Sun Enterprise E3000-E6500 CPU/Memory
Board Dynamic Reconfiguration Cook Book
Last update 5/6/99

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Audience

This document is intended for Sun SEs, System Administrators and Operators who need to be able to dynamically reconfigure CPU/Memory boards in the Sun Enterprise E3000-E6500 series servers.

References

Solaris 7 5/99 is required.
Sun Enterprise 6x00, 5x00, 4x00, 3x00 Dynamic Reconfiguration User's Guide
Solaris 7 5/99 Release notes supplement for Sun Hardware
Symon 2.0.1 documentation
cfgadm man page

Introduction

Dynamic Reconfiguration of CPU, Memory and I/O boards during system operation is a feature available exclusively from Sun among all the Unix and Windows NT vendors. It *significantly* increases the availability of a system by allowing upgrades to be done while users on online. The use of this feature is not difficult but does require some planning and understanding of the hardware and software issues involved.

This document outlines the planning and preparation steps. It also provides line by line description of the removal and installation processes and commands. It does not intend to replace the DR User's Guide, but to supplement it. Refer to the DR User's Guide for a complete description of the terms used. Only CPU/Memory boards are addressed currently

Preparation for using DR

Before using DR, a number of configuration decisions must be made and the apropriate changes to files or PROM settings.

System Interleaving controls

In order to unconfigure active CPU/Memory boards, the memory on that board must not be interleaved with other boards. Although there is no apparent difference to the user with interleaving disabled,

performance of the system may change. The Enterprise Server series supports up to 16 way interleaving if a sufficient number of memory banks is installed. The current OBP controls support maximum interleaving or no interleaving.   Interleaving is not a consideration for I/O Board DR/AP configurations.

Note:It is not necessary to disable interleaving if boards will only be added to the system.

Interleaving can be disabled at the OBP prompt and is persistent across reboots and power cycle operations. Make sure to document the fact that interleaving is turned off for a particular system. In addition, any performance analysis of the system should take interleaving into account. Boards may not be removed from the system if the memory on the board is interleaved. Insertion operations of a new board do not require interleaving to be disabled, but the new board will not be interleaved until the next reboot operation.

```
#halt
ok setenv memory-interleave min
ok printenv
ok boot
```

The system can be returned to the default condition with:

```
ok setenv memory-interleave max
ok printenv
```

Configuring /etc/system

Three lines may need to be added to /etc/system in Solaris 7 5/99. This requirement may be removed in future revisions. The system must then be re-booted.

```
#required for I/O DR support
set pln:pln_enable_detach_suspend=1
set soc:soc_enable_detach_suspend=1

#required only for CPU/Memory DR
#required only if CPU/Memory boards are to be removed
set kernel_cage_enable=1
```

DR restrictions and limitations

There are a number of things that can prevent removal or insertion of a CPU/Memory board.

1.   Processes bound to CPUs using pbind. This will prevent the bound CPU from being removed. Unbind processes before removing a board.

2.   Certain memory locking operations prevent a board from being removed. A panic may occur when a database package uses shared memory segments that are 2Gbytes or larger.

3.   The CPU and I/O board assigned as "JTAG" master are considered critical resources and cannot be removed. This is lowest numbered board, and it is listed as non-detachable by `cfgadm -s cols=ap_id:info` command.

4.   The board in which the Solaris kernel resides can not be removed. It is noted as "perma-nent" by cfgadm.

5.   CPU/Memory boards in which memory is interleaved cannot be removed.

6.   The machine must be running CPU OBP version 3.2.21

7.   Inserting a failed board can immediately crash the system (post doesn't catch all errors -- connecting a bad board that passes post can crash the system) (Workaround: Must insert a "known good" component)

8.   DR connect operation hangs in single user mode. The work around is to manually load lock manager module before doing DR operation.

> 32-bit kernel:
>   # modload /kernel/misc/klmmod
> 64-bit kernel:
>   # modload /kernel/misc/sparcv9/klmmod

9.   Currently, the insertion of two or more boards is not supported, unless each new board is first connected and configured before the next new board is inserted (WORKAROUND: You must connect and configure each new board before inserting the next board)

Inserting and removing boards

CPU/Memory boards are easy to insert and remove. There are no cabling issues as in the I/O Board. There are only a few things to be aware of.

1.   Boards should be inserted or removed firmly and in less than 1 second. Delays longer than 1 second cause the bus to stall and the system to crash.

2.   Proper anti-static precautions should always be observed.

3.   On E3xxx - E5xxx a blank filler board should be inserted when a board is removed. This is to maintain proper cooling. For E6xxx a "load" board should be inserted.

4.   Observe the LED status before removing the board. Correct status is:

Power	Service	Running
Off	Yellow	Off

5.   Console messages will indicate when boards are inserted or removed.

Unconfiguring a CPU/Memory Board

These steps are required to drain the memory, unconfigure and disconnect a CPU/Memory board. For a complete description of the terms and device names, refer to the DR User's Guide.

The demonstration system is an E6500 with 4.864 GB of RAM and 5 CPU Memory boards. Before starting the operation, vmstat shows 4.6 GB free RAM. (Always ignore the first line as it is an average since boot time.)

Checking the current system status

```
# vmstat 5
 procs     memory            page            disk          faults      cpu
 r b w   swap   free  re  mf pi po fr de sr s0 s1 s2 s3   in   sy   cs us sy id
 0 0 0 4007448 4243888 0   5  7  3  3  0  0  1  0  0  0  148  213   47  0  0 100
 0 0 0 4382200 4668128 0   1  0  0  0  0  0  0  0  0  0  155    5   36  0  0 100
```

prtdiag itemizes the complete CPU/Memory configuration. Note the 1-way interleaving. Board 2 has been selected to be removed.

```
System Configuration:  Sun Microsystems  sun4u 16-slot Sun Enterprise E6500
System clock frequency: 84 MHz
Memory size: 4864Mb

======================== CPUs ========================

                       Run    Ecache    CPU     CPU
Brd   CPU   Module     MHz      MB      Impl.   Mask
---   ---   -------   -----   ------   ------   ----
 0     0       0       336     4.0     US-II    2.0
 0     1       1       336     4.0     US-II    2.0
 2     4       0       336     4.0     US-II    2.0
 2     5       1       336     4.0     US-II    2.0
 4     8       0       336     4.0     US-II    2.0
 4     9       1       336     4.0     US-II    2.0
 8    16       0       336     4.0     US-II    2.0
 8    17       1       336     4.0     US-II    2.0
10    20       0       336     4.0     US-II    2.0
10    21       1       336     4.0     US-II    2.0


======================== Memory ========================

                                            Intrlv.  Intrlv.
Brd   Bank   MB    Status   Condition  Speed  Factor   With
---   -----  ----  -------  ---------  -----  -------  -------
 0     0    1024   Active      OK      60ns   1-way
 0     1     256   Active      OK      60ns   1-way
 2     0    1024   Active      OK      60ns   1-way
 2     1     256   Active      OK      60ns   1-way
 4     0    1024   Active      OK      60ns   1-way
 4     1     256   Active      OK      60ns   1-way
 8     0     256   Active      OK      60ns   1-way
 8     1     256   Active      OK      60ns   1-way
10     0     256   Active      OK      60ns   1-way
10     1     256   Active      OK      60ns   1-way
```

cfgadm is the command the provides the status and control for system boards. With no options, it lists the receptacles, occupants and condition. "ac1" is the device name for memory associated with the board in slot 2.   The device names for memory are assigned chronologically, not by board number. cfgadm -s cols=ap_id:info can be used to associate the "ac" number with the slot number.

```
# cfgadm
Ap_Id                Receptacle   Occupant     Condition
ac0:bank0            connected    configured   ok
ac0:bank1            connected    configured   ok
ac1:bank0            connected    configured   ok
ac1:bank1            connected    configured   ok
```

```
ac2:bank0              connected    configured    ok
ac2:bank1              connected    configured    ok
ac3:bank0              connected    configured    ok
ac3:bank1              connected    configured    ok
ac4:bank0              connected    configured    ok
ac4:bank1              connected    configured    ok
sysctrl0:slot0         connected    configured    ok
sysctrl0:slot1         connected    configured    ok
sysctrl0:slot2         connected    configured    ok
sysctrl0:slot3         connected    configured    ok
sysctrl0:slot4         connected    configured    ok
sysctrl0:slot5         connected    configured    ok
sysctrl0:slot6         empty        unconfigured unknown
sysctrl0:slot7         connected    configured    ok
sysctrl0:slot8         connected    configured    ok
sysctrl0:slot9         connected    configured    ok
sysctrl0:slot10        connected    configured    ok
sysctrl0:slot11        empty        unconfigured unknown
sysctrl0:slot12        empty        unconfigured unusable
sysctrl0:slot13        empty        unconfigured unknown
sysctrl0:slot14        empty        unconfigured unusable
sysctrl0:slot15        empty        unconfigured unknown
```

This cfgadm command provides more information about the boards in the system. ac4 memory is marked as "permanent". This is because the kernel resides there and cannot be mapped out.

Boards in slot 0 (CPU) and slot 1 (I/O) are marked "non-detachable because they are considered "critical resources". The lowest numbered CPU/Memory board is assigned the job of "JTAG master" and cannot be detached.

```
# cfgadm -s cols=ap_id:info
Ap_Id               Information
ac0:bank0           slot0 1Gb base 0x0
ac0:bank1           slot0 256Mb base 0xc0000000
ac1:bank0           slot2 1Gb base 0x40000000
ac1:bank1           slot2 256Mb base 0xd0000000
ac2:bank0           slot4 1Gb base 0x80000000
ac2:bank1           slot4 256Mb base 0xe0000000
ac3:bank0           slot8 256Mb base 0xf0000000
ac3:bank1           slot8 256Mb base 0x100000000
ac4:bank0         slot10 256Mb base 0x110000000 permanent
ac4:bank1         slot10 256Mb base 0x120000000 permanent
sysctrl0:slot0      non-detachable   100 MHz capable
sysctrl0:slot1      non-detachable   100 MHz capable
sysctrl0:slot2      cpu 0: 336 MHz cpu 1: 336 MHz 100 MHz capable
sysctrl0:slot3      100 MHz capable
sysctrl0:slot4      100 MHz capable
sysctrl0:slot5      100 MHz capable
sysctrl0:slot6
sysctrl0:slot7      100 MHz capable
sysctrl0:slot8      100 MHz capable
sysctrl0:slot9      100 MHz capable
sysctrl0:slot10     100 MHz capable
sysctrl0:slot11
sysctrl0:slot12
sysctrl0:slot13
sysctrl0:slot14
sysctrl0:slot15


Starting the process
```

The cfgadm command is used to drain memory first. Each of the 2 memory banks must be unconfigured separately.

Note: It is not necessary to issue these commands at the system console; however, there will be system messages at the console providing the status of installed and removed boards.

```
# cfgadm -c unconfigure ac1:bank0
Mar  3 11:48:22 whirlwind unix: NOTICE: unconfiguring memory bank 0 in slot 2
Mar  3 11:48:23 whirlwind unix: NOTICE: memory bank 0 in slot 2 is unconfigured


# cfgadm -c unconfigure ac1:bank1
Mar  3 11:49:33 whirlwind unix: NOTICE: unconfiguring memory bank 1 in slot 2
Mar  3 11:49:34 whirlwind unix: NOTICE: memory bank 1 in slot 2 is unconfigured
```

psrinfo shows 10 CPUs online. CPU 4 and 5 are associated with Board 2. (CPU number = board number times 2 and times 2 plus 1.)

```
# psrinfo
0        on-line    since 03/02/99 15:27:57
1        on-line    since 03/02/99 15:27:57
4        on-line    since 03/02/99 15:28:08
5        on-line    since 03/02/99 15:28:08
8        on-line    since 03/02/99 15:03:42
9        on-line    since 03/02/99 15:03:42
16       on-line    since 03/02/99 15:03:42
17       on-line    since 03/02/99 15:03:42
20       on-line    since 03/02/99 15:03:42
21       on-line    since 03/02/99 15:03:42
```

Our next step is to unconfigure the board. Solaris will take any processes off of CPU 4 and 5 and re-schedule them on the remaining CPUs. It is not necessary to use psradm to offline the CPUs

```
# cfgadm -c unconfigure sysctrl0:slot2
Mar  3 11:50:13 whirlwind unix: NOTICE: unconfiguring cpu board in slot 2
Mar  3 11:50:14 whirlwind unix: NOTICE: Processor 4 powered off.
Mar  3 11:50:14 whirlwind unix: NOTICE: Processor 5 powered off.
Mar  3 11:50:15 whirlwind unix: NOTICE: cpu board in slot 2 is unconfigured
```

Use cfgadm with no option to check the board status. Note that the ac1 memory banks are now gone. Slot 2 is unconfigured but still connected.

```
# cfgadm
Ap_Id                  Receptacle   Occupant      Condition
ac0:bank0              connected    configured    ok
ac0:bank1              connected    configured    ok
ac2:bank0              connected    configured    ok
ac2:bank1              connected    configured    ok
ac3:bank0              connected    configured    ok
ac3:bank1              connected    configured    ok
ac4:bank0              connected    configured    ok
ac4:bank1              connected    configured    ok
sysctrl0:slot0         connected    configured    ok
sysctrl0:slot1         connected    configured    ok
sysctrl0:slot2         connected    unconfigured ok
sysctrl0:slot3         connected    configured    ok
sysctrl0:slot4         connected    configured    ok
sysctrl0:slot5         connected    configured    ok
sysctrl0:slot6         empty        unconfigured unknown
sysctrl0:slot7         connected    configured    ok
sysctrl0:slot8         connected    configured    ok
sysctrl0:slot9         connected    configured    ok
sysctrl0:slot10        connected    configured    ok
```

```
sysctrl0:slot11      empty          unconfigured unknown
sysctrl0:slot12      empty          unconfigured unusable
sysctrl0:slot13      empty          unconfigured unknown
sysctrl0:slot14      empty          unconfigured unusable
sysctrl0:slot15      empty          unconfigured unknown
```

Final step is logically disconnecting the board so that it can be removed.

```
# cfgadm -c disconnect sysctrl0:slot2
Mar  3 11:50:48 whirlwind unix: NOTICE: disconnecting cpu board in slot 2
Mar  3 11:50:49 whirlwind unix: NOTICE: cpu board in slot 2 is disconnected
Mar  3 11:50:49 whirlwind unix: NOTICE: board 2 is ready to remove
```

cfgadm now shows slot2 as disconnected and unconfigured.

```
# cfgadm
Ap_Id                  Receptacle   Occupant     Condition
ac0:bank0              connected    configured   ok
ac0:bank1              connected    configured   ok
ac2:bank0              connected    configured   ok
ac2:bank1              connected    configured   ok
ac3:bank0              connected    configured   ok
ac3:bank1              connected    configured   ok
ac4:bank0              connected    configured   ok
ac4:bank1              connected    configured   ok
sysctrl0:slot0         connected    configured   ok
sysctrl0:slot1         connected    configured   ok
sysctrl0:slot2         disconnected unconfigured unknown
sysctrl0:slot3         connected    configured   ok
sysctrl0:slot4         connected    configured   ok
sysctrl0:slot5         connected    configured   ok
sysctrl0:slot6         empty        unconfigured unknown
sysctrl0:slot7         connected    configured   ok
sysctrl0:slot8         connected    configured   ok
sysctrl0:slot9         connected    configured   ok
sysctrl0:slot10        connected    configured   ok
sysctrl0:slot11        empty        unconfigured unknown
sysctrl0:slot12        empty        unconfigured unusable
sysctrl0:slot13        empty        unconfigured unknown
sysctrl0:slot14        empty        unconfigured unusable
sysctrl0:slot15        empty        unconfigured unknown
```

You may now remove the board in slot 2. The console will issue a message that the board was removed.

Configuring a newly installed board

After installing a new CPU/Memory board, there are several status commands that can be used to determine the status of the system. This partial listing from prtdiag indicates that there is a board in slot 2 that is disabled.

```
# /usr/platform/sun4u/sbin/prtdiag
System Configuration:  Sun Microsystems  sun4u 16-slot Sun Enterprise E6500
System clock frequency: 84 MHz
Memory size: 3584Mb

======================== CPUs ========================

                    Run    Ecache   CPU     CPU
Brd   CPU   Module   MHz      MB    Impl.   Mask
---   ---   -------  -----  ------  ------  ----
 0     0      0       336    4.0    US-II    2.0
 0     1      1       336    4.0    US-II    2.0
 4     8      0       336    4.0    US-II    2.0
```

```
    4      9     1       336    4.0   US-II    2.0
    8     16     0       336    4.0   US-II    2.0
    8     17     1       336    4.0   US-II    2.0
   10     20     0       336    4.0   US-II    2.0
   10     21     1       336    4.0   US-II    2.0



========================= Memory =========================

                                          Intrlv.  Intrlv.
Brd    Bank    MB     Status    Condition  Speed   Factor   With
---    ----    ----   -------   ---------  -----   -------  -------
  0      0    1024    Active       OK      60ns    1-way
  0      1     256    Active       OK      60ns    1-way
  4      0    1024    Active       OK      60ns    1-way
  4      1     256    Active       OK      60ns    1-way
  8      0     256    Active       OK      60ns    1-way
  8      1     256    Active       OK      60ns    1-way
 10      0     256    Active       OK      60ns    1-way
 10      1     256    Active       OK      60ns    1-way


Detached Boards
===============
  Slot   State       Type            Info
  ----   ---------   ------          ---------------------------------------
    2    disabled    cpu
```

vmstat indicates about 3.3 GB of free ram

```
# vmstat 5
 procs       memory              page                disk          faults        cpu
 r b w    swap    free   re  mf pi po fr de sr s0 s1 s2 s3   in    sy   cs us sy id
 0 0 0 3968088 4198936  0   4  5  2  2  0  0  1  0  0  0  135  183   40  0  1 99
 0 0 0 3249616 3376520  0   1  0  0  0  0  0  2  0  0  0  157    7   39  0  0 100
```

cfgadm indicates that the board is disconnected currently.

```
# cfgadm
Ap_Id                 Receptacle    Occupant     Condition
ac0:bank0             connected     configured   ok
ac0:bank1             connected     configured   ok
ac2:bank0             connected     configured   ok
ac2:bank1             connected     configured   ok
ac3:bank0             connected     configured   ok
ac3:bank1             connected     configured   ok
ac4:bank0             connected     configured   ok
ac4:bank1             connected     configured   ok
sysctrl0:slot0        connected     configured   ok
sysctrl0:slot1        connected     configured   ok
sysctrl0:slot2        disconnected  unconfigured unknown
sysctrl0:slot3        connected     configured   ok
sysctrl0:slot4        connected     configured   ok
sysctrl0:slot5        connected     configured   ok
sysctrl0:slot6        empty         unconfigured unknown
sysctrl0:slot7        connected     configured   ok
sysctrl0:slot8        connected     configured   ok
sysctrl0:slot9        connected     configured   ok
sysctrl0:slot10       connected     configured   ok
sysctrl0:slot11       empty         unconfigured unknown
sysctrl0:slot12       empty         unconfigured unusable
sysctrl0:slot13       empty         unconfigured unknown
sysctrl0:slot14       empty         unconfigured unusable
sysctrl0:slot15       empty         unconfigured unknown
```

Upon configuring an installed board, the system will put it through a POST. This takes about 60 seconds and *will stall all activity* on the system during this time.

```
# cfgadm -v -c configure sysctrl0:slot2
system will be temporarily suspended to connect a board: proceed (yes/no)?y
<60 second system stall>

Mar  3 11:58:32 whirlwind unix: NOTICE: connecting cpu board in slot 2
Mar  3 11:59:37 whirlwind unix: NOTICE: cpu board in slot 2 is connected
Mar  3 11:59:37 whirlwind unix: NOTICE: configuring cpu board in slot 2
Mar  3 11:59:37 whirlwind unix: NOTICE: cpu board in slot 2 is configured
```

cfgadm now indicates that slot2 is connected and configured. The memory, however, at ac1 still needs to be configured.

```
# cfgadm
Ap_Id                  Receptacle   Occupant     Condition
ac0:bank0              connected    configured   ok
ac0:bank1              connected    configured   ok
ac1:bank0              connected    unconfigured unknown
ac1:bank1              connected    unconfigured unknown
ac2:bank0              connected    configured   ok
ac2:bank1              connected    configured   ok
ac3:bank0              connected    configured   ok
ac3:bank1              connected    configured   ok
ac4:bank0              connected    configured   ok
ac4:bank1              connected    configured   ok
sysctrl0:slot0         connected    configured   ok
sysctrl0:slot1         connected    configured   ok
sysctrl0:slot2         connected    configured   ok
sysctrl0:slot3         connected    configured   ok
sysctrl0:slot4         connected    configured   ok
sysctrl0:slot5         connected    configured   ok
sysctrl0:slot6         empty        unconfigured unknown
sysctrl0:slot7         connected    configured   ok
sysctrl0:slot8         connected    configured   ok
sysctrl0:slot9         connected    configured   ok
sysctrl0:slot10        connected    configured   ok
sysctrl0:slot11        empty        unconfigured unknown
sysctrl0:slot12        empty        unconfigured unusable
sysctrl0:slot13        empty        unconfigured unknown
sysctrl0:slot14        empty        unconfigured unusable
sysctrl0:slot15        empty        unconfigured unknown
```

drvconfig builds the device entries for the new memory. There is no console response for this command.

```
# drvconfig -i ac
```

Before configuring the memory banks, they must be tested using the cfgadm commands. The quick test takes about 65 seconds for 1 GB of RAM.

```
# cfgadm -o quick -t ac1:ba nk0
# cfgadm -o quick -t ac1:bank1
```

After a succesful test, the memory can be configured.

```
# cfgadm -c configure ac1:bank0
Mar  3 12:12:11 whirlwind unix: NOTICE: configuring memory bank 0 in slot 2
Mar  3 12:12:12 whirlwind unix: NOTICE: memory bank 0 in slot 2 is configured
```

```
# cfgadm -c configure ac1:bank1
Mar  3 12:12:33 whirlwind unix: NOTICE: configuring memory bank 1 in slot 2
Mar  3 12:12:33 whirlwind unix: NOTICE: memory bank 1 in slot 2 is configured
```

cfgadm now shows slot2 and memory banks ac1 fully configured.

```
# cfgadm
Ap_Id                   Receptacle    Occupant       Condition
ac0:bank0               connected     configured     ok
ac0:bank1               connected     configured     ok
ac1:bank0               connected     configured     ok
ac1:bank1               connected     configured     ok
ac2:bank0               connected     configured     ok
ac2:bank1               connected     configured     ok
ac3:bank0               connected     configured     ok
ac3:bank1               connected     configured     ok
ac4:bank0               connected     configured     ok
ac4:bank1               connected     configured     ok
sysctrl0:slot0          connected     configured     ok
sysctrl0:slot1          connected     configured     ok
sysctrl0:slot2          connected     configured     ok
sysctrl0:slot3          connected     configured     ok
sysctrl0:slot4          connected     configured     ok
sysctrl0:slot5          connected     configured     ok
sysctrl0:slot6          empty         unconfigured unknown
sysctrl0:slot7          connected     configured     ok
sysctrl0:slot8          connected     configured     ok
sysctrl0:slot9          connected     configured     ok
sysctrl0:slot10         connected     configured     ok
sysctrl0:slot11         empty         unconfigured unknown
sysctrl0:slot12         empty         unconfigured unusable
sysctrl0:slot13         empty         unconfigured unknown
sysctrl0:slot14         empty         unconfigured unusable
sysctrl0:slot15         empty         unconfigured unknown
```

psrinfo indicates that CPU 4 and 5 (on board 2) on powered off. They must be enabled with the psradm command. This allows Solaris to begin utilizing the CPUs.

```
# psrinfo
0       on-line    since 03/02/99 15:27:57
1       on-line    since 03/02/99 15:27:57
4       powered-off  since 03/03/99 08:54:09
5       powered-off  since 03/03/99 08:54:09
8       on-line    since 03/02/99 15:03:42
9       on-line    since 03/02/99 15:03:42
16      on-line    since 03/02/99 15:03:42
17      on-line    since 03/02/99 15:03:42
20      on-line    since 03/02/99 15:03:42
21      on-line    since 03/02/99 15:03:42

# psradm -n 4 5

# psrinfo
0       on-line    since 03/02/99 15:27:57
1       on-line    since 03/02/99 15:27:57
4       on-line    since 03/03/99 08:57:17
5       on-line    since 03/03/99 08:57:17
8       on-line    since 03/02/99 15:03:42
9       on-line    since 03/02/99 15:03:42
16      on-line    since 03/02/99 15:03:42
17      on-line    since 03/02/99 15:03:42
20      on-line    since 03/02/99 15:03:42
21      on-line    since 03/02/99 15:03:42
```

vmstat now indicates 4.67 GB of free ram

```
# vmstat 5
 procs     memory             page            disk          faults      cpu
 r b w   swap  free  re  mf pi po fr de sr s0 s1 s2 s3  in   sy   cs us sy id
 0 0 0 105000 238520  0   0  0  0  0  0  0  0  0  0  0 162   41   49  0  0 100
 0 0 0 4381840 4671560 0  1  0  0  0  0  0  0  0  0  0 154    6   37  0  0 100
```

prtdiag shows all CPUs and boards in place.

```
# /usr/platform/sun4u/sbin/prtdiag
System Configuration:  Sun Microsystems  sun4u 16-slot Sun Enterprise E6500
System clock frequency: 84 MHz
Memory size: 4864Mb

========================= CPUs =========================

                    Run    Ecache   CPU     CPU
Brd  CPU   Module   MHz      MB     Impl.   Mask
---  ---   ------   -----  ------   ------  ----
 0    0      0      336     4.0     US-II    2.0
 0    1      1      336     4.0     US-II    2.0
 2    4      0      336     4.0     US-II    2.0
 2    5      1      336     4.0     US-II    2.0
 4    8      0      336     4.0     US-II    2.0
 4    9      1      336     4.0     US-II    2.0
 8   16      0      336     4.0     US-II    2.0
 8   17      1      336     4.0     US-II    2.0
10   20      0      336     4.0     US-II    2.0
10   21      1      336     4.0     US-II    2.0


========================= Memory =========================

                                             Intrlv.  Intrlv.
Brd   Bank   MB    Status   Condition  Speed  Factor   With
---   -----  ----  -------  ---------  -----  -------  -------
 0     0     1024  Active      OK      60ns   1-way
 0     1      256  Active      OK      60ns   1-way
 2     0     1024  Active      OK      60ns   1-way
 2     1      256  Active      OK      60ns   1-way
 4     0     1024  Active      OK      60ns   1-way
 4     1      256  Active      OK      60ns   1-way
 8     0      256  Active      OK      60ns   1-way
 8     1      256  Active      OK      60ns   1-way
10     0      256  Active      OK      60ns   1-way
10     1      256  Active      OK      60ns   1-way

========================= IO Cards =========================

      Bus   Freq
Brd   Type  MHz   Slot  Name                               Model
---   ----  ----  ----  ---------------------------------  ---------------------
 1    SBus   25    0    DOLPHIN,sci
 1    SBus   25    2    QLGC,isp/sd (block)                QLGC,ISP1000U
 1    SBus   25    3    SUNW,hme
 1    SBus   25    3    SUNW,fas/sd (block)
 1    SBus   25   13    SUNW,socal/sf (scsi-3)             501-3060
 3    SBus   25    0    DOLPHIN,sci
 3    SBus   25    3    SUNW,hme
 3    SBus   25    3    SUNW,fas/sd (block)
 3    SBus   25   13    SUNW,socal/sf (scsi-3)             501-3060
 5    SBus   25    0    QLGC,isp/sd (block)                QLGC,ISP1000U
 5    SBus   25    2    QLGC,isp/sd (block)                QLGC,ISP1000
 5    SBus   25    3    SUNW,hme
 5    SBus   25    3    SUNW,fas/sd (block)
 5    SBus   25   13    SUNW,socal/sf (scsi-3)             501-3060
 7    SBus   25    2    QLGC,isp/sd (block)                QLGC,ISP1000
 7    SBus   25    3    SUNW,hme
```

```
7    SBus    25     3    SUNW,fas/sd (block)
7    SBus    25    13    SUNW,socal/sf (scsi-3)              501-3060
9    PCI     33     1    SUNW,hme-pci108e,1001              SUNW,cheerio
9    PCI     33     3    SUNW,isptwo/sd (block)             QLGC,ISP1040B

No failures found in System
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```