

Sun Enterprise 10000 Dynamic Reconfiguration User's Guide



THE NETWORK IS THE COMPUTER™

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This book describes the Dynamic Reconfiguration (DR) feature, which enables the Sun Enterprise 10000 server administrator to logically attach and detach system boards while the server is running. The system administrator should have a working knowledge of UNIX systems, particularly those based on the Solaris operating environment. The book introduces the reader to the concepts of DR, describes how to configure the system to use DR, and explains how to use DR.

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Preface

This book describes the Dynamic Reconfiguration (DR) feature, which enables you to logically attach and detach system boards from the Sun™ Enterprise™ 10000 server while other domains continue running.

Before You Read This Book

This book is intended for the Sun Enterprise 10000 system administrator who has a working knowledge of UNIX® systems, particularly those based on the Solaris™ operating environment. If you do not have such knowledge, first read the *Solaris User and System Administrator* in AnswerBook2™ format provided with this system and consider UNIX system administration training.

How This Book Is Organized

This document contains the following chapters:

Chapter 1 introduces basic concepts related to the Dynamic Reconfiguration feature.

Chapter 2 describes how to configure the Dynamic Reconfiguration system before you begin using it.

Chapter 3 describes how to use DR to attach and detach system boards.

Using UNIX Commands

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

See one or more of the following sources for this information:

- AnswerBook2 online documentation for the Solaris operating environment, particularly those dealing with Solaris system administration
- Other software documentation that you received with your system

Typographic Conventions

TABLE P-1 Typographic 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 <code>root</code> to do this. To delete a file, type <code>rm filename</code> .

Shell Prompts

TABLE P-2 Shell Prompts

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

Related Documentation

TABLE P-3 Related Documentation

Application	Title	Part Number
User	<i>Sun Enterprise 10000 SSP User's Guide</i>	805-2955-10
Reference	<i>Sun Enterprise 10000 SSP Reference Manual</i>	805-3362-10
	<i>Sun Enterprise 10000 Dynamic Reconfiguration Reference Manual</i>	805-7986-10
Release Notes	<i>Release Notes Supplement Solaris 7 5/99</i>	Printed in Media Kit.

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Introduction to DR

Dynamic Reconfiguration (DR) enables you to logically attach and detach system boards to and from the operating system without causing machine downtime. DR is used in conjunction with hot swap, which is the process of physically removing or inserting a system board. You can use DR to add a new system board, reinstall a repaired system board, or modify the domain configuration on the Sun Enterprise 10000 system.

If a system board is being used by a domain, you must detach it before you can power it off and remove it. After a new or upgraded system board is inserted and powered on, you may attach it to the domain.

You can execute DR operations from the SSP through the Hostview GUI (see `hostview(1M)`) or through the `dr(1M)` shell application. DR supports the following operations:

- **DR Attach** – Logically attaches a system board to the operating system running in a domain. A system board is logically attached when its resources—processors, memory, and I/O adapters—are configured into a domain and are available to the Solaris operating environment. The system board must already be present in the system, powered on, and not be a member of a domain. Normally, you attach a system board after it is inserted and powered on by your service provider or after it is detached from another domain.
- **DR Detach** – Logically detaches a system board from a domain. A system board is logically detached when its resources—processors, memory, and I/O adapters—are removed from the domain configuration and are no longer available to the domain. Normally, you detach a system board to either move it to another domain or prepare it for removal.

While DR operations are being performed within a domain, the `dr_daemon(1M)` (see the *Sun Enterprise 10000 Dynamic Reconfiguration Reference Manual*) and the operating environment write messages regarding the status or exceptions of DR requests to the domain syslog message buffer (`/var/adm/messages`) and the SSP message files (`$(SSPOPT)/adm/host/messages` and `$(SSPOPT)/adm/messages`). In

addition to the status and exception information displayed by Hostview and the `dr(1M)` shell application, the `dr_daemon(1M)` and operating environment messages are useful for determining the status of DR requests.

Note – Only one DR operation per platform can be active at any time. A DR operation that is partially completed and then dismissed within one domain does not prevent a subsequent DR operation from being started in a different domain. A partially completed DR operation must be finished before a subsequent DR operation is permitted in the same domain.

DR Configuration Issues

This chapter describes how to configure a domain for all DR operations and capabilities. For the Solaris 2.5.1 and Solaris 2.6 5/98 operating environment, the DR features are enabled only when the OpenBoot™ PROM (OBP) environment variable `dr-max-mem` is set to a non-zero value. For the Solaris 7 5/99 version, the `dr-max-mem` is no longer used.



Caution – Be careful when choosing the slot into which a board is inserted to prevent disk controller renumbering. For more information, see “Reconfiguration After a DR Operation” on page 20.

Memory: `dr-max-mem`

The value for `dr-max-mem` depends on the version of the Solaris operating environment (2.5.1, 2.6, or 2.7) that is running in the domain.

Note – For the Solaris 2.5.1 and Solaris 2.6 5/98 versions, DR features are disabled on domains that have less than 512 Mbytes of memory. This memory limit does not exist for the Solaris 7 5/99 version.

dr-max-mem With the Solaris 7 5/99 Version

With the Solaris 7 5/99 version, `dr-max-mem` is no longer used. Instead, the DR feature, specifically DR Detach, must be enabled by using the `system(4)` variable `kernel_cage_enable`. A caged kernel confines the nonpageable memory to a minimal (most often one) number of systems boards. By default, the kernel cage is disabled, preventing DR Detach operations.

Note – DR Attach is enabled regardless of the setting of `kernel_cage_enable`.

▼ To Enable the Kernel Cage

1. Edit the `/etc/system` file so that `kernel_cage_enable` equals 1.

```
set kernel_cage_enable=1
```

2. Reboot the domain.

After the reboot completes successfully, you can verify that the kernel cage is enabled by reviewing the `/var/adm/messages` file for the following message.

```
NOTICE: DR Kernel Cage is ENABLED
```

Configuration for DR Detach

This section describes how to configure DR before you perform a detach operation.

I/O Devices

The DR Detach feature works with Alternate Pathing (AP) or Solstice™ DiskSuite™ mirroring when you detach a board that hosts I/O controllers that are attached to vital system resources. If, for example, the root (`/`) or `/usr` partition is on a disk attached to a controller on the board, the board cannot be detached unless there is a hardware alternate path to the disk, and AP has been configured to take advantage of it, or the disk is mirrored. The alternate path or the mirrors must be hosted by

other boards in the domain. The same applies to network controllers. The board that hosts the Ethernet controller that connects the SSP to the Sun Enterprise 10000 platform cannot be detached unless an alternate path exists to an Ethernet controller on another board for this network connection.

Note – To enable device suspension for the `soc` and `pln` drivers, you must edit the `/etc/system` file so that the `pln_enable_detach_suspend` and `soc_enable_detach_suspend` variables are set to 1.

The domain swap space should be configured as multiple partitions on disks attached to controllers hosted by different boards. With this kind of configuration, a particular swap partition is not a vital resource because swap partitions can be added and deleted dynamically (see `swap(1M)` for more information).

Note – When memory (`swapfs`) or swap space on a disk is detached, there must be enough memory or swap space remaining in the domain to accommodate currently running programs.

A board that hosts non-vital system resources can be detached whether or not there are alternate paths to the resources. All of the devices on the board must be closed before the board can be detached; all of its file systems must be unmounted; and, its swap partitions must be deleted. You may have to kill processes that have open files or devices, or place a hard lock on the file systems (using `lockfs(1M)`) before you unmount the boards.

All I/O device drivers involved with I/O devices on the board(s) must support the `DDI_DETACH` option in the detach entry-point of the driver. This option releases all system resources associated with that device or adapter.

Memory

If you use memory interleaving between system boards, those system boards cannot be detached because DR does not yet support interboard interleaving. By default, `hpost(1M)` does not set up boards with interleaved memory. Look for the following line in the `hpost(1M)` file `.postrc` (see `postrc(4)`):

```
mem_board_interleave_ok
```

If `mem_board_interleave_ok` is present, you may not be able to detach a board that uses memory interleaving.

Note – If you use the `ndd(1m)` command to set the configuration parameters for network drivers, the parameters may not persist after a DR Detach or DR Attach operation. Use the `/etc/system` file or the `driver.conf` file for a specific driver to set the parameters permanently.

Pageable and Nonpageable Memory

Before you can detach a board, the operating system must vacate the memory on that board. Vacating a board means flushing its pageable memory to swap space and copying its nonpageable (that is, kernel and OBP memory) to another memory board. To relocate nonpageable memory, the operating environment on a domain must be temporarily suspended, or quiesced. The length of the suspension depends on the domain I/O configuration and the running workloads. Detaching a board with nonpageable memory is the only time when the operating environment is suspended; therefore, you should know where nonpageable memory resides, so you can avoid significantly impacting the operation of the domain. When permanent memory is on the board, the operating environment must find other memory to receive the copy.

You can use the `dr(1M)` command `drshow(1M)` to determine if the memory on a board is pageable or nonpageable:

```
% dr
dr> drshow board_number mem
```

Similarly, you can determine if the memory on a board is pageable by looking at the DR Memory Configuration window, which is available when you perform a detach operation within Hostview. The DR Memory Configuration window is described in “Viewing Domain Information” on page 49.

For the Solaris 7 5/99 version, the kernel and OBP load into the highest physical address space, which generally is on the highest numbered system board in the domain. Exceptions to this rule do exist, so you should always use the `drshow(1M)` command to check the memory on the board.

Target Memory Constraints

When permanent memory is detached, DR chooses a target memory area to receive a copy of the memory. The DR software automatically checks for total adherence. It does not allow the DR memory operation to continue if it cannot verify total adherence. A DR memory operation might be disallowed because of the following reasons:

- The domain is not large enough to hold a copy of the nonpageable memory.
- The domain is interleaved with memory on other boards.

In the Solaris 7 5/99 version, if no target board is found, the detach operation is refused, and DR displays the following warning message on the system console:

```
WARNING: sfdr: sfdr_pre_release_mem: no available target for mem-  
unit (board.0)
```

Correctable Memory Errors

Correctable memory errors indicate that the memory on a system board (that is, one or more of its Dual Inline Memory Modules (DIMMs), or portions of the hardware interconnect) may be faulty and need replacement. When the SSP detects correctable memory errors, it initiates a record-stop dump to save the diagnostic data, which can interfere with a DR detach operation. Therefore, Sun Microsystems suggests that when a record-stop occurs from a correctable memory error, you allow the record-stop dump to complete its process before you initiate a DR Detach operation.

If the faulty component causes repeated reporting of correctable memory errors, the SSP performs multiple record-stop dumps. If this happens, you should temporarily disable the dump-detection mechanism on the SSP, allow the current dump to finish, then initiate the DR Detach operation. After the detach operation finishes, you should re-enable the dump detection.

▼ To Re-Enable Dump Detection

1. **Log in to the SSP as the ssp user.**
2. **Disable record-stop dump detection:**

```
SSP% edd_cmd -x stop
```

This command suspends all event detection on all of the domains.

3. **Monitor the in-progress record-stop dump:**

```
SSP% ps -ef | grep hpost
```

In the `grep(1)` output, the `-D` option of `hpost` indicates that a record-stop dump is in progress.

4. Perform the DR Detach operation.

5. Enable event detection:

```
SSP% edd_cmd -x start
```

Swap Space

The domain swap configuration consists of the swap devices and `swapfs` (memory). The domain must contain enough swap space so that it can flush pageable memory. For example, if you want to remove 1 Gbyte of memory from a 2-Gbyte domain, you will need 1 Gbyte of swap space, depending on the load. Insufficient swap space prevents DR from completing the detach of a board that contains memory. If this happens, the memory drain phase does not complete, so you must abort the detach operation.

Reconfiguration After a DR Operation

This section describes how to reconfigure your domain after you have attached or detached a system board.

The DR user interface enables you reconfigure the domain after a DR Attach or DR Detach operation. The reconfiguration sequence is the same as the reconfiguration boot sequence (`boot -r`):

```
drvconfig; devlinks; disks; ports; tapes;
```

When you execute the reconfiguration sequence after you attach a board, device path names not previously seen by the domain are written to the `/etc/path_to_inst` file. The same path names are also added to the `/devices` hierarchy, and links to them are created in the `/dev` directory.

When to Reconfigure

You should reconfigure the domain if any of the following conditions occur:

- Board Addition – When you add a board to a domain, you must execute the reconfiguration sequence to configure the I/O devices that are associated with the board.

- Board Deletion – If you remove a board that is not to be replaced, you may, but do not have to, execute the reconfiguration sequence to clean up the `/dev` links.
- Board Replacement – If you remove a board then reinsert it in a different slot or if you replace a board with another board that has different I/O devices, you must execute the reconfiguration sequence to configure the I/O devices that are associated with the board. However, if you replace a board with another board that hosts the *same* set of I/O devices, inserting the replacement into the *same* slot, you do not need to execute the reconfiguration sequence. But, be sure to insert a replacement board into the same slot that was vacated to retain the original mapping of `/dev` links to physical names.

Disk Devices

Disk controllers are numbered consecutively as the `disks(1M)` program encounters them. All disk partitions are assigned `/dev` names according to the disk controller number that `disks(1M)` assigns. For example, all disk partitions that are accessible using disk controller 1 are named `/dev/dsk/cXtYdZsW`

where:

`X` is the disk controller number

`Y`, in most cases, corresponds to the disk target number

`Z` corresponds to the logical unit number, and

`W` corresponds to the partition number.

When the reconfiguration sequence is executed after a board is detached, the `/dev` links for all of the disk partitions on that board are deleted. The remaining boards retain their current numbering. Disk controllers on a newly inserted board are assigned the next available lowest number by `disks(1M)`.

Note – The disk controller number is part of the `/dev` link name used to access the disk. If that number changes during the reconfiguration sequence, the `/dev` link name also changes. This change may affect file system tables and software, such as Solstice DiskSuite, which use the `/dev` link names. Update `/etc/vfstab` files and execute other administrative actions to change the `/dev` link names.

DR and AP Interaction

DR notifies the AP subsystem when system boards are attached, detached, or placed in the drain state. In addition, DR queries AP about which controllers are in the AP database and their status (active or inactive). This communication occurs between the `dr_daemon(1M)` and `ap_daemon(1M)`. If the `ap_daemon(1M)` is not present, an error message is placed in the syslog messages buffer of the domain and DR operations continue without error. To disable this interaction, use the `-a` option when you invoke `dr_daemon(1M)`. See the `dr_daemon(1M)` man page in the *Sun Enterprise 10000 Dynamic Reconfiguration Reference Manual*.

If you are using AP version 2.1, the operating environment automatically switches off the active disk controllers on outgoing boards during the complete-detach phase of DR. If you are using AP version 2.0, you need to manually switch off the active disk controllers before you start the complete-detach phase. For the Solaris 7 5/99 version, you must upgrade to AP version 2.2. For more information about DR and AP interaction, see the *Sun Enterprise Servers Alternate Pathing 2.2 User's Guide*. For more information about AP and SDS, refer to the *RAS Companion*.

RPC Time-Out or Loss of Connection

The `dr_daemon(1M)`, which runs in each domain, communicates with Hostview and the `dr(1M)` shell application (both of which run on the SSP) by way of Remote Procedure Calls (RPCs). If an RPC time-out or connection failure is reported during a DR operation, check the domain. The daemon must be configured in the `/etc/inetd.conf` file of the domain. The following line (which appears on a single line) must be present in the file:

```
300326/4 tli rpc/tcp wait root \  
/platform/SUNW,Ultra-Enterprise-10000/lib/dr_daemon
```

If the DR daemon is configured in `/etc/inetd.conf`, kill the `dr_daemon(1M)` if it is currently running. In addition, send a HUP signal to the `inetd(1M)` daemon to cause it to re-read the `inetd.conf(4)` configuration file:

```
# kill dr_daemon_pid  
# kill -HUP inetd_pid
```

In the first command, *dr_daemon_pid* is the process ID of the DR daemon. In the second command, *inetd_pid* is the process ID of the *inetd(1M)* daemon. You can check */var/adm/messages* for possible error messages from *inetd(1M)* if it is having trouble starting the *dr_daemon(1M)*. The DR daemon executable file should exist in the */platform/SUNW,Ultra-Enterprise-10000/lib* directory.

At this point, try the DR operation again, starting from the beginning.

System Quiescence Operation

During a DR Detach operation on a system board with nonpageable OBP or kernel memory, the operating environment is briefly quiesced; that is, all operating environment and device activity on the domain centerplane must cease during the critical phase of the operation. The quiescence only affects the target domain; other domains in the system are not affected.

Before it can quiesce, the operating environment must temporarily suspend all processes, processors, and device activities. If the operating environment cannot quiesce, it displays its reasons, which may include the following:

- Real-time processes are running in the domain.
- A device that cannot be quiesced by the operating environment (that is, a suspend-unsafe device) is open.

The conditions that cause processes not to suspend are generally temporary in nature. You can retry the operation until the quiescence succeeds.

A quiescent failure due to real-time processes or open suspend-unsafe devices is known as a forcible condition. You have the option of performing either a retry or forced retry. When you force the quiescence, you give the operating environment permission to continue with the quiescence even if forcible conditions are still present.



Caution – Exercise care when using the *force* option.

If a real-time process is running, determine if suspending the process would produce an adverse effect on the functions performed by the process. If not, you can force the operating environment to quiesce. (To force a quiescence, you can either click the **Force** button within Hostview as described in “To Detach a Board With Hostview” on page 43, or enter the *complete_detach* command with the *force* option within the *dr(1M)* shell application. Otherwise, you can abort the operation and try again later.

If any suspend-unsafe device is open and cannot be closed, you can manually suspend the device, and then force the operating environment to quiesce. After the operating environment resumes, you can manually resume the device (see “Suspend-Safe/Suspend-Unsafe Devices” on page 24).

If the operating environment fails to quiesce, pay close attention to the reasons for the failure. If the operating environment encountered a transient condition—a failure to suspend a process—you can try the operation again. If, however, the condition(s) requires your approval (for example, a real-time process is running) or intervention (for example, a suspend-unsafe device is open), you can force the operating environment to quiesce.

Suspend-Safe/Suspend-Unsafe Devices

A suspend-safe device is one that does not access the domain centerplane (for example, it does not access memory or interrupt the system) while the operating environment is quiesced. A driver is considered suspend-safe if it supports operating environment quiescence (suspend/resume) and guarantees that when a suspend request is successfully completed, the device that the driver manages will not attempt to access the domain centerplane, even if the device is open when the suspend request is made. All other I/O devices are suspend-unsafe when open.

Note – At the time of this printing, the drivers released by Sun Microsystems that are known to be suspend-safe are `st`, `sd`, `isp`, `esp`, `fas`, `sbus`, `pci`, `pei-pci`, `qfe`, `hme` (SunFastEthernet), `nf` (NPI-FDDI), `qe` (Quad Ethernet), `le` (Lance Ethernet), the SSA drivers (`soc`, `pln`, and `ssd`), and the Sun StorEdge A5000 drivers (`sf`, `socal`, `ses`).

Note – To enable device suspension for the `soc` and `pln` drivers, you must edit the `/etc/system` file so that the `pln_enable_detach_suspend` and `soc_enable_detach_suspend` variables are set to 1.

The operating environment refuses a quiesce request if a suspend-unsafe device is open. If you can manually suspend the device, you can force the operating environment to quiesce. To manually suspend the device, you may have to close the device by killing the processes that have it open, ask users not to use the device, or disconnect the cables. For example, if a device that allows asynchronous unsolicited input is open, you can disconnect its cables prior to quiescing the operating environment, preventing traffic from arriving at the device and the device from accessing the domain centerplane. You can reconnect the cables after the operating environment resumes. If you cannot make a device suspend its access to the domain

centerplane, you should not force the operating environment to quiesce. Doing so could cause a domain to crash or hang. Instead, postpone the DR operation until the suspend-unsafe device is no longer open.



Caution – If you attempt a forced quiesce operation while activity is occurring on a suspend-unsafe device, the domain may hang. However, if the domain hangs, it will not affect other domains that are running on the Sun Enterprise 10000 system.

Special Handling for Tape Devices

For the Solaris 7 5/99 operating environment, tape devices that are natively supported by Sun Microsystems are suspend-safe and detach-safe (see `st(7D)` for a list of natively-supported drives). If a system board that you are detaching contains a natively-supported tape device, you can safely detach the board without suspending the device. If you want to use a tape device that is not natively supported by Sun Microsystems, you can use it, but you should make it detach-safe. To ensure correct input/output and DR operations, you need to make a suitable entry in `/kernel/drv/st.conf` with the `ST_UNLOADABLE (0x0400)` flag set in the entry (see `st(7D)` for more information). After you update `st.conf`, you must reboot the domain to process the new entry.

Special Handling of Sun StorEdge A3000

The Sun StorEdge A3000 (formerly known as the RSM Array 2000) has dual controller paths with automatic load balancing and automatic failover. To detach a system board that has one or both of the StorEdge A3000 controllers, the controllers on the board that is being detached must be idle or offline. You can take these controllers offline manually by using the `rm6` or `rdacutil` programs before you attempt to detach the system board.

DR and DDI

Not all drivers support the Sun Enterprise 10000 system Dynamic Reconfiguration (DR) features. To support DR, a driver must be able to perform two basic DDI/DKI (Device Driver Interface/Device Kernel Interface) functions, `DDI_DETACH` and `DDI_SUSPEND/DDI_RESUME`. These two functions impact DR in different ways. The

DR driver verifies the support of these entry points within the I/O drivers by verifying the existence of the `D_HOTPLUG` bit in the `flags` field of the `cb_ops` of the I/O drivers.

DR and `DDI_DETACH`

You can detach a system board that hosts a device only if the driver for that device supports the `DDI_DETACH` interface, or is not currently loaded. `DDI_DETACH` provides the ability to detach a particular instance of a driver without impacting other instances that are servicing other devices. A driver that supports `DDI_DETACH` is called *detach-safe*; a driver that does not support `DDI_DETACH` is called *detach-unsafe*.

Detaching a detach-unsafe driver that is loaded involves the following process.

- Stopping all usage of the controller for the detach-unsafe device and all other controllers of the same type on all of the boards in the domain.

Because the detach-unsafe driver must be unloaded, you must stop usage of that controller type on *all* of the system boards in the domain. The remaining controllers can be used again after the DR Detach is complete.

- Using standard Solaris interfaces to manually close and to unload all such drivers on the board.

See `modload(1M)` in the *SunOS Reference Manual*.

- Detaching the system board in the normal fashion.

If you cannot accomplish the above process, you can reboot the domain with the board blacklisted (see `blacklist(4)`), so the board can be removed later.

Note – Many third-party drivers (those purchased from vendors other than Sun Microsystems) do not support the standard Solaris `modunload(1M)` interface. Conditions that invoke the functions occur infrequently during normal operation and the functions are sometimes missing or work improperly. Sun Microsystems suggests that you test these driver functions during the qualification and installation phases of any third-party device.

DR and `DDI_SUSPEND/DDI_RESUME`

To perform a DR Detach of a board that contains nonpageable memory, the domain must be quiesced. Memory can be detached only when all of the drivers throughout the entire domain (not just on the board being detached) either support the

DDI_SUSPEND/DDI_RESUME driver interface, or are closed. Drivers that support these DDI functions are called *suspend-safe*; drivers that do not are called *suspend-unsafe*.

The most straightforward way to quiesce a domain is to close any suspend-unsafe devices. For each network driver you must execute the `ifconfig(1M)` command with its `down` parameter, then again with its `unplumb` parameter (see `ifconfig(1M)` for more information).

Note – It should be possible to unplumb all network drivers. However, this action is rarely tested in normal environments and may result in driver error conditions. If you use DR, Sun Microsystems suggests that you test these driver functions during the qualification and installation phases of any *suspend-unsafe* device.

If the system refuses to quiesce because a *suspend-unsafe* driver is open, you can force the operating domain to quiesce. Doing so forces the operating environment to permit the detach. Note that, although a detach can be forced to proceed when there are open *suspend-unsafe* devices in the system, it is not possible to force a detach when a *detach-unsafe* device resides on the board and its driver is loaded.

To successfully force the operating environment to quiesce, you must manually quiesce the controller. Procedures to do that, if any, are device-specific. The device must not transfer any data, reference memory, or generate interrupts during the operation. Be sure to test any procedures used to quiesce the controller while it is open prior to executing them on a production system.



Caution – Using the `force` option to quiesce the operating environment, without first successfully quiescing the controller, can result in a domain failure and subsequent reboot.

Using Dynamic Reconfiguration

Attaching a System Board

This section gives a broad overview of the actions that occur when you execute DR Attach. For step-by-step instructions, see “To Attach a Board With Hostview” on page 31.

You can attach system boards that are present in the machine, powered on, and not part of an active domain (that is, not being used by an operating environment). These unattached boards may have been hot-swapped into the domain after the domain was booted, blacklisted when the domain was booted, or detached from another domain.

Note – If the system board has been hot-swapped into the domain, you should use the `thermal_config(1M)` command immediately after the board has been powered on.

Prior to attaching a board, diagnostics are run on the board, requiring that at least one processor be present on the board and not be blacklisted. After you have selected an eligible board and a target domain, the DR Attach operation proceeds through two operations: Init Attach and Complete Attach.

Init Attach

During the Init Attach phase, DR diagnoses and configures the selected board, preparing it and its devices for attachment to the operating environment. During this phase, DR performs the following tasks:

- Adds the board to the board list of the target domain in the `domain_config(4)` file on the SSP.
- Runs `hpost -H` on the board to configure it. `hpost(1M)` isolates the board on the Sun Enterprise 10000 system centerplane by placing it into a single-board hardware domain (see `hpost(1M)`).
- Runs `obp_helper -H` which loads `download_helper` to the board, and takes the processors on the board out of reset mode, allowing them to spin in `download_helper`.
- Reconfigures the centerplane and board domain mask registers, placing the board in the target hardware domain.

DR displays the output of these `hpost(1M)` and `obp_helper(1M)` operations, including the steps that succeeded and those that caused exceptions.

If `hpost(1M)` and `obp_helper(1M)` succeed, the operating system is notified and requests OBP to probe the board. The operating environment then scans the OBP device tree and adds the devices to its configuration, but the drivers are not loaded.

After the Init Attach phase is completed, the OBP board configuration can be displayed to confirm which devices are present on the board. You can then enter the Complete Attach phase, or you can abort the operation.

If you abort the operation, DR removes the board configuration from the operating environment data structures and removes the board from the `domain_config(4)` file, leaving the board in a state where it is not assigned to any domain. The board can then be removed from the system by using hot swap, left in the system unattached, or attached at a later time.

Complete Attach

During the Complete Attach phase, DR attempts to complete the attach operation by making the resources that are hosted by the new system board available to the operating environment. If a problem occurs that prevents the attachment of any device on the board, the `dr_daemon(1M)` (described in the *Sun Enterprise 10000 Dynamic Reconfiguration Reference Manual*) logs that problem in the system message buffer. To determine which devices were successfully attached, display and check the domain configuration for the board.

After a board is successfully attached, you have the option of reconfiguring the I/O devices. See “Reconfiguration After a DR Operation” on page 20 for more information. This operation can take several minutes to complete.

Attach Buttons

When you perform an attach operation using the Hostview GUI (which transparently calls a separate executable: `drview(1M)`), the following buttons appear at various times during the attach process:

- **init attach** – Begins the attach operation (see “Init Attach” on page 29). After the operation has completed successfully, the label on this button changes to `complete`.
- **complete** – Completes the attach operation (see “Complete Attach” on page 30).
- **reconfig** – Automatically reconfigures the device directories in the domain. You may want to run the reconfiguration operation after attaching a board (see “Reconfiguration After a DR Operation” on page 20).
- **abort** – Cancels the attach operation. This button is enabled after the Init Attach operation has been successfully completed (see “Init Attach” on page 29).
- **dismiss** – Terminates the step that is currently in progress, but leaves the board in its current state (Present, Init Attach, In Use). You can remove the DR Attach window by choosing dismiss at any point during the attach operation. The dismiss button terminates any work being done on the SSP for the attach operation. For example, if `hpost(1M)` is running when you click dismiss, that `hpost(1M)` process is terminated. Note that `dismiss` does not terminate work being done on the host by way of RPCs to the `dr_daemon(1M)`. After an RPC is initiated, the host completes the RPC regardless of whether or not the calling program is waiting for the RPC to finish. The host `dr_daemon(1M)` keeps track of the progress of the attach operation. After the Init Attach operation completes successfully, it remembers this state. Therefore, you can dismiss the window, then return to the DR operation later and complete or abort the attach.
- **help** – Accesses online information regarding DR Attach operations.

▼ To Attach a Board With Hostview

Note – Before you perform the following steps, you should read “Attaching a System Board” on page 29.

- 1. From Hostview, select the proper view of the system from the View menu.**
Choose the view that contains the board you want to attach.
- 2. From Hostview, select the board you want to attach.**
- 3. From Hostview, choose Configuration > Board > Attach.**
The Attach Board and Domain Selection window is displayed (FIGURE 3-1).

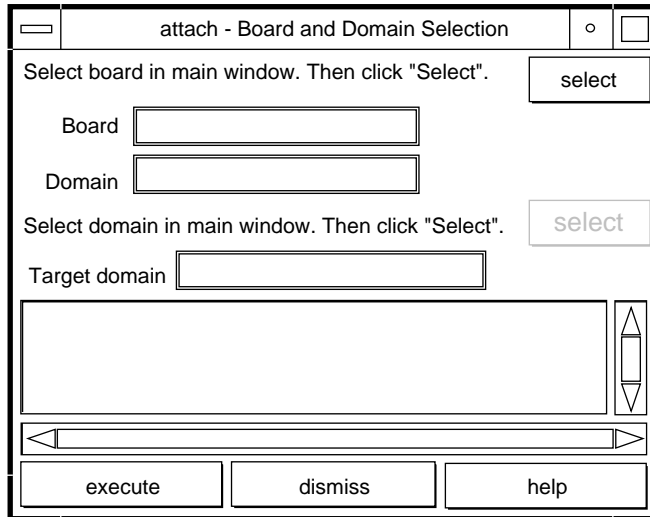


FIGURE 3-1 Attach Board and Domain Selection Window

4. Click the top select button.

The Board field is automatically filled in for you. If the board is part of a domain, the Domain field is also filled in for you. (You can also manually edit these fields.)

5. In the main Hostview window, use the View menu to select the domain to which you want to attach the board.

6. Click the bottom Select button.

The Target Domain field is automatically filled in for you. (You can also manually edit that field.)

7. Click the execute button.

If any errors occur, the error messages appear in the main Hostview window. Otherwise, the Dynamic Reconfiguration window is displayed with the init attach button visible (FIGURE 3-2).

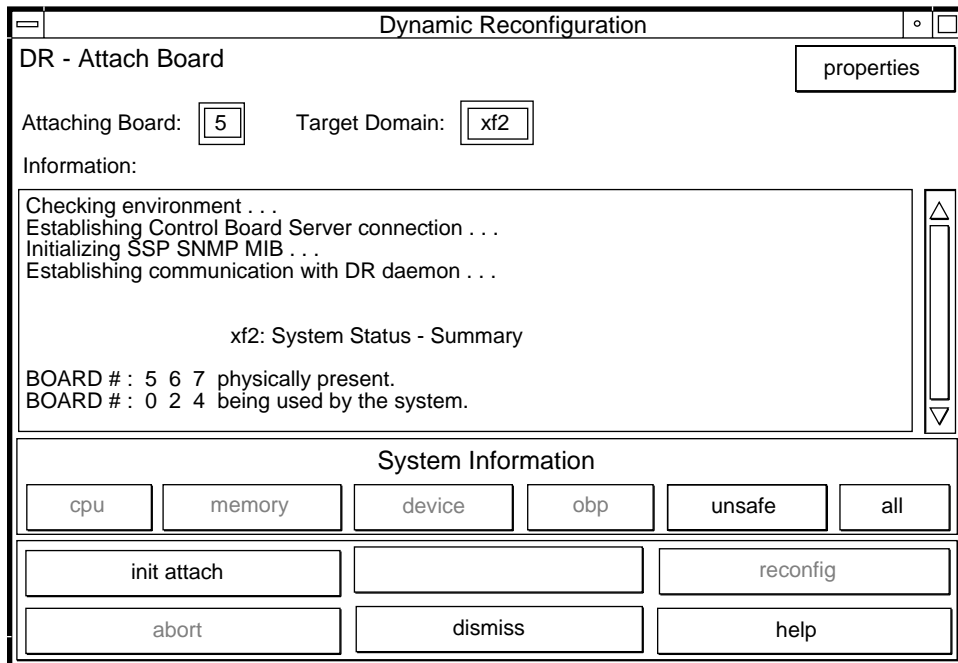


FIGURE 3-2 Dynamic Reconfiguration Window With `init attach` Button

8. Click the `init attach` button.

Clicking on the `init attach` button begins the first phase of the board attach process. First, the system updates the `SSP domain.config(4)` file by adding the system board to the board list of the target domain. Next, the system uses `hpost(1M)` to self-test the system board. After the self-test is complete, the board is made visible to the running target domain by merging it into the hardware domain by modifying the centerplane and the system board hardware registers. Finally, during the conclusion of the `init attach`, OBP probes the new board to discover what CPU, I/O, and memory resources are present on the board. When this phase is finished, the caption on the button changes to `complete`. Before you click the `complete` button, however, you may want to view the domain information to verify that you want to proceed, as described in “Viewing Domain Information” on page 49.

Typically, the `Init Attach` operation can take a few minutes to complete. Output from the `hpost(1M)` command is directed to the Information pane of the Dynamic Reconfiguration window.

If the `Init Attach` fails, look for the cause in the output in the Information pane. After you have determined the cause, you may want to choose `Init Attach` again.

If the `Init Attach` operation completes successfully, the window changes to that shown in FIGURE 3-3, with the `complete` button enabled.

9. Click the complete button.

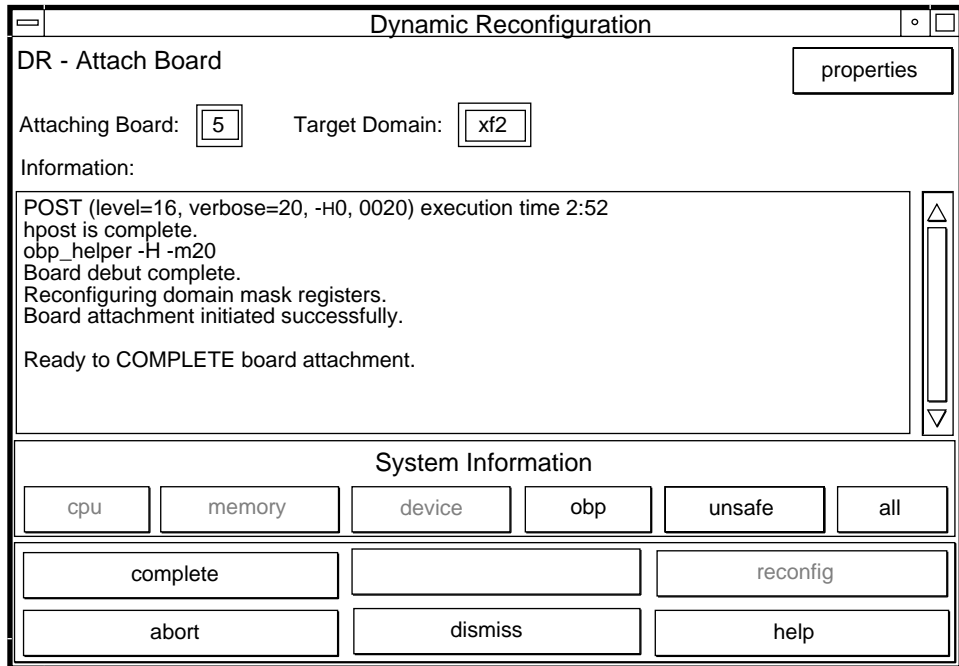


FIGURE 3-3 Dynamic Reconfiguration Window With the complete Button

The complete operation normally takes less than one minute to finish. When it has successfully completed, DR displays the following message:

```
Board attachment completed successfully
```

The system board resources—processors, memory, and I/O devices—are now available to the operating system.

You can view the domain information about the newly attached board by using the buttons (CPU, Memory, Device, and so forth), as described in “Viewing Domain Information” on page 49.



Caution – Before you choose the reconfig button, be sure to read “Reconfiguration After a DR Operation” on page 20.

10. Click the dismiss button.

The DR Attach operation is complete.

▼ To Attach a Board By Using `dr(1M)`

Note – The following procedure explains how to attach a board by using `dr(1M)` with SSP version 3.1, or higher. If you are using SSP version 3.0, refer to a previous version of the *Dynamic Reconfiguration User's Guide*.

Before you perform the following steps, read “Attaching a System Board” on page 29. The process of attaching a board is very similar whether you use Hostview or `dr(1M)`. The basic concepts are not repeated in this section.

The `dr(1M)` shell was introduced in Chapter 1. A quick reference guide is available in the `dr(1M)` application by using the `help` command.

1. **Set `SUNW_HOSTNAME` to the appropriate domain by using the `domain_switch(1M)` command.**

```
% domain_switch domain_name
```

2. **Use the `dr(1M)` command in an SSP Window to bring up the `dr(1M)` prompt.**
In the following example, the target domain is called `xf3`.

```
% dr
Checking environment...
Establishing Control Board Server connection...
Initializing SSP SNMP MIB...
Establishing communication with DR daemon...

      xf3: Domain Status - Summary

BOARD #: 0 1 2 5 6 8 9 10 11 13 physically present.
BOARD #: 4 7 being used by the domain.
dr>
```

3. Begin the `init_attach(1M)` operation for the designated board.

In this example, board 6 is being attached to `xf3` domain.

```
dr> init_attach 6
Initiate attaching board 6 to domain xf3.
Adding board 6 to domain_config file.
/opt/SUNWssp/bin/hpost -H40,28
Opening SNMP server library...

Significant contents of /export/home/ssp/.postrc:
blacklist_file ./bf
redlist_file ./rf
Reading centerplane asics to obtain bus configuration...
Bus configuration established as 3F.
phase cplane_isolate: CP domain cluster mask clear...
...
phase final_config: Final configuration...
Configuring in 3F, FOM = 2048.00: 4 procs, 4 SCards, 1024 MBytes.
Creating OBP handoff structures...
Configured in 3F with 4 processors, 4 SBus cards, 1024 MBytes
memory.
Interconnect frequency is 83.294 MHz, from SNMP MIB.
Processor frequency is 166.631 MHz, from SNMP MIB.
Boot processor is 6.0 = 24
POST (level=16, verbose=20, -H28,0040) execution time 3:07
hpost is complete.
obp_helper -H -m24
Board debut complete.
Reconfiguring domain mask registers.
Board attachment initiated successfully.

Ready to COMPLETE board attachment.
```

4. Abort or complete the attach operation.

- After the system successfully completes the `init_attach(1M)` operation, you can use the `drshow(1M)` OBP display to see an inventory of the board resources.

```
dr> drshow board_number OBP
```

- If you wish to abort the attach operation, use the `abort_attach(1M)` command.

```
dr> abort_attach board_number
```

- If you wish to complete the board attach operation, use the `complete_attach(1M)` command.

```
dr> complete_attach 6
Completing attach for board 6.
Board attachment completed successfully.
dr>
```

After you successfully attach the board, all of the `drshow(1M)` displays become available.

5. Use the `drshow(1M)` to display the I/O information for the newly attached board.

```
dr> drshow 6 IO

      SBus Controllers and Devices for Board 6

----- Sbus 0 : Slot 0 : SUNW,pln0 -----

device   opens   name                               usage
-----   -
ssd0      0       /dev/dsk/clt0d0s0
ssd16     0       /dev/dsk/clt1d0s0
ssd32     0       /dev/dsk/clt2d0s0
ssd48     0       /dev/dsk/clt3d0s0
ssd64     0       /dev/dsk/clt4d0s0
ssd80     0       /dev/dsk/clt5d0s0

----- Sbus 0 : Slot 1 : SUNW,pln2 -----

device   opens   name                               usage
-----   -
ssd96     0       /dev/dsk/c2t0d0s0
ssd97     0       /dev/dsk/c2t0d1s0
...

```

6. Type `exit` to terminate this `dr(1M)` session.

```
dr> exit
%
```

The SSP login shell prompt is again displayed.

Detaching a System Board

This section gives a broad overview of the actions that occur when you execute DR Detach. For step-by-step instructions, see “To Detach a Board With Hostview” on page 43.

System boards that are currently being used by the operating environment can be detached if they meet the requirements covered in “Configuration for DR Detach” on page 16. After you select an eligible board, you can detach that board by performing two operations: Drain and Complete Detach.

Drain

The primary function of the Drain operation is to determine how the board’s memory is to be vacated by the operating environment and, if required, to select a target memory area for copying the nonpageable memory on a board. If a suitable target memory area is not available when the drain operation is requested, the request is denied. If the drain is rejected for this reason, you can continue to retry until target memory is available. See “Configuration for DR Detach” on page 16.

After the Drain operation is started, the pageable memory on the board is flushed to a disk, which removes it from use by the domain. Whenever a page of memory becomes free, that page is locked from further use. The drain has no noticeable impact on the processes using the CPU and I/O resources on the board. However, less memory is available to the domain.

Note – After memory is drained, enough memory and swap space must remain in the domain to accommodate the current workloads.

During the drain period, Hostview and `dr(1M)` are available to monitor the detach progress. You can view the current status of the drain operation, including the number of memory pages remaining to be drained, and the usage of devices on the board. With this information, you can prepare the domain for detaching the remaining board devices.

If you decide not to proceed with the detach operation, you can abort the operation, and the memory on the board is returned to regular usage. You can also abort the operation during the drain process or after the drain has been completed. If extreme memory pressure exists during the drain, you will see little, or no, progression in the percentage of drained pages, and you may want to abort the drain and wait until the workload on the domain has decreased, enabling it to accommodate the reduction in memory.

The drain operation is complete when all of the memory pages are free from usage. You can then complete the detach operation.

Complete Detach

Before you can complete the detach operation, you must terminate all usage of board resources (processors, memory, and I/O devices). DR terminates the use of memory, processors, and network devices automatically, but you must terminate the use of all non-network I/O devices.

Note – To identify the components that are on the board to be detached, use `drshow(1M)`, which is an option of the `dr(1M)` command, or use the display windows in Hostview (select the `Configuration` menu and then choose the `Board` pull-down menu and the `Detach` menu item). Another somewhat less informative way to identify the components is to use the `prtdiag(1M)` command on the domain.

Network Devices

DR automatically terminates usage of all network interfaces on the board that is being detached. When you complete the detach operation, the `dr_daemon(1M)` identifies all configured interfaces on the board being detached and issues the following `ifconfig(1M)` commands on each such interface.

```
ifconfig interface down
ifconfig interface unplumb
```

Additionally, if FDDI interfaces are detached, DR kills the FDDI network monitoring daemon before you perform the detach operation. DR then restarts it after the detach is complete. Note that the `/usr/sbin/nf_snmd` daemon for `nf` devices is neither started nor stopped when a board that contains a FDDI interface is attached.

DR does not execute these commands on a board that contains a network interface that fits any of the following conditions. In these cases, the detach operation fails and DR displays an error message.

- The interface is the primary network interface for the domain; that is, the interface whose IP address corresponds to the network interface name contained in the file `/etc/nodename`. Note that bringing down the primary network interface for the domain prevents network information name services from

operating, which results in the inability to make network connections to remote hosts using applications such as `ftp(1)`, `rsh(1)`, `rcp(1)`, `rlogin(1)`. NFS client and server operations are also affected.

- The interface is on the same subnet as the SSP host for the system; that is, the subnet of the IP address that corresponds to the SSP host name found in `/etc/ssphostname`. Bringing down this interface interrupts communication between the host and SSP. Since DR operations are initiated on the SSP, control of the detach process would be lost. (Note that the `/etc/ssphostname` file contains the name of the SSP that controls the host; therefore, if you rename the SSP, the `/etc/ssphostname` must be manually updated.)
- The interface is the active alternate for an Alternate Pathing (AP) metadvice when the AP metadvice is plumbed. Interfaces used by AP should not be the active path when the board is being detached. AP 2.1 performs the switch automatically; however, you can manually switch the active path to an interface that is not on the board being detached. If no such path exists, manually execute the `ifconfig down` and `ifconfig unplumb` commands on the AP interface. (To manually switch an active path, use the `apconfig(1M)` command.)



Caution – Unmounting network interfaces may affect NFS client systems.

Non-Network Devices

All non-network devices must be closed before they are detached. In the Hostview device display and in the `drshow(1M)` I/O listing, there is an open count field that indicates how many processes have opened particular devices. To see which processes have these devices open, use the `fuser(1M)` command on the domain.

You must perform certain tasks for non-network devices. Although the following list of tasks implies a sequence of order, strict adherence to the order is not necessary.

1. If the redundancy features of Alternate Pathing or Solstice DiskSuite mirroring are used to access a device connected to the board, reconfigure these subsystems so that the device or network is accessible using controllers on other system boards. Note that for Alternate Pathing 2.1, the system automatically switches the disk devices to an alternate interface if one is available.
2. Unmount file systems, including Solstice DiskSuite metadvice partitions that have a board-resident partition (for example, `umount /partit`).
3. Remove Alternate Pathing or Solstice DiskSuite databases from board-resident partitions. The location of Alternate Pathing or Solstice DiskSuite databases is explicitly chosen by the user and can be changed.

4. Remove any private regions used by Sun Enterprise Volume Manager™ or Veritas Volume Manager. Volume manager by default uses a private region on each device that it controls, so such devices must be removed from volume manager control before they can be detached.
5. Remove disk partitions from the swap configuration by using `swap(1M)`.
6. Either kill any process that directly opens a device or raw partition, or direct it to close the open device on the board.
7. If a detach-unsafe device is present on the board, close all instances of the device and use `modunload(1M)` to unload the driver.
8. Kill all of the real-time processes that are open if the operating environment must be suspended.



Caution – Unmounting shared file systems by using the `share(1M)` utility may affect NFS client systems.

Processes

You must perform certain tasks for non-network devices. Although the following list of tasks implies a sequence of order, strict adherence to the order is not necessary.

1. If the operating environment must be suspended, kill all of the real-time processes that are open.
2. Kill any processes that are bound to on-board processors.

When a board is detached, all processes bound to its processors are automatically unbound. You can use `pbind(1M)` to rebind them to other processors.

Processors

The boot processor is responsible for servicing the tick-timer interrupts and for maintaining the netcon BBSRAM buffer. Before detaching a board on which the boot processor resides, the `dr_daemon(1M)` must assign the boot processor role to another active (online) processor.

Finishing the Complete Detach Operation

After all board usage is terminated, you can perform the Complete Detach operation. If a device is still in use at this time, the detach operation fails and the device in use is reported. After you resolve the problem, you can perform the Complete Detach operation again.

If the board that you want to detach contains nonpageable memory, the Complete Detach operation may also fail due to quiescence problems, which are described in “System Quiescence Operation” on page 23. After you resolve the quiescent problem, you can again execute the complete detach operation.

If you decide that you do not want to proceed with the detach operation at this time, you can abort the detach. The memory on a board is returned to normal usage and detached board devices are reattached. If the system configuration was modified to remove board usage (that is, file systems were unmounted and networks were unplumbed), you must undo these modifications and return the devices to normal operation.

After the board is successfully detached from the operating environment, it is isolated from the centerplane. In addition, the board list is automatically updated in the SSP `domain_config(4)` file.

You can now attach the board to another domain, power it off, and remove it by way of hot-swapping, leaving it in the system unattached, or reattaching it at a later time.

Hostview Detach Buttons

The Hostview detach window displays the following buttons at various times during a detach operation:

TABLE 3-1 Hostview Buttons

Button	Description
drain	Drains the memory (see “Drain” on page 38). After the drain operation is finished, the drain button becomes the complete button.
complete	Completes the detach operation after the board has been fully drained (see “Complete Detach” on page 39).
force	Permits you to complete the detach operation by forcibly quiescing the domain (see “System Quiescence Operation” on page 23). If the complete detach operation fails due to a forcible quiesce condition, the force button is enabled.

TABLE 3-1 Hostview Buttons (Continued)

Button	Description
reconfig	Reconfigures device directories in a domain automatically. You may want to run reconfig after permanently detaching a board. Use reconfig with extreme caution (see “Reconfiguration After a DR Operation” on page 20 for more information).
abort	Cancels the DR operation, and returns the board to normal operation. This button is enabled after the drain operation starts and remains enabled until the complete detach operation starts. To stop the draining of memory and cancel the detach, choose abort (see “Detaching a System Board” on page 38).
dismiss	Cancels any step that is in progress, and leaves the board in its current state (In Use, drain, Present). At any point during the DR Detach operation you can remove the DR Detach window by choosing dismiss which terminates any work being done on the SSP for the detach operation. Note that dismiss does not terminate work being done on the host through RPC calls to the <code>dr_daemon(1M)</code> . After an RPC call is initiated, the host completes the RPC call regardless of whether or not Hostview is waiting for the RPC call to finish. The host <code>dr_daemon(1M)</code> keeps track of the progress of the detach operation. After the drain is started, it remembers this state. Therefore, you can dismiss the window and then return later to either complete or abort the detach operation.
help	Accesses online information regarding DR detach operations.

▼ To Detach a Board With Hostview

Note – Before you execute the following steps, read “Detaching a System Board” on page 38.

1. **From the Hostview window, use the View menu to select the domain in which the board is attached.**
2. **Click the icon of the board you want to detach.**
3. **From the Hostview menu, choose Configuration > Board > Detach.**

The Detach Board and Domain Selection window is displayed (FIGURE 3-4).

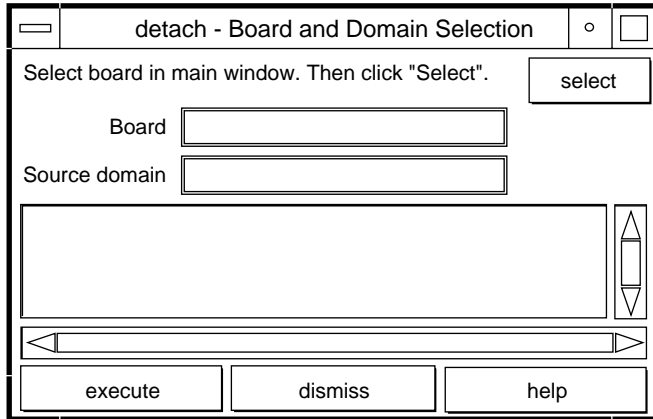


FIGURE 3-4 Detach—Board and Domain Selection Window

4. Click the select button.

The Board and Source domain fields are automatically filled in for you. (You can also manually edit these fields if you wish.)

5. Click the execute button.

If the target domain is not currently booted, the detach operation simply manipulates the domain configuration file on the SSP. However, if the domain is running, the following window is displayed (FIGURE 3-5).

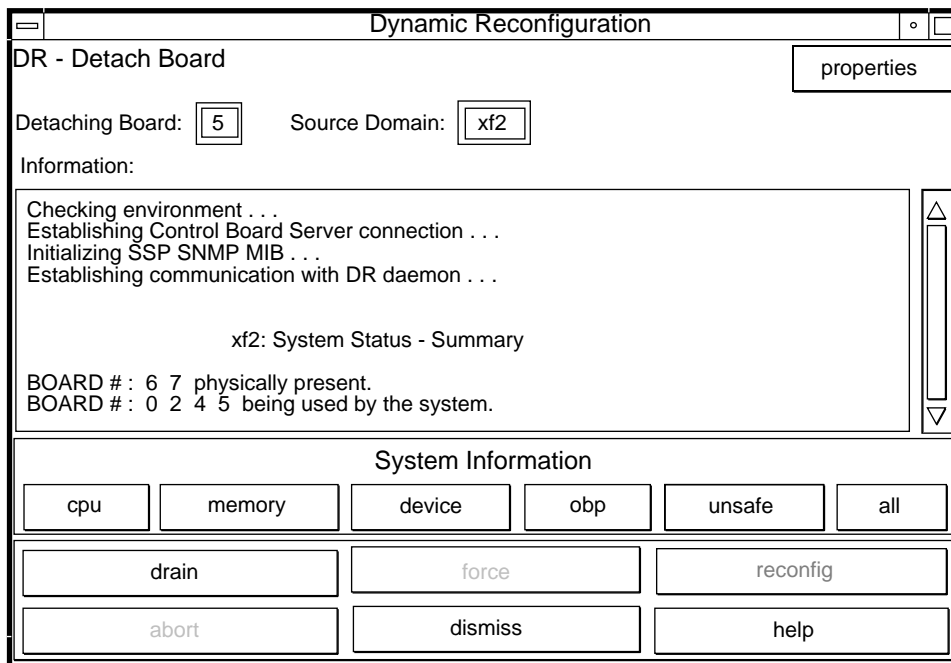


FIGURE 3-5 Dynamic Reconfiguration Window With the drain Button

6. Click the drain button.

Hostview begins draining memory. The memory information is displayed and enables you to monitor the progress of the drain operation.

The memory drain statistics are automatically updated at periodic intervals if you enable the Auto Update Domain Information Displays option in the DR Properties window, as described in “Viewing Domain Information” on page 49.

If the drain operation fails, an explanatory message appears in the Information pane. After you have determined the cause, and corrected it, you can choose drain again.

You may proceed to the next step without waiting; it does not depend on completion of the drain.

7. To determine which devices are active on the board, click the device button.

The DR Device Configuration window is displayed and is periodically updated, providing you with a current snapshot of device usage.

8. Terminate all usage of board-resident I/O devices.

For more information, see “Complete Detach” on page 39.

When the complete button is displayed, DR is finished draining the memory, and you can proceed to the next step.

9. Select the complete button.

This operation may take several minutes to complete, particularly if an operating environment quiescence is necessary. When it is finished, the board devices are detached from the operating system.

If your attempt to complete the detach fails, it may be due to any of the following reasons:

- All online processors in the domain are on the board being detached.
- The board you want to detach contains the last processor in the “default” processor set. You must add an additional processor from another system board before you retry the Detach operation.
- Primary network interfaces are on the board being detached. You must stop all usage of these networks manually (see “Complete Detach” on page 39).
- All usage of the I/O devices on the board you want to detach has not been stopped. The Information pane identifies the device on which the error was encountered (see “Complete Detach” on page 39).
- The operating environment quiescence failed. You must determine and resolve the cause of the error (see “System Quiescence Operation” on page 23).

After you have resolved the reason for the failure, you can select either complete or force to complete the detach. If there are no further problems, the board is detached and reset. When the board is successfully detached, the following message is displayed:

```
Board detachment completed successfully.
```



Caution – Before you choose the reconfig button, you should read “Reconfiguration After a DR Operation” on page 20.

You can now either reconfigure the device directories or dismiss the Detach window. The board can be powered off and removed by hot-swapping, or it can be attached to another domain, left in the system unattached, or reattached at a later time.

▼ To Detach a Board By Using `dr(1M)`

Before you execute the following steps, read “Detaching a System Board” on page 38. The process of detaching a board is very similar with either Hostview or `dr(1M)`. The basic concepts are not repeated in this section. The `dr(1M)` program was introduced in Chapter 1.

1. Set `SUNW_HOSTNAME` to the appropriate domain using the `domain_switch(1M)` command.
2. Use the `dr(1M)` command in an SSP Window to bring up the `dr(1M)` prompt. In the following example, the target domain is called `xf3`.

```
% dr
Checking environment...
Establishing Control Board Server connection...
Initializing SSP SNMP MIB...
Establishing communication with DR daemon...

xf3: Domain Status - Summary

BOARD #: 0 1 2 5 6 8 9 10 11 13 physically present.
BOARD #: 4 7 being used by the domain.
dr>
```

3. Use the `drain(1M)` to drain the board.

```
dr> drain 6
Removing board 6 from domain_config file.
Start draining board 6
Board drain started. Retrieving Domain Info...

    Bound Processes for Board 6

cpu    user  sys  procs
---    ----  ---  -----
 24      0    1
 25      0    1
 26      0    1
 27      0    1

    Active Devices for Board 6

device    opens  name                usage
-----    -----  ----
ssd384      0    /dev/rdisk/c5t0d0s4  AP database

    Memory Drain for Board 6 - IN PROGRESS

Reduction= 1024 MBytes
Remaining in Domain= 1024 MBytes
Percent Complete= 99% (5696 KBytes remaining)

Drain operation started at Wed Oct 09 18:06:00 1996
Current time                Wed Oct 09 18:06:34 1996
Memory Drain is in progress. When Drain has finished,
you may COMPLETE the board detach.

dr>
```

The `drain(1M)` command initiates the drain operation and returns to the shell prompt immediately. You can monitor the progress of the drain operation with the following command:

```
dr> drshow board_number drain
```

Note – In addition, you can initiate the drain with the `wait` option of the `drain(1M)` command, which does not return to the shell prompt until after the drain has completed. Refer to `drain(1M)` for more information regarding the `wait` option.

4. After the drain operation has finished successfully, use the `complete_detach(1M)` command to complete the detach.

```
dr> complete_detach 6
Completing detach of board 6
Operating System has detached the board.
Reconfiguring domain mask registers.
Board 6 placed into loopback.
Board detachment completed successfully.
dr>
```

If the Complete Detach fails with the message “Operating system failed to quiesce due to forcible conditions” and if you have determined the root cause of the quiescent failure, you can retry the `complete_detach` with the `force` option. (You can see the console messages to help determine the cause of the quiescent failure.) Refer to `complete_detach(1M)` for more information.

You can abort the Detach operation, rather than complete it. To do so, use the command `abort_detach board_number`, instead of the `complete_detach` command shown above.

Viewing Domain Information

Both `dr(1M)` and Hostview enable you to display information about the suspend-unsafe devices as well as information about the board selected during DR operations. For `dr(1M)`, this information is accessible by using the `drshow(1M)` command. From Hostview, this information is available by clicking the `cpu`, `memory`, `device`, `obp`, and `unsafe` buttons in the attach or detach windows.

Note – You should view and use the domain information *before* you attempt to drain the memory on the board.

The informational content is the same for both `dr(1M)` and Hostview. Note that the `cpu`, `memory`, and `device` displays are only enabled when the board is attached to the operating environment. When the `cpu`, `memory`, and `device` displays are

available, they always contain accurate information. The obp display shows the information known to OBP, but it is not as detailed as the other three displays. This section shows how to use the displays.

▼ To View Domain Information with Hostview

- Click on any of the System Info buttons during the DR operation (FIGURE 3-6).

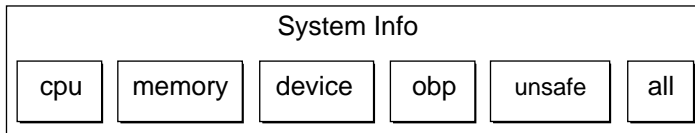


FIGURE 3-6 System Information Buttons

When you click any of these buttons, a window is displayed, and it remains open until you click the dismiss button within that window.

If you click the All button, all of the currently enabled windows are displayed.

▼ To Specify How Windows Are Updated

1. Click the Properties button in the Dynamic Reconfiguration window (FIGURE 3-7).

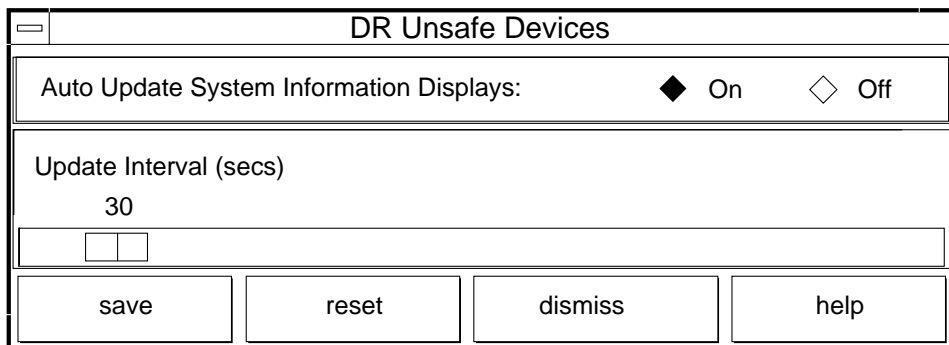


FIGURE 3-7 DR Properties Window

2. To cause displays to be updated, set Auto Update Domain Information Displays to On (the default).

3. Set the Update Interval to a value (in seconds) to determine how often updates occur.

If you set Auto Update Domain Information Displays to Off, the displays are not updated; each display is a snapshot taken at the time the button was pressed.

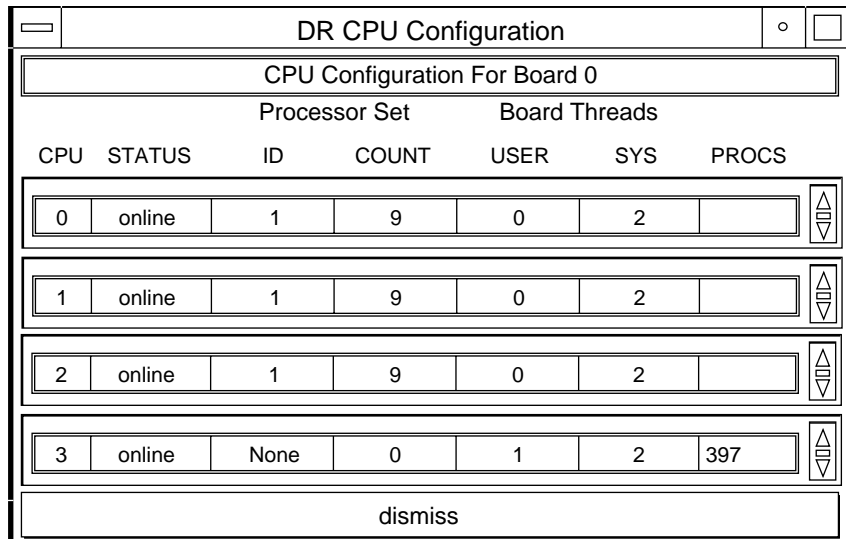
4. Click the Save button to save the settings between Hostview invocations.

Note – When the update interval is set to a low value, such as 10 seconds, and several information windows are displayed, responsiveness of the DR windows may be degraded. This is especially true when device detail windows are displayed. Each time an information window is updated, an RPC is issued to the `dr_daemon(1M)` running on the domain. The `dr_daemon` is an iterative RPC server, so each RPC request is run sequentially.

▼ To View DR CPU Configuration Information

- Click the `cpu` button.

The DR CPU Configuration window is displayed (FIGURE 3-8).



The screenshot shows a window titled "DR CPU Configuration". Inside, there is a sub-header "CPU Configuration For Board 0". Below this is a table with columns for CPU, STATUS, ID, COUNT, USER, SYS, and PROCS. The table contains four rows of data. At the bottom of the window is a "dismiss" button.

CPU Configuration For Board 0						
Processor Set				Board Threads		
CPU	STATUS	ID	COUNT	USER	SYS	PROCS
0	online	1	9	0	2	
1	online	1	9	0	2	
2	online	1	9	0	2	
3	online	None	0	1	2	397

FIGURE 3-8 DR CPU Configuration Window

The DR CPU Configuration window shows specific information about each processor on the selected board.

TABLE 3-2 DR CPU Configuration Information

Heading	Description
CPU ID	Displays the ID number of the selected board.
STATUS	Displays the status of the selected board (that is, whether the board is online or offline).
Processor Set	ID – Displays the ID number of the processor set to which the processor belongs. If the processor belongs to the default set, the word none appears in the box. COUNT – Displays the number of CPUs in the processor set.
Bound Threads	Displays the number of user and system bound threads and the process IDs of the bound threads. Some operating system device drivers may bind threads to processors to provide better servicing of a device. Threads may be bound to a processor by use of the <code>pbind(1M)</code> command.
PROCS	Displays the process IDs of the user processes that are bound to a CPU.

▼ To View DR Memory Configuration Information

- **Click the memory button.**

The DR Memory Configuration window is displayed (FIGURE 3-9).

DR Memory Configuration	
System Memory Sizes (MB)	
Current System:	2048
Attached Capacity:	18432
dr-max-mem:	20480
Memory Detach:	enabled
Memory Configuration for Board 0	
Memory Size(MB):	1024
Interleave Board:	no interleave
Physical Pages:	9437184-9568255
Board contains all pageable memory.	
Memory Drain for Board 0	ESTIMATED
Reduction:	1024
Remaining in System:	1024
Percent Complete:	
Drain Start Time:	
Current Time:	
dismiss	

FIGURE 3-9 DR Memory Configuration Window

The DR Memory Configuration window is divided into three panels:

TABLE 3-3 DR Memory Configuration Information

System Memory Sizes (Domain Memory Information)

Current Domain	Total size of memory in the domain from all boards
Attach Capacity	Amount of memory that can be added by using the DR Attach operation
<code>dr-max-mem</code>	Current value of the OBP variable <code>dr-max-mem</code> (for more information, see “Memory: <code>dr-max-mem</code> ” on page 15)

Memory Configuration for Board 0 (Board-Level Information)

Memory Size (MB)	Amount of memory on the selected board
Interleave Board	Board that the selected board is interleaved with
Physical Pages	Highest and lowest physical pages that are occupied by the memory on this board (Small memory areas in the middle of this range may not be used by this board. Note that DR is not able to detach boards that have interleaved memory.)

Status/State (the display depends on the status/state of the operation)

Unavailable	A suitable target memory area is not currently available.
Estimated	The estimated values are displayed prior to starting the drain operation. The values displayed reflect the memory configuration that would result if the drain operation were started at this point. Note that the estimated values may differ from the in-progress values depending on the domain memory usage at the time drain was started.
In Progress	The drain operation is in progress.
Complete	The drain operation is finished.

Memory Drain Information

Reduction	Amount of memory to be removed from domain usage when the board is detached
Remaining in Domain	Domain memory size after the board is detached

TABLE 3-3 DR Memory Configuration Information (*Continued*)

Percent Complete	How far the drain operation has progressed. Note that the time required to drain each memory page is not constant. Some memory pages take longer to drain than others.
Drain Start Time	The time the drain operation was started.
Current Time	The current time, which can be compared to the drain start time to see how long the drain operation has been in progress.

▼ To View DR Device Configuration Information

- **Click the device button.**

The DR Device Configuration window is displayed (FIGURE 3-10).

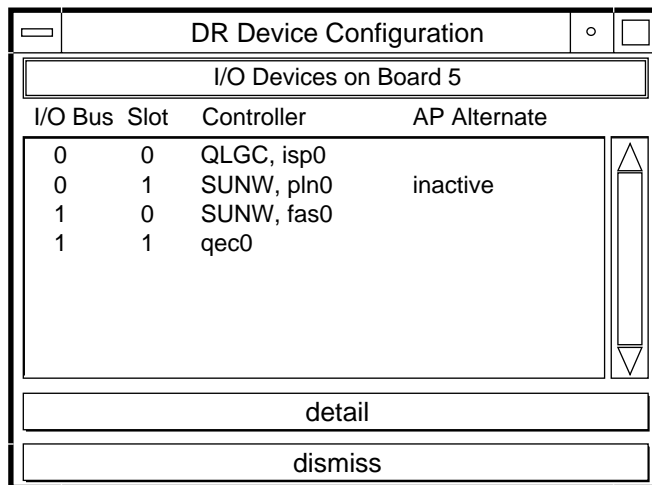


FIGURE 3-10 DR Device Configuration Window

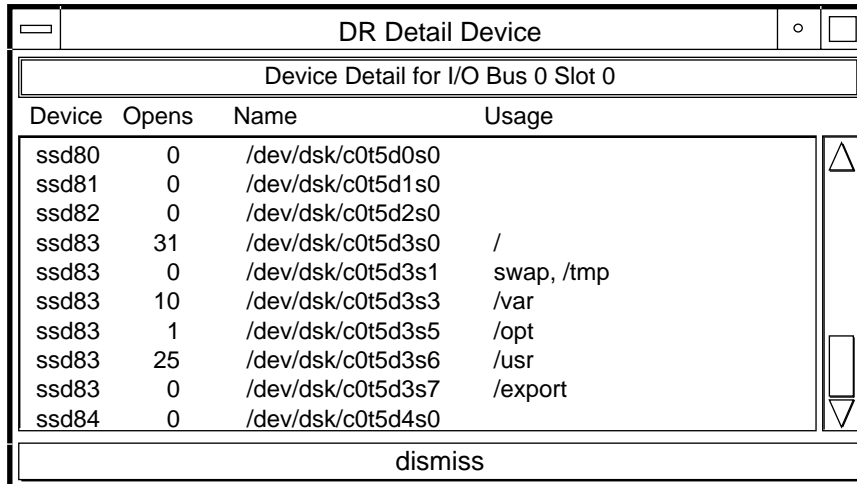
The controllers or devices in each slot are listed. The controller and device names are a concatenation of their device name and their operating environment instance number (for example, `sd31`).

Note – The DR Device Configuration window may not show all of the devices that are physically present on the board. For example, controllers whose drivers are unattached do not appear in the list. The device display that is available by using the `obp` button lists the cards on the board that were successfully probed and identified.

▼ To View DR Device Detailed Information

1. Highlight one or more controller(s).
2. Choose Detail.

The following window is displayed for each selected controller (FIGURE 3-11).



Device Detail for I/O Bus 0 Slot 0			
Device	Opens	Name	Usage
ssd80	0	/dev/dsk/c0t5d0s0	
ssd81	0	/dev/dsk/c0t5d1s0	
ssd82	0	/dev/dsk/c0t5d2s0	
ssd83	31	/dev/dsk/c0t5d3s0	/
ssd83	0	/dev/dsk/c0t5d3s1	swap, /tmp
ssd83	10	/dev/dsk/c0t5d3s3	/var
ssd83	1	/dev/dsk/c0t5d3s5	/opt
ssd83	25	/dev/dsk/c0t5d3s6	/usr
ssd83	0	/dev/dsk/c0t5d3s7	/export
ssd84	0	/dev/dsk/c0t5d4s0	

dismiss

FIGURE 3-11 DR Detail Device Window

The current usage information for each device is shown. The window includes an open count (if available) and the common name (for example, a disk partition, a metadvice, or an interface name) by which the device is known. Additional usage information is also provided, including the partition mount points, network interface configuration, swap space usage, and metadvice usage.

Note – Some device usage, such as disk partitions used for Sun Solstice DiskSuite databases, Alternate Pathing databases, and Sun Enterprise Volume Manager usage, may not be reported.

If a controller or network interface is part of the AP database, the window indicates that it is active or that it is an AP alternate. For active AP alternates, the usage of the AP metadvice is displayed.

▼ To View DR OBP Configuration Information

Note – The information in the DR OBP Configuration window is derived from the OBP device tree, and is less detailed than the information that is available from the other windows described in this section. For example, in the init attach state, only the I/O adapters are known—not the devices attached to those controllers nor the memory interleave configuration. This window is usually used when a board is in the init attach state.

- **Click the obp button.**

The DR OBP Configuration window is displayed (FIGURE 3-12).

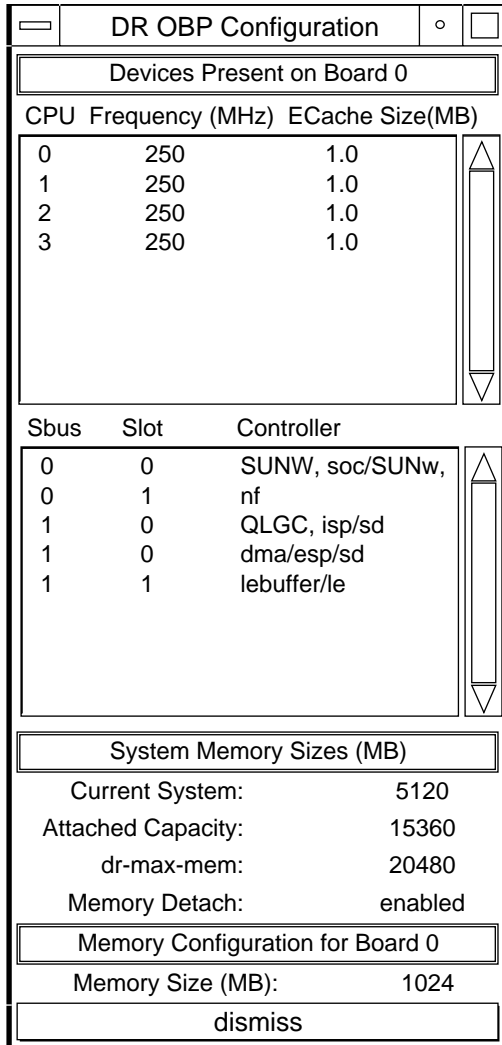


FIGURE 3-12 DR OBP Configuration Window

▼ To View the DR-Unsafe Devices

- **Click the unsafe button.**

The DR Unsafe Devices window is displayed (FIGURE 3-13).

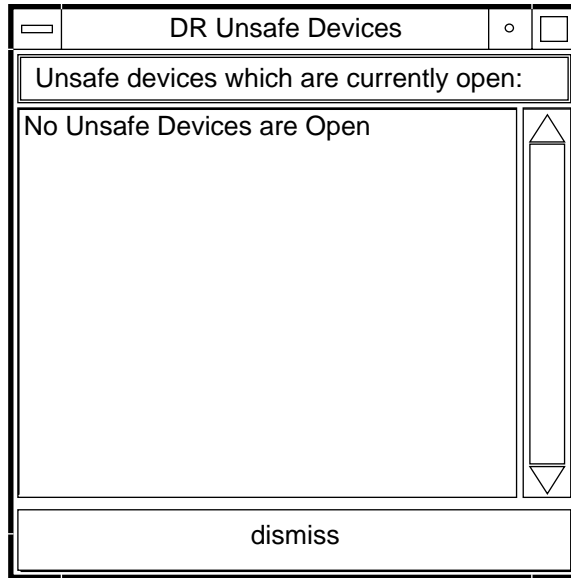


FIGURE 3-13 DR Unsafe Devices Window

The DR Unsafe Devices window shows the suspend-unsafe devices that are open across the entire domain, not just those that are resident on the selected system board. This information is useful for determining the cause of operating environment quiescence errors due to unsafe devices being open.

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