Veritas™ Cluster Server Application Note: SunFire 6800 Dynamic Reconfiguration

Solaris

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Veritas cluster server application note: SunFire 6800 dynamic reconfiguration

Introduction

This application note describes how to perform dynamic reconfiguration (DR) operations on VCS clustered system domains of the SunTM Fire 6800 server. The DR operations typically include configuring and unconfiguring CPU/memory boards to and from domains and configuring and unconfiguring I/O cards to and from I/O boards in a domain. I/O boards cannot be dynamically reconfigured, but the PCI cards on I/O boards can be dynamically reconfigured.

These operations allow switching boards from one domain to another or permit removing a board or card to upgrade or replace it. DR operations can be performed while the operating environment continues to run. However, a DR operation performed on a CPU/memory board that has permanent memory requires that the system domain be temporarily suspended and, in this case, VCS must be stopped. This document describes the procedures for shutting down and restarting VCS.

Note: Currently, VCS does not support using DR in clusters where I/O controllers and storage use Sun’s Alternate Pathing (AP).

Do not use the following procedures to dynamically reconfigure a network interface card used for a VCS private heartbeat link. If you need to do so, you must stop VCS before proceeding.

Note: The Sun documentation for dynamic reconfiguration on the Sun Fire 6800 contains comprehensive descriptions of procedures and commands. To avoid damaging system boards and components, you should be familiar with the procedures for their removal and replacement.

Supported software

- Solaris 8 and Solaris 9
- VERITAS Cluster Server, releases 2.0, 3.5 (any patch level) or later
- VERITAS Volume Manager, as supported by the VCS version
- VERITAS File System, as supported by the VCS version

Note: Please check that you are using the latest version of this document.

Dynamic reconfiguration in VCS environment - Overview

The boards in an S6800 domain may contain I/O controllers, CPUs, or memory. Typically, boards within a domain have their functions duplicated on other boards. For example, you can remove a board with CPU or memory dynamically because another board in the domain can perform the equivalent functions.

In a VCS cluster of domains, dynamic reconfiguration operations in one domain may cause VCS to detect that resources are unavailable and initiate failover to another domain. Therefore, it is advisable to freeze persistently the service groups running in the domain and stop VCS before running DR operations. See “When must you stop VCS when performing DR?” on page 11.

For users of VERITAS DBE/AC *for Oracle9i RAC*, it is necessary to stop the Oracle RAC instance within the domain being reconfigured if VCS must be stopped. This permits communications among other RAC instances to occur while the instance in the one domain is temporarily stopped.

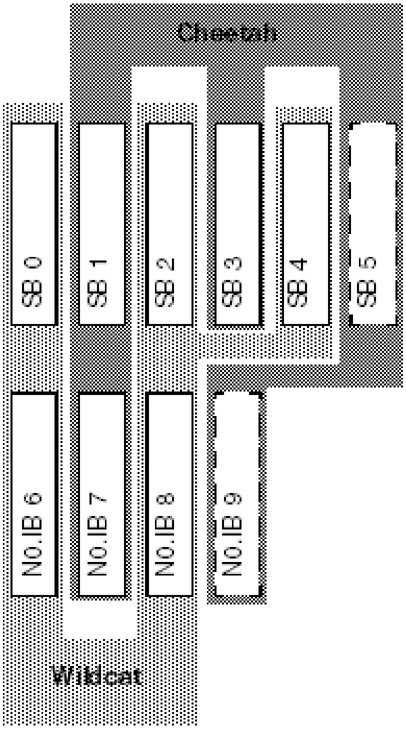
Planning to reconfigure devices

To be dynamically reconfigured, the boards must satisfy the following conditions:

- Critical resources on boards must be redundant. For example, boards for which CPUs and memory are redundant can be reconfigured after their function has been replaced and their activity stopped. A CPU board that contains the only CPU in a domain cannot be moved.
- A memorsy board containing permanent memory, such as the OpenBootTM PROM or kernel memory, can be moved after the memory has been moved to another board. DR on boards with permanent memory requires VCS to be shut down.
- Disk drives must be accessible via alternate pathways. The Dynamic Multipathing (DMP) feature can provide alternate paths. Before moving a host bus adapter, switch all the card's functions to an alternate card. An HBA that controls sole access to an active drive cannot be moved.
- Activity on a PCI card must be stopped before the card is removed.

Example S6800 configuration

The following example configuration serves as a reference for some of the procedures described in this docment.



On Sun Fire 6800 systems, system boards are numbered SB0 through SB5 and I/O boards are numbered N0.IB6 through N0.IB9. In the example shown above, two domains have been configured.

Listing all boards in all domains

You can display information about all boards in all domains in one S6800 server using the showboards command when you are logged in as superuser to the platform shell. For example, the boards that can be dynamically configured are listed at the bottom of the output:

```
# showboards
Slot     Pwr Component Type            State      Status     Domain
----     --- --------------            -----      ------     ------
SSC0     On  System Controller              Main        Passed     -
SSC1     On  System Controller              Spare       -          -
ID0      On  Sun Fire 6800 Centerplane      -           OK         -
```

```
PS0       On   A152 Power Supply              -          OK          -
PS1       On   A152 Power Supply              -          OK          -
PS2       On   A152 Power Supply              -          OK          -
PS3       On   A152 Power Supply              -          OK          -
PS4       On   A152 Power Supply              -          OK          -
PS5       On   A152 Power Supply              -          OK          -
FT0       On   Fan Tray                       Low Speed  OK          -
FT1       On   Fan Tray                       Low Speed  OK          -
FT2       On   Fan Tray                       Low Speed  OK          -
FT3       On   Fan Tray                       Low Speed  OK          -
RP0       On   Repeater Board                 -          OK          -
RP1       On   Repeater Board                 -          OK          -
RP2       On   Repeater Board                 -          OK          -
RP3       On   Repeater Board                 -          OK          -
/N0/SB0   On   CPU Board                      Active     Passed      A
/N0/SB1   On   CPU Board                      Active     Passed      C
/N0/SB2   Off  CPU Board                      Assigned   Not tested  A
/N0/SB3   On   CPU Board                      Active     Passed      C
/N0/SB4   On   CPU Board                      Assigned   Under Test  A
/N0/SB5   On   CPU Board                      Active     Passed      C
/N0/IB6   On   PCI I/O Board                  Active     Passed      A
/N0/IB7   On   PCI I/O Board                  Active     Passed      C
/N0/IB8   On   CPCI I/O Board                 Active     Passed      A
/N0/IB9   On   PCI I/O Board                  Active     Passed      C
```

Listing boards in a domain

You can list the boards in a domain using the `cfgadm` command. For example, if you are logged into the `wildcat` domain (see “Example S6800 configuration” on page 9), enter:

```
# cfgadm
```

The output resembles:

```
Ap_Id               Type          Receptacle    Occupant      Condition
N0.IB6               PCI_I/O_Boa    connected     configured    ok
N0.IB8               CPCI_I/O_Bo    connected     configured    ok
N0.SB0               CPU_Board      connected     configured    ok
N0.SB2              CPU_Board      disconnected  unconfigured  unknown
N0.SB4               CPU_Board      connected     configured    ok
c0                  scsi-bus       connected     configured    unknown
pcisch4:sg8slot     stpcipci/fhs   connected     configured    ok
pcisch5:sg8slot     fibre/nhs      connected     configured    ok
pcisch6:sg8slot3    stpcipci/fhs   connected     configured    ok
pcisch7:sg8slot1    stpcipci/fhs   connected     configured    ok
```

In the example output shown above, the board N0.IB8 contains four slots, all of which are occupied by PCI cards, listed at the bottom of the output.

When must you stop VCS when performing DR?

It is necessary to stop VCS and unconfigure GAB and LLT in certain circumstances as described in the following paragraphs.

CPU/memory boards

If the CPU/memory board to be removed contains permanent memory, the operating system's function must be suspended to permit dynamic reconfiguration to occur. In such a case, VCS must be stopped.

However, you do not need to stop VCS when:

- You are performing DR on a board that does not contain permanent memory.
  Typically, in a domain with multiple CPU/memory boards, one board has permanent memory, while the others do not.
- When you are performing DR to add a new board to the domain.
  The existing functions in the domain are not affected by the dynamic addition of a new CPU/memory board.

Note: If you must reconfigure multiple boards and a board with permanent memory is among them, reconfigure the board with permanent memory last. This sequence ensures minimum VCS downtime.

To determine if the CPU/memory board has permanent memory

1. Log into the domain as domain administrator.
2. List the boards with permanent memory in the domain by entering:

```
# cfgadm -av | grep permanent
SB2::memory connected    configured   ok         base
address 0x1e000000000, 16777216 KBytes total, 2001200 KBytes
permanent
```

The output in the example shows SB2 to contain permanent memory. Before this board can be dynamically reconfigured, VCS must be stopped. The procedures are described in "Stopping VCS in a standard environment" on page 12 and "Stopping VCS in an Oracle9i RAC environment" on page 14. Other CPU/memory boards in the domain do not contain permanent memory and may be dynamically reconfigured without stopping VCS.

I/O boards

You must stop VCS when you reconfigure an I/O board in the following circumstances:

- When the I/O board requiring reconfiguration contains all the private network links used by the domain.
- When the I/O board contains the only public network links used by the domain.
- When the I/O board contains all of the paths to a storage device.

Stopping and starting VCS

This section contains:

- The procedures for stopping VCS if it is required for dynamic reconfiguration
- The procedures for starting VCS if it has been stopped for dynamic reconfiguration

Stopping VCS in a standard environment

If you are running VERITAS DBE/AC *for Oracle9i RAC*, see "Stopping VCS in an Oracle9i RAC environment" on page 14.

When you must dynamically reconfigure a board containing permanent memory, you must stop VCS in the domain. Applications running on clusters of three or more domains remain highly available on two or more domains if VCS operation must be stopped on one domain. In a cluster of two domains, the applications running during reconfiguration are not highly available when VCS must be stopped on one of the domains.

To stop VCS in a standard environment

1. Log in as administrator to the domain (`wildcat`, for example) you are reconfiguring.
2. List the VCS service groups to determine which are online on the domain:

   ```
   # hagrp -list
   ```

3. If you can switch the service groups running on the domain to another domain (`cheetah`, for example), do the following:

   a. Switch the service groups:

   ```
   # hagrp -switch service_grp_name -to cheetah
   ```

b Verify the service groups are offline on `wildcat`:

```
# hastatus
```

c Stop VCS on `wildcat`:

```
# hastop -local
```

4 If you cannot switch the online service groups to another system, freeze each of them for the duration of dynamic reconfiguration as follows:

a Make the VCS configuration writable:

```
# haconf -makerw
```

b Freeze each of the service groups persistently:

```
# hagrp -freeze service_grp_name -persistent
```

c Verify the groups are frozen:

```
# hagrp -display | grep Frozen
```

d Make the configuration read-only:

```
# haconf -dump -makero
```

e Stop VCS:

```
# hastop -local -force
```

5 Unconfigure GAB:

```
# /sbin/gabconfig -U
```

6 Unconfigure LLT:

```
# /sbin/lltconfig -U
```

When you are prompted, answer “**y**” to confirm that you want to stop LLT.

7 Remove the GAB and LLT modules from the kernel.

a Determine the IDs of the GAB and LLT modules:

```
# modinfo | egrep "gab|llt"
305 78531900  30e 305   1  gab
292 78493850  30e 292   1  llt
```

b Unload the GAB and LLT modules based on their module IDs:

```
# modunload -i 305
# modunload -i 292
```

8 You can begin performing dynamic reconfiguration.

Restarting VCS in a standard environment

If you are ready to restart VCS in the domain where you are performing dynamic reconfiguration, use the following procedure. If you are running VERITAS DBE/AC *for Oracle9i RAC*, and are ready to restart VCS, see “Restarting VCS in an Oracle9i RAC environment” on page 16.

To restart LLT, GAB, and VCS

1. Restart LLT:

   ```
   # /etc/rc2.d/S70llt start
   ```

2. Restart GAB:

   ```
   # /etc/rc2.d/S92gab start
   ```

3. Start VCS:

   ```
   # hastart
   ```

4. Verify GAB and VCS are started:

   ```
   # /sbin/gabconfig -a
   GAB Port Memberships
   ===============================================================
   Port a gen 4a1c0001 membership 012
   Port h gen g8ty0002 membership 012
   ```

To bring service groups online

1. Determine which service groups are frozen (see step 4 on page 13):

   ```
   # hagrp -display | grep Frozen
   ```

2. Make the configuration writable:

   ```
   # haconf -makerw
   ```

3. Unfreeze the frozen service groups:

   ```
   # hagrp -unfreeze service_grp_name -persistent
   ```

4. Make the configuration read-only.

   ```
   # haconf -dump -makero
   ```

Stopping VCS in an Oracle9i RAC environment

If VCS must be stopped on a domain where VERITAS DBE/AC *for Oracle9i RAC* is running, the Oracle RAC application on the domain being reconfigured must be offlined. In addition, the GAB, LLT, LMX, and VXFEN modules must be unconfigured. Performing these steps ensures that other instances do not attempt communication with the stopped instance, which could cause the application to hang when the instance does not respond.

To stop VCS in a VERITAS DBE/AC for oracle9i RAC environment

1. Log in as administrator to the domain being reconfigured (`wildcat`, for example).

2. List the configured VCS service groups and see which are online in the domain:

   ```
   # hagrp -list
   ```

3 Based on the output of step 2, offline each service group that is online in the domain `wildcat`. Use the following command:

```
# hagrp -offline service_grp_name -sys wildcat
```

4 Stop VCS:

```
# hastop -local
```

In addition to port h, this command stops the CVM drivers using ports v and w.

5 Stop and unconfigure the drivers required by DBE/AC:

```
# cd /opt/VRTSvcs/rac
# ./uload_drv
Unloading qlog
Unloading odm
Unloading fdd
Unloading vxportal
Unloading vxfs
```

6 Unconfigure the VCSMM and I/O fencing drivers, which use ports b and o, respectively:

```
# /sbin/vxfenconfig -U
# /sbin/vcsmmconfig -U
```

7 Unconfigure the LMX driver:

```
# /sbin/lmxconfig -U
```

8 Verify that the drivers h, v, w, f, q, d, b, and o are stopped. They should not show memberships when you use the `gabconfig -a` command:

```
# gabconfig -a
GAB Port Memberships
=============================================================
Port a gen 4a1c0001 membership 01
```

9 Unload the VCSMM, I/O fencing, and LMX modules.

a Determine the module IDs for VCSMM, I/O fencing, and LMX:

```
# modinfo | egrep "lmx|vxfen|vcsmm"
237 783e4000  25497 237   1  vcsmm (VERITAS Membership Manager)
238 78440000  263df 238   1  vxfen (VERITAS I/O Fencing)
239 7845a000  12b1e 239   1  lmx (LLT Mux 3.5B2)
```

b Unload the VCSMM, I/O fencing, and LMX modules based on their module IDs:

```
# modunload -i 237
# modunload -i 238
# modunload -i 239
```

10 Unconfigure GAB:

```
# /sbin/gabconfig -U
```

11 Unconfigure LLT

```
# /sbin/lltconfig -U
```

12 Remove the GAB and LLT modules from the kernel.

a Determine the IDs of the GAB and LLT modules:

```
# modinfo | egrep "gab|llt"
305 78531900  30e 305   1  gab
292 78493850  30e 292   1  llt
```

b Unload the GAB and LLT modules based on their module IDs:

```
# modunload -i 305
# modunload -i 292
```

13 You can begin performing dynamic reconfiguration.

Restarting VCS in an Oracle9i RAC environment

If you used the procedure described in "Stopping VCS in an Oracle9i RAC environment" on page 14 before dynamically reconfiguring a CPU/memory board, used the following procedures to restart VCS and online the service groups.

To restart LLT, GAB, VCS, and DBE/AC processes

1 Restart LLT:

```
# /etc/rc2.d/S70llt start
```

2 Restart GAB:

```
# /etc/rc2.d/S92gab start
```

3 Restart the LMX driver:

```
# /etc/rc2.d/S71lmx start
```

4 Restart the VCSMM driver:

```
# /etc/rc2.d/S98vcsmm start
```

5 Restart the VXFEN driver:

```
# /etc/rc2.d/S97vxfen start
```

6 Restart the ODM driver:

```
# mount /dev/odm
```

7 Start VCS:

```
# hastart
```

8 Verify that the CVM service group is online:

```
# hagrp -state cvm
```

9 Verify the GAB memberships required for DBE/AC *for Oracle9i RAC* are configured:

```
# /sbin/gabconfig -a
GAB Port Memberships
============================================================
Port a gen 4a1c0001 membership 012
Port b gen g8ty0002 membership 012
Port d gen 40100001 membership 012
Port f gen f1990002 membership 012
Port h gen g8ty0002 membership 012
Port o gen f1100002 membership 012
Port q gen 28d10002 membership 012
Port v gen 1fc60002 membership 012
Port w gen 15ba0002 membership 012
```

10 Online the service groups that had been take offline in step 3 on page 15:

```
# hagrp -online service_grp_name -sys wildcat
```

Dynamically reconfiguring CPU/memory boards

You may want to remove a CPU/memory board that is malfunctioning. Or, you may want to reconfigure a board from one domain to another where it is more needed.

To reassign a board from one domain to another, you must unconfigure it from one domain and reassign it to another domain. This can be done without physically removing the board from its slot. To replace a board, however, you must unconfigure it from one domain, physically remove it, add its replacement board and reconfigure it to the domain.

Performing dynamic reconfiguration on a CPU/memory board

Use the following procedure to dynamically reconfigure a CPU/memory board.

Determine the status of the board you are reconfiguring

1 If necessary, log in as the administrator to the domain containing the CPU/memory board.

2 Determine the attachment point of the board you are removing:

```
# cfgadm
Ap_Id          Type      Receptable     Occupant      Cond
.
N0.SB2         CPU       connected      configured    ok
.
```

3 Make sure you have checked whether the board has permanent memory. See “To determine if the CPU/memory board has permanent memory” on page 11 if necessary.

- If the board in the domain you want to dynamically reconfigure contains permanent memory, be sure you have first stopped VCS using the procedures described in "Stopping VCS in a standard environment" on page 12 or described in "Stopping VCS in an Oracle9i RAC environment" on page 14, whichever is appropriate.
- If the board you want to reconfigure does not contain permanent memory, you can proceed to dynamically reconfigure it.

To unbind processes bound to CPU on the board

1. To determine if any processes are bound to a CPU, enter:

   ```
   # pbind -q
   ```

   If a processes is bound to the board, the output indicates the process ID and the ID number of the CPU:

   ```
   process id 650: 0
   ```

   If you see no output or see output showing no processes bound to a CPU on the board you are reconfiguring, perform the steps in "To unconfigure the board" on page 18.

2. Unbind all processes bound to the CPU on the board. For example, enter:

   ```
   # pbind -u 650
   ```

3. Rebind the processes to a processor on another board, if necessary. For example, bind process 650 to processor with ID 9, which is on another board, using the command:

   ```
   # pbind -b 650 9
   ```

   If you attempt to unconfigure a board with processes bound to it, you receive a message that resembles:

   ```
   cfgadm: Hardware specific failure: unconfigure SB15: Failed to
   off-line:dr@0:SB15::cpu3
   ```

To unconfigure the board

1. Unconfigure and disconnect the board:

   ```
   # cfgadm -v -c disconnect SB2
   ```

2. If the board does not contain permanent memory, the command's output resembles:

   ```
   request delete capacity (4 cpus)
   request delete capacity (524288 pages)
   request delete capacity N0.SB2 done
   request offline SUNW_cpu/cpu8
   request offline SUNW_cpu/cpu9
   request offline SUNW_cpu/cpu10
   request offline SUNW_cpu/cpu11
   request offline SUNW_cpu/cpu8 done
   request offline SUNW_cpu/cpu9 done
   request offline SUNW_cpu/cpu10 done
   ```

```
request offline SUNW_cpu/cpu11 done
unconfigure N0.SB2
unconfigure N0.SB2 done
notify remove SUNW_cpu/cpu8
notify remove SUNW_cpu/cpu9
notify remove SUNW_cpu/cpu10
notify remove SUNW_cpu/cpu11
notify remove SUNW_cpu/cpu8 done
notify remove SUNW_cpu/cpu9 done
notify remove SUNW_cpu/cpu10 done
notify remove SUNW_cpu/cpu11 done
disconnect N0.SB2
disconnect N0.SB2 done
poweroff N0.SB2
poweroff N0.SB2 done
unassign N0.SB2 skipped
```

Skip to step 4.

3 If the board has permanent memory, the system prompts you to proceed:

```
System may be temporarily suspended; proceed (yes/no)?
```

If you answer "yes," DR proceeds. The system is suspended during reconfiguration. When the system resumes operation on another board, the board you are reconfiguring is disconnected. If the disconnect operation succeeds, the output resembles:

```
request suspend SUNW_OS
request suspend SUNW_OS done
request delete capacity (524288 pages)
request delete capacity SB2 done
request offline SUNW_cpu/cpu8
request offline SUNW_cpu/cpu9
request offline SUNW_cpu/cpu10
request offline SUNW_cpu/cpu11
request offline SUNW_cpu/cpu8 done
request offline SUNW_cpu/cpu9 done
request offline SUNW_cpu/cpu10 done
request offline SUNW_cpu/cpu11 done
unconfigure SB2
unconfigure SB2 done
notify remove SUNW_cpu/cpu8
notify remove SUNW_cpu/cpu9
notify remove SUNW_cpu/cpu10
notify remove SUNW_cpu/cpu11
notify remove SUNW_cpu/cpu8 done
notify remove SUNW_cpu/cpu9 done
notify remove SUNW_cpu/cpu10 done
notify remove SUNW_cpu/cpu11 done
disconnect SB2
disconnect SB2 done
poweroff SB2
poweroff SB2 done
unassign SB2 skipped
```

```
notify resume SUNW_OS
notify resume SUNW_OS done
```

If the output succeeds, skip to step 4.

Note: If there are real-time processes running on the board you are unconfiguring, the disconnect operation may not succeed. You must stop these processes in the appropriate manner before continuing with DR.

a If the board has real-time processes that must be stopped, the DR operation fails, indicating the PID of those processes that are running. For example:

```
.
notify remove SUNW_cpu/cpu9 done
notify remove SUNW_cpu/cpu10 done
notify remove SUNW_cpu/cpu11 done
cfgadm: Hardware specific failure: unconfigure SB2:
Cannot
quiesce realtime thread: 621
```

To determine the name of the processes, use the command:

```
# ps -ef | grep PID
```

b Stop the process in the appropriate manner. For example, the processes in our example must be stopped using the `kill` command:

```
# kill -9 PID
```

c Retry the command in step 1.

4 To verify the board is disconnected and unconfigured, use the `cfgadm` command:

```
# cfgadm
Ap_Id          Type      Receptable     Occupant       Cond
.
N0.SB2         CPU       disconnected   unconfigured   unknown
.
```

Now you can remove the board from the slot, or reassign it to another domain.

Caution: Do not remove the board until you have verified it is disconnected.

5 If you are replacing the board immediately, see “To add a board to a domain” on page 21. If you are reconfiguring the board to another domain, see “To reconfigure a board to another domain” on page 22. Otherwise, return the cluster to operation without replacing the disconnected CPU/memory board using the procedure in the following section.

Adding a CPU/memory board

If you have unconfigured a CPU/memory board from a domain, you can remove it or reassign it to another domain. To add a CPU/memory board to a domain, you need not stop VCS.

To add a board to a domain

1. Log in as administrator to the domain where you plan to add or configure the board.
2. If you are adding a new or a replacement board to a domain (for example, `wildcat`), verify the state of the slot to contain the board. To be configured with a new board, the slot must have the following states and condition:
   - Receptacle state: empty
   - Occupant state: unconfigured
   - Condition: unknown

   Verify this by using the `cfgadm` command to list the slots, as in the following example. In the `wildcat` domain, slot `SB2` is to contain the CPU board:

   ```
   # cfgadm
   Ap_Id          Type      Receptable     Occupant      Cond
   .
   N0.SB2         unknown   empty          unconfigured  unknown
   ```
3. Use the `cfgadm` command to connect and configure a CPU or memory board:

   ```
   cfgadm -v -c configure SBx
   ```

   For example:

   ```
   # cfgadm -v -c configure SB2
   assign SB2
   assign SB2 done
   poweron SB2
   poweron SB2 done
   test SB2
   test SB2 done
   connect SB2
   connect SB2 done
   configure SB2
   configure SB2 done
   notify online SUNW_cpu/cpu8
   notify online SUNW_cpu/cpu9
   notify online SUNW_cpu/cpu10
   notify online SUNW_cpu/cpu11
   notify add capacity (4 cpus)
   notify add capacity (524288 pages)
   notify add capacity SB2 done
   ```

4 Verify the new board has been connected and configured using the command `cfgsadm`. For example:

```
# cfgadm
Ap_Id          Type      Receptable     Occupant      Cond
.
N0.SB2         CPU       connected      configured    ok
```

To reconfigure a board to another domain

1 If you have unconfigured a board from one domain (for example, `wildcat`) and plan to configure it to another domain (for example, `cheetah`), verify the state of the slot containing the board.

To be configured to another domain, the board in the slot must have the following states and condition:

- Receptacle state: disconnected
- Occupant state: unconfigured
- Condition: unknown

2 Verify this by using the `cfgadm` command to list the boards, as in the example. Log in as administrator to the domain (`cheetah`) where you plan to add the board and verify the state of the slot:

```
# cfgadm
Ap_Id          Type      Receptable     Occupant      Cond
.
N0.SB2         unknown   disconnected   unconfigured  unknown
.
.
```

3 Use the `cfgadm` command to connect and configure a CPU or memory board:

```
cfgadm -v -c configure SBx,
```

For example:

```
# cfgadm -v -c configure SB2
```

After the system configures and tests the board, it displays a message in the domain console log indicating the configuration of the components.

4 Verify the reconfiguration of the board using `cfgadm`:

```
# cfgadm
Ap_Id          Type      Receptable     Occupant      Cond
.
N0.SB2         CPU       connected      configured    ok
.
.
```

5 You can log into the platform level and use the `showboards` command to verify that SB2 is now part of the cheetah domain:

```
# showboards
```

The output resembles:

```
Retrieving board information. Please wait
Location    Pwr    Type of Board   Board Status  Test Status
Domain
--------    ---    -------------   ------------  -----------
------
N0.SB0      On     CPU             Active        Passed
wildcat
N0.SB1      On     CPU             Active        Passed
cheetah
N0.SB2      On     CPU             Active        Passed
cheetah
N0.SB3      On     CPU             Active        Passed
cheetah
N0.SB4      On     CPU             Active        Passed
wildcat
N0.SB5      On     CPU             Active        Passed
cheetah
N0.SB6      On     CPU             Active        Passed
wildcat
.
.
```

Dynamically reconfiguring I/O boards

You can dynamically reconfigure I/O boards and PCI cards on I/O boards.

Dynamically reconfiguring PCI cards

A card containing a host bus adapter can be removed and replaced on an I/O board. If a failed HBA has been used with other adapters on separate cards in a dynamic multipathing (DMP) configuration, I/O can proceed through the alternate path and VCS need not be stopped.

To determine the status of the card you are unconfiguring

1 Log into the domain as the administrator. For the following example, the I/O board is in the `wildcat` domain.

2 Check the status of the boards. On the `wildcat` domain, use the `cfgadm` command:

```
# cfgadm
```

The output resembles:

```
Ap_Id                  Type          Receptacle   Occupant
Condition
N0.IB6      HPCI       connected     configured   ok
N0.IB8      HPCI       connected     configured   ok
N0.SB0                 CPU           connected    configured    ok
```

```
.
pcisch4:sg8slot2     stpcipci/fhs connected    configured    ok
pcisch5:sg8slot0     fibre/nhs    connected    configured
failed
pcisch6:sg8slot3     stpcipci/fhs connected    configured    ok
pcisch7:sg8slot1     stpcipci/fhs connected    configured    ok
.
```

The failed card, `pcisch5:sg8slot0`, is to be removed and replaced.

To remove a PCI card

1. Disable the controllers on the I/O system card using the vxdmpadm command:

   ```
   vxdmpadm disable ctlr=ctlr
   # vxdmpadm disable ctlr=c3
   ```

   If the card has more than one controller, repeat this command for each controller on the card.

2. Disconnect the card:

   ```
   # cfgadm -v -c disconnect pcisch1:sg8slot0
   ```

3. Check the states and the condition of the card using the `cfgadm` command:

   ```
   # cfgadm
   ```

   The disconnected card must have the following states and condition:

   - Receptacle state: disconnected
   - Occupant state: unconfigured
   - Condition: unknown

4. Remove the disconnected card only if it is powered off.

To add a card

1. Verify that the slot you selected can accept a device, such as a PCI card. To accept a device, the slot must have the following states and condition:

   - Receptacle state: empty or disconnected
   - Occupant state: unconfigured
   - Condition: unknown

   Verify this by using the `cfgadm` command to list all of the system boards, as in the following example for the `wildcat` domain:

   ```
   # cfgadm
   ```

   The output resembles:

   ```
   Ap_Id               Type         Receptacle   Occupant
   Condition
   N0.IB6      HPCI    connected    configured   ok
   N0.IB8      HPCI    connected    configured   ok
   N0.SB0              CPU          connected    configured    ok
   N0.SB2              CPU          connected    configured    ok
   ```

```
c0                  scsi-bus     connected    configured
unknown
.
.
pcisch4:sg8slot2    stpcipci/fhs connected    configured    ok
pcisch5:sg8slot0    unknown      disconnected unconfigured
unknown
pcisch6:sg8slot3    stpcipci/fhs connected    configured    ok
pcisch7:sg8slot1    stpcipci/fhs connected    configured    ok
```

2 Add the replacement PCI card to the empty card slot.

3 To configure the new card, use the `cfgadm` command. For example:

```
# cfgadm -c configure pcisch1:sg8slot0
```

After the system configures and tests the board, it displays a message in the domain console log indicating the configuration of the components.

4 Check the states and the condition of the board using the `cfgadm` command; it must be “`connected`,” “`configured`,” and “`ok`.”

5 Enable the controller for the HBA:

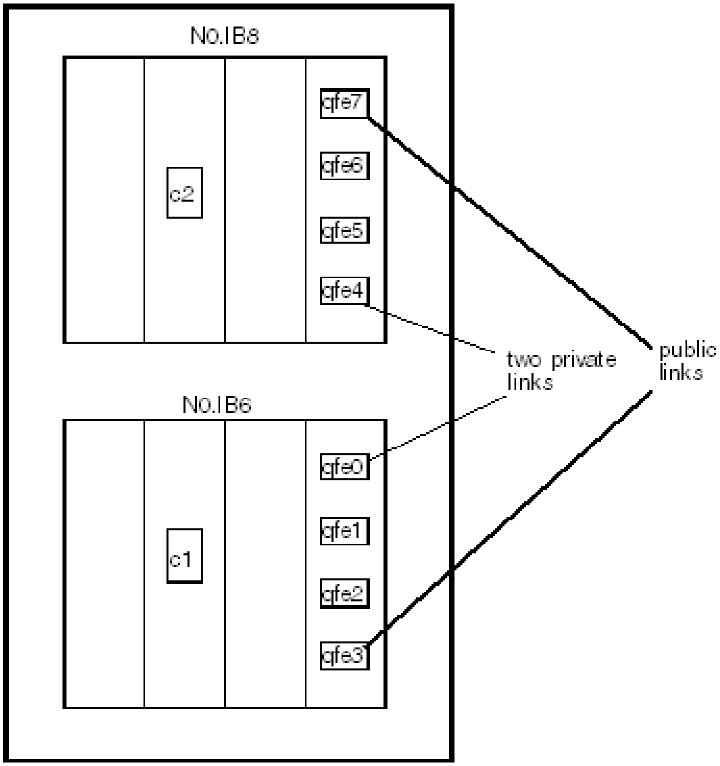
```
vxdmpadm enable ctlr=ctlr
# vxdmpadm enable ctlr=c3
```

Note that this command succeeds if the controller is accessible to the domain and I/O can be performed on it.

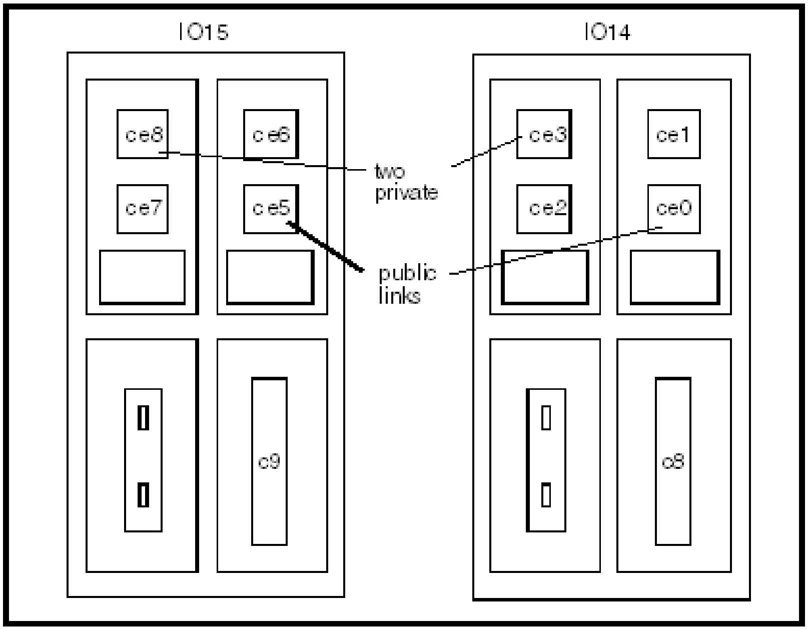
Dynamically reconfiguring an I/O board

In the following scenario, a cluster consists of the wildcat and the leopard domains. The cluster is running service groups on the wildcat domain, which includes I/O boards N0.IB8 and N0.IB6. N0.IB8 requires dynamic reconfiguration because of a malfunctioning component. The domain leopard includes I/O boards IO14 and IO15. The disk controllers and NICs are labeled in the following diagrams.

Domain: wildcat



Domain: Leopard



The highlights of the procedure to dynamically reconfigure the board N0.IB8 board in the wildcat domain include:

- ✔ Disabling all the active controllers on the board.
- ✔ Disabling all the NIC devices used for private communications on the board
- ✔ Disabling all the NIC devices used for public communications on the board
- ✔ Disabling the IO board and removing it
- ✔ Adding the replacement IO board
- ✔ Enabling the replacement board
- ✔ Enabling the public NIC devices
- ✔ Enabling the private NIC devices
- ✔ Enabling the active controllers

To verify the status of the cluster before DR

1. Use the VCS command `hastatus -sum` to verify the current state of the service groups in the cluster. Use the command before reconfiguring the I/O board and after reconfiguration to verify the cluster's state:

```
-- SYSTEM STATE
-- System               State                Frozen
A  leopard              RUNNING              0
A  wildcat              RUNNING              0

-- GROUP STATE
-- Group         System   Probed  AutoDisabled State
B  ServiceGroupA leopard  Y       N            OFFLINE
B  ServiceGroupA wildcat  Y       N            ONLINE
```

2. By using the `cfgadm -lv` command, you can show the I/O boards and cards in the `wildcat` domain. For example:

```
# cfgadm -lv
```

In the output (not shown), the board N0.IB8 is reported to be `connected`, `configured`, and `ok`. In addition, the condition of each of the slots on N0.IB8 are reported.

To disable the controllers on the board

1. Disable the active controllers on the I/O system card using the `vxdmpadm` command:

```
vxdmpadm disable ctlr=ctlr
# vxdmpadm disable ctlr=c2
```

2. Using the `vxdmpadm` command, verify that controller `c2` is disabled:

```
# vxdmpadm listctlr all
CTLR-NAME       ENCLR-TYPE      STATE      ENCLR-NAME
=====================================================
c0              Disk            ENABLED    Disk
c2              HDS9960         DISABLED   HDS99600
c1              HDS9960         ENABLED    HDS99600
```

3. If a card has more than one controller, repeat this command for each controller on the card to be reconfigured.

To list the status of the private network links and to disable them

1. Enter the command `lltstat -nv`:

```
# lltstat -nv
LLT node information:
Node                 State       Links
* 0 wildcat            OPEN        2
1 leopard            OPEN        2
2                    CONNWAIT    0
.
.
```

```
31                   CONNWAIT    0
```

The output shows that both domains have two links for private communication. Both links are “OPEN,” that is, operational.

2 Display the `/etc/llttab` file on the `wildcat` domain.

```
# cat /etc/llttab
set-node wildcat
set-cluster 13
link qfe4 /dev/qfe:4 - ether - -
link qfe0 /dev/qfe:0 - ether - -
```

The devices `qfe0` and `qfe4` are shown as the private network links.

3 Disable the private network link device, `qfe4`,on I/O board N0.IB8

```
# /sbin/lltconfig -u qfe4
```

4 Check the status of the private network links:

```
# lltstat -nv
LLT node information:
Node                 State       Links
* 0 wildcat           OPEN         2
leopard              OPEN        1
2                    CONNWAIT    0
.
.
.
31                   CONNWAIT    0
```

To list the status of the public NICs and to disable them

1 Use the command `ifconfig -a`. For example, `qfe3` (on board N0.IB6) and `qfe7` (on board N0.IB8), the NICs used for the public network connections, are operational.

```
# ifconfig -a
lo0: flags=1000849<UP,LOOPBACK,RUNNING,MULTICAST,IPv4> mtu 8232
index
    1 inet 127.0.0.1 netmask ff000000
ge0: flags=1000843<UP,BROADCAST,RUNNING,MULTICAST,IPv4> mtu 1500
    index 2 inet 10.182.65.99 netmask fffff000 broadcast
    10.182.79.255 ether 0:3:ba:8:ec:40
qfe3:
flags=9040843<UP,BROADCAST,RUNNING,MULTICAST,DEPRECATED,IPv4,
    NOFAILOVER> mtu 1500 index 3 inet 10.182.66.143 netmask
    ffffff00 broadcast 10.255.255.255 groupname mn1 ether
    0:3:ba:8:ec:40
qfe7:
flags=9040843<UP,BROADCAST,RUNNING,MULTICAST,DEPRECATED,IPv4,
    NOFAILOVER> mtu 1500 index 4 inet 10.182.66.144 netmask
    ffffff00 broadcast 10.255.255.255 groupname mn1 ether
    0:3:ba:8:ec:40
```

2. To disable the device `qfe7` on board N0.IB8, use the commands:

   ```
   # ifconfig qfe7 down
   # ifconfig qfe7 unplumb
   ```

   Use the ifconfig -a command to verify that qfe7 is down:

   ```
   # ifconfig -a
   ```

   No information about qfe7 should appear in the output.

To disable and remove the IO board

1. When the controllers and network interface cards are disabled, disconnect the board:

   ```
   # cfgadm -f -c disconnect N0.IB8
   ```

2. Use the `cfgadm -al` command to check the status of N0.IB8. In the output, the fields `Receptable`, `Occupant`, and `Condition` for N0.IB8 show `disconnected`, `unconfigured`, and `unknown` respectively.

The I/O board may be physically removed at this time. Before adding the new board to the wildcat domain, you must test it in another spare domain. Refer to the *Sun Enterprise 6x00, 5x00, 4x00, and 3x00 Systems Dynamic Reconfiguration User's Guide*.

To add the new IO board

Use the following procedure to add the new I/O board. Make sure that the output of the `cfgadm` command shows the slot where the new board is to be added has the status `disconnected`, `unconfigured`, and `unknown`.

1. Physically add the board, connecting all necessary cables, and configure it:

   ```
   # cfgadm -c configure N0.IB8
   ```

2. Run the `cfgadm -al` to verify the board has been configured; the board should be `connected`, `configured`, and `ok`.

3. Reconfigure the network interface cards on the new board:

   ```
   # ifconfig qfe7 plumb
   # ifconfig qfe7 up
   ```

4. Run the command `ifconfig -a` to verify `qfe7` is up and running.

5. Reconfigure LLT to reestablish the private network links:

   ```
   # /sbin/lltconfig -t qfe4 -d /dev/qfe:4
   ```

6. Verify the private network links are restored using the command `lltstat -nv`:

   ```
   # /sbin/lltstat -nv
   ```

7. Enable the controller `c2` on the N0.IB8 using `vxdmpadm` command:

   ```
   # vxdmpadm enable ctlr=c2
   ```

8. Verify the controller is up and running:

   ```
   # vxdmpadm listctlr all
   ```