to use for testing. Once disabled, the volume set is no longer usable except as stand-alone copies, and cannot be re-enabled.

`iiadm -d`

Syntax

```
iiadm -d shadow
iiadm -g io-groupname -d
```



Caution – The Sun StorEdge Instant Image `iiadm -e enable` command automatically adds configured volumes to the Sun StorEdge Storage Volume (SV) driver’s configuration. When you use the `iiadm -d disable` command option, the volumes are not automatically removed.

To safely remove volumes from SV control and the Sun StorEdge configuration:

1. **Disable the volumes in the Sun StorEdge software using the `iiadm -d` command.**
2. **Remove the volumes from SV control using the `svadm -d <volume>` command.**

To Detach an Overflow Volume

Use this option to detach an overflow volume from a volume set or from all volume sets within an I/O group.

This option executes only if the volume set has no data on the overflow volume. One such instance is immediately after a point-in-time snapshot of the master is taken.

```
iiadm -D
```

Syntax

```
iiadm -D shadow
```

```
iiadm -g io-groupname -D
```


To Enable Volume Sets

Note – See “Cautions: Enable, Copy, and Update” on page 9.

Note – You must use a volume for a bitmap. File-based bitmaps are not supported in the Instant Image software Version 3.0.

The enable option enables an Instant Image volume set, composed of the specified master volume, shadow volume, and bitmap volume, then causes a point-in-time snapshot of the master volume, either dependent or independent, to be taken on the shadow volume.

You can enable the volume set as a member of an I/O group by specifying the name of the I/O group. If the I/O group exists, the volume set is attached to it; if the I/O group does not exist, it is created and the volume set is attached to it. The volume set is enabled as a compact dependent shadow volume if the shadow volume you specify is smaller than the master volume. You can, and should, attach an overflow volume later with the `-A` option to any compact dependent shadow volume set.

Use this option to initially create Instant Image volume sets. You can create the volume sets with or without assigning them to an I/O group. At a later time, you can move any volume set into any I/O group with the move option.

`iiadm -e`

Syntax

```
iiadm -e { ind | dep } master shadowvol bitmap
```

```
iiadm -g io-groupname -e { ind | dep } master shadowvol bitmap
```

Options

<code>ind</code>	Independent shadow; all master volume data is copied to the shadow volume.
<code>dep</code>	Dependent shadow; a master volume-dependent, point-in-time snapshot of the master volume, which is accessible through the shadow volume.

To Export a Shadow Volume

Use this option to export a shadow volume or all the shadow volumes in an I/O group so that another host can import them. One instance when you would want to do this is to continue business transactions on a secondary host while the primary host is unavailable.

```
iiadm -E
```

Syntax

```
iiadm -E shadowvol
```

```
iiadm -g io-groupname -E
```

To Print Command Usage

Use this option to print a summary of usage for all Instant Image options and modifiers.

When you enter a command improperly, `iiadm` sends an abbreviated command usage summary to `stderr`. Use the `-h` option to display the usage summary of all `iiadm` options.

```
iiadm -h
```

Syntax

```
iiadm -h
```

To Display Volume Set Status

Use this command when you want to display the status of volume sets. Specify the name of the volume set to check its status, or enter `all` to check all volume sets. A typical use of this option is to check the status of a copy or update operation before using the target volume for any other operations. See also “To Wait for a Copy or Update to Complete” on page 43.

```
iiadm -i
```

Syntax

```
iiadm -i { shadow | all }
```

```
iiadm -g io-groupname -i
```

Options

shadow display the status of the named volume set

all display the status of all volume sets

Sample output:

```
# iiadm -i /dev/vx/rdisk/shadowdg/shadowvoll
/dev/vx/rdisk/masterdg/mastervoll: (master volume)
/dev/vx/rdisk/shadowdg/shadowvoll: (shadow volume)
/dev/vx/rdisk/rootdg/bitvoll: (bitmap volume)
Independent copy (this is an independent shadow volume set)
Volume size:        200
Percent of bitmap set: 0 (the bitmap is clean)
```

To Import a Shadow Volume

Use this option to import a previously exported shadow volume using a specified bitmap. Use this bitmap later to rejoin the shadow volume to its master volume. This is typically done by a secondary host importing the shadow volume exported by the primary host.

```
iiadm -I
```

Syntax

```
iiadm -I shadowvol bitmap
```

To Join a Shadow Volume

Use this command to join the shadow volume to its master volume using a specific bitmap. The sequence for joining a shadow volume to its original master volume is:

1. On the importing host, Host B, suspend the volume set that includes the imported shadow volume.
2. To the original host, Host A, copy the bitmap that was in use on Host B.
3. On Host A, issue the join command.
4. On Host B, disable the volume set that was using the imported shadow volume.

```
iiadm -J
```

Syntax

```
iiadm -J shadowvol bitmap
```

Options

bitmap optional bitmap volume

Note – You may not need to copy the bitmap to Host A if the bitmap is on a dual-ported drive.

Caution – Once a shadow is rejoined to its original master on Host A, Host B should not use the shadow volume even if it is still accessible.



To List Volume Sets

This option lists either all volume sets or all volume sets in an I/O group.

```
iiadm -l
```

Syntax

```
iiadm -l
```

```
iiadm -g io-groupname -l
```

Sample output:

```
# iiadm -l
ind /dev/vx/rdisk/masterdg/mastervol5
/dev/vx/rdisk/shadowdg/shadowvol5 /dev/vx/rdisk/rootdg/bitvol5
dep /dev/vx/rdisk/masterdg/mastervol4
/dev/vx/rdisk/shadowdg/shadowvol4 /dev/vx/rdisk/rootdg/bitvol4
ind /dev/vx/rdisk/masterdg/mastervol3
/dev/vx/rdisk/shadowdg/shadowvol3 /dev/vx/rdisk/rootdg/bitvol3
dep /dev/vx/rdisk/masterdg/mastervol2
/dev/vx/rdisk/shadowdg/shadowvol2 /dev/vx/rdisk/rootdg/bitvol2
ind /dev/vx/rdisk/masterdg/mastervol1
/dev/vx/rdisk/shadowdg/shadowvol1 /dev/vx/rdisk/rootdg/bitvol1
```

To List Overflow Volumes or Groups

This option lists either all overflow volumes or all I/O groups.

```
iiadm -L
```

Syntax

```
iiadm -L
```

```
iiadm -g -L
```

Sample output:

```
# iiadm -g -L
groupone
# iiadm -L
/dev/vx/rdsk/rootdg/overflowvol
```


To Move a Volume Set

Use this option to move one or more volume sets into an I/O group. The volume set can be a member of an existing I/O group or not a member. The move operation does not involve data operations so there is no need to quiesce the application before moving the volume set. You can move the volume set into the NULL I/O group, meaning no I/O group, using two double-quote marks instead of an I/O group name.

Most Instant Image options, such as the copy option, can be used with the group command and help to simplify Instant Image operations. Use the move option to place volume groups into I/O volume groups so they can be operated on at the same time with single commands.

```
iiadm -m
```

Syntax

```
iiadm -g io-groupname -m shadow-1 shadow-2 ... shadow-n
```

```
iiadm -g "" -m shadow
```

To Offline a Volume Set

This option causes a specific volume set or all volume sets in an I/O group to be marked as offline.

Use this option to mark a set as offline when you suspect an impending hardware failure.

```
iiadm -o
```

Syntax

```
iiadm -o shadow
```

```
iiadm -g io-groupname -o
```

To Initialize an Overflow Volume

This option initializes an overflow volume for use with volume sets that were enabled with compact dependent shadow volumes.

Once initialized, the overflow volume can be attached to any number of compact dependent shadow volumes, depending on available space.

If existing overflow volume space is insufficient, use this option after you enable a volume set with a compact dependent shadow volume, then attach the overflow volume to the volume set to receive any data overflows.

```
iiadm -O
```

Syntax

```
iiadm -O overflow
```

To Set Copy Parameters

Use this option to tune the copy process so that the copy does not excessively consume system resources. This *throttled copy* is tuned by setting the maximum number of chunks of data (100 through 60000) to be sent before pausing and by setting the length of the pause, in system clock ticks (1 through 10000), before sending the next series of chunks of data. In this way, the copy proceeds to completion without preventing other processes from using the system. The software defaults to minimum settings for both parameters.

Get copy parameters for a specific volume set with the `iiadm -P shadow` command. Get copy parameters for an I/O group with the `iiadm -g io-groupname -P` command.

The Instant Image software, at installation, defaults to the minimum settings for both parameters: *delay* and *units*. Use this option to speed up copies if your system has idle time during copy operations. Use this command to slow down copies if other applications require more system resources during copy operations.

`iiadm -P`

Syntax

`iiadm -P delay units shadow`

`iiadm -P shadow`

`iiadm -g io-groupname -P delay units`

`iiadm -g io-groupname -P`

Options

delay number of system clock ticks (1-10000) between copy operations
units number of chunks of data (100-60000) sent before pausing for the set delay

Sample output:

```
# iiadm -P /dev/vx/rdisk/shadowdg/shadowvol3  
volume: /dev/vx/rdisk/shadowdg/shadowvol3  
copy delay: 2  
copy unit: 100  
# iiadm -g groupone -P  
volume: /dev/vx/rdisk/shadowdg/shadowvol2  
copy delay: 2  
copy unit: 100  
volume: /dev/vx/rdisk/shadowdg/shadowvol4  
copy delay: 3  
copy unit: 1000
```

To Display Overflow Volume Status

This option displays the status of the specified overflow volume.

Note – In order for this command option to work correctly, the overflow volume must be attached to at least one compact dependent shadow volume.

Use this option to determine:

- The number of volume sets attached to the overflow volume.
- The number of volume sets currently using the overflow volume.
- The total number of chunks in the overflow volume.
- The total number of used chunks.
- The total number of available chunks.

`iiadm -Q`

Syntax

`iiadm -Q overflow`

Sample output:

```
# iiadm -Q /dev/vx/rdsk/rootdg/overflowvol
Total number of attached shadows: 1
Number of currently attached shadows: 1
Total number of chunks: 159
Number of chunks ever allocated: 1
Number of unused chunks: 158
```

To Resume Suspended Volume Sets

This option continues Instant Image operations for the specified volume set, for all volume sets in an I/O group, or for all volume sets suspended by the suspend option, using the state saved in the associated bitmap. Any copy or update operation that was in progress when the volume was suspended also resumes.

Use this command when you want to resume Instant Image operations for the currently suspended specified set. You cannot perform copy or update operations while the set is suspended. See also “To Suspend Volume Sets” on page 40.

```
iiadm -r
```

Syntax

```
iiadm -r { all | shadow }
```

```
iiadm -g io-groupname -r
```

To Reset a Volume Set or I/O Volume Group

This option places specific volume sets that are offline or all volume sets in an I/O group that are offline to the online state.

Use this option to return volume sets to the online state after the condition that caused them to be marked offline has been corrected. After executing this option, the best state available for the volume set will be reestablished. A point-in-time snapshot will be created or, in the case of independent copy volume sets where the bitmap was offline, the master and shadow volumes will be marked as different.

```
iiadm -R
```

Syntax

```
iiadm -R shadow
```

```
iiadm -g io-groupname -R
```

▼ To Reset a Master Volume with Multiple Shadows

Caution – The `iiadm -g group -R` command *must not* be used with multiple shadows of single masters because all the resets occur at the same time with unpredictable results.

If the master volume with multiple shadow volumes is placed offline, return it to the online state with the `iiadm -R` command, as follows:

1. **Reset all independent shadow sets, except the shadow set that you want to update the master volume with.**

```
# iiadm -R shadow shadow2 ... shadowN
```

2. **Wait for all reset operations to finish.**

```
# iiadm -w shadow shadow2 ... shadowN
```


3. **Reset the volume set containing the shadow volume you want to update the master volume with.**

```
# iiadm -R shadow
```

4. **Wait for the copy to complete.**

```
# iiadm -w shadow
```

5. **Reset all dependent shadow sets.**

```
# iiadm -R shadow shadow2 ... shadowN
```

To Suspend Volume Sets

Note – See “Cautions: Enable, Copy, and Update” on page 9.

This option suspends the Instant Image software for a specified currently enabled volume set, for all volume sets in an I/O group, or for all volume sets. The state of any copy or update is saved in the associated bitmaps for later completion.

Use this command when you want to temporarily suspend (but not disable) the Instant Image software for the specified volume sets. You cannot perform copy or update operations while the volume set is suspended. See also “To Resume Suspended Volume Sets” on page 37.

```
iiadm -s
```

Syntax

```
iiadm -s { shadow / all }
```

```
iiadm -g io-groupname -s
```

Options

shadow suspend the named volume set

all suspend all volume sets

To Update a Volume Set

Note – See “Cautions: Enable, Copy, and Update” on page 9.

Use this option to update a volume set or all volume sets in an I/O group, either from master to shadow or from shadow to master.

If you do a shadow-to-master update, the system prints a query that asks if a shadow-to-master update is what you really want. You can stop this message from being printed with the `-n` command option.

Use this option whenever you want to update the point-in-time shadow copy of the master volume or to update the master from the shadow. The update option incrementally updates the volumes with only changed data, as tracked in the bitmaps, and is very quickly completed, as compared to a full volume copy, which takes longer. If you need a full volume copy, use the copy option.

```
iiadm -u
```

Syntax

```
iiadm -u { s | m } shadow  
iiadm -g io-groupname -u { s | m }
```

Options

s	update from master to shadow
m	update from shadow to master

To Print Software Versions

Use this option to print the version of the major software modules when you need to know the software versions that are installed. One such time is during a software update.

```
iiadm -v
```

Syntax

```
iiadm -v
```

Sample output:

```
# iiadm -v  
InstantImage version 3.nn
```

To Wait for a Copy or Update to Complete

This option causes the system to wait for Instant Image to complete any in-progress copy or update operation on a volume set or on all volume sets in an I/O group before allowing another command to execute on that volume set.

Use this command when you need to be sure the copy or update operation has completed before invoking another Instant Image command that affects that volume set.

- Use this command after enabling the Instant Image software with the `independent` option or after you have issued a copy or update command.
- Use this command before you disable the Instant Image software for a volume set that could have a copy or update operation in progress.

This command is useful when used as part of a script.

```
iiadm -w
```

Syntax

```
iiadm -w shadow
```

```
iiadm -g io-groupname -w
```


Using Instant Image

This chapter contains examples showing how to configure, enable, and use the Instant Image software. The examples in this chapter show how to perform operations using the Instant Image command-line interface (CLI). This chapter includes:

- “Instant Image Operations” on page 46
- “Sizing Requirements for Volume Sets” on page 47
- “Enabling Volume Sets” on page 48
- “Using Overflow Volumes” on page 50
- “Moving Volume Sets” on page 52
- “Setting Parameters” on page 53
- “Updating, Copying, and Waiting” on page 54
- “Listing Volumes” on page 58
- “Displaying Status” on page 59
- “Aborting Copy or Update” on page 60
- “Suspending and Resuming Sets” on page 61
- “Offlining and Resetting Volume Sets” on page 63
- “Disabling Volume Sets” on page 65
- “Exporting, Importing, and Joining Shadows” on page 67
- “Displaying Help and Software Versions” on page 69

Instant Image Operations

This section discusses the operation of the Instant Image software from a system administrator's viewpoint. Typical tasks are described in detail with examples. The example use these volume names:

Volume Name	Definition
<code>/dev/rdisk/c1t3d0s0</code>	The name of the master volume
<code>/dev/rdisk/c1t3d0s4</code>	The name of the shadow volume
<code>/dev/rdisk/c1t2d0s5</code>	The name of the bitmap volume
<i>io-groupname</i>	The name of the I/O group
<code>/dev/rdisk/c1t4d0s6</code>	The name of the overflow volume

All Instant Image commands are accessed on the following path:

```
/usr/opt/SUNWesm/sbin/iiadm
```

Instant Image operations include but are not limited to:

1. Enabling the Instant Image software for the volumes you have selected.
2. Using the Instant Image fast resynchronization commands to quickly update volumes when necessary.
3. Using the Instant Image Copy feature to perform full volume copies.

You typically perform a full volume copy only when you need two physically-separate volumes, or if a volume has become corrupted or has failed. Copying from master to shadow overwrites the shadow volume with the master contents; copying from shadow to master overwrites the master volume with the changed shadow contents. However, you can choose to enable the volume group as independent, which performs a full volume copy from master to shadow.

4. Disabling the Instant Image software, if you choose to do so. You can keep the Instant Image software enabled indefinitely.

Sizing Requirements for Volume Sets

Before you can enable master, shadow, or bitmap volumes for use by the Instant Image software, you must create the volumes with your volume manager. The Instant Image software supports Veritas Volume Manager, Sun Solstice Disk Suite, and raw volumes.

You can have multiple I/O groups of volume sets; the number is limited only by the amount of storage you have physically available.

- An Instant Image master volume can be any size.
- An Instant Image independent shadow volume must be the same size (or greater) than the master volume size. However, to prevent reverse sync problems, the shadow should be the same size as the master.
- An Instant Image dependent shadow volume can be any size, but should easily exceed the total number of expected writes to both the master and shadow volumes during the time the dependent shadow volume is expected to be in use. The Instant Image software supports a shared overflow volume, which can store excess changes, over the configured size of the dependent shadow volume. If the overflow volume is full, or not specified, then a change can't be recorded in the dependent shadow volume, forcing it to become inconsistent and subsequently taken off-line.
- An Instant Image bitmap volume's size is based on the size of the master volume and the type of volume set being created (independent, full-sized dependent, or compact dependent) as follows:
 - For independent or full shadow dependent volume sets:

8 Kbytes per 1 Gbyte of master volume size (rounded-up to the nearest whole Gigabyte), plus an additional 24 Kbytes for overhead.

For example, to shadow a 3 Gbyte master volume, the bitmap size must be $(3 * 8 \text{ Kbytes}) + 24\text{Kbytes}$, or 48 Kbytes in size.
 - For compact dependent shadow volume sets:

256 Kbytes per 1 Gbyte of master volume size (rounded up to the nearest whole Gbyte), plus 8 Kbytes per Gbyte of master volume (rounded up to the nearest whole Gbyte), plus an additional 24 Kbytes for overhead.

For example, to shadow a 3 Gbyte master volume, the bitmap size must be $(3 * 256 \text{ Kbytes}) + (3 * 8 \text{ Kbytes}) + 24 \text{ Kbytes}$, or 816 Kbytes in size.

If you enable a volume set with a bitmap that is too large, the volume set is created even though space may be wasted. If you enable a volume set with a bitmap that is too small, the enable command fails with an error message.

Enabling Volume Sets

Note – Use a volume for the bitmap. File-based bitmaps are not supported.

▼ To Enable an Independent Volume Set

Use the `-e ind` option to enable the Instant Image software for an independent volume set. A full volume shadow copy of the master volume will be performed. Both master volume and shadow volume will be available at once, but the shadow volume will be treated as a dependent shadow until the full copy is complete. See also “To Enable Volume Sets” on page 23.

1. **Unmount the shadow volume** `/dev/rdisk/c1t3d0s4`.
2. **Enable an independent volume set by typing:**

```
# iiaadm -e ind /dev/rdisk/c1t3d0s0 /dev/rdisk/c1t3d0s4 /dev/rdisk/c1t2d0s5
(to enable an independent volume set)
# iiaadm -g io-groupname -e ind /dev/rdisk/c1t3d0s0 /dev/rdisk/c1t3d0s4 \
/dev/rdisk/c1t2d0s5
(to enable an independent volume set in an I/O group)
```

3. **Mount the shadow volume,** `/dev/rdisk/c1t3d0s4`.

You now have an independent volume set. If the volume set is enabled in a non-existent I/O group, it will be created.

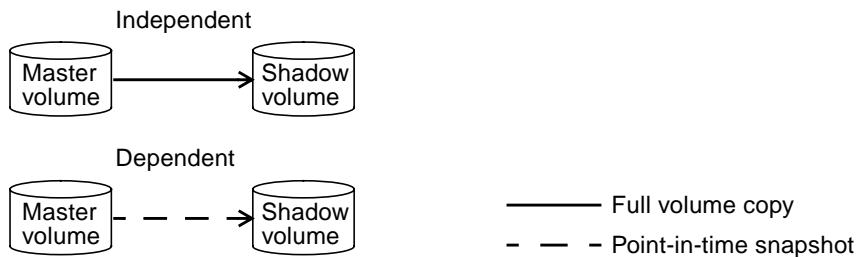


FIGURE 3-1 Enabling Instant Image Volume Sets

▼ To Enable a Dependent Volume Set

Use the `-e dep` option to enable the Instant Image software for a dependent volume set. No copy will take place and the volume set will be available at once. See also “To Enable Volume Sets” on page 23.

1. **Unmount the shadow volume** `/dev/rdisk/c1t3d0s4`.
2. **Enable a dependent volume set by typing:**

```
# iiadm -e dep /dev/rdisk/c1t3d0s0 /dev/rdisk/c1t3d0s4 /dev/rdisk/c1t2d0s5
(to enable a dependent volume set)
# iiadm -g io-groupname -e dep /dev/rdisk/c1t3d0s0 /dev/rdisk/c1t3d0s4 \
/dev/rdisk/c1t2d0s5
(to enable a dependent volume set in an I/O group)
```

3. **Mount the shadow volume.**

You now have a master volume-dependent point-in-time snapshot of the data. If the volume set is enabled in a non-existent I/O group, the I/O group will be created.

Storage Volume Limit

All Sun StorEdge data services together have a default limit of 1024 storage volumes. If you are using the Instant Image software alone, this imposes a limit of 341 volume sets each composed of three volumes: master, shadow, and bitmap. If you are also using Sun StorEdge Network Data Replicator, the volume sets are divided between the two applications.

If you want to increase the storage volume limit, edit `/kernel/drv/nsctl.conf` and specifically the number associated with `nsc_max_devices`. Doing so will cause more memory to be consumed and could cause you to have to adjust the value in `nsc_global_pages` value in `mc_rms.conf`. Only an experienced system administrator should make these changes.

Using Overflow Volumes

You can initialize an overflow volume for use with compact dependent shadow volumes then attach the overflow volume to selected volume sets. You can also detach an overflow volume from a volume set.

▼ To Initialize an Overflow Volume

Before you can attach an overflow volume to a volume set, the overflow volume must be initialized. See also “To Initialize an Overflow Volume” on page 33.

- **Initialize an overflow volume by typing:**

```
# iiadm -O /dev/rdisk/c1t4d0s6
```

You can now attach dependent volume sets with compact dependent shadows to the newly initialized overflow volume. Any number of compact dependent shadows can be attached to an overflow volume as long as it has sufficient storage space.

▼ To Attach Overflow Volumes to Volume Sets

A dependent volume set with a compact dependent shadow should have an overflow volume attached to it so that any writes to the volume set, if it gets full, can be redirected to the overflow volume. See also “To Attach an Overflow Volume” on page 19.

- **Attach an overflow volume to a volume set by typing:**

```
# iiadm -A /dev/rdisk/c1t4d0s6 /dev/rdisk/c1t3d0s4
```

- **Attach an overflow volume to all compact dependent shadow volume sets in an I/O group by typing:**

```
# iiadm -g io-groupname -A /dev/rdisk/c1t4d0s6
```

▼ To Detach Overflow Volumes from Volume Sets

Use this option if you want to detach an overflow volume from a volume set. See also “To Detach an Overflow Volume” on page 22.

- **Detach an overflow volume from a volume set by typing:**

```
# iiadm -D /dev/rdisk/c1t3d0s4
```

- **Detach an overflow volume from all compact dependent shadow volume sets in an I/O group by typing:**

```
# iiadm -g io-groupname -D
```

If the overflow volume contains any data associated with any set that you are trying to detach, the command will fail.

Moving Volume Sets

Volume sets can be moved into and out of I/O groups for ease of management. All volume sets within an I/O group respond to commands sent to the I/O group.

▼ To Move Volume Sets into I/O Groups

Use the `-m` option to move volume sets into I/O groups for ease of management. Move a volume set out of any I/O group by typing two double-quote marks instead of the I/O group name. See also “To Move a Volume Set” on page 31. If you move the volume set into a non-existent I/O group, the Instant Image software will create that I/O group.

- Move the volume set into an I/O group by typing:

```
# iiadm -g io-groupname -m /dev/rdisk/c1t3d0s4  
(to move a volume set into an I/O group)
```

- Move the volume set out of an I/O group by typing:

```
# iiadm -g "" -m /dev/rdisk/c1t3d0s4  
(to move a volume set out of an I/O group)
```

Setting Parameters

Volume copy can be throttled by setting the copy parameters so that copy operations do not adversely affect ongoing business operations by consuming system resources.

▼ To Get and Set Copy Parameters

Use the `-P` option to set copy parameters after enabling your volume sets and collecting them in I/O groups for ease of management. When an update or a copy is in progress, two settings determine how much impact the copy or update has on availability of system resources to other applications. The first setting is the number of chunks of data to copy (100 through 60000) before delaying to allow other applications access. The second setting is the length of time, in system clock ticks (1 through 10000), to wait before sending the next series of data chunks. You also get the current settings of these parameters with the `-P` option. The Instant Image software defaults to minimum settings. See also “To Set Copy Parameters” on page 34.

- **Set copy parameters for a specific volume set by typing:**

```
# iiadm -P delay units /dev/rdisk/c1t3d0s4
```

- **Set copy parameters for all volume sets in an I/O group by typing:**

```
# iiadm -g io-groupname -P delay units
```

- **Get copy parameters for a specific volume set by typing:**

```
# iiadm -P /dev/rdisk/c1t3d0s4
```

- **Get copy parameters for all volume sets in an I/O group by typing:**

```
# iiadm -g io-groupname -P
```

Updating, Copying, and Waiting

To bring the master volume and the shadow volume into synchronization, you can perform either an update or a copy. An update writes only the blocks of data that have changed as recorded in the bitmap. A copy operation performs a full write, which takes longer than an update. You can update the master volume from the shadow or the shadow volume from the master. If necessary, you can cause the Instant Image software to wait for a copy or update to complete before executing the next command.

Note – Take the same precautions using Instant Image Copy and Update options as you would using the `dd(1M)` command to copy between raw devices. That is, unmount the target of the copy and update operation first. You can unmount the source device also, to stop write operations to it and ensure a consistent shadow copy, but this source unmount is not required. After issuing the copy or update, remount the device(s) and resume the workload; you do not have to wait for the operation to complete.

▼ To Update Volume Sets

Use the `-u` option to perform fast resynchronizations, or updates, of volume set at much faster speeds than most full volume copy or mirroring operations. See also “To Update a Volume Set” on page 41.

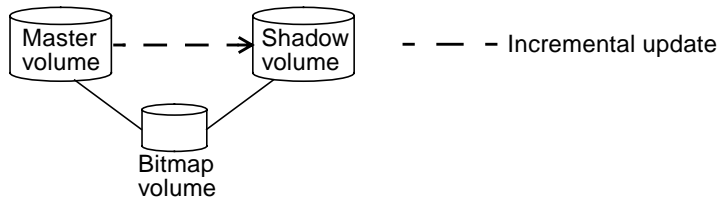


FIGURE 3-2 Updating the Shadow

Update the Shadow From the Master

1. **Unmount the shadow volume** `/dev/rdsk/c1t3d0s4`.

2. Update the shadow volume by typing:

```
# iiadm -u s /dev/rdisk/c1t3d0s4
(update the shadow from the master in the specified volume set)
# iiadm -g io-groupname -u s
(update all volume group shadows associated with the specified I/O group)
```

3. Mount the shadow volume.

Update the Master From the Shadow

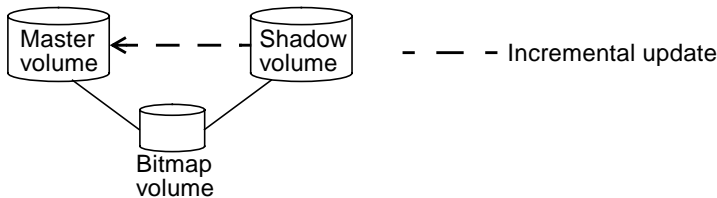


FIGURE 3-3 Updating the Master

1. Unmount the master volume /dev/rdisk/c1t3d0s0.

2. Update the master volume by typing:

Note – The specified volume in this example is the shadow volume, even though you are updating the master volume. This is correct; always specify the set’s shadow volume when performing options.

```
# iiadm -u m /dev/rdisk/c1t3d0s4
(update the master from the shadow in the specified volume set)
# iiadm -g io-groupname -u m
(update all volume group masters from their shadows in the specified I/O group)
```

3. Mount the master volume.

▼ To Perform Full Copy Operations

You typically perform a full volume copy only when you need two physically-separate volumes, if a volume has become corrupted, or a volume has failed. See also “To Copy Volumes” on page 20.

Copy All Data From the Master Volume to the Shadow

1. **Unmount the shadow volume** `/dev/rdisk/c1t3d0s4`.
2. **Copy all data from the master volume to the shadow by typing:**

```
# iiaadm -c s /dev/rdisk/c1t3d0s4  
(copy all data from master volume to shadow volume in the specified volume set)  
# iiaadm -g io-groupname -c s  
(copy all data from all masters in an I/O group to their shadows)
```

3. **Mount the shadow volume.**



FIGURE 3-4 Copy Master to Shadow

Copy All Data From the Shadow Volume to the Master



FIGURE 3-5 Copy Shadow to Master

1. **Unmount the master volume** `/dev/rdisk/c1t3d0s0`.
2. **Copy all data from the shadow volume to the master by typing:**

Note – The specified volume in this example is the shadow volume, even though you are overwriting the master volume. This is correct; always specify the set’s shadow volume when performing options.

```
# iiadm -c m /dev/rdisk/c1t3d0s4
(copy all data from shadow volume to master volume in the specified volume set)
# iiadm -g io-groupname -c m
(copy all data from all shadows in an I/O group to their masters)
```

3. Mount the master volume.

▼ To Wait for Completion of Copy or Update

When you start a copy or an update and you want to issue another command involving volume sets that are part of the copy or update, issue a wait command then your next command. The Instant Image software will wait until the copy or update is complete before proceeding with the next command. See also “To Wait for a Copy or Update to Complete” on page 43.

- **Wait for a copy or update to a specific volume set to complete by typing:**

```
# iiadm -w /dev/rdisk/c1t3d0s4
```

- **Wait for copies or updates to all volume sets in an I/O group to complete by typing:**

```
# iiadm -g io-groupname -w
```

Listing Volumes

The Instant Image software enables you to list various sets and volumes as required.

▼ To List Volume Sets

You can use the `-l` option to list all volume sets or you can list all volume sets in a specific I/O group. See also “To List Volume Sets” on page 29.

- **List all volume sets by typing:**

```
# iiadm -l
```

- **List all volume sets in an I/O group by typing:**

```
# iiadm -g io-groupname -l
```

▼ To List Overflow Volumes

Use the `-L` option to list all overflow volumes. See also “To List Overflow Volumes or Groups” on page 30.

- **List all overflow volumes by typing:**

```
# iiadm -L
```

▼ To List I/O Groups

Use the `-L` option to list all I/O groups. See also “To List Overflow Volumes or Groups” on page 30.

- **List all I/O groups by typing:**

```
# iiadm -g -L
```

Displaying Status

You can display the status of volume sets and of overflow volumes. This enables you to see the progress of copy and update operations and the status of overflow volumes.

▼ To Display Volume Set Status

Use the `-i` option to check the status of a volume set or of all volume sets in an I/O group. Use this option after issuing a copy or an update command to see if the copy or update has finished execution. Also see “To Display Volume Set Status” on page 26.

- Display the status of a specific volume set by typing:

```
# iiadm -i /dev/rdisk/c1t3d0s4
```

- Display the status of all volume sets in an I/O group by typing:

```
# iiadm -g io-groupname -i
```

▼ To Display Overflow Volume Status

Use the `-Q` option to display the status of overflow volumes and determine total overflow capacity, how much capacity is in use, and how much capacity is available. See also “To List Overflow Volumes or Groups” on page 30.

- Display the status of a specific overflow volume by typing:

```
# iiadm -Q /dev/rdisk/c1t4d0s6
```

Note – If the overflow volume is not attached to any compact dependent shadow volumes and you use the `iiadm -Q` option, you will get an error message.

Aborting Copy or Update

Update operations and copy operations can consume system bandwidth. You can abort these operations during busy times and continue them later.

▼ To Abort a Copy or an Update

Use the `-a` option to abort a copy or update that is in process. The state of the copy or update will be saved so that you can complete the operation at a later time. See also “To Abort a Copy or Update” on page 18.

- **Abort the copy or update to a specific volume set by typing:**

```
# iiadm -a /dev/rdisk/c1t3d0s4
```

- **Abort all copy or update operations to all volume sets in an I/O group by typing:**

```
# iiadm -g io-groupname -a
```

To resume the copy or update, you only need to reissue the copy or update command for the affected volume set.

Note – The master and shadow volumes of an independent volume set are complete, consistent volumes that can be used independently (hence the name), after you disable the volume set. Thus prior to allowing a disable operation to complete, both the master and shadow volumes must be left in a consistent state.

If an Instant Image copy or update operation is in progress, you will be unable to disable the volume set using the `iiadm -d` command option. If you were to abort the copy or update operation using the `iiadm -a` command option, the volumes would still be inconsistent, and a disable command option would not be allowed.

If you must disable an independent volume set while a copy or update is in progress, and you are not concerned with the consistency of the target volume, first suspend the volume set with the `iiadm -s` command option, then disable the volume set with the `iiadm -d` command option. The target (master or shadow) volume of the copy or update operation is left in an inconsistent state. Before disabling a dependent set, unmount the shadow volume.

Suspending and Resuming Sets

Suspend a volume set to halt operations on that volume set.



Caution – Do not write to suspended volume sets because the data could become inconsistent.

▼ To Suspend a Volume Set

Use the `-s` option to suspend operation of a volume set, of all volume sets in an I/O group, or all volume sets. Suspended sets can be resumed. See also “To Suspend Volume Sets” on page 40.

- **Suspend a specific volume set by typing:**

```
# iiadm -s /dev/rdisk/c1t3d0s4
```

- **Suspend all volume sets in an I/O group by typing:**

```
# iiadm -g io-groupname -s
```

- **Suspend all volume sets by typing:**

```
# iiadm -s all
```

▼ To Resume Volume Sets

Use the `-r` option to resume operations to a suspended volume set. Any copy or update that was in process when the volume set was suspended will be resumed. See also “To Resume Suspended Volume Sets” on page 37.

- **Resume a specific volume set by typing:**

```
# iiadm -r /dev/rdisk/c1t3d0s4
```

- **Resume all volume sets in an I/O group by typing:**

```
# iiadm -g io-groupname -r
```

- **Resume all volume sets by typing:**

```
# iiadm -r all
```

Offlining and Resetting Volume Sets

Volume sets that are offline for any reason can be put back on line with the reset command.

▼ To Offline Volume Sets

A volume set can go offline if there is a hardware failure or you can take the volume set offline with the `-o` option. Note that the volume set, while still associated, is not considered to contain valid shadow data after the set is brought back online. See also “To Offline a Volume Set” on page 32.

- **Take a volume set offline by typing:**

```
# iiadm -o /dev/rdisk/c1t3d0s4
```

▼ To Reset Volume Sets

An offlined volume set can be brought back online with the `-R` option after the reason for the offline status has been cleared. Note that the volume set, while still associated, is not considered to contain valid shadow data. See also “To Reset a Volume Set or I/O Volume Group” on page 38.

- **Reset an offlined volume set by typing:**

```
# iiadm -R /dev/rdisk/c1t3d0s4
```

- **Reset all offlined volume sets in an I/O group by typing:**

```
# iiadm -g io-groupname -R
```

Caution – The `iiadm -g group -R` command *must not* be used with multiple shadows of single masters because all the resets occur at the same time with unpredictable results.

If the master volume of more than one shadow volume (multiple shadows) goes offline and, upon repair, must be returned online with the `iiadm -R` command, follow this procedure:

1. **Reset all independent shadow sets, except the shadow set that you want to update the master volume with.**

```
# iiadm -R shadow shadow2 ... shadowN
```

2. **Wait for all these resets to finish with the `-w` command.**

```
# iiadm -w shadow shadow2 ... shadowN
```

3. **Reset the final shadow set that contains the shadow volume you want to update the master volume with.**

```
# iiadm -R shadow
```

4. **Wait for the copy to complete.**

```
# iiadm -w shadow
```

5. **Reset all dependent shadow sets..**

```
# iiadm -R shadow shadow2 ... shadowN
```

TABLE 3-1 Reset Command Results for Various Volume Types

Offline Volume Type	After Issuing A Reset, The Instant Image 3.0 Software:
Dependent shadow volume	Automatically updates the shadow volume from the master volume, using volume differences stored by the bitmap volume
Independent shadow volume	Automatically copies the master volume to the shadow volume
Bitmap	Resynchronizes the volume pair by copying the master volume to the shadow volume

Disabling Volume Sets

Disabling a volume set ends the association of the volumes within the volume set. The association of the data in the volume set cannot be reestablished except by enabling the volume set again, which causes a full copy of the master to the shadow in an independent volume set, or a dependent shadow volume. In either case, the volume set is new and the data status at the time of disable is lost. Disable a volume set only if you are finished using it as an Instant Image volume set.

▼ To Disable Volume Sets

See also “To Disable Volume Sets” on page 21 and “Instant Image Interaction With svadm” on page 10.

Note – The master and shadow volumes of an independent volume set are complete, consistent volumes that can be used independently (hence the name), after you disable the volume set. Thus prior to allowing a disable operation to complete, both the master and shadow volumes must be left in a consistent state.

If an Instant Image copy or update operation is in progress, you will be unable to disable the volume set using the `iiadm -d` command option. If you were to abort the copy or update operation using the `iiadm -a` command option, the volumes would still be inconsistent, and a disable command option would not be allowed.

If you must disable an independent volume set while a copy or update is in progress, and you are not concerned with the consistency of the target volume, first suspend the volume set with the `iiadm -s` command option, then disable the volume set with the `iiadm -d` command option. The target (master or shadow) volume of the copy or update operation is left in an inconsistent state. Before disabling a dependent set, unmount the shadow volume.

- **Disable the Instant Image software for a volume set by typing:**

```
# iiadm -d /dev/rdisk/c1t3d0s4
```

- **Disable all volume sets in an I/O group by typing:**

```
# iiadm -g io-groupname -d
```



Caution – The Sun StorEdge Instant Image `iiadm -e enable` command automatically adds configured volumes to the Sun StorEdge Storage Volume (SV) driver's configuration. However, when you use the `iiadm -d disable` command option, the volumes are *not* automatically removed.

To safely remove volumes from SV control and the Sun StorEdge configuration:

1. **Disable the volumes in the Sun StorEdge software using the `iiadm -d` command.**
2. **Remove the volumes from SV control using the `svadm -d <volume>` command.**

Exporting, Importing, and Joining Shadows

The Instant Image functionality implemented via the three `iiadm` command options: `-E` (export), `-I` (import), and `-J` (join) allow for a dual ported shadow volume to be deported back and forth between a primary and secondary host while under Instant Image control. This capability allows shadow volume processing by its associated applications to be off-loaded to a secondary host without impacting the primary host's master volume or its associated applications.

Retaining Instant Image control of the shadow volume while on the secondary host maintains bitmap integrity to facilitate fast resynchronization via copy or update processing at a later time. While the shadow volume is deported to a secondary node, read and write access to the master volume is still tracked by Instant Image. Read and write access to the shadow volume on the secondary host is also tracked by Instant Image using a second bitmap.

Once secondary host processing has completed, the shadow volume and second bitmap can be deported from the secondary host back to the primary host and rejoined with the master volume such that the master, shadow, and bitmap consistency is reconstructed. After completing the join processing, the Instant Image set is now in the same state as it would have been if the secondary host processing to the shadow volume was performed on the primary host.

▼ To Export a Shadow Volume

You can use the `-E` option to export the shadow volume from an independent volume set on Host A so that a second host, Host B, can import and use the shadow. See also “To Export a Shadow Volume” on page 24.

- **Export a shadow volume from Host A by typing:**

```
# iiadm -E /dev/rdisk/c1t3d0s4
```

- **Export all shadow volumes from an I/O group on Host A by typing:**

```
# iiadm -g io-groupname -E
```

The shadow volume from Host A can now be imported by Host B.

▼ To Import a Shadow Volume

Use the `-I` command at Host B to import an exported shadow volume from Host A. While exported, the shadow volume must be tracked by a bitmap volume at Host B; you must specify this bitmap when you import the shadow at Host B. See also “To Import a Shadow Volume” on page 27.

- **Import a shadow volume with a bitmap volume by typing:**

```
# iiadm -I /dev/rdisk/c1t2d0s5 /dev/rdisk/c1t3d0s4
```

▼ To Join a Shadow Volume

When an exported shadow is suspended at Host B, where it had been imported, the shadow can be rejoined with its master volume on Host A. The bitmap from Host B will be concatenated with the bitmap at Host A to include all changes at Host B in the now rejoined shadow. See also “To Join a Shadow Volume” on page 28.

1. **On Host B, suspend the volume set that includes the imported shadow volume.**
2. **Copy to Host A the bitmap that was in use on Host B.**
3. **On Host A, issue the join command.**

```
# iiadm -J /dev/rdisk/c1t2d0s5 /dev/rdisk/c1t3d0s4
```

4. **On Host B, disable the volume set that was using the imported shadow volume.**

Note – You may not need to copy the bitmap to the original host if the bitmap is on a dual-ported drive.

Note – The bit map from Host B (which can be a file) that was copied across to be joined can be removed from Host A once the join command is complete.



Caution – Once a shadow is rejoined to its original master on Host A, Host B should not use the shadow volume even if it is still accessible.

Displaying Help and Software Versions

The Instant Image software can be made to display help information as well as software version numbers of installed modules.

If you enter `iiadm` with no arguments or options, the full help text is sent to `stderr` just as though you typed `iiadm -h`.

▼ To Display Help Information

Help information is displayed in two ways: in context with an incorrectly entered command line, and in response to the `-h` option. Bad command lines get specific help for the command in question. The `-h` option causes the entire help content to be sent to `stderr`.

- **Display the entire help text by typing:**

```
# iiadm -h
```

- **Or by typing:**

```
# iiadm
```

▼ To Display Software Version Numbers

The version numbers of installed Instant Image modules is accessible through the `-v` option. See also “To Print Software Versions” on page 42.

- **Display the software version numbers by typing:**

```
# iiadm -v
```


Glossary

bitmap volume	The file used to track the location of data changes on the shadow and master volumes for use in later resynchronization.
compact dependent shadow volume	As form of shadow volume that is smaller than its associated master volume, enabling efficient use of available storage capacity where the data writes to the master are limited and quantifiable.
dependent shadow volume	A volume-dependent, point-in-time snapshot. When you enable an Instant Image volume pair, you must specify the shadow volume as dependent or as independent. For a dependent shadow, Instant Image does not perform a full volume copy. The dependent shadow volume relies on the master for all unmodified data blocks. Disabling a dependent shadow volume causes it to be invalidated.
dual-ported device	A dual-ported disk has two ports, making it possible to connect the disk through two cables to two different controllers. Either controller, at any one time, can transmit data to and receive data from that one disk.
fast resynchronization	Occurs when Instant Image updates volumes by copying all 32Kbyte segments flagged as different between the master and shadow volumes. The master can be used to update the master, and the master can be used to update the shadow, depending on which volume is being updated. Updating does not copy all volume data, only changed data, and is quicker than a full volume copy.
independent shadow volume	A volume-independent, physically-separate full volume copy. When you enable an Instant Image volume pair, you must specify the shadow volume as dependent or as independent. For an independent shadow, Instant Image performs a full volume copy to the shadow, which remains a valid copy after Instant Image is disabled.

invalidate	To make invalid. After disabling a dependent volume, Instant Image clears the first 64Kbytes of data in the volume to prevent users from accessing invalid or inconsistent data.
I/O group	A group to which Instant Image volume sets are assigned for ease of management. When a command is executed against an I/O group, it is executed against all included volume sets.
master volume	The volume that contains the original data that is copied to the shadow volume.
multiple shadow volumes	The result when more than one shadow volume is attached to a single master volume so that more than one application can use the master volume in a volume set.
overflow volume	A volume that is attached to a compact dependent shadow volume to accomodate excess data and prevent a failure. One overflow volume can be attached to more than one compact dependent shadow volume.
point-in-time snapshot	A copy or image of volume data captured or copied at a particular moment.
quiesce	To stop operations of a database application momentarily so that Instant Image update and copy operations will not encounter data errors. After the update or copy command is issued, the database application can be restarted.
resynchronization	See <i>fast resynchronization</i> .
segment	A 32Kbyte track of data.
shadow volume	The volume containing a point-in-time snapshot of data from the master volume.
Sun Cluster tag	A specific Sun Cluster name that is used to reference that cluster for action by an Instant Image command.
throttling a copy	To program the maximum number of chunks to be copied before executing a programmed delay to prevent an Instant Image copy from monopolizing system resources.
volume set	A group of three volumes: the volume pair, which comprises the master volume and the shadow volume, and a bitmap volume. A volume set that includes a compact dependent shadow volume can also include an optional overflow volume to receive data when the dependent short-shadow volume is full.
volume pair	A volume pair includes two volumes: the master volume and its associated shadow volume. Volume pairs always have bitmaps associated with them. The combination of all three volumes is called a volume set.

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