# Memory Driver Performance

**TABLE 1. Memory Performance Comparison - N x MB (integer N) copies**

| | SPARC 10/41 OS 4.1.3 | DEC Alpha 2100/ A500MP OSF/1 V3.0 | DEC Alpha 3000/M400 OSF 1.3 | DEC 5000/240 Ultrix | SGI, Crimson Elan, IRIX 4.0.4 | SGI, Challenge L IRIX 5.2 |
|---|---|---|---|---|---|---|
| Aligned Memory Copy | 17-24 MB/s | 64 MB/s | 49 MB/s | 25 MB/s | 9.5 MB/s | 10 MB/s |
| Unaligned Memory Copy | 17 MB/s | 64 MB/s | 44 MB/s | 20 MB/s | 0.43 MB/s | 0.4 MB/s |
| Subroutine Call | 16 us | < 1 us | < 1 us | 19 us | 1 us | 11 \| 15 us |
| Register to Memory (8 bytes) | 39 MB/s | 269 MB/s | 98 MB/s | 50 MB/s | 52 MB/s | 52 MB/s |
| Register to Memory (4 bytes) | 48 MB/s | 154 MB/s | 90 MB/s | 31 MB/s | 35 MB/s | 60 MB/s |
| Allocate and Clear Memory | 11 MB/s | 42 MB/s | 56 MB/s | 24 MB/s | 26 MB/s | 30 MB/s |

**TABLE 2. Memory Performance Comparison - F x MB (F non-integral) copies**

| | SPARC 10/40 OS 4.1.3 | SPARC 10/612 Solaris 2.4 | DEC Alpha 2100/ A500MP OSF/1 V3.0 | DEC Alpha 3000/M400 OSF/1 V1.3 | DEC 5000/240 Ultrix | SGI, Crimson Elan, IRIX 4.0.4 | SGI, Challenge L IRIX 5.1 |
|---|---|---|---|---|---|---|---|
| Aligned Memory Copy | 17-19 MB/s | 26 MB/s | 90 MB/s | 52 MB/s | 25 MB/s | 26/52 MB/s | 39 MB/s |
| Unaligned Memory Copy | 17 MB/s | 26 MB/s | 90 MB/s | 42 MB/s | 20 MB/s | 4.2 MB/s | 7.5 MB/s |
| Subroutine Call | 16 us | 1 | < 1 us | < 1 us | 19 us | 1 us | 10 us |
| Register to Memory (2 words) | 30 MB/s | 60.1 MB/s | 251 MB/s | 108 MB/s | 50 MB/s | 45/78 MB/s | 80 MB/s |
| Register to Memory (1 word) | 30 MB/s | 70 MB/s | 151 MB/s | 94 MB/s | 31 MB/s | 30/40 MB/s | 60 MB/s |
| Allocate and Clear Memory | 11 MB/s | 13 MB/s | 42 MB/s | 52 MB/s | 24 MB/s | 5.7 MB/s | 29 MB/s |
| | | | | | | | |
| MIPS (ratio) | 3.3 | | | | (3.2) | | (6.1) |
| mixed arith-metic bench-mark (ratio) | (1.0) 6.1 MIPS | | | | (2.1) o-all(3.0) | | (4.6) |
| FMIPS (ratio) | (1.0) 20 MIPS | (1.33) | (13.2) | (8.7) | (0.55) | (2.2) | (1.4) non-brch (7.2) |

## Summary:

For the memory sub-system, except for the DEC Alpha, the all machines seem to have similar speed memory chips (See the number after each architecture).    The SGI system has very uneven performance (re: size of buffer being copied) which may be caused by interleaving memory, and/or a poor memory driver.

Performance ordering:

1) Dec 2100/A500MP (Alpha)            128 MB mem

2) Dec 3000/M400 (Alpha)              128 MB mem

3) SGI, Challenge L R4400/CR5.0, IRIX 5.2    * (***) (70 ns memory chip)

4) Dec 5000                 (80 ns memory chip)

5) SGI, Crimson Elan, IRIX 4.0.4    *              (80 ns)

6) Sparc-20/612            (80 ns)

7) Sparc-1000 ** (70 ns)

8) Sparc-10/40 (80 ns)

* If there are many unaligned memory operations on SGI machines, the performance would be worse than SPARCstations.

** The overall performance of Sparc1000 is about 20-22% faster than Sparc10.

*** The SGI memory sub-system exhibits the following problems:

(1) Copy operation is three times slower when memory is allocated at integral megabyte boundaries (1MB, 2MB, ...)

(2) Unaligned memory operations are four times slower than aligned operations.

(3) When using unaligned memory operations, AND integral megabyte buffers, then the operations are 25 to 80 time slower than the fastest case.

# Notation:

The following Benchmarks use ratio comparing to Sparc-10 or whatever has a number in a pair of parenthesis (). The number in the () is the benchmark from **benchnew** and considered as ratio **1.** On page 6, everything is from benchnew and does not use the ratio.

The SCSI disk testing is done on one SCSI controller with multiple disk drives attached.

**TABLE 3. Overall Performance Comparison - 0.5-0.98 x MB copies**

| | Sun 4-110<br>SunOS4.1.3 | SPARC 1+ OS 4.1.3 / Solaris 2.3 | Sparc5-85 Solaris 2.4 | SPARC 10/40 OS 4.1.3 | SPARC 20/60 Solaris 2.4 | DEC Alpha 2100/ A500MP OSF1/V3.0 | 486/66-32MB |
|---|---|---|---|---|---|---|---|
| Aligned Memory Copy | 5.7 MB/s | 7.3 MB/s<br>same | 25 MB/s | 17-26 MB/s | 32 MB/s | 84 \| 112 MB/s | 13 MB |
| Unaligned Memory Copy | 4.1 MB/s | 5.99 MB/s<br>same | 22.5 MB/s | 24 MB/s | 30 MB/s | 84 \| 95 MB/s | 13 MB |
| Subroutine Call | 1 us | 16 / 4 us | 2 us | 10 us | 1 | < 1 us | 32 us |
| Register to Memory (8 bytes) | 6.55 MB/s | 10 MB/s<br>12.7 MB/s | 60 MB/s | 45 MB/s | 72 MB/s | 224 MB/s | 15 MB |
| Register to Memory (4 bytes) | 5.8 MB/s | 10 MB/s<br>11 MB/s | 45 MB/s | 53 MB/s | 75 MB/s | 134 MB/s | 34 MB |
| Allocate & Clear Memory | 4.3 MB/s | 3.8 MB/s<br>3.4 MB/s | 8.88 MB/s | 12.7 MB/s | 13.5 MB/s | 44.5 MB/s | 15 MB |
| | | | | | | | |
| MIPS | | | 1.25 | (3.3 MIPS) | 1.45 | 7.36 | |
| mixed arithmetic benchmark (ratio) | | | 1.4 | (6.05MIPS) | 1.5<br>2.5/125Mhz | 6.87<br>no brench<br>14.4 \| 13.2 | 1.5 |
| FMIPS | 1.13/20 = 0.0565 | 0.11 | 0.6 | 1.0 / (20MIPS) | 1.5<br>2.6/125Mhz | 1.11 | |
| VFFT — $128^3$ | | | | | | | |
| | | | | | | | |
| Disk SCSI<br>1 disk<br>MB/s | | | | Maximum disk R/rate<br>W/3.47 | Maximum disk R/rate<br>W/3.56 | | N/A |
| 2 disks | | | | R/6.8<br>W6.2 | R/8.32<br>W/6.5 | | |
| 3 disks | | | | R/8.1<br>W/6.5 | R/8.52<br>W/6.5 | | |
| 4 disks | | | | | | | |

The OPTi chipset has slice better memory speed but little lower calculation speed. BSDi has 10% better overall performance than both FreeBSD and Linux.

**Table 4:** Overall **Performance Comarison**

| | Sparc 10/42 Solaris 2.4 | Sparc 2 | Sparc 1000 Solaris 2.4 | Pentium100 Linux 1.2.3 | Pentium60 BSDi 2.0 | Pentium100 BSDi 2.0 | Pentium100 FreeBSD 2.1 |
|---|---|---|---|---|---|---|---|
| Aligned Memory Copy | 24 MB | 5.7 MB | 25 MB | 21 MB/s | 18 MB | 23 MB/s | |
| Unaligned Memory Copy | 21.6 MB | 5.3 MB | 23 MB | 21 MB/s | 18 MB | 23 MB/s | |
| Subroutine Call | 1 us | 12 us | < 1us | 5 us | 22 | 4 | |
| Register to Memory (8 bytes) | 51 MB | 13 MB | 52 MB | 73 MB/s | 64 MB | 80 MB/s | |
| Register to Memory (4 bytes) | 48.75 MB | 13 MB | 55 MB | 36 MB/s | 32 MB | 40 MB/s | |
| Allocate & Clear Memory | 9.1MB | 5 MB | 13 MB | 15 MB/s | 10.5 MB | 14 MB/s | |
| | | | | | | | |
| MIPS | (3.3 MIPS) | | 1.25 | 8.48 | 5.5 | 9.1 | |
| mixed arith-metic bench-mark (ratio) | (6.05MIPS ) | | 1.4 | 4.05 | 2.76 | 4.6 | |
| FMIPS | 1.0 / (20MIPS) | 0.4 | 1.25 | 0.8 | 0.57 | 0.9 | |
| VFFT — $128^3$ | 50s | 2:39m | | N/A | 45s | 21-26s | |
| 128 x $256^2$ | 7:04m | 11:37m | 2:50 | N/A | | 1:50m | |
| Disk SCSI | 1R/Max<br>1W/3.56 | 2R/.8.32<br>2W/6.2 | 3R/8.52<br>3W/6.5 | See Below | N/A | See Below | |
| Buslogic BT-946C MB/s | For PC only | | | 1R/MAX 2R/7.2<br>3R/7.5 4R/7.8 | | | |
| NCR53c810 MB/s | single controller For PC only | | | | 1R/Max 2R/6.7<br>3R/7.2 4R/8.2<br>1W/3.07 2W/5.5<br>3-4W/6 MBps | | |

## **Table 5:** Overall **Performance Comarison for Pentinum**

| Pentium100 FreeBSD 2.1<br><br>**See** *Comments for* **more** M/B **info**. | ASUS PCI/-P54SP4 SIS 70ns | ASUS PCI/ I-P54TP4 Intel Triton 70-60ns | PN-2000 Intel neptune 70ns | Baby-AT Intel neptune 70-60ns | PT-2000 Intel Triton 60ns | **(at 75MHz)** ZAPPA Intel Triton P5/PCI 70-60ns | HP VECRA XV 5/90 Pentium 90 |
|---|---|---|---|---|---|---|---|
| Aligned Memory Copy | 27 MB/s | 31.5 MB/s | 23 | 21 | 1% slower than ASUS mother-board<br><br>120 MHz (60 Mhz bus - memory 70ns) the memory subsystem is better than ASUS SIS at 66 MHz bus speed | 22 | 27 |
| Unaligned Memory Copy | 27 MB/s | 31.6 | 23 | 21 | | 22 | 27 |
| Subroutine Call | 2 us | 2 | 4 | 1 | | 2 | 2 |
| Register to Memory (8 bytes) | 91 MB/s | 104 | 80 | 73 | | 77 | 86 |
| Register to Memory (4 bytes) | 45 MB/s | 52 | 40 | 36.5 | | 42 | 43 |
| Allocate & Clear Memory | 17 MB/s | 20.5 | 14 | 14 | | 15.5 | 16 |
| | | | | | | | |
| MIPS | 31.5 | 31.6 | 31 | 31 | 31.27 | 23.5 | 28.4 |
| mixed arith-metic bench-mark (ratio) | 28.5 | 28.7 | 28 | 28 | 28.2 | 21.25 | 25.8 |
| FMIPS | 19.26 | 19.15 | 19 | 19 | | 15 | 17.4 |
| VFFT — $128^3$ (BSD/OS)<br><br>(FreeBSD) | 26s / 64MB<br>26s / 32MB<br><br>24s / 32MB | 25s / 64MB<br>25s / 32MB<br>21s / 64MB<br>24s / 32MB | 26s / 96MB<br>28s / 32MB | | | N/A | N/A |
| 128 x $256^2$ (BSD/OS)<br><br>(FreeBSD) | 2:24/64MB<br>7:31/32MB | 1:54/64MB<br>7:25/32MB<br>1:50/64MB<br>5:09/32MB | 2:03/96MB | | | N/A | N/A |
| Disk SCSI | NCR53c810 | | | | | | N/A |
| One controller MByte/sec.<br>Two Controllers | 1R/Max 2R/8.3<br>3R/8.4 4R/8.55<br>3R/15.0 4R/16 | | 3R/8.4 4R/8.55<br>3R/14.8 4R/16.5 | | 1W/56-51%R 2W/6.0<br><br>3W/8.8 4W/11.6 | | |
| 3 Controllers | 5R/19<br>5W/13.5<br>6R/20<br>(4% Idle)<br>6W/14 | 5R/20.5<br>5W/15<br>6R/24.5<br>(70% Idle)<br>6W/17.75 | | similar to left<br>6R/24.6<br>(70% Idle) | | | |

## **Table 6:** Overall **Performance Comarison for Pentinum**

| Pentium 133MHz FreeBSD 2.1.7<br><br>**See** *Comments for* **more** M/B **info**. | Intel Endeavor2 (120 MHz) 60ns | Intel Endeavor2 60ns | ASUS PCI/ P/I-P55TVP4 Triton II 70-60ns | ASUS PCI/ P/I-P55TVP4 Triton II 70-60ns FreeBSD2.2 | Same as left (SAL) FreeBSD2.2 use 2.1.x compiler | Same as left (SAL) but 200MHz | Same as left (SAL) but pure 2.2 |
|---|---|---|---|---|---|---|---|
| Aligned Memory Copy | 33.4 | 33.4 | 40 | 40 | SAL | SAL | SAL |
| Unaligned Memory Copy | 33.4 | 33.4 | 40 | 40 | SAL | SAL | SAL |
| Subroutine Call | 3 | 2-4 | 2-4 us | 2-3 | SAL | 1-3us | SAL |
| Register to Memory (8 bytes) | 155.75 | 172 | 173.6 | 174.5 | SAL | 174 | SAL |
| Register to Memory (4 bytes) | 78 | 86.7 | 87.8 | 87.8 | SAL | SAL | SAL |
| Allocate & Clear Memory | 30 | 33.3 | 33.5 | 60 | SAL | 63.5 | SAL |
| | | | | | | | |
| MIPS | 36 | 40 | 40.3 | 27.4 | 40.7 | 60.6 | 41 |
| mixed arithmetic benchmark (ratio) | 33.4 | 37 | 37.4 | 30.6 | 37.6 | 55.9 | 45.8 |
| FMIPS | 22.7 | 25.3 | 25.6 | 26.3 | 25.6 | 38.3 | 39 |
| VFFT — $128^3$<br>(BSD/OS)<br><br>(FreeBSD) | | | | | | | |
| 128 x $256^2$<br>(BSD/OS)<br><br>(FreeBSD) | | | | | | | |
| Disk SCSI | NCR53c825 Seagaet ST15150W | | | | | | |
| One controller MByte/sec.<br><br>Two Controllers | 1R/6.72 2R/13.5<br>3R/16 4R/16<br>(90% idel)<br>3R/20 4R/27 | | 1w/3.375 2w/6.75<br>3w/10.125 4w/13.25<br>(92.5% idel) | | | | |
| 3 Controllers | 5R/33.6<br>5W/16.875<br>6R/40.35<br>(88% Idle)<br>6W/20.25 | | | | | | |

## **Table 7:** Overall **Performance Comarison for Pentinum Pro**

| Pentium (Pro) 200MHz FreeBSD 2.1.7<br><br>**See** *Comments for* **more** M/B **info**. | ASUS PCI/ P/I-P55TVP4 Triton II 60ns FreeBSD2.2 | ASUS PCI/ P/I-P55TVP4 Triton II 60ns | AUSU P/I-P6NP5 Natoma 60 ns | Tyan Pro S1662 Natoma 60ns | E-4000 167 MHz Solaris 2.5.1 | Sparc Ultra1 143 MHz Solaris 2.5.1 | Sparc Ultra2 200 MHz Solaris 2.5.1 |
|---|---|---|---|---|---|---|---|
| Aligned Memory Copy | 40 | 40 | | 30 | 202 (222) | 172 | 200 (240) |
| Unaligned Memory Copy | 40 | 40 | | 30 | 202 | 172 | 200 |
| Subroutine Call | 2-3 | 1-3us | | < 1us | 1us | <= 1us | < 1 us |
| Register to Memory (8 bytes) | 174 | 174 | | 48 | 148 | 149 | 185 |
| Register to Memory (4 bytes) | 88 | 88 | | 47 | 126 | 91 | 162 |
| Allocate & Clear Memory | 64 | 35 | | 40 (44) | 63 | 70 | 76 |
| | | | | | psrinfo | | |
| MIPS | 39.5 | 60 | | 78.8 | < 22 | 18 | 26 |
| mixed arithmetic benchmark (ratio) | 45 | 55.9 | | 71 | 32.5 | 27.5 | 38.6 |
| FMIPS | 38 | 38 | | 57.8 | 43 | 36.5 | 51.3 |
| VFFT — $128^3$ (BSD/OS)<br>(FreeBSD) | | 11s / 64MB | | 5s / 64MB | 9s / 1GB | 12s/64MB | |
| 128 x $256^2$ (BSD/OS)<br>(FreeBSD) | | ?/64MB<br>?/32MB<br>1:01/64MB | | 31s / 64MB | 41s / 1GB | 1:12 | |
| Disk SCSI | NCR53c825 | | | | Sun | | |
| One controller MByte/sec.<br><br>Two Controllers | 1R/6.72<br>3R/16<br><br>3R/20 | 2R/13.5<br>4R/16<br><br>4R/27 | 1w/3.375<br>3w/10.125 | 2w/6.75<br>4w/13.25 | | | |
| 3 Controllers | 5R/33.6<br>5W/16.875<br>6R/40.35 (95% Idle)<br>6W/20.25 | | | | | | |

**Comments**:

ASUS PCИ-P54SP4 SIS:

FreeBSD can handle two memory slots. If four memory slots (two banks) are all used, the memory access speed drops to 15%.

Intel **ZAPPA** (Intel Triton) P5/PCI: <*Similar* to **TMC PCI54IT** *motherboard*>

FreeBSD has a problem to configure 3COM 3C509B network interface on this motherboard. It gets “3C509 pencil marked!”[1] error message. The BSDi has problem to probe NCR SCSI controller on it. The memory performance is not stable (vary from 85 - 102 MB).

*** The performance in above table is an 100MHz CPU but runs at only 75 MHz. The vendor cannot it work at 100MHz, so, it has been returned, and the testing is not completed. TMC M/B has been returned too due to its problems.

FreeBSD 2.1 + NCR SCSI controller with different motherboards:

On **ASUS + SIS** chipset motherboard, when reading rate from a single drive is 5.18 MBps, the dual disk reading rate on the same SCSI bus is 8.15 MBps. If the single disk reading rate is 6.6 MBps, the dual disk reading rate on the same SCSI bus is 7.9 MBps. This is done with switching SCSI controllers. The CPU or memory bus is saturated at 3 NCR SCSI controller with 5 disk drives. That is, adding the sixth disk drive onto the third SCSI controller will not rise any disk I/O performance.

What is the bottleneck? If PCI controller works right, then the CPU is most likely the bottleneck. The DMA Tx rate can be either 45 MBps (32 bits mode) or 90 MBps (64-bit mode), so the memory supposes not be the bottleneck. In 5-disk reading test, the CPU idle time is more than 25%. In 6-disk reading test, the CPU idle is 4%.

Compare with **ASUS PCI/I-P54TP4 (Intel Triton** chipset), using 5/6 disks on three NCR SCSI controllers (same 3 cards), the CPU idle keeps same, about 67 ~ 75% for reading and 80 ~ 87% for writing. We know that the motherboard with Intel Triton chipset has much better memory performance; so the main factor on disk performance is the memory bandwidth plus the PCI controller. The **Intel PT-2000** motherboard is good as **ASUS PCI/I-P54TP4**. It has a problem for FreeBSD to initialize 3C509B cards. **ASUS P/I-P55TP4XE** performance is similar to **PCI/I-P54TP4**. It is in baby size and can run up to 150 MHz.

The Intel Neptune chipset is OK on above competition except memory performance and overall performance. It left about 70% CPU idle when 6 disks are read.

The performance of **Intel Baby-AT neptune** motherboard is similar to **PN-2000**, but it has a little problem on 3Com 3C509B card [1] for FreeBSD.

[1] I have **fixed** the “*pencil mark*!” problem in **FreeBSD** in 9/20/95.

```
---------------- system configuration --------------
Alpha_OSF/1V3.0: show
vmunix: Alpha boot: available memory from 0x8e8000 to 0x7ffe000
vmunix: DEC OSF/1 V3.0 (Rev. 347); Mon Oct 3 13:05:17 PDT 1994
vmunix: physical memory = 128.00 megabytes.
vmunix: available memory = 114.54 megabytes.
vmunix: using 483 buffers containing 3.77 megabytes of memory
vmunix: Firmware revision: 3.6
vmunix: PALcode: OSF version 1.35
vmunix: ibus0 at nexus
vmunix: Digital 2100 Server Model A500MP
vmunix: cpu 0 EV-4s 1mb b-cache
vmunix: gpc0 at ibus0
vmunix: pci0 at ibus0
vmunix: tu0: DECchip 21040-AA: Revision: 2.2
vmunix: tu0 at pci0
vmunix: tu0: DEC TULIP Ethernet Interface, hardware address: 08-00-
2B-E2-55-7C

: swapon -vs
Swap partition /dev/re0b (default swap):
    Allocated space:        32766 pages (255MB)
    In-use space:            2593 pages (  7%)
    Free space:             30173 pages ( 92%)


Total swap allocation:
    Allocated space:        32766 pages (255MB)
    Reserved space:          3617 pages ( 11%)
    In-use space:            2593 pages (  7%)
    Available space:        29149 pages ( 88%)

: vmstat -M

Memory usage by bucket:

bucket#  element_size  elements_in_use  elements_free  bytes_in_use
    4           16           1082             966          17312
    5           32             51             461           1632
    6           64            218             166          13952
    7          128            180              76          23040
    8          256            201             279          51456
    9          512            910             962         465920
   10         1024            103             233         105472
   11         2048             19              97          38912
   12         4096              4               4          16384
   13         8192              3              29          24576
   14        16384              5              22          81920
```

```
   15        32768             2              0           65536
   16        65536             5              0          327680
   17       131072             0              0               0
   18       262144             0              0               0
   19       524288             0              0               0

Total memory being used from buckets = 1233792 bytes
Total free memory in buckets = 1666176 bytes


Memory usage by type: Type and Number of bytes being used

MBUF         = 5632     MCLUSTER     = 34816    SOCKET       = 19200
PCB          = 18944    ROUTETBL     = 1568     IFADDR       = 1152
MBLK         = 7168     MBLKDATA     = 20544    STRHEAD      = 5120
STRQUEUE     = 14848    STRMODSW     = 3072     STRSYNCQ     = 4032
STREAMS      = 3344     FILE         = 7744     DEVBUF       = 29952
UFS MOUNT    = 768      ADVFS        = 8192     IPM ADDR     = 128
IFM ADDR     = 192      VNODE        = 424448   DMASG        = 3920
KALLOC       = 329856   TEMP         = 66432


Sparc20: dmesg
pac: enabled - SuperSPARC/SuperCache
cpu0: TI,TMS390Z55 (mid 8 impl 0x0 ver 0x3 clock 60 MHz)
mem = 65536K (0x4000000)
avail mem = 56586240
Ethernet address = 8:0:20:22:97:5f
root nexus = SUNW,SPARCstation-20
: swap -l
swapfile             dev  swaplo blocks   free
/dev/dsk/c0t3d0s1   32,25      8 263080 178432
: swap -s
total: 45976k bytes allocated + 12280k reserved = 58256k used, 111196k
available


IRIX: hinv
2 150 MHZ IP19 Processors
CPU: MIPS R4400 Processor Chip Revision: 5.0
FPU: MIPS R4010 Floating Point Chip Revision: 0.0
Data cache size: 16 Kbytes
Instruction cache size: 16 Kbytes
Secondary unified instruction/data cache size: 1 Mbyte
Main memory size: 64 Mbytes, 1-way interleaved
I/O board, Ebus slot 5: IO4 revision 1
Integral EPC serial ports: 4
Integral Ethernet controller: et0, Ebus slot 5
FDDIXPress controller: ipg0, version 1
Integral SCSI controller 1: Version WD33C95A
```

```
Integral SCSI controller 0: Version WD33C95A
CDROM: unit 6 on SCSI controller 0
Disk drive: unit 1 on SCSI controller 0
HIPPI adapter: hippi0, slot 5 adap 6, firmware version 10238176
Integral EPC parallel port: Ebus slot 5
VME bus: adapter 0 mapped to adapter 21
VME bus: adapter 21
:swap -l
lswap path        dev    pri swaplo   blocks    free  maxswap   vswap
    2 /.swap.virtual
               128,16     2      0        0        0        0   80000
    1 /dev/swap
               128,17     0      0   524288   437280   524288       0
: swap -s
total: 42.48m allocated + 55.09m add'l reserved = 97.57m bytes used,
243.64m bytes available
```

```
Pentinum-100: dmesg

FreeBSD 2.1.0-950726-SNAP #0: Tue Aug  8 12:22:44  1995
CPU: 100-MHz Pentium 815\\100 (Pentium-class CPU)
  Origin = "GenuineIntel"  Id = 0x525  Stepping=5
  Features=0x1bf<FPU,VME,PSE,MCE,CX8,APIC>
real memory  = 33161216 (8096 pages)
avail memory = 30871552 (7537 pages)
chip0 <CPU-PCI bridge> rev 1 on pci0:0
chip1 <PCI-ISA bridge> rev 2 on pci0:7
```

```
pstat -sk (== swapinfo : FreeBSD only)
Device      1K-blocks     Used    Avail Capacity  Type
/dev/wd0s2b     81920        0    81856     0%    Interleaved
```