



Advanced Techniques for HP-UX System Administrators

Bill Hassell

Director of IT

Systems and Methods, Inc.

Agenda

- Setting up new systems
- Standardizing for easy administration
- Performance and Kernel Tuning
- Memory Management
- Disk space management
- Logfile management
- Useful tools
- Additional resources



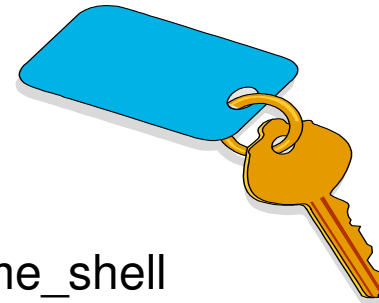
Setting up new systems

- Disk layout
 - Internal/external issues
 - VG00 design
 - Massive Ivols, flat directories
- Networking
 - SAM, netconf, set_parms
 - 100BaseT issues
- Cron jobs
 - Logfiles, cleanup, backup



Setting up new systems

- Root's shell
 - /sbin/sh
 - POSIX /usr/bin/sh vs. Bourne
 - /usr/bin/sh vs. Korn shell
 - Users can change: `chsh login-name /usr/bin/some_shell`
- Login tty settings:
 - # is erase 1 char (backspace)
 - Fix all logins with a one-time command:
`stty erase '^H' < /dev/ttyconf`
 - Add others such as:
`stty erase "^H" kill "^U" intr "^C" eof "^D" -parity ixoff`
 - Use to set tty defaults such as baud rate

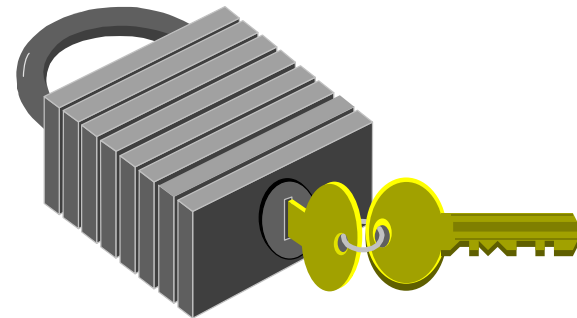


Setting up new systems

- Basic security fixes
 - `find /usr/local -type d -print -exec chmod 755 {} \;`
 - umask is missing in /etc/profile and /etc/csh.login
 - `umask 022`
 - `umask 077`
 - Search for world-write permissions in important directories:
 - `find /etc /usr /opt /dev /sbin /stand -perm -002`
 - Add: `\( -type d -o -type f \)` to look at just files and directories
 - Add secure database mountpoints, etc

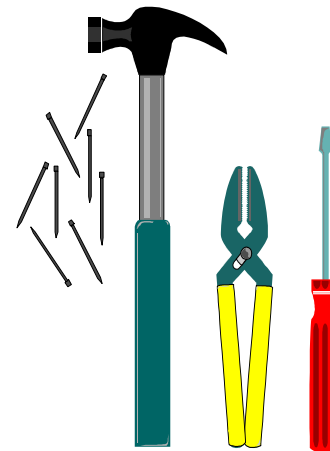
Setting up new systems

- Basic security fixes (continued)
 - **/etc/path**
 - World-writable directories
 - **pwd** (::: or ::: or :.)
 - Symlinks
 - Duplicate paths
 - Non-existent directories
 - scan-path script
 - Password and group file checks
 - **pwck**
 - **grpck**
 - Check /etc/passwd for duplicate UID's:
 - **logins -d**



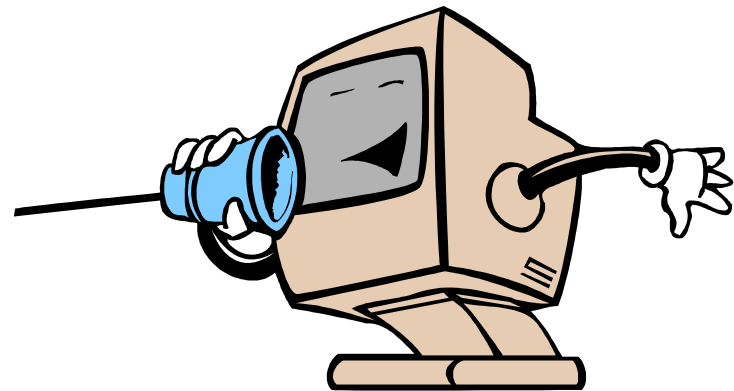
Setting up new systems

- Basic security fixes (continued)
 - `/etc/hosts.equiv .rhosts`
 - World-writable?
 - Valid user?
 - Root?
 - suid scripts/programs
 - No scripts allowed
 - Purpose
 - Owner
 - Location
 - `/etc/fstab: nosuid`



Standardizing for easy administration

- Login methods
 - telnet
 - remsh/rlogin
 - Xwindows
 - SSH
- Shells
 - POSIX (/usr/bin/sh)
 - Bourne (/usr/old/bin/sh)
 - Korn shell (/use/bin/ksh)
 - C shell
 - Bash, tcsh, etc



Standardizing for easy administration

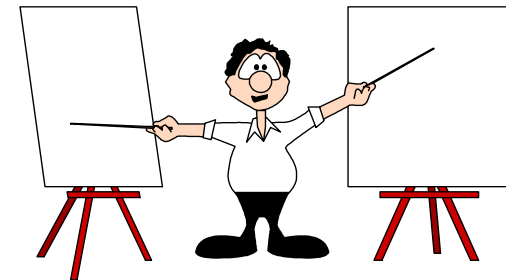
- Standard profiles

- `set -u`

- ulimit settings:

```
ulimit -a
time(seconds)          unlimited
file(blocks)            unlimited
data(kbytes)            65536
stack(kbytes)           8192
memory(kbytes)          unlimited
coredump(blocks)        0
nofiles(descriptors)    60
```

- Eliminate core files: `ulimit -Sc 0`



Standardizing for easy administration

- Standard profiles
 - Interactive versus batch
 - Errors: `stty: not a typewriter`
 - Separate the interactive commands:
 - Multiple `if interactive` statements
 - Or separate the interactive portion in a separate script
 - Interactive commands: `stty tput ttytype`
 - Interactive settings: `$TZ $DISPLAY`
 - Login controls: `/etc/nologin`
 - 11.0 with security patches, standard on 11i
 - Add: `NOLOGIN=1` to `/etc/default/security`

Standardizing for easy administration

- Standard profiles
 - `$HOME/.profile`
 - `/etc/skel` to standardize new users, or replace
 - Can't keep from being changed by users (`$HOME` must be writable which means no file is safe)
 - Same interactive issues with batch logins
 - May want to have `$HOME/.localprofile` for user mods

- Download sample profiles:

<ftp://contrib:9unsupp8@hprc.external.hp.com/sysadmin/profiles>

Standardizing for easy administration

- Other /etc/skel files:
 - **.exrc** (vi defaults)
 - **nows** (don't wrap searches around)
 - **ic** (ignore case on searches)
 - **ai** (follow prev left indent)
 - **aw** (update source at shell escapes: !)
 - **wm** (wrap to next line, =0 no wrap)
 - **report** (shows # of lines changed)
 - **showmode** (INPUT or REPLACE MODE tag)

set nows ic autoindent autowrite wrapmargin=2 ...

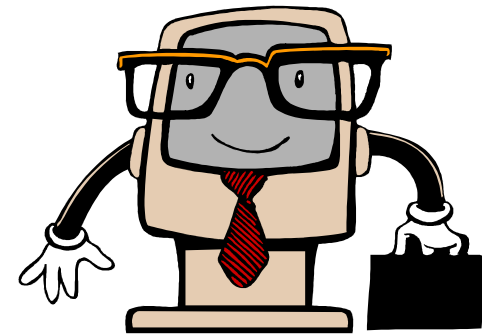


Standardizing for easy administration

- Restricted access methods
 - Restricted shells: rsh, rksh, rcsch
 - \$HOME is / for user
 - NO access to /usr or any other directories
 - Must create a local bin with binaries and set \$PATH
 - Usually simpler to use a menu script (no shell)
- Backup procedures
 - Classic tools: tar cpio pax dump
 - No index, no search, no error recovery, no changer support, no largefiles
 - fbackup/frecover
 - Index on every tape, high speed search, error recovery, change hooks, largefile-capable

Standardizing for easy administration

- Backup procedures (cont'd)
 - Features:
 - Largefiles, error recovery, changer support, parallel tape drives, network backup/restore, multi-platform, centralized indexing
 - Commercial backup programs
 - OmniBack
 - Veritas
 - Legato
- Disaster recovery (loss of boot disk)
 - Mirroring
 - Ignite/UX



Standardizing for easy administration

- `print_manifest` (from Ignite/UX)
- from the contributed software archive:
`ftp://contrib:9unsupp8@hprc.external.hp.com`
 - `gatherer.sh`
 - `nightowl`
 - `nickel` (HTML generator)
- Webmin: `www.webmin.com` (Perl-based)
 - Included with HP's Apache



Standardizing for easy administration

- `print_manifest` (from Ignite/UX)

```
h60/TELNET using HP70092 Terminal settings=h60.r1w
File Edit Connection Setup Macro Window Help Resize Colors

System Information

Your Hewlett-Packard 9000 computer has software installed
configured as follows.

The system was created December 19, 2002, 21:46:43 EST
It was created with Ignite-UX revision B.2.7.93.

-----
NOTE: You should retain this information for future reference
-----

System Hardware

Model:          9000/887/G60/H60
Main Memory:    384 MB
Processors:     1
OS mode:        32 bit
HW capability:   32 bit
LAN hardware ID: 0x080009D4118F
LAN hardware ID: 0x080009D4F935
LAN hardware ID: 0x080009B74AFB
Software ID:    1948801231
```

```
h60/TELNET using HP70092 Terminal settings=h60.r1w
File Edit Connection Setup Macro Window Help Resize Colors

Storage devices      HW Path      Interface
HP HP35470A          52.0.0      HP 28655A - SE SCSI ID=7
SEAGATE ST34572N 4340 Mb 52.6.0      HP 28655A - SE SCSI ID=7
HP C1533A            52.4.0      HP 28655A - SE SCSI ID=7
SEAGATE ST12400N 2048 Mb 52.3.0      HP 28655A - SE SCSI ID=7
TOSHIBA CD-ROM XM-5401TA 52.2.0      HP 28655A - SE SCSI ID=7
SEAGATE ST12400N 2048 Mb 52.1.0      HP 28655A - SE SCSI ID=7

I/O Interfaces
Class      H/W Path      Driver      Description
ext_bus    4              scsi1        HP 28655A - SE SCSI ID=7
ext_bus    5              lpr2         HP 28655A - Parallel Interface

lanmux     8              lanmux0      HP J2146A - 802.3 LAN
lan         8.1            lan3         HP J2146A - 802.3 LAN
ext_bus    12             scsi1        HP 28655A - SE SCSI ID=7
ext_bus    13             lpr2         HP 28655A - Parallel Interface

lanmux     16             lanmux0      HP J2146A - 802.3 LAN
lan         16.1           lan3         HP J2146A - 802.3 LAN
ext_bus    20             scsi1        HP 28655A - SE SCSI ID=7
ext_bus    21             lpr2         HP 28655A - Parallel Interface

ext_bus    52             scsi1        HP 28655A - SE SCSI ID=7
```


Standardizing for easy administration

- Centralized patching
 - Pick a central server
 - Create a hierarchical structure (test, pre-production, production)
 - Use swcopy to add patches and patch depots
 - Use swreg to make the depot visible on the network (don't use NFS)
 - On clients, use swlist to view the remote depot(s)
swlist -l depot @ patch_servername
 - Network installs:
swinstall -s depot_name@patch_servername file_set (or *)

Standardizing for easy administration

- Spooler management
 - Connections
 - Parallel, serial, SCSI, Network
 - Remote (Windows, Linux, solaris, AIX)
 - RFC 1179
 - Control files and options
 - Printer scripts and filters
 - Network (HP JetDirect)
 - Port 9100
 - Jetadmin now HP Printer Installer
 - addqueue, removequeue, transferqueue
 - Troubleshooting
 - Spoolkick procedure



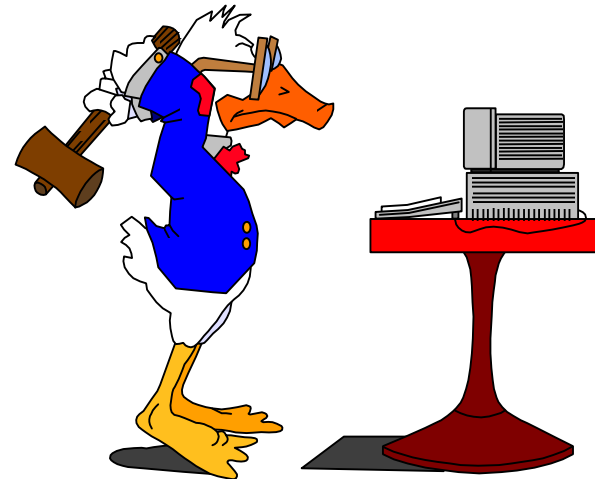
Performance and Kernel Tuning

- What can be changed
- Performance measurement
 - Built-in tools
 - SarCheck
 - MetaView, Performance Gallery
 - Glance/gpm, Measureware
- Kernel parameters
 - Filesystems
 - Processes
 - RAM and virtual memory
 - Network



Performance and Kernel Tuning

- What can be changed
 - Most kernel params size tables, provide limits or set behavior
 - CPU bound
 - Multi-CPU features
 - I/O bound
 - Disk
 - Swap (memory limited)
 - LAN



Performance and Kernel Tuning

Filesystem parameters

- **nfile:** 14min, no limit
 - Every opened file (including multiple opens)
 - Formula scales with maxusers
 - Every process has a minimum of 3
- **nflocks:** 2min, 200def, no limit
 - Maximum number of open file-locks
 - One file may have several locks
 - Application dependent
 - Databases may need hundreds

Performance and Kernel Tuning

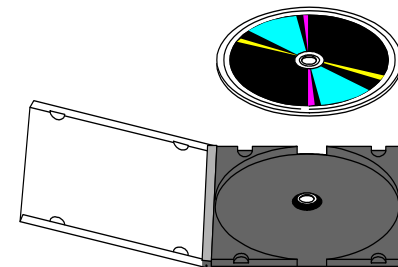
Filesystem parameters

- **ninode:** 14min, no limit
 - In-memory cache of **unique** current and recent HFS file locations
 - Speeds re-open, multi-process file access
 - Indirectly controls the size of the DNLC, ncsiz, ncdnode and vx_ninode.
 - 1000 to 8192, lower if ncsiz is adjusted
 - Formula in SAM is not useful for large systems
 - Best recommendations are in NFS Performance book by Dave Olker

Performance and Kernel Tuning

Filesystem parameters

- **ncdnode:** 14min, no limit
 - In-memory cache of **unique** current and recent CDFS file locations (CDROM)
 - Speeds re-open, multi-process file access
 - Usually OK unless multiple user access needed for CDROM or multiple CDROM drives



Performance and Kernel Tuning

Filesystem parameters

- **maxfiles:** 60 default
 - Maximum number of files opened by a single process
 - Used to control runaway processes
 - Override with setrlimit(2) system call or **ulimit -n**
 - Hard ceiling is **maxfiles_lim**
 - Commonly recommended too high (4096) by database vendors
 - Commonly recommended **maxfiles** = **maxfiles_lim** but not a good idea (use ulimit as needed)

Performance and Kernel Tuning

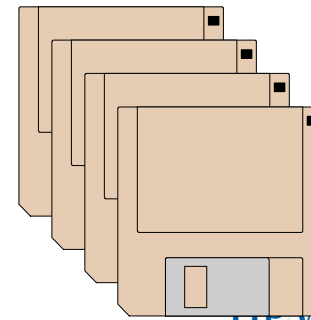
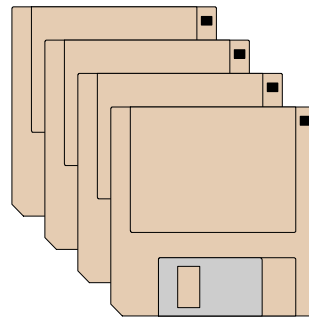
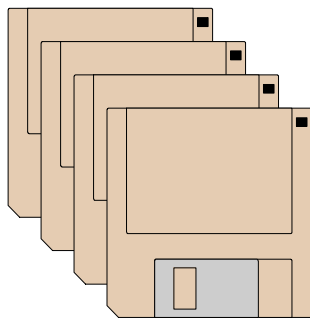
Filesystem parameters

- **fs_async:**
 - 0 = synchronous writes to directory structures
 - 1 = async
 - Apx. 20-30% faster write speed (no read change)
 - Very high probability of data loss with a powerfail or system panic (fsck fails to fix)
- **Default_disk_ir:**
 - 0 = no immediate reporting (waits for writes to complete)
 - 1 = immediate reporting (disk buffers writes)
 - Applies to all disks including raw devices

Performance and Kernel Tuning

Filesystem parameters

- **disksort_seconds:**
 - HP-UX gives priority to serial rd/wt queues
 - Intense serial I/O slows random I/O
 - Value in seconds to wait before changing priority



Performance and Kernel Tuning

Process parameters

- **nproc:**
 - Maximum processes to run at same time
 - Often way too low in servers
- **maxuprc:**
 - Maximum processes owned by a single UID
 - Collective, not per login
 - Generic logins can require hundreds or more

Performance and Kernel Tuning

Process parameters

- **maxdsiz:** 256 megs default (was 64megs)
 - 32bit programs only
 - Max can be 2Gb (SAM) but mapping limits are 960 and 1750 depending on compiler (or chatr) options. 3+ Gb with tricks.
 - **ulimit -d** to create a lower limit
- **maxdsiz_64:** 64 megs default
 - 64bit programs only
 - Max is 4000 Gb

Mem_mgt + proc_mgt note (/usr/share/doc – not 11i)

Performance and Kernel Tuning

Process parameters

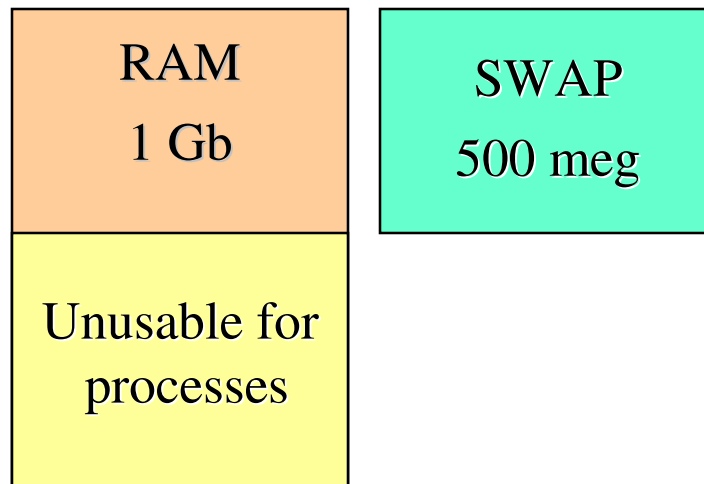
- **maxssiz:** 8 megs default
 - 32bit programs only
 - Seldom needs changing
 - Exception for specialized programs or poor design (pass by data not address/pointer)
- **maxtsiz:** 64megs default
 - Maximum for unchanging instructions
 - Directly related to executable's file size
 - 2Gb max (32bit) or 4096Gb (64bit)

Performance and Kernel Tuning

Process parameters

- **maxswapchunks:**
 - Used to size maximum swap (32Gb)
 - Useable swap is:
 - $\text{maxswapchunks} * \text{swchunk} * \text{dev_bsize}$ where: $\text{swchunk}=2048$ and $\text{dev_bsize}=1024$
 - Leave swchunk as default
 - Formula simplifies to:
 $\text{maxswapchunks} = \text{DESIRED-SWAP} / 2097152$
- **nswapdev, nswapfs:**
 - Maximum swap devices and filesystems

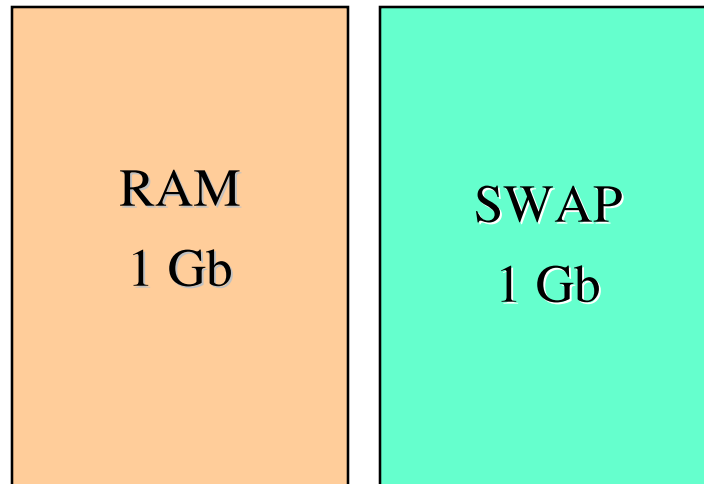
Performance and Kernel Tuning



`swapmem_on=0`

In this example, only 500 megs is usable for processes since Virtual Memory is only 500 megs.

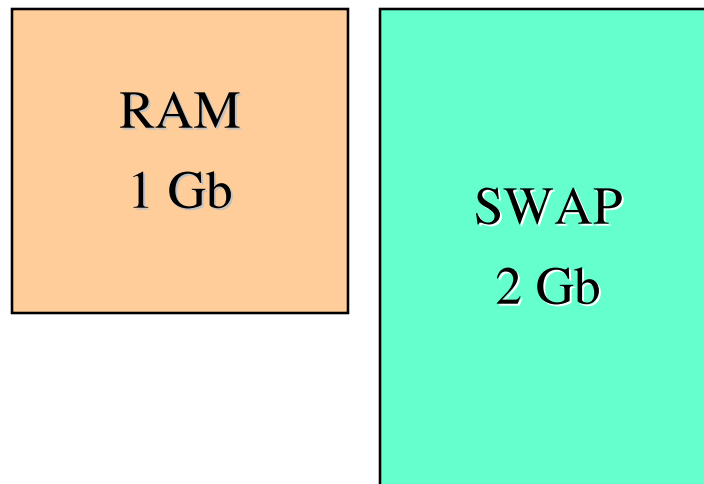
Performance and Kernel Tuning



`swpmem_on = 0`

In this example, 1 Gb is usable for processes since Virtual Memory is 1 Gb too...but no paging will take place

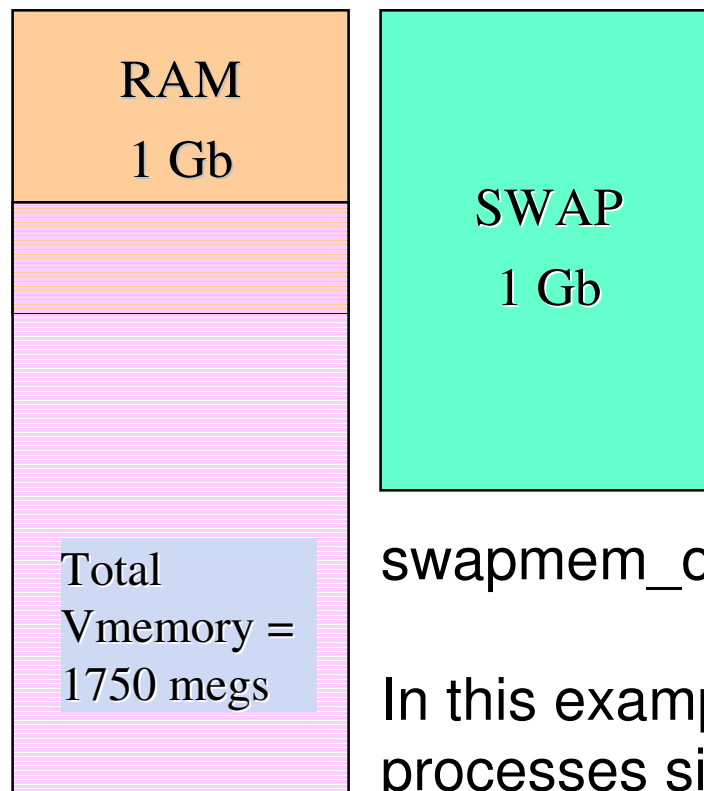
Performance and Kernel Tuning



`swappiness = 0`

In this example, 2 Gb is usable for processes since Virtual Memory is 2 Gb too...some paging may be take place

Performance and Kernel Tuning



`swappiness = 1`

In this example, 1.75 Gb is usable for processes since Virtual Memory is 1 Gb plus .75 Gb in RAM which is not pageable

Performance and Kernel Tuning

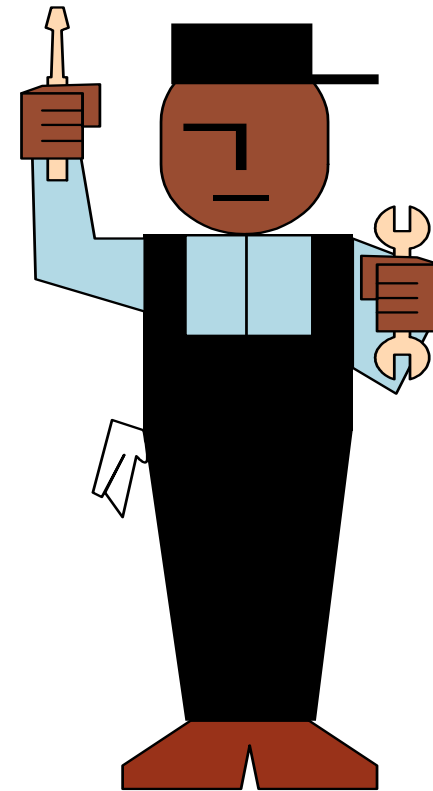
Process parameters

- **timezone, dst:**
 - Default value for environments without \$TZ (daemons)
 - **dst** controls a limited number of daylight saving rules
- **npty nstrpty,nstrtel:**
 - Controls maximum interactive network sessions
 - Must match device files (insf)
 - Use SAM to handle device files automatically
- **maxusers:**
 - Not a parameter but a formula adjustment
 - No relation to user licenses or session limits

Performance and Kernel Tuning

Performance tuning

- Vocabulary
 - I/O Bound
 - Disk Thrashing
 - Swap Thrashing
 - Resource Limits



Performance and Kernel Tuning

Performance tuning

- Measurement:
 - **uptime**:
 - User count (standard logins)
 - Load average (**runqueue**)

uptime

```
6:37pm up 81 days, 23:43, 103 users,  
load average: 0.07, 0.08, 0.07
```

uptime

```
8:11pm up 181 days, 23:43, 907 users,  
load average: 43.07, 22.08, 16.07
```

Performance and Kernel Tuning

Performance tuning

- **sar** (system activity reporter)
 - b buffer cache activity
 - c System Calls
 - d Block Device Activity
 - u CPU Utilization

[ATL]:rc /root # sar -b 1 16

HP-UX rc B.10.20 A 9000/871 02/13/00

	bread/s	lread/s	%rcache	burit/s	lurit/s	%ucache	pread/s	purit/s
18:59:37								
18:59:38	0	95	100	0	2	100	0	0
18:59:39	0	0	0	0	0	0	0	0
18:59:40	0	8	100	1	0	0	0	0
18:59:41	0	608	100	0	1	100	0	0
18:59:42	0	0	0	0	0	0	0	0
18:59:43	0	7	100	0	0	0	0	0
18:59:44	0	0	0	0	0	0	0	0
18:59:45	0	0	0	0	0	0	0	0
18:59:46	0	5	100	15	0	0	0	0
18:59:47	12	17	29	0	29	100	0	0
18:59:48	16	660	98	0	57	100	0	0
18:59:49	0	0	0	0	0	0	0	0
18:59:50	0	10	100	0	0	0	0	0
18:59:51	0	0	0	0	0	0	0	0
18:59:52	0	1	100	0	0	0	0	0
18:59:53	0	7	100	0	0	0	0	0
Average	2	89	98	1	6	82	0	0

[ATL]:rc /root #



File Edit Connection Setup Script Window Help

[ATL]:rc /root # sar -c 1 16

HP-UX rc B.10.20 A 9000/871 02/13/00

	scall/s	sread/s	surit/s	fork/s	exec/s	rchar/s	uchar/s
19:13:37	4799	40	17	0.00	0.00	20145426	0
19:13:38	4321	31	14	0.00	0.00	29396911	0
19:13:39	4164	440	380	0.99	0.99	10951731	8111
19:13:40	4266	423	373	0.00	0.00	24076288	39936
19:13:41	4520	48	27	0.00	0.00	33132544	39936
19:13:42	3979	26	15	0.00	0.00	19338240	0
19:13:43	4200	33	17	0.00	0.00	19484672	8192
19:13:44	3764	26	10	0.00	0.00	15081188	0
19:13:45	4092	13	19	0.00	0.00	22126675	0
19:13:46	4046	35	16	0.00	0.00	16132562	0
19:13:47	4181	28	14	0.00	0.00	24333964	0
19:13:48	4154	31	14	0.00	0.00	24376269	0
19:13:49	3992	22	19	0.00	0.00	26704896	105472
19:13:50	3505	10	5	0.00	0.00	26141696	0
19:13:51	4006	38	19	0.00	0.00	21020962	0
19:13:52	4240	26	15	0.00	0.00	25302109	0
19:13:53							
Average	4140	80	61	0.06	0.06	22345256	12592

[ATL]:rc /root #

185,18

HP2392A -- rc.atl.hp.com via TELNET

Num



File Edit Connection Setup Script Window Help

[ATL]:rc /root # sar -d 1 8

HP-UX rc B.10.20 A 9000/871 02/13/00

	device	%busy	avque	r+u/s	blks/s	avwait	avserv
19:16:59	c0t8d0	0.99	0.50	2	18	1.21	8.98
19:17:00	c0t10d0	37.62	0.50	52	164	5.05	7.74
19:17:01	c0t8d0	7.07	0.50	5	10	3.91	13.76
	c0t10d0	22.22	0.50	25	121	4.04	8.27
19:17:02	c0t8d0	20.00	6.65	27	432	51.40	54.97
	c0t10d0	89.00	61.04	145	2250	344.68	52.39
19:17:03	c0t8d0	3.96	0.50	3	6	6.39	13.24
	c0t10d0	32.67	0.50	46	170	44.67	12.80
19:17:04	c0t10d0	49.00	0.50	63	236	4.85	7.26
19:17:05	c0t8d0	3.96	0.50	5	10	4.04	10.98
	c0t10d0	36.63	0.50	53	162	5.21	6.66
19:17:06	c0t8d0	3.03	0.50	2	4	3.70	15.35
	c0t10d0	32.32	0.50	36	117	4.95	9.11
19:17:07	c0t8d0	17.82	0.50	21	44	4.89	8.94
	c0t10d0	12.87	0.50	23	77	3.91	7.08
Average	c0t8d0	7.11	3.05	8	65	23.99	28.99
Average	c0t10d0	39.03	20.23	55	412	119.68	22.72

[ATL]:rc /root #

260,18

HP2392A -- rc.atl.hp.com via TELNET

Num

[ATL]:rc /root # sar -u 1 16

HP-UX rc B.10.20 A 9000/871 02/13/00

19:21:01	%usr	%sys	%wio	%idle
19:21:02	3	68	14	15
19:21:03	2	62	17	19
19:21:04	2	66	16	16
19:21:05	2	68	16	14
19:21:06	1	62	17	20
19:21:07	1	43	26	29
19:21:08	3	61	18	18
19:21:09	1	35	33	31
19:21:10	2	73	11	14
19:21:11	3	63	17	17
19:21:12	1	68	15	16
19:21:13	2	65	16	17
19:21:14	3	68	16	13
19:21:15	0	56	23	21
19:21:16	3	67	15	15
19:21:17	1	78	8	13

Average 2 63 17 18

[ATL]:rc /root #

Performance and Kernel Tuning

Performance tuning

- **sar** (system activity reporter)
 - a File Access
 - v Kernel Parameters

[ATL]:rc /root # sar -a 1 3

HP-UX rc B.10.20 A 9000/871 02/13/00

	iget/s	namei/s	dirbk/s
19:31:10			
19:31:11	0	10	6
19:31:12	29	129	306
19:31:13	9	18	5

Average 13 52 106

[ATL]:rc /root # du -s /home > /dev/null &

[1] 10380

[ATL]:rc /root # sar -a 1 5

HP-UX rc B.10.20 A 9000/871 02/13/00

	iget/s	namei/s	dirbk/s
19:31:23			
19:31:24	2639	2133	85
19:31:25	2672	2385	120
19:31:26	2607	2388	136
19:31:27	2683	2226	135
19:31:28	2682	2249	53

Average 2656 2275 106

[ATL]:rc /root # sar -v 1 16

HP-UX rc B.10.20 A 9000/871 02/13/00

	text-sz	ov	proc-sz	ov	inod-sz	ov	file-sz	ov
19:35:13	N/A	N/A	585/2000	0	3995/4000	0	1919/6010	0
19:35:14	N/A	N/A	585/2000	0	3995/4000	0	1919/6010	0
19:35:15	N/A	N/A	585/2000	0	3995/4000	0	1919/6010	0
19:35:16	N/A	N/A	585/2000	0	3995/4000	0	1919/6010	0
19:35:17	N/A	N/A	586/2000	0	4000/4000	0	1920/6010	0
19:35:18	N/A	N/A	585/2000	0	4000/4000	0	1919/6010	0
19:35:19	N/A	N/A	585/2000	0	4000/4000	0	1919/6010	0
19:35:20	N/A	N/A	585/2000	0	4000/4000	0	1919/6010	0
19:35:21	N/A	N/A	586/2000	0	4000/4000	0	1920/6010	0
19:35:22	N/A	N/A	585/2000	0	3999/4000	0	1919/6010	0
19:35:23	N/A	N/A	585/2000	0	3999/4000	0	1919/6010	0
19:35:24	N/A	N/A	594/2000	0	4000/4000	0	1948/6010	0
19:35:25	N/A	N/A	594/2000	0	4000/4000	0	1948/6010	0
19:35:26	N/A	N/A	594/2000	0	4000/4000	0	1949/6010	0
19:35:27	N/A	N/A	594/2000	0	4000/4000	0	1953/6010	0
19:35:28	N/A	N/A	594/2000	0	4000/4000	0	1956/6010	0
19:35:29	N/A	N/A	594/2000	0	4000/4000	0	1955/6010	0

[ATL]:rc /root #

Performance and Kernel Tuning

Performance tuning

- **iostat** - report I/O Statistics
 - Number of seeks per second
 - Kbytes transferred per second
 - Milliseconds per average seek

```
[ATL]:rc /root # iostat 2 3
```

device	bps	sps	mtps
c0t9d0	0	0.0	1.0
c0t11d0	0	0.0	1.0
c0t8d0	0	0.0	1.0
c0t10d0	0	0.0	1.0
c0t5d0	0	0.0	1.0
c0t9d0	0	0.4	1.0
c0t11d0	5112	10.2	1.0
c0t8d0	0	0.0	1.0
c0t5d0	5111	9.8	1.0
c0t9d0	0	0.5	1.0
c0t11d0	5554	10.8	1.0
c0t8d0	1	0.0	1.0
c0t5d0	5556	10.8	1.0

Run 1 = zeros

```
[ATL]:rc /root #
```

Performance and Kernel Tuning

Performance tuning

- **vmstat**

vmstat [-dnS] [interval [count]]

vmstat -f | -s | -z

- Virtual Memory Statistics

- **-d** Adds disk transfers per second
- **-n** Format for 80 columns
- **-S** Processes swapped rather than paging

[ATL]:rc /root # vmstat 1 18

procs			memory				page						faults		cpu		
r	b	w	avm	free	re	at	pi	po	fr	de	sr	in	sy	cs	us	sy	id
0	0	0	13331	67976	0	0	0	0	0	0	0	0	0	0	14	10	76
1	0	0	13643	67946	14	5	0	0	0	0	0	347	660	100	3	-2	99
1	0	0	13643	67946	11	4	0	0	0	0	0	347	602	109	11	-1	90
1	0	0	13643	67946	9	3	0	0	0	0	0	350	572	113	5	0	95
1	0	0	13643	67946	7	2	0	0	0	0	0	353	536	112	-3	1	102
1	0	0	13643	67815	18	2	0	0	0	0	0	374	1065	139	0	91	9
5	0	0	14100	67811	15	1	0	0	0	0	0	411	1527	188	11	83	7
5	0	0	14100	67805	12	0	0	0	0	0	0	416	1996	207	6	87	6
5	0	0	14100	67805	9	0	0	0	0	0	0	417	2375	226	1	92	7
5	0	0	14100	67804	7	0	0	0	0	0	0	426	2520	239	11	82	7
5	0	0	14100	67802	9	1	1	0	0	0	0	432	2722	251	6	89	5
4	0	0	14492	67800	8	0	0	0	0	0	0	431	2672	256	0	94	6
4	0	0	14492	67800	6	0	0	0	0	0	0	437	2688	261	2	93	6
4	0	0	14492	67793	4	0	0	0	0	0	0	431	2670	262	5	89	6
4	0	0	14492	67793	3	0	0	0	0	0	0	433	2808	266	-1	95	6
4	0	0	14492	67790	2	0	0	0	0	0	0	427	2798	262	1	93	6
5	0	0	14737	67790	1	0	0	0	0	0	0	427	2744	260	1	94	5
5	0	0	14737	67790	0	0	0	0	0	0	0	441	2786	279	2	93	6

[ATL]:rc /root #



File Edit Connection Setup Script Window Help

[ATL]:rc /root # vmstat -nd 1 2

VM

memory		re	at	pi	page	fr	de	sr	in	faults	
avm	free				po					sy	cs
14082	68666	8	0	0	0	0	0	0	513	2791	298

CPU

cpu			procs		
us	sy	id	r	b	w
4	93	3	5	0	0
5	90	5			

Disk Transfers

device	xfer/sec
c0t9d0	18
c0t11d0	17
c0t8d0	16
c0t10d0	8
c0t5d0	31

[ATL]:rc /root #

713,1

HP70092 -- rc.atl.hp.com via TELNET

Num

Performance and Kernel Tuning

Performance tuning

- **vmstat** (cont)
 - **-f** fork and page summary:
vmstat -f
9043939 forks, 448300514 pages, average= 49.57
 - **-S** Summary
 - **-Z** Zero kernel sums

```
[ATL]:rc /root # vmstat -s
0 swap ins
0 swap outs
0 pages swapped in
0 pages swapped out
38679 total address trans. faults taken
13410 page ins
0 page outs
180 pages paged in
0 pages paged out
12738 reclaims from free list
13231 total page reclaims
0 intransit blocking page faults
24941 zero fill pages created
10379 zero fill page faults
9358 executable fill pages created
0 executable fill page faults
0 swap text pages found in free list
5636 inode text pages found in free list
0 revolutions of the clock hand
0 pages scanned for page out
0 pages freed by the clock daemon
210553 cpu context switches
809959 device interrupts
55205 traps
1572971 system calls
[ATL]:rc /root #
```

Performance and Kernel Tuning

Performance tuning

- **top:**
 - System data - Summary
 - name and time
 - Load Average 1,5,15 minutes
 - % time in user,nice,system,idle,etc
 - Memory:Virtual and Real
 - Individual Processes

System: hpuerca

Mon Jun 12 23:47:05 1995

Load averages: 0.00, 0.02, 0.05

324 processes: 320 sleeping, 1 waiting, 3 starting

Cpu states:

CPU	LOAD	USER	NICE	SYS	IDLE	UNK5	UNK6	INTR	SSYS
0	0.00	0.0%	0.0%	0.8%	99.2%	0.0%	0.0%	0.0%	0.0%
1	0.00	0.4%	0.0%	1.4%	98.2%	0.0%	0.0%	0.0%	0.0%
---	---	---	---	---	---	---	---	---	---
avg	0.00	0.2%	0.0%	1.0%	98.8%	0.0%	0.0%	0.0%	0.0%

Memory: 97564K (43988K) real, 89828K (48012K) virtual, 168952K free Screen #
1/21

CPU	TTY	PID	USERNAME	PRI	NI	SIZE	RESD	STATE	TIME	%WCPU	%CPU	COMMAND
0	p7	21345	blh	179	20	284K	324K	wait	0:00	2.26	1.47	top
0	p7	21327	blh	158	20	224K	80K	sleep	0:00	0.68	0.48	-ksh
1	?	21263	mjb	156	20	388K	260K	sleep	0:01	0.25	0.25	vi /tmp/
0	p7	21326	root	154	20	52K	144K	sleep	0:00	0.33	0.23	rlogind
1	?	3	root	128	20	0K	0K	sleep	34:12	0.22	0.22	statdaem
1	?	231	root	154	20	7644K	7692K	sleep	87:00	0.18	0.18	/etc/nam
0	?	0	root	128	20	0K	0K	sleep	15:47	0.09	0.09	swapper
1	?	15996	lp	154	20	76K	188K	sleep	0:16	0.09	0.09	/usr/lib
1	?	220	root	154	20	88K	184K	sleep	7:03	0.08	0.08	/etc/ine
1	?	86	root	154	20	20K	72K	sleep	8:33	0.07	0.07	syncer



C I



File Edit Connection Setup Macro Window Help

System: vbox

Mon Feb 11 10:18:43 2002

Load averages: 1.13, 1.14, 1.14

155 processes: 136 sleeping, 19 running

Cpu states:

CPU	LOAD	USER	NICE	SYS	IDLE	BLOCK	SWAIT	INTR	SSYS
0	3.00	0.0%	99.4%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%
1	1.00	0.0%	98.0%	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2	1.00	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
3	1.00	0.2%	98.6%	1.2%	0.0%	0.0%	0.0%	0.0%	0.0%
4	1.00	0.2%	99.2%	0.6%	0.0%	0.0%	0.0%	0.0%	0.0%
5	1.00	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
6	1.01	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
7	1.00	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
8	1.00	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
9	1.00	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10	1.00	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
11	1.00	0.0%	99.6%	0.0%	0.4%	0.0%	0.0%	0.0%	0.0%
12	1.00	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
13	1.00	0.0%	99.0%	0.8%	0.2%	0.0%	0.0%	0.0%	0.0%
14	1.00	0.0%	98.4%	1.6%	0.0%	0.0%	0.0%	0.0%	0.0%
---	---	---	---	---	---	---	---	---	---
avg	1.13	0.0%	99.4%	0.4%	0.2%	0.0%	0.0%	0.0%	0.0%

Memory: 270956K (251936K) real, 286788K (275892K) virtual, 15099772K free Page

24, 80

HP70092 -- hpuerci.atl.hp.com via TELNET

Num

Performance and Kernel Tuning

Performance tuning

- **Glance/Plus**
 - HP measurement package
 - midaemon for better metrics
 - character mode interface
 - **gpm** for Xwindcows
 - Extensive measurement options
 - Alarms



C I



File Edit Connection Setup Macro Window Help

B3692A GlancePlus C.03.35.00 10:10:26 hpuerci 9000/800 Current Avg High

CPU Util	S	SNN		I	33%	25%	33%
Disk Util	F	F		I	70%	78%	87%
Mem Util	S	SU	UB	I	88%	88%	88%
Swap Util	U	UR	R	I	34%	34%	34%

PROCESS LIST

Users= 13

Process Name	PID	PPID	Pri	User Name	CPU Util (100% max)	Cum CPU	Disk IO Rate	Block RSS	On
du	1207	25100	148	root	29.7/20.6	2.0	108/ 112	196kb	10

Page 1 of 1

Process
List

CPU
Report

Memory
Report

Disk
Report

Next
Keys

Select
Process

Help

Exit
Glance

67,1

HP70092 -- hpuerci.atl.hp.com via TELNET

Num



CI



File Edit Connection Setup Macro Window Help

B3692A GlancePlus C.03.35.00 10:11:39 hpuerci 9000/800 Current Avg High

Cpu Util	SSN	N	100%	100%	100%
Disk Util	F	F	13%	7%	13%
Mem Util	S	SU	88%	88%	88%
Swap Util	U	UR	34%	34%	34%

PROCESS LIST

Users= 13

Process Name	PID	PPID	Pri	User Name	CPU Util (100% max)	Cum CPU	Disk IO Rate	Block On
sh	1320	25100	237	root	97.1/95.0	5.7	0.0/ 0.0	196kb PRI

Page 1 of 1

Process
List

CPU
Report

Memory
Report

Disk
Report

Next
Keys

Select
Process

Help

Exit
Glance

101,1

HP70092 -- hpuerci.atl.hp.com via TELNET

Num

B3692A GlancePlus C.03.35.00 10:30:43 e35 9000/816 Current Avg High

CPU Util	S	SARU	U	I	31%	13%	74%
Disk Util	F	FV	U	I	28%	7%	63%
Mem Util	S	SU	UB	B	I	98%	100%
Swap Util	U	UR	R	I	56%	56%	57%

MEMORY REPORT

Users= 2

Event	Current	Cumulative	Current Rate	Cum Rate	High Rate
Page Faults	873	52674	174.6	52.6	440.3
Page In	187	15666	37.4	15.6	122.2
Page Out	78	439	15.6	0.4	22.2
KB Paged In	768kb	32.4mb	153.6	33.0	357.7
KB Paged Out	472kb	2.2mb	94.4	2.2	98.1
Reactivations	5	977	1.0	0.9	3.9
Deactivations	7	989	1.4	0.9	2.7
KB Deactivated	12kb	12kb	2.4	0.0	2.4
VM Reads	57	6467	11.4	6.4	29.6
VM Writes	52	394	10.4	0.3	19.8

Total VM : 27.6mb Sys Mem : 11.1mb User Mem: 46.9mb Phys Mem: 64.0mb

Active VM: 12.0mb Buf Cache: 4.8mb Free Mem: 1.3mb

V

Page 1 of 1

Process
ListCPU
ReportMemory
ReportDisk
ReportNext
KeysSelect
Process

Help

Exit
Glance

MEMORY REPORT					Users=	2
Event	Current	Cumulative	Current Rate	Cum Rate	High Rate	
Page Faults	0	588	0.0	4.1	60.7	
Page In	0	96	0.0	0.6	15.7	
Page Out	0	0	0.0	0.0	0.0	
KB Paged In	0kb	604kb	0.0	4.2	231.4	
KB Paged Out	0kb	0kb	0.0	0.0	0.0	
Reactivations	0	0	0.0	0.0	0.0	
Deactivations	0	0	0.0	0.0	0.0	
KB Deactivated	0kb	0kb	0.0	0.0	0.0	
VM Reads	0	45	0.0	0.3	15.0	
VM Writes	0	0	0.0	0.0	0.0	

Page 1 of 1

Exit Glance

B3692A GlancePlus C.03.50.00 11:59:52 shady 9000/879 Current Avg High

CPU Util	S	SU			26%	10%	44%
Disk Util	FV			U	74%	55%	98%
Mem Util	S	SU		UBB	100%	41%	100%
Swap Util	U	UR	R		39%	17%	39%

MEMORY REPORT

Users= 2

Event	Current	Cumulative	Current Rate	Cum Rate	High Rate
Page Faults	27099	122876	4516.5	499.9	4516.5
Page In	28	7455	4.6	30.3	623.8
Page Out	1351	9360	225.1	38.0	238.1
KB Paged In	120kb	12.6mb	20.0	52.6	506.9
KB Paged Out	18.4mb	125.3mb	3136.0	521.8	3667.7
Reactivations	3	11	0.5	0.0	0.9
Deactivations	0	15	0.0	0.0	0.5
KB Deactivated	96kb	96kb	16.0	0.3	16.0
VM Reads	16	1143	2.6	4.6	39.8
VM Writes	988	9094	164.6	36.9	256.1

Total VM : 710.8mb	Sys Mem : 161.1mb	User Mem: 566.1mb	Phys Mem: 768.0mb
Active VM: 671.3mb	Buf Cache: 38.4mb	Free Mem: 2.4mb	

Page 1 of 1

Process
List

CPU
Report

Memory
Report

Disk
Report

Next
Keys

Select
Process

Help

Exit
Glance

B3692A GlancePlus C.03.50.00 12:55:40 shady 9000/879 Current Avg High

Metric	State	Value	Current	Avg	High
CPU Util	S	SU	51%	5%	51%
Disk Util	V		3%	6%	100%
Mem Util	S	SU	95%	96%	100%
Swap Util	U	UR	72%	54%	72%

PROCESS LIST

Users= 2

Process Name	PID	PPID	Pri	User Name	CPU Util (200% max)	Cum CPU	Disk IO Rate	RSS	Thd Cnt
scrdaemon	1345	1	241	root	99.8/ 1.2	10.2	0.0/ 0.0	364kb	1
swapper	0	0	127	root	0.0/ 0.1	0.9	1.3/ 0.2	16kb	1
mallocbig	3315	1983	154	root	0.0/ 1.4	12.4	0.0/ 0.0	529.4mb	1

Page 1 of 1

Process
List

CPU
Report

Memory
Report

Disk
Report

Next
Keys

Select
Process

Help

Exit
Glance

B3692A GlancePlus C.03.50.00 12:57:00 shady 9000/879 Current Avg High

Resource	State	Wait	Memory	Open	Next	Process	Process	Process
CPU Util	S	SU	U				51%	9%
Disk Util							0%	5%
Mem Util	S	SU	UB B				95%	96%
Swap Util	U	UR	R				72%	55%

Resources PID: 3315, mallocbig PPID: 1983 euid: 0 User: root

CPU Usage (util):	0.0	Log Reads :	0	Wait Reason :	STRMS
User/Nice/RT CPU:	0.0	Log Writes:	0	Total RSS/VSS :	529.4mb/ 1.27gb
System CPU :	0.0	Phy Reads :	0	Traps / Vfaults:	0/ 0
Interrupt CPU :	0.0	Phy Writes:	0	Faults Mem/Disk:	0/ 0
Cont Switch CPU :	0.0	FS Reads :	0	Deactivations :	0
Scheduler :	HPUX	FS Writes :	0	Forks & Vforks :	0
Priority :	154	VM Reads :	0	Signals Recd :	0
Nice Value :	20	VM Writes :	0	Mesg Sent/Recd :	0/ 0
Dispatches :	0	Sys Reads :	0	Other Log Rd/Wt:	0/ 0
Forced CSwitch :	0	Sys Writes:	0	Other Phy Rd/Wt:	0/ 0
VoluntaryCSwitch:	0	Rau Reads :	0	Proc Start Time	
Running CPU :	0	Rau Writes:	0	Mon Feb 11 12:40:38 2002	
CPU Switches :	0	Bytes Xfer:	0kb		

C - cum/interval toggle % - pct/absolute toggle

Page 1 of 1

Process
Resource

Wait
States

Memory
Regions

Open
Files

Next
Keys

Process
Syscalls

CPU	Util	S	SA	I	8%	14%	97%
Disk	Util	V		I	2%	8%	67%
Mem	Util	S	SU	UB	83%	96%	100%
Swap	Util	U	UR	R	53%	56%	59%

		DISK REPORT					Users= 2			
Req	Type	Requests	%	Rate	Bytes	Cum Req	%	Cum Rate	Cum	Byte
Local	Logl Rds	11	100.0	2.1	1kb	8231	99.4	6.7	119.9mb	
	Logl Wts	0	0.0	0.0	0kb	50	0.6	0.0	50kb	
	Phys Rds	8	88.9	1.5	60kb	9146	79.0	7.5	50.7mb	
	Phys Wts	1	11.1	0.1	2kb	2438	21.0	2.0	9.4mb	
	User	0	0.0	0.0	0kb	497	4.3	0.4	6.8mb	
	Virt Mem	8	88.9	1.5	60kb	9478	81.8	7.8	50.2mb	
	System	1	11.1	0.1	2kb	1609	13.9	1.3	3.1mb	
	Raw	0	0.0	0.0	0kb	0	0.0	0.0	0kb	
Remote	Logl Rds	0	0.0	0.0	0kb	0	0.0	0.0	0kb	
	Logl Wts	0	0.0	0.0	0kb	0	0.0	0.0	0kb	
	Phys Rds	0	0.0	0.0	0kb	0	0.0	0.0	0kb	
	Phys Wts	0	0.0	0.0	0kb	0	0.0	0.0	0kb	

B3692A GlancePlus C.03.35.00 10:36:10 e35 9000/816 Current Avg High

Metric	Unit	Value	Current	Avg	High
CPU Util	S	SAARU U	53%	51%	53%
Disk Util	F	FV U	72%	82%	91%
Mem Util	S	SU UB B	96%	97%	97%
Swap Util	U	UR R	60%	60%	60%

IO BY FILE SYSTEM					Users= 2	
Idx	File System	Device	Type	Log I	IO	Phys IO
1	/	/dev/vg00/lvol3	vxfs	2.8/	3.1	7.6/ 7.1
2	/stand	/dev/vg00/lvol1	hfs	0.6/	0.5	0.6/ 0.5
3	/var	/dev/vg00/lvol8	vxfs	1.7/	2.1	27.2/ 23.5
4	/usr	/dev/vg00/lvol7	vxfs	2.6/	2.9	58.5/ 56.3
5	/tmp	/dev/vg00/lvol4	vxfs	0.0/	0.0	0.0/ 0.0
6	/opt	/dev/vg00/lvol6	vxfs	0.0/	0.2	0.9/ 1.8
7	/home	/dev/vg00/lvol5	vxfs	0.0/	0.0	0.0/ 0.0
8	lvm swap device	/dev/vg00/lvol2	hfs	0.0/	0.0	10.4/ 13.3

Top disk user: PID 24075, du

82.7 IOs/sec

S - Select a Disk

Page 1 of 1

IO By File Sys	IO By Disk	IO By Log Vol	Swap Space
-------------------	---------------	------------------	---------------

Next Keys	CPU By Processr	Alarm History	Select
--------------	--------------------	------------------	--------



File Edit Connection Setup Script Window Help

B3692A GlancePlus C.02.30.00 22:09:54 rc 9000/871 Current Avg High

Cpu Util	S	SAU					96%	97%	100%
Disk Util	F	F					25%	22%	25%
Mem Util	S	SU	UB		B		59%	59%	59%
Swap Util	U	UR	R				18%	18%	18%

		DISK REPORT				Users= 103			
Req	Type	Requests	%	Rate	Bytes	Cum Req	%	Cum Rate	Cum Byte
Local	Logl Rds	14	100.0	2.0	421kb	265	99.6	35.8	4.7mb
	Logl Wts	0	0.0	0.0	0kb	1	0.4	0.1	0kb
	Phys Rds	891	100.0	132.9	2.7mb	963	100.0	130.1	2.9mb
	Phys Wts	0	0.0	0.0	0kb	0	0.0	0.0	0kb
	User	637	71.5	95.0	701kb	683	70.9	92.2	751kb
	Virt Mem	0	0.0	0.0	0kb	0	0.0	0.0	0kb
	System	254	28.5	37.9	2.0mb	280	29.1	37.8	2.2mb
Remote	Raw	0	0.0	0.0	0kb	0	0.0	0.0	0kb
	Logl Rds	0	0.0	0.0	0kb	0	0.0	0.0	0kb
	Logl Wts	0	0.0	0.0	0kb	0	0.0	0.0	0kb
	Phys Rds	0	0.0	0.0	0kb	0	0.0	0.0	0kb
	Phys Wts	0	0.0	0.0	0kb	0	0.0	0.0	0kb

Page 1 of 2

Process
List

CPU
Report

Memory
Report

Disk
Report

Next
Keys

Select
Process

Help

Exit
Glance

53,1

HP70092 -- rc.atl.hp.com via TELNET

Num



File Edit Connection Setup Script Window Help

B3692A GlancePlus C.02.30.00 22:11:18 rc 9000/871 Current Avg High

CPU Util	S	[Green bar]				SU	66%	82%	100%		
Disk Util	F	[Green bar]				F	37%	30%	46%		
Mem Util	S	SU	[Red bar]				UB	B	59%	59%	59%
Swap Util	U	UR	[Red bar]				R	18%	18%	18%	

Idx	Device	Util	IO BY DISK			LogI IO		Users= 103 Phys IO	
			Qlen	KB/Sec					
1	8/4.9.0	1/ 12	0.0	4.7/	52.8	8.1/	28.0	0.6/	15.8
2	8/4.5.0	0/ 11	0.0	1.8/	91.5	0.0/	3.4	0.4/	17.1
3	8/4.8.0	4/ 14	0.0	23.8/	60.5	na/	na	3.8/	16.2
4	8/4.10.0	36/ 22	10.4	196.3/	103.3	na/	na	48.1/	29.9
5	8/4.11.0	37/ 28	2.0	152.9/	135.4	0.0/	0.0	54.3/	39.7

Top disk user: PID 13978, du

54.7 IOs/sec S - Select a Disk

Page 1 of 1

IO By File Sys	IO By Disk	IO By LogI Vol	Swap Space
-------------------	---------------	-------------------	---------------

Next Keys	CPU By Processr	Alarm History	Select
--------------	--------------------	------------------	--------

```

B3692A GlancePlus C.02.30.00      22:12:17      rc 9000/871      Current  Avg  High
-----
CPU Util      S [62%] SU
Disk Util     F [40%] F
Mem Util      S [59%] SU UB B
Swap Util     U [18%] UR A
  
```

SYSTEM TABLES REPORT

Users= 103

System Table	Available	Used	Utilization	High(%)
Proc Table (nproc)	2000	590	30	30
File Table (nfile)	6010	1940	32	33
Shared Mem Table (shmmni)	200	9	5	5
Message Table (msgmni)	50	2	4	4
Semaphore Table (semmni)	64	8	13	13
File Locks (nflocks)	500	65	13	13
Pseudo Terminals (npty)	1400	148	11	11
Buffer Headers (nbuf)	23556	23556	100	100

Page 1 of 2

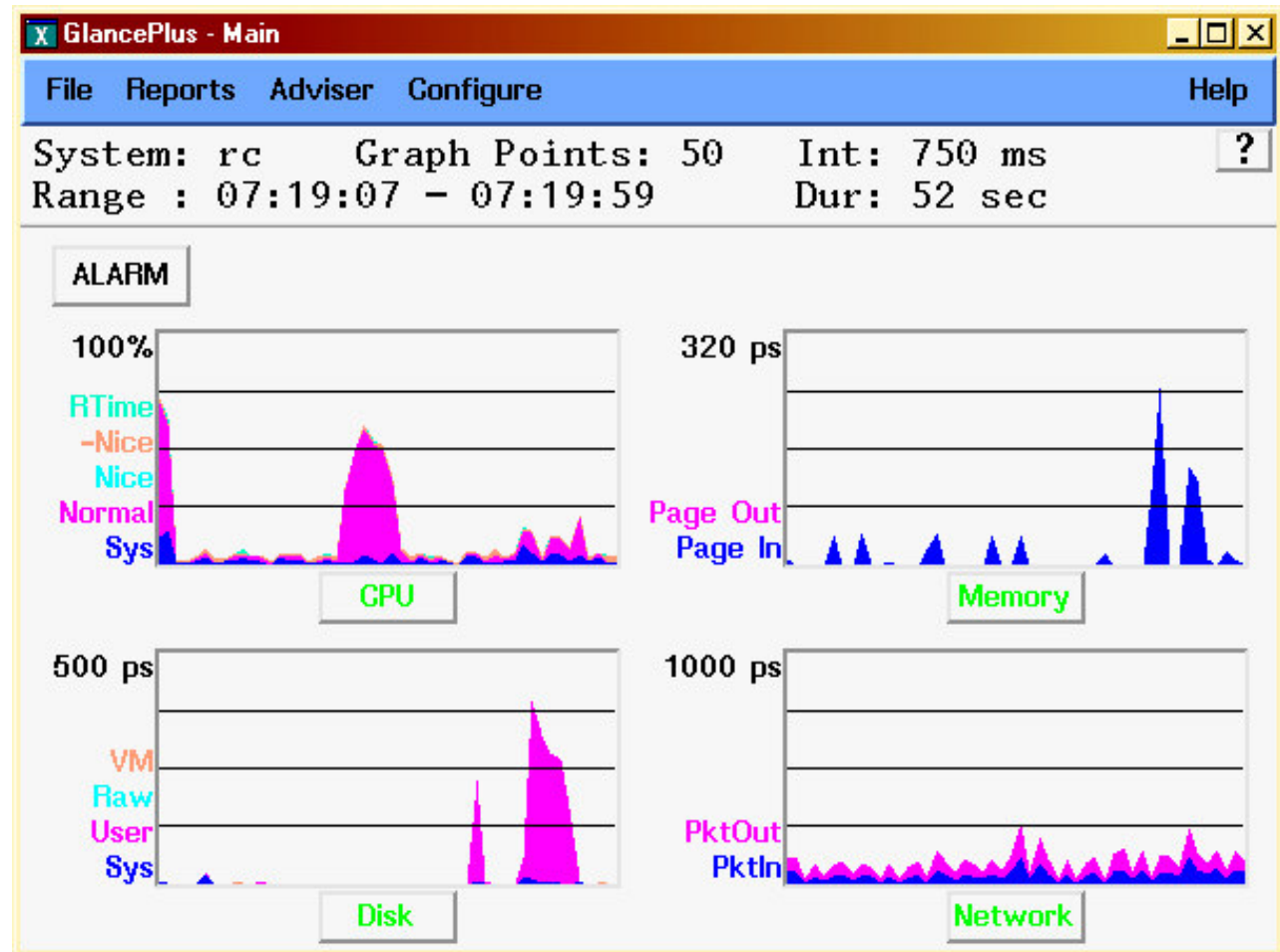
Global Waits	Global Syscalls	DCE Global	System Tables
--------------	-----------------	------------	---------------

Next Keys	Netwk By Interface	NFS Global	NFS By System
-----------	--------------------	------------	---------------

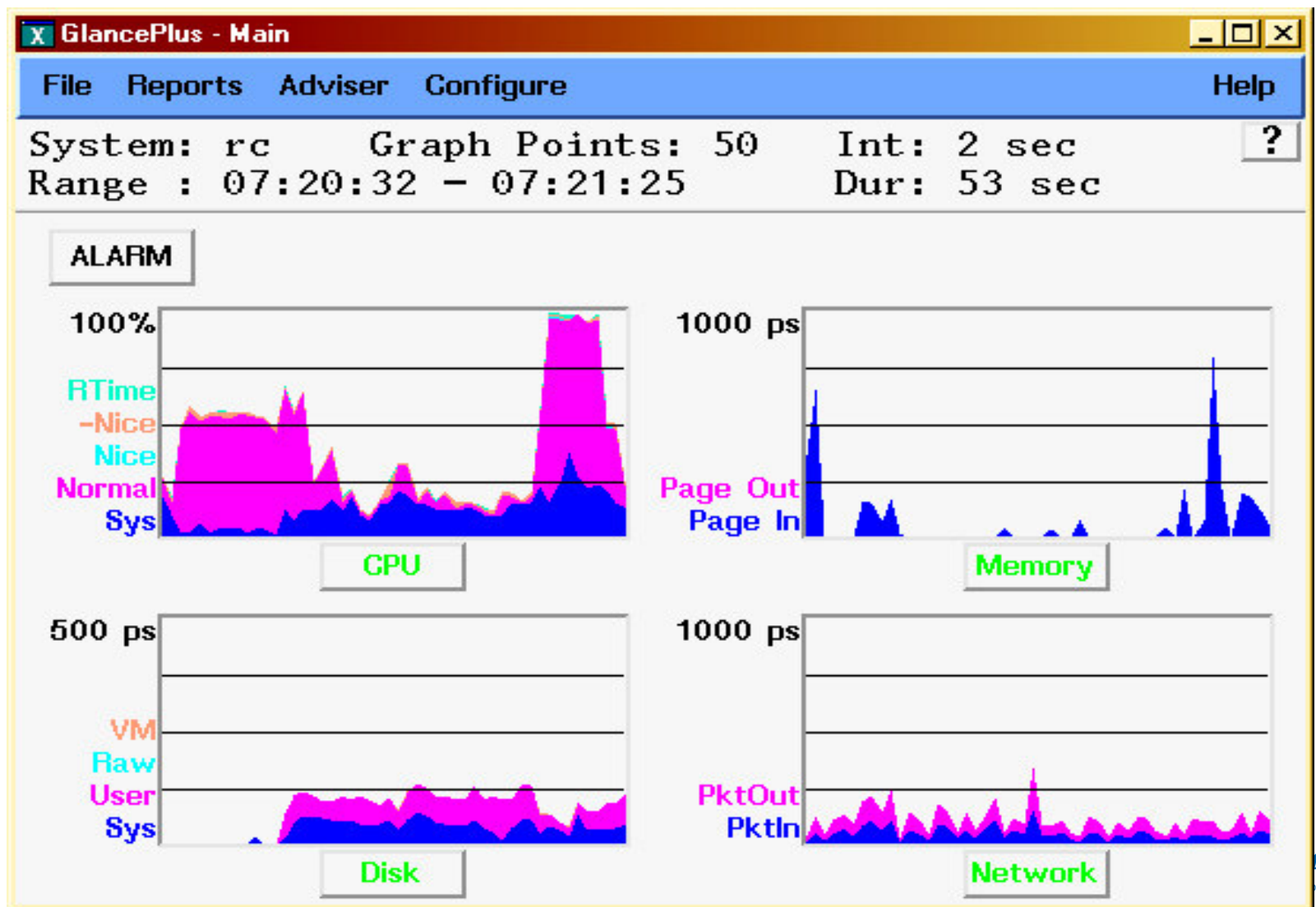
Performance and Kernel Tuning

Performance tuning

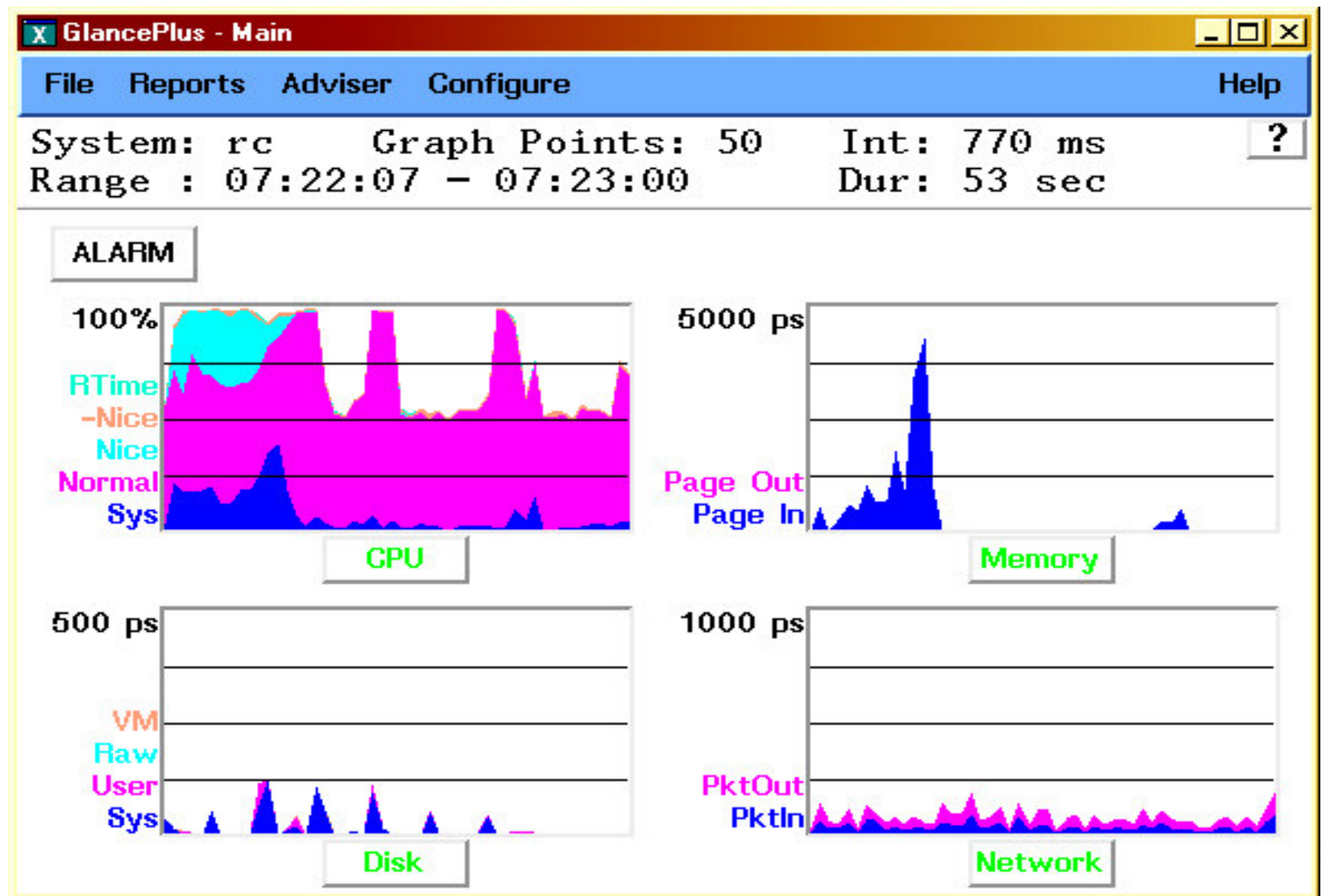
- **gpm:**
Xwindows
interface



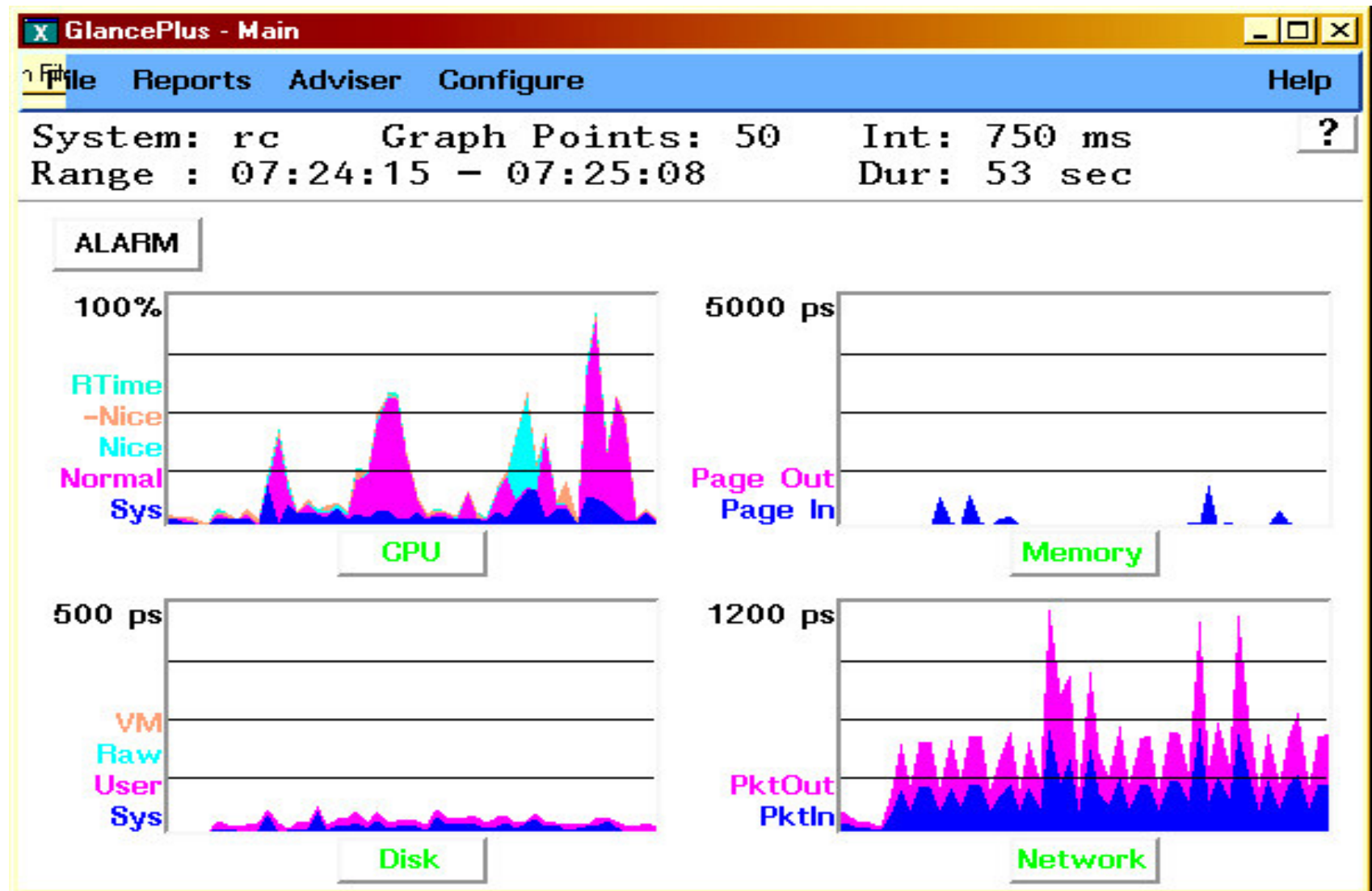
Performance and Kernel Tuning



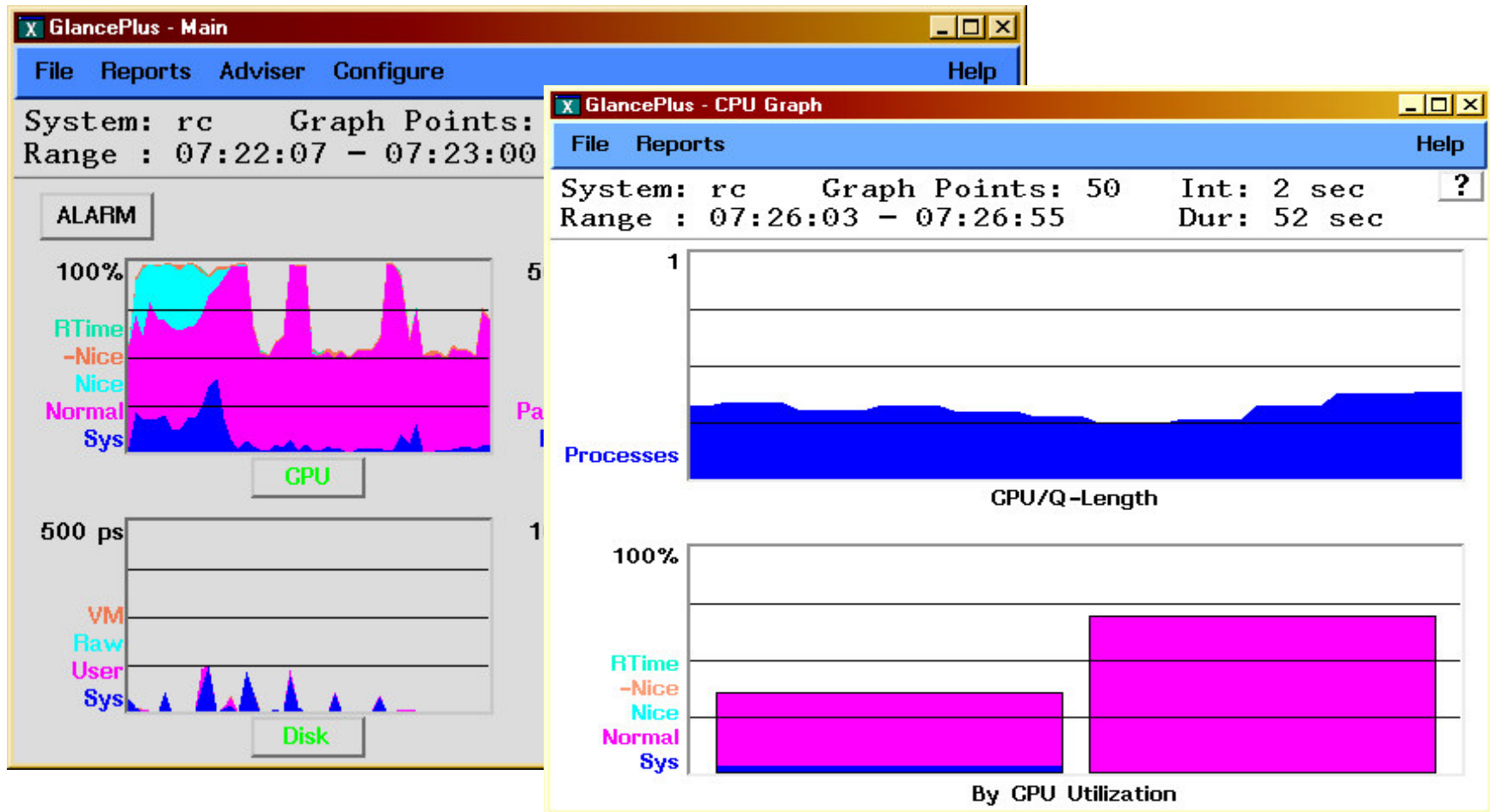
Performance and Kernel Tuning



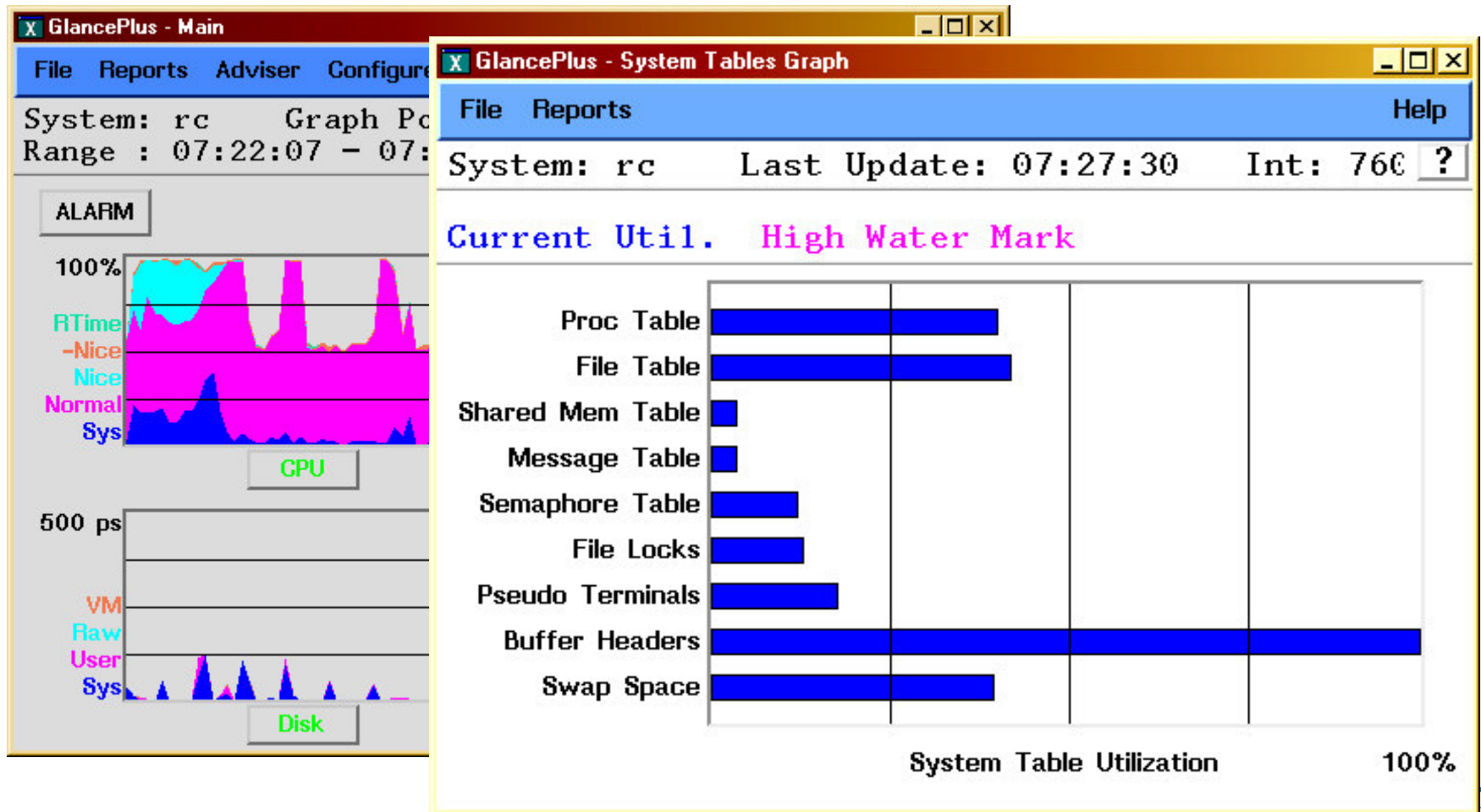
Performance and Kernel Tuning



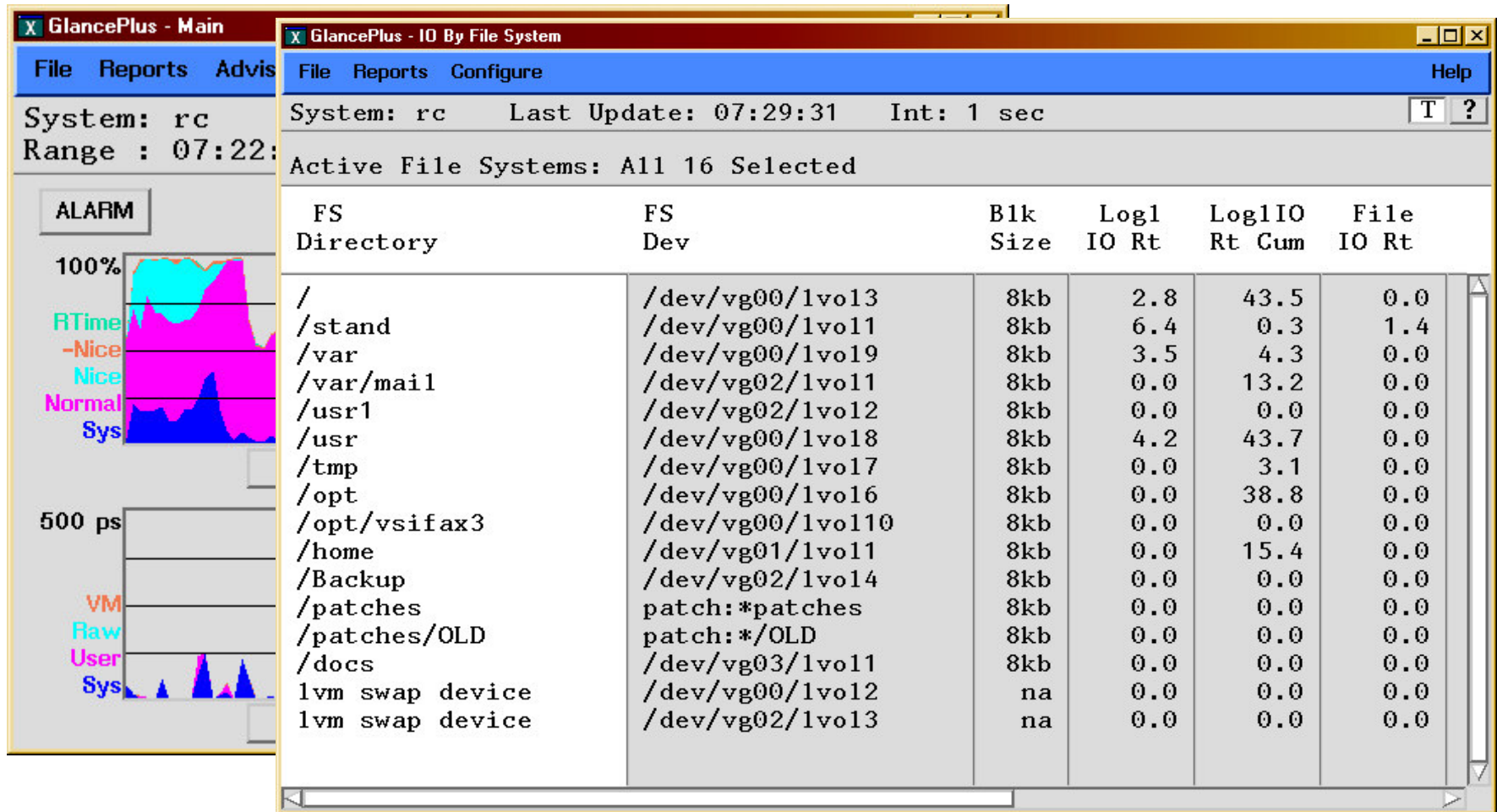
Performance and Kernel Tuning



Performance and Kernel Tuning



Performance and Kernel Tuning



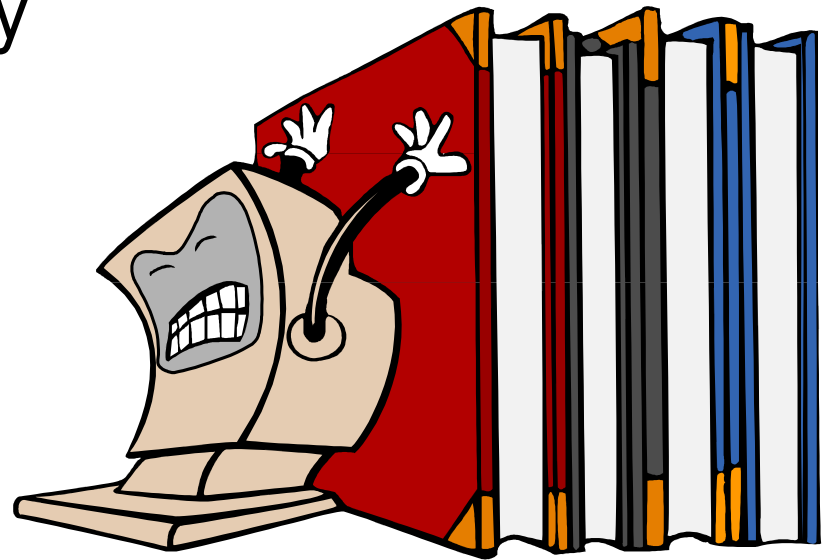
Performance and Kernel Tuning

Performance tuning

- What can you change:
 - Move busy filesystems to other disks
 - Move disks to additional channels
 - Add more processors (and/or change processor speed)
 - Add more RAM (application dependent)
 - Change large data area programs to use large memory pages (chattr) to reduce TLB misses
 - Use AutoPort Aggregation (APA) for parallel data transfers (and fallback reliability)

Memory Management

- 32/64 bit
- 32 bit Data area
- 32 bit Shared memory
- Memory windows



Memory Management

- 32/64 bit
 - HP-UX operating system
 - Hardware dependent
 - 32bit only
 - 32/64bit (either)
 - 64bit only (new machines)
 - 32bit programs run in either
 - 64bit programs only for 64bit HP-UX
 - 64bit programs remove memory map limitations, not a performance feature

Memory Management

- 32 bit Data area
 - 32bit programs have four 1000meg quadrants
 - Default data area = 960megs apx.
 - Compiler or chatr options for EXEC_MAGIC allow quadrant 1 and 2 to be combined for about 1750 megs total data area
 - Adjust maxdsiz if necessary
 - Documentation in /usr/share/doc for mem_mgt and proc_mgt (missing in 11i)

Memory Management

- 32 bit Shared memory
 - Most common limitation for 32bit database programs
 - Oracle: SGA is shared memory
 - Similar limits (960megs and 1750 megs)
 - Use SHMEM_MAGIC option for 1750 meg access
 - (all sharing processes must match)
 - **ALL** 32bit shared memory processes have one map (fragmentation, memory mapped files, shared libraries)
 - Use **ipcs -bmop** for a snapshot (does not show fragmentation)
 - Get **shminfo** from the [hprc.external.hp.com](ftp://contrib:9unsupp8@hprc.external.hp.com) ftp site:
<ftp://contrib:9unsupp8@hprc.external.hp.com/sysadmin>

Memory Management

- Memory windows
 - Reserves a separate memory map to remove fragmentation issues
 - Memory-mapped files, shared libraries are in memory window 0 (plus 'normal' shared memory processes)
 - Need patches for 11.0 to enable
 - Set kernel param for quantity of windows
 - Start ALL sharing programs with memory window startup command.

Disk space management

- Root filesystem
 - VG00 size and management
 - HP-UX only, possibly user \$HOME
 - 3-6Gb typical
 - New systems have 36/72Gb internal (too big)
 - Or use external disks
 - SCSI vs. fibre channel
 - Boot issues for external arrays
 - NAS versus SAN
 - Mirroring
 - Ignite/UX and VG00
 - Striping VG00

Disk space management

- Small versus large disks
 - JBODs
 - Arrays
- Large I/Os
 - Large files versus thousands of small files
 - Flat versus hierarchical directory structure
 - Performance
 - System impact (from users)
 - Managing files and backups

Disk space management

- Filesystem types:
 - **HFS** (Fast FileSystem - BSD, circa 1984)
 - **VxFS** (Veritas FileSystem, aka Journaled FileSystem) or **JFS**
 - **CDFS** (CDROM FileSystem - ISO 9660 only)
 - **NFS** (Network FileSystem)

Disk space management

- **HFS** (Fast FileSystem - BSD, circa 1984)
 - McKusick HPF and fragmentation
 - fsck proportional to directory size
 - Inode count fixed at creation
 - resizing
 - up = umount, lvextend, extendfs
 - down = umount, backup, lvreduce, newfs, reload from backup, mount

Disk space management

- **JFS** (Veritas filesystem, not Volume Manager)
 - Aka: Journaled FileSystem or JFS
 - Inodes created as needed
 - Very busy filesystem may need defrag
 - Online (Advanced) JFS option needed for online resizing and advanced options
 - Better overall performance than HFS

Disk space management

- **CDFS** (CDROM filesystem)
 - ISO 9660 only (see below)
 - 8.3 UPPERCASE filenames plus ;1 version
 - 11.0 patch for –ocdcase to lower UPPERCASE and remove ;1 version (but no long filenames)
 - HP makes special (non-standard) CD's for Core, Application, SupportPlus, etc that have long filenames
 - PFS (Portable FileSystem) to perform RockRidge or long filename translation
 - Recent patches add –orr to natively handle long filenames
 - No direct support for Joliet, audio, multimedia, DVD
 - No direct support for CD writers

Disk space management

- **NFS** (Network FileSystem)
 - Network-based filesystem (server and clients)
 - Stateless so performance issues exist
 - Does require tuning for heavy usage
 - Version 2 = no largefiles
 - Version 3 = largefile-capable
 - nfsstat very useful
 - **biod** and **nfsd** quantity
 - Network quality
 - NFS Performance book by Dave Olker

Disk space management

- VG00 filesystem design
 - / (root) lvol
 - HP-UX only, rest = mountpoints
 - Static: size to about 256 megs
 - **/etc /dev /sbin** (that's all!)
 - **/stand** lvol
 - Only HFS filesystem
 - Holds bootable kernels (current and previous)
 - 60-200 megs

Disk space management

- VG00 filesystem design - other HP-UX mountpoints
 - **/usr** = HP-UX and local executables, libraries
 - **/bin and /lib**
 - **/usr/local** versus **/usr/contrib**
 - Perhaps 400-1000 megs
 - **/opt** = application installation directories
 - /opt/app-name
 - bin doc lib lbin etc man...
 - Perhaps 500-1500 megs
 - **/tmp** = system temporary directory (note: system)
 - Not for users, scripts, etc
 - Perhaps 200-400 megs

Disk space management

- VG00 filesystem design - other HP-UX mountpoints
 - **/var** = variable directory
 - Most critical directory in HP-UX
 - When full, daemons and processes abort
 - Used by many unrelated subsystems
 - Ideally, separate mountpoint lvol will be created for the most intrusive directories:
 - **/var/mail**
 - **/var/spool**
 - **/var/tmp**
 - **/var/adm**
 - **/var/adm/crash**
 - **/var/adm/sw**

Disk space management

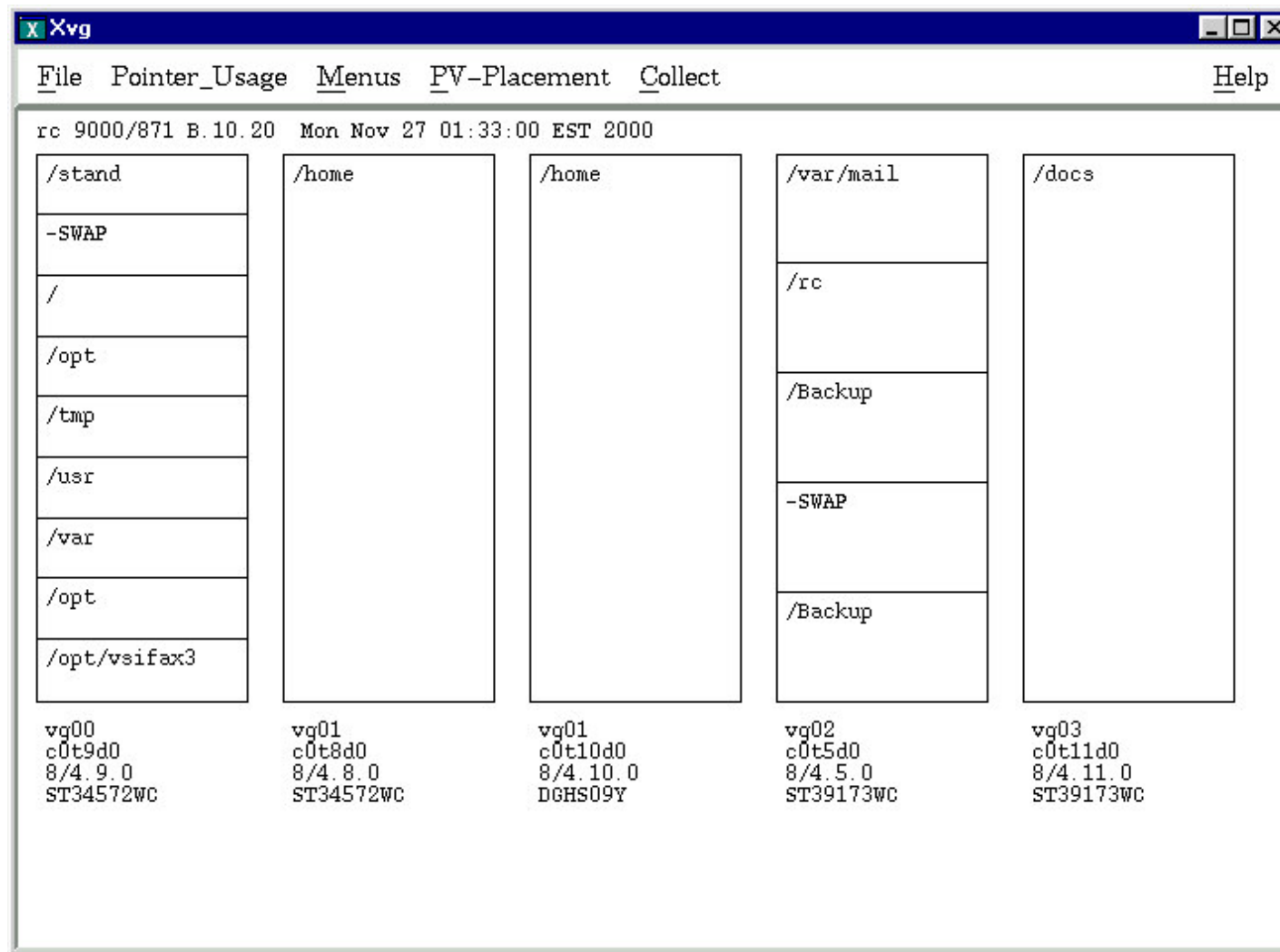
- VG00 filesystem design - other HP-UX mountpoints
 - **/home** = user home directories
 - Highly variable
 - When full, cause little impact to production processes
 - May require active space management or quotas



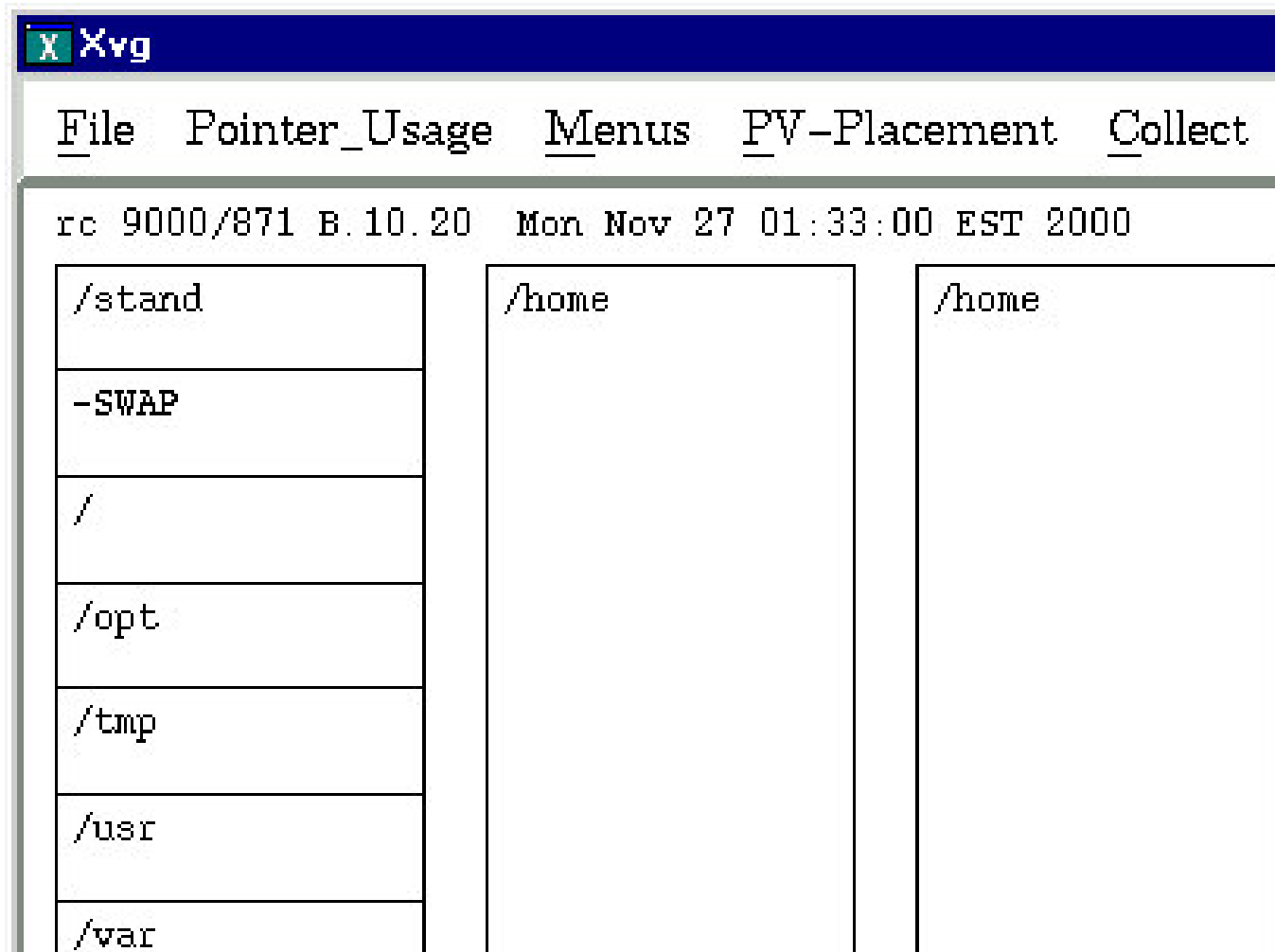
Disk space management

- XVG
 - Contributed Xwindow program
 - Visualize disk layout
 - Highlight swap, free space, filesystem types
 - Highlight non-contiguous areas
 - Download from:
<ftp://contrib:9unsupp8@hprc.external.hp.com/sysadmin>

Xvg Display Program



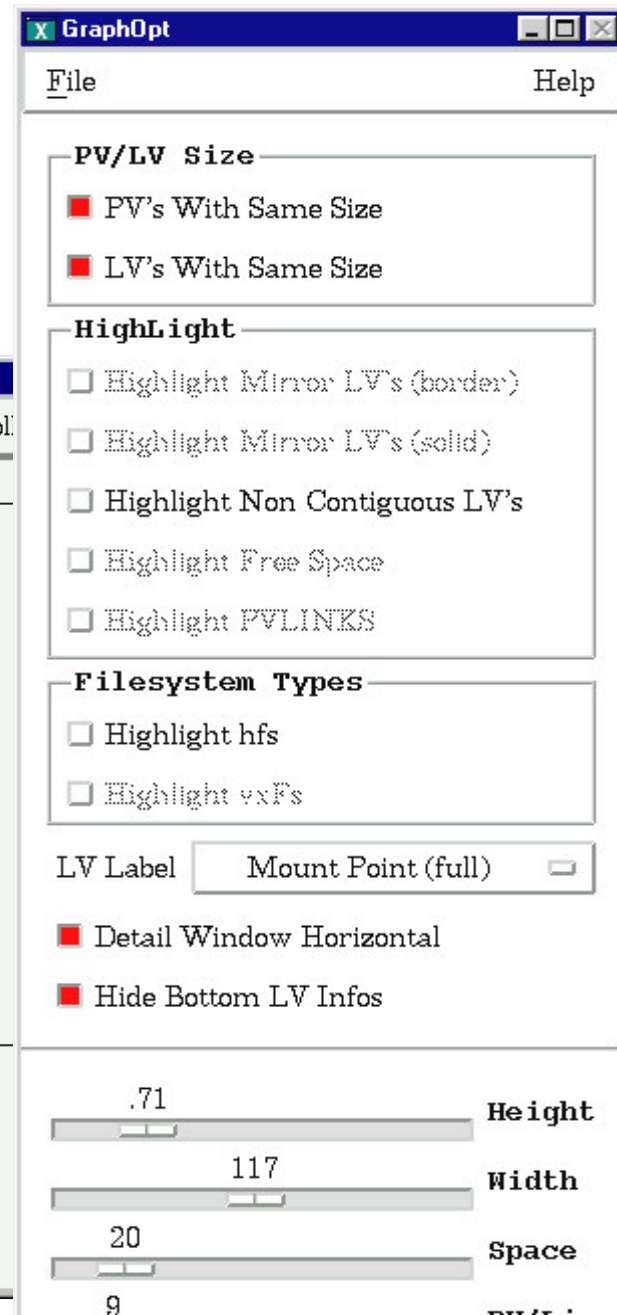
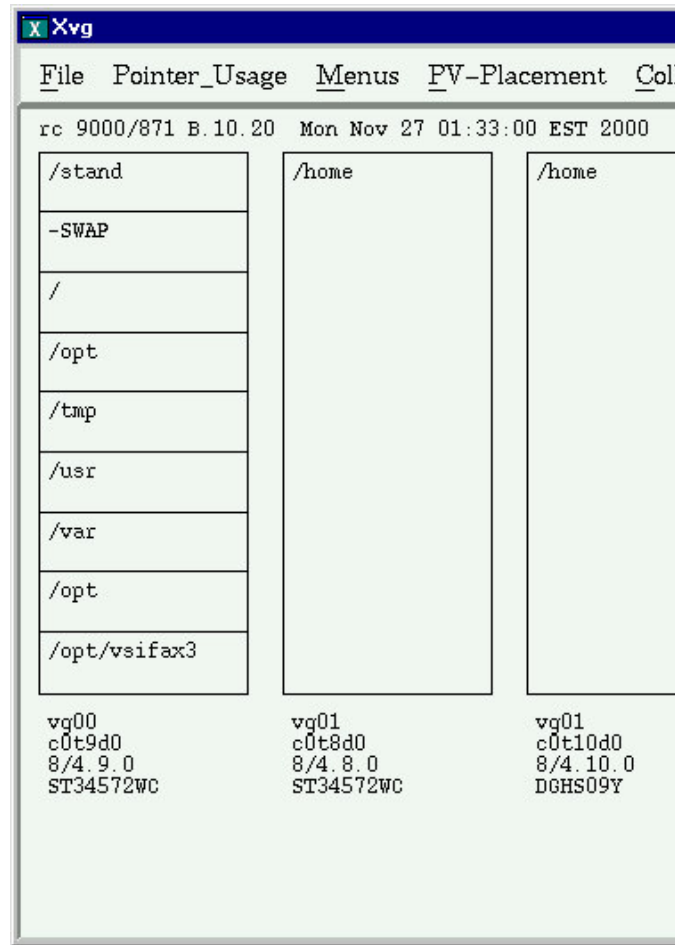
Xvg Display Program



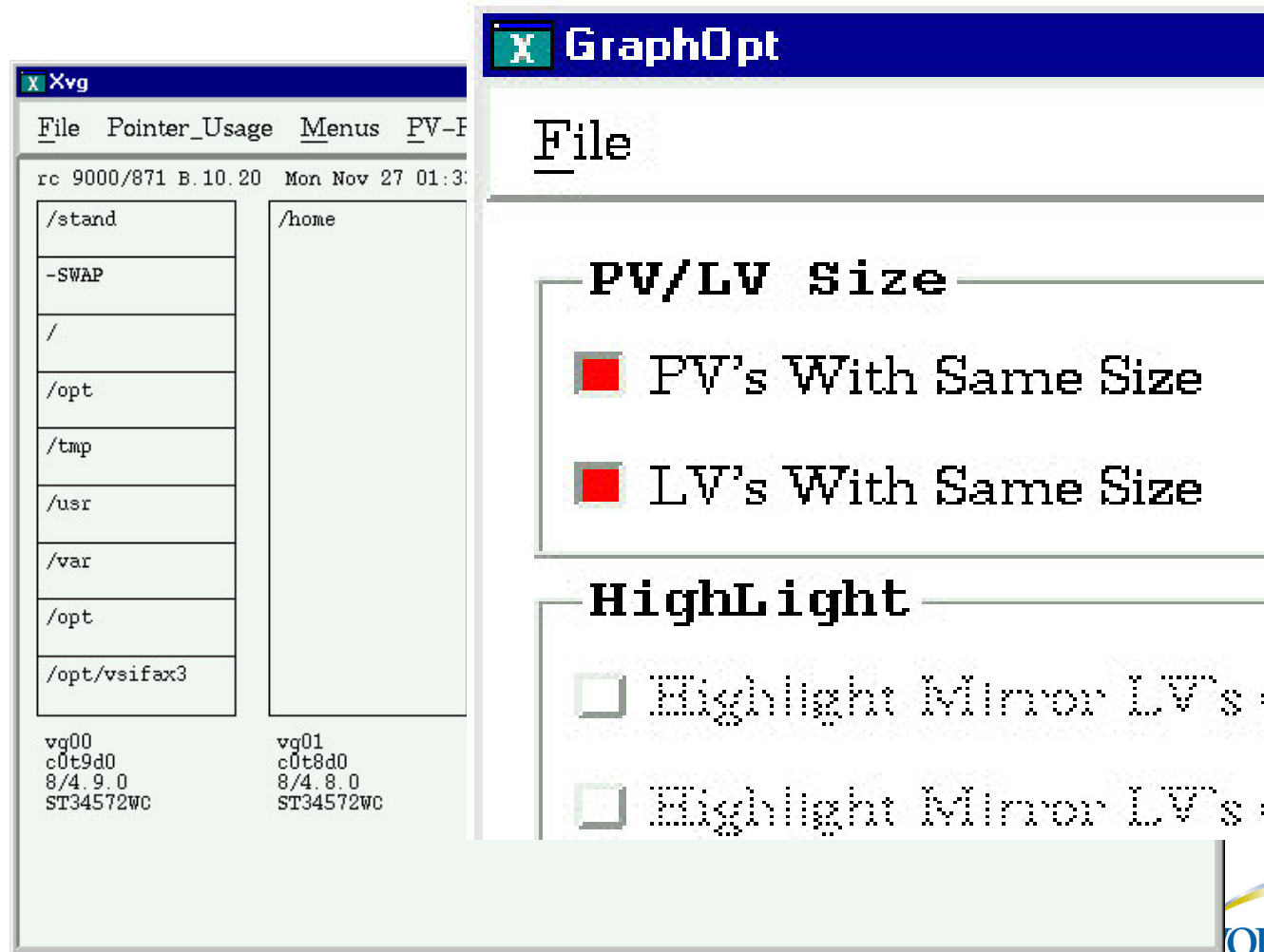
Xvg Display Program

/var		
/opt		
/opt/vsifax3		
vg00 c0t9d0 8/4.9.0 ST34572WC	vg01 c0t8d0 8/4.8.0 ST34572WC	vg01 c0t10 8/4.1 DGHS0

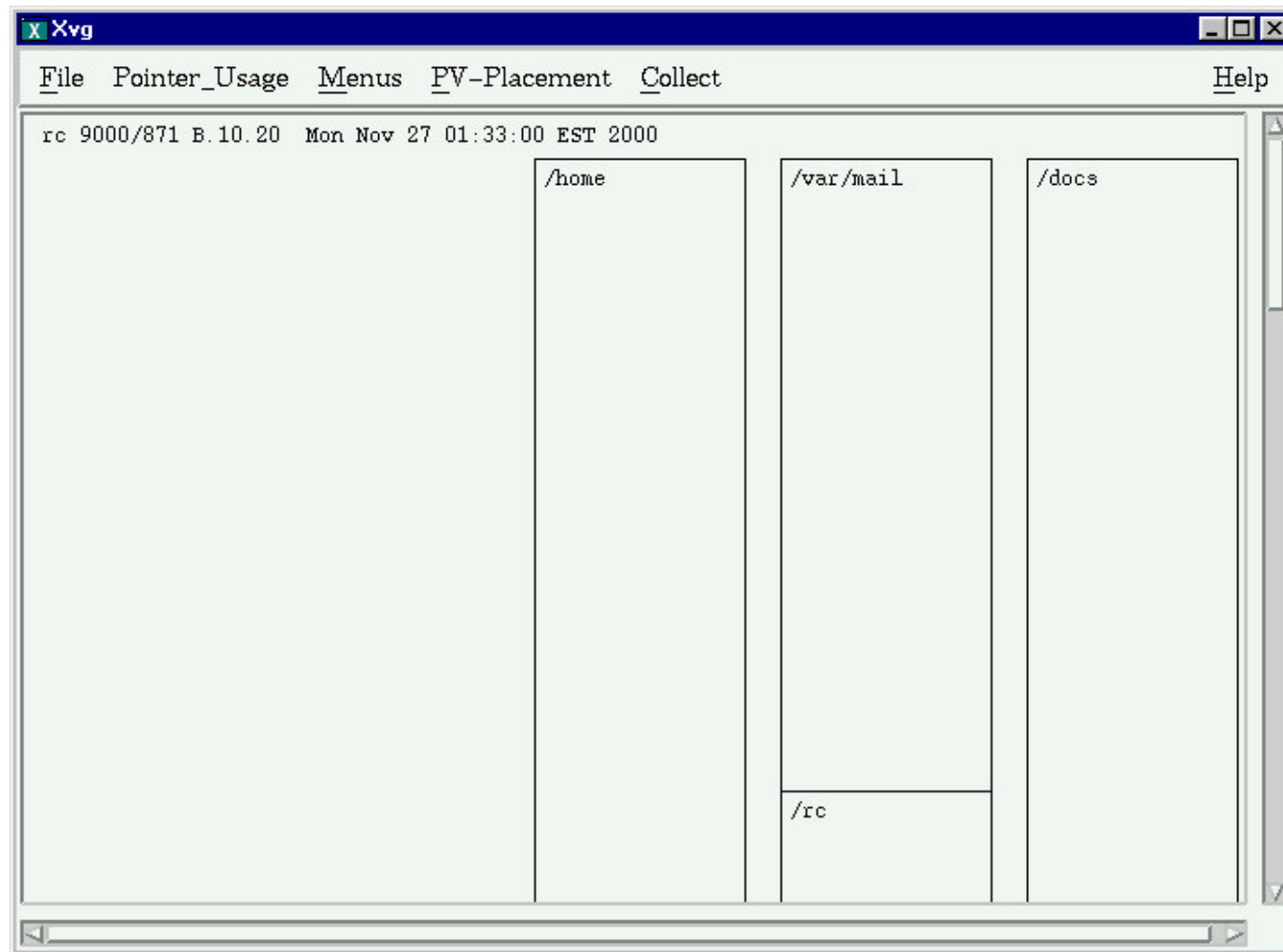
Xvg Display Program



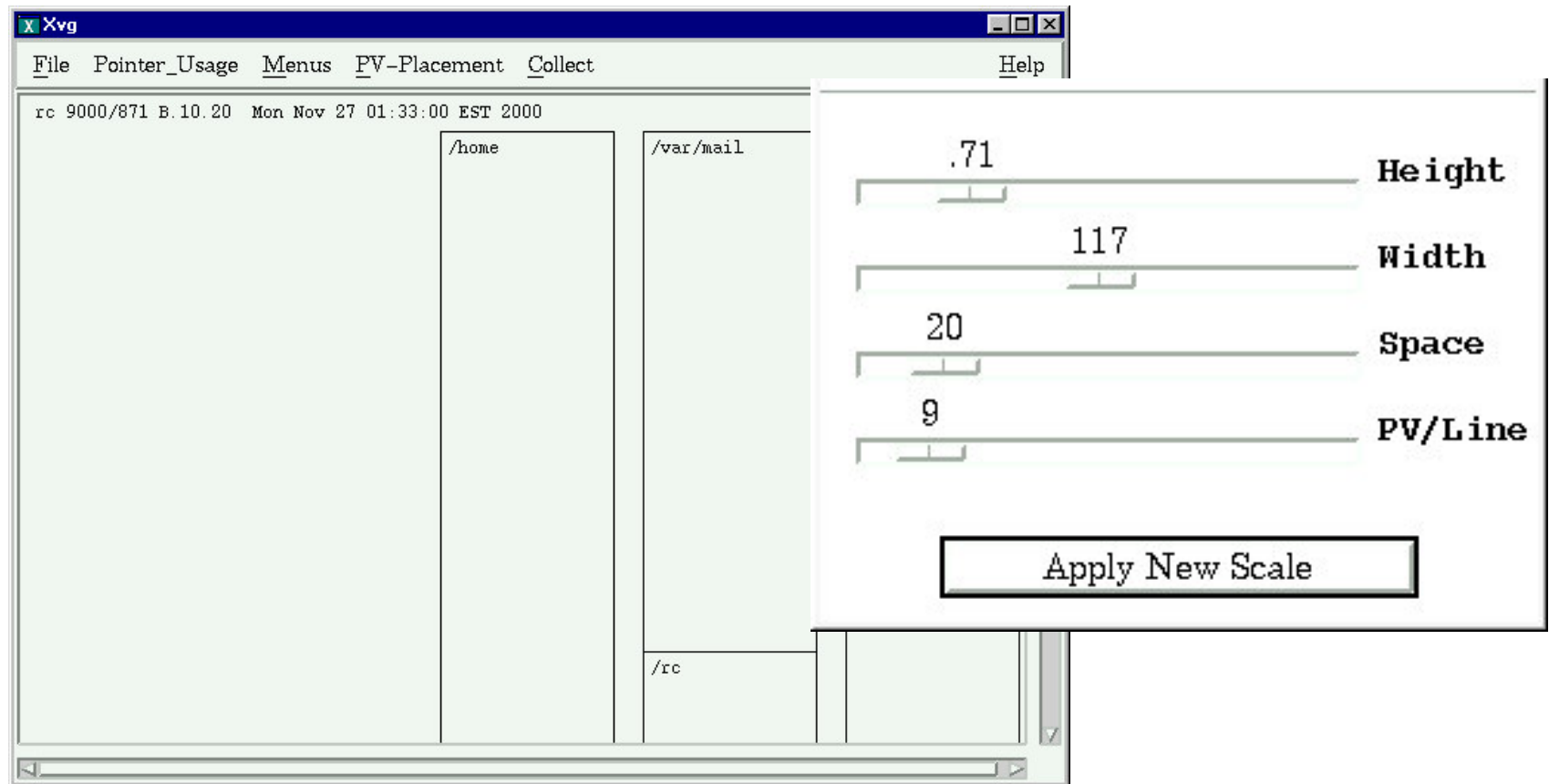
Xvg Display Program



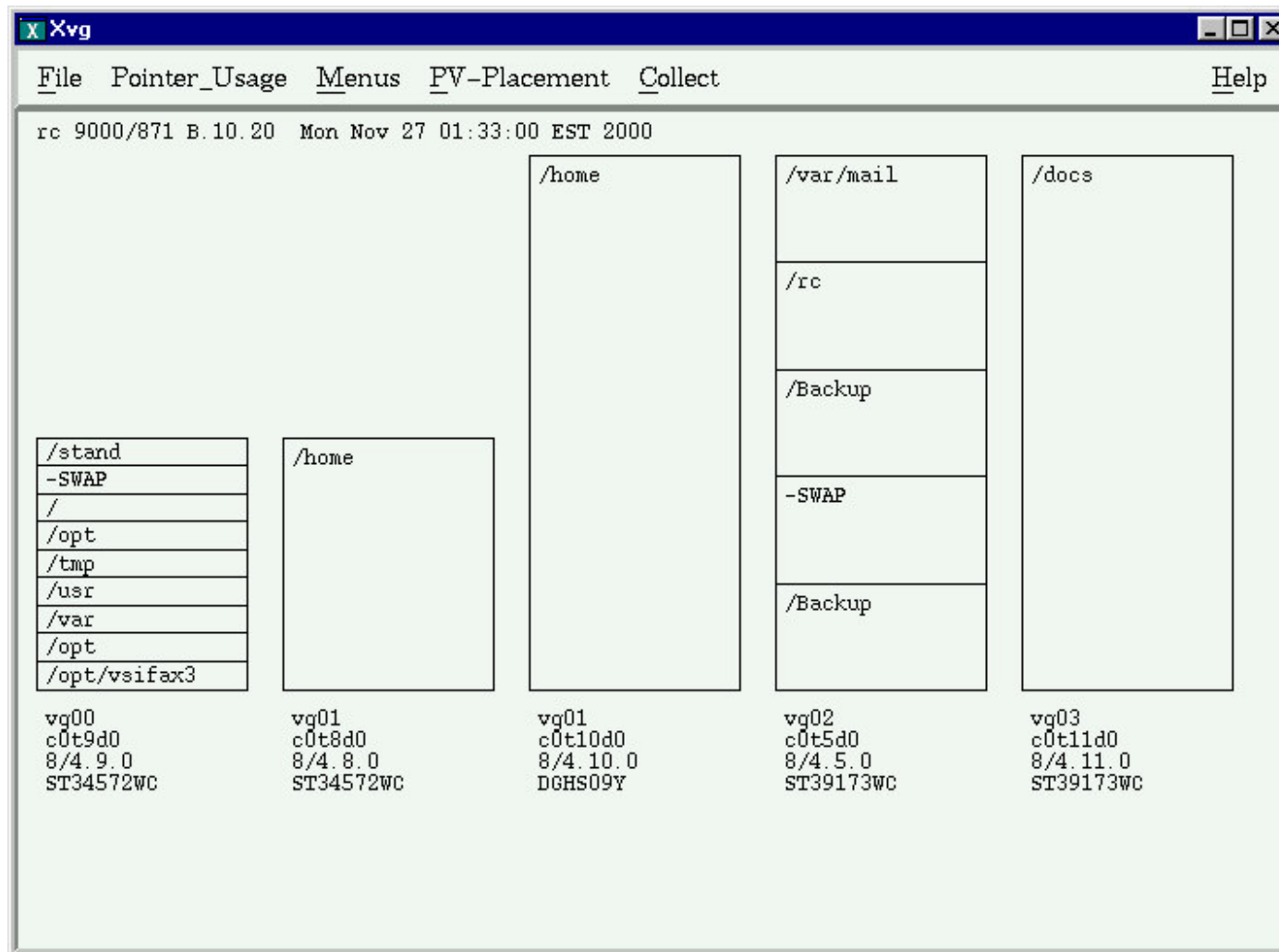
Xvg Display Program



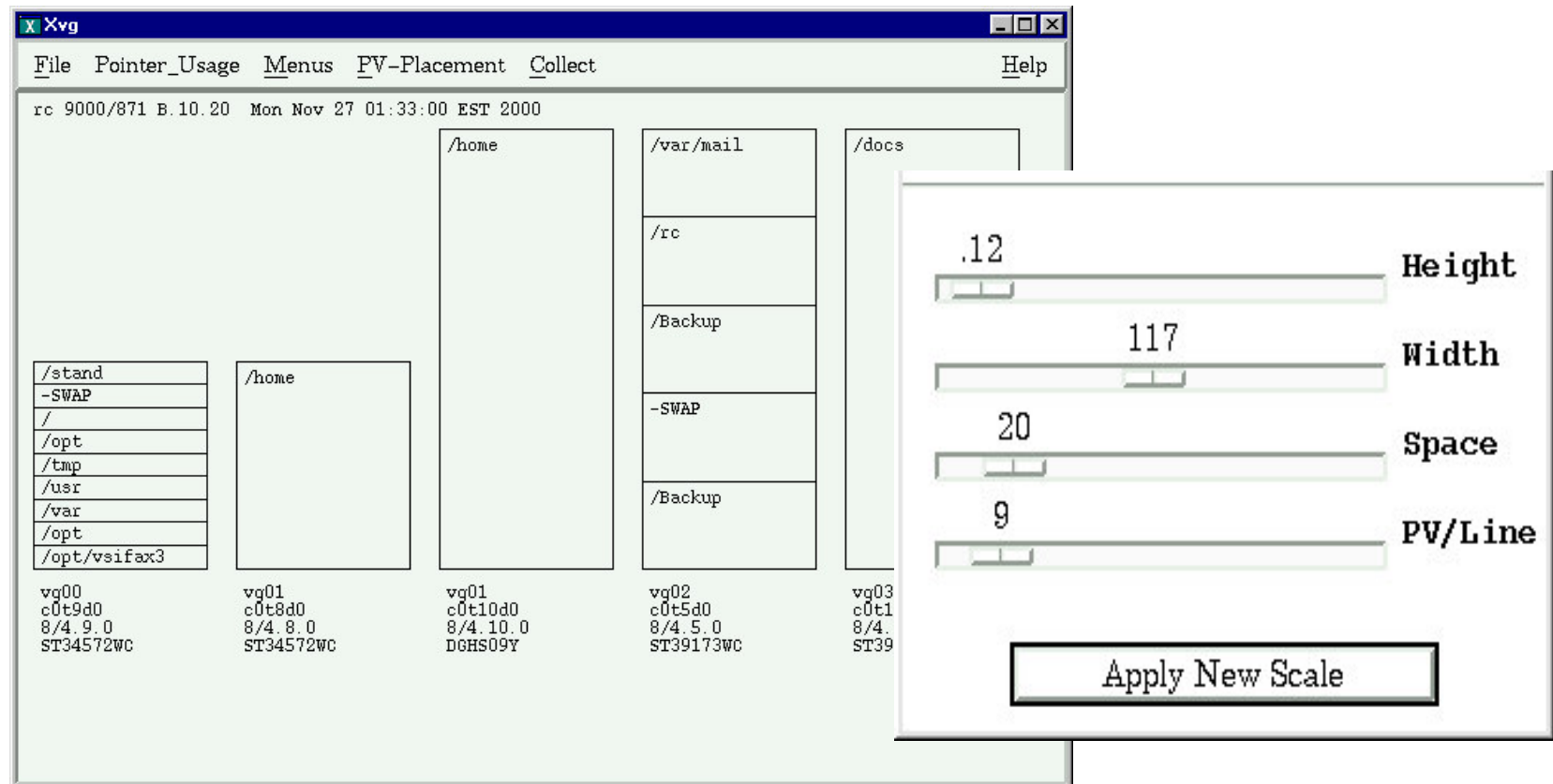
Xvg Display Program



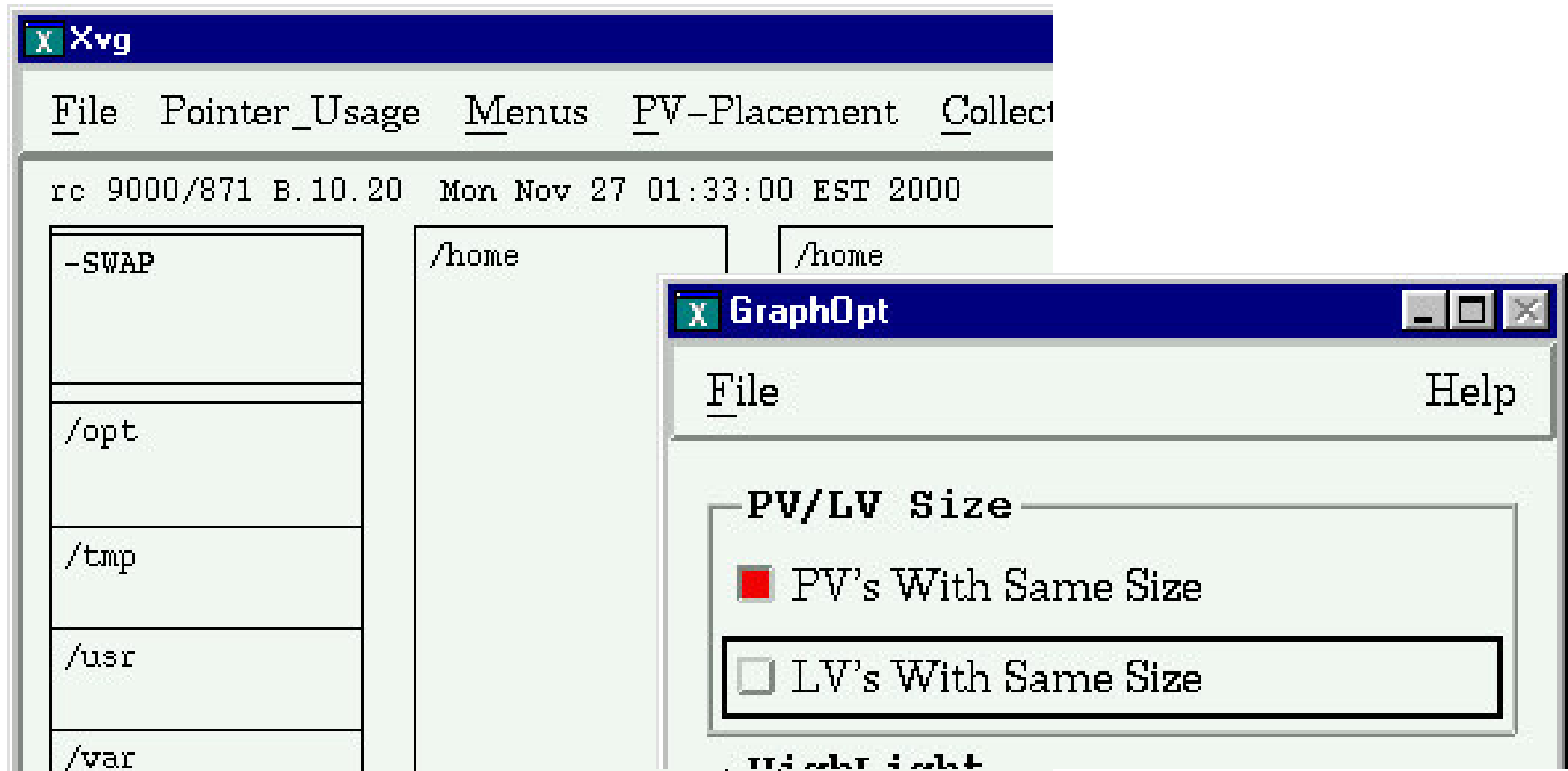
Xvg Display Program



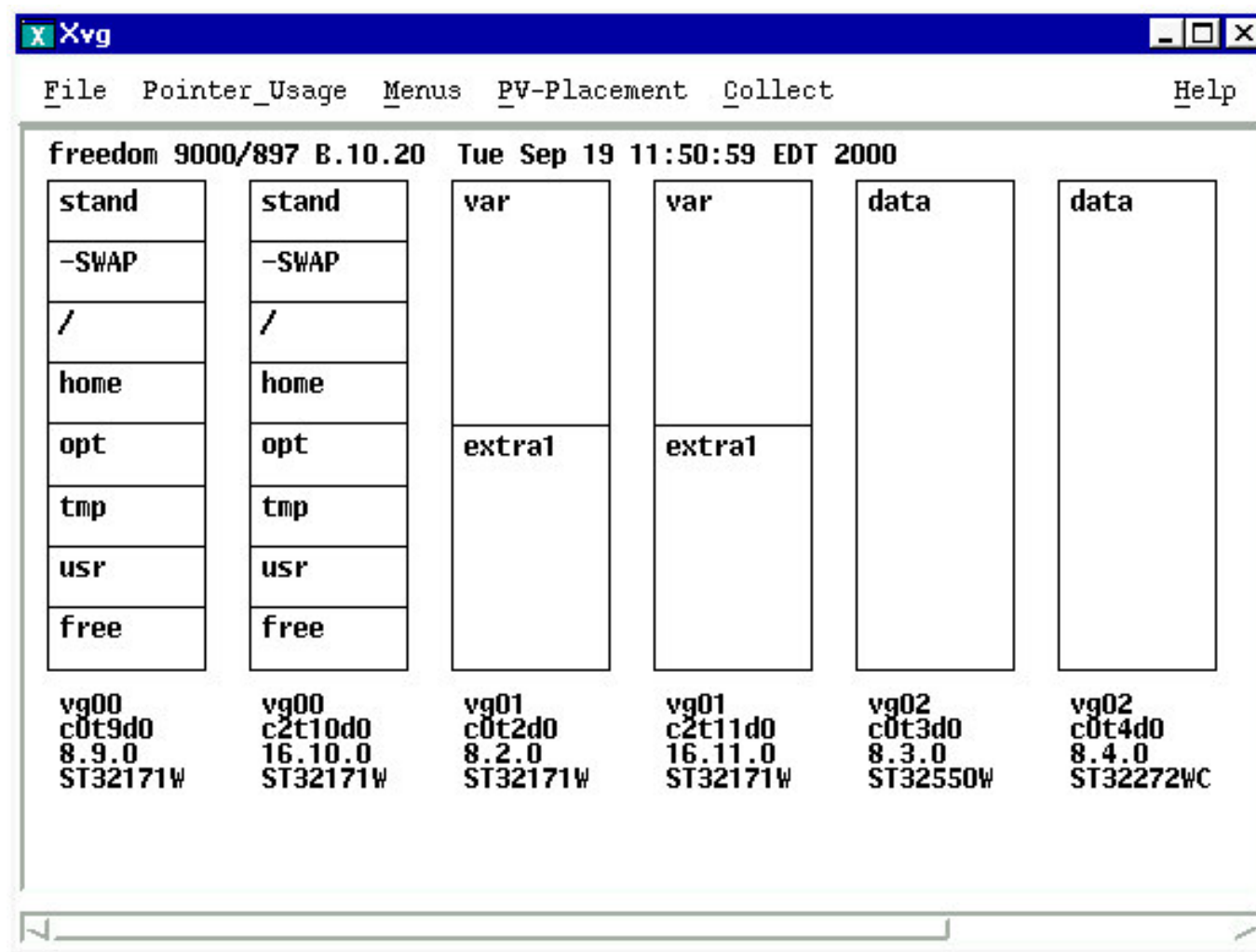
Xvg Display Program



Xvg Display Program



Xvg Display Program



Xvg - continued

The screenshot shows the Xvg window titled "Xvg" with a menu bar: File, Pointer_Usage, Menus, PV-Placement, Collect, Help. The status bar displays "freedom 9000/897 B.10.20 Tue Sep 19 11:50:59 EDT 2000".

The main display area shows a disk layout visualization with four columns representing different storage configurations. The first two columns are labeled "stand" and the last two are labeled "var". Each column contains a stack of boxes representing logical volumes (LVs) and their attributes.

stand	stand	var	var	data	data
-SWAP	-SWAP				
/	/				
home	home				
opt	opt				
tmp	tmp				
usr	usr				
free	free	extra1	extra		
vg00 c0t9d0 8.9.0 ST32171W	vg00 c2t10d0 16.10.0 ST32171W	vg01 c0t2d0 8.2.0 ST32171W	vg01 c2t11 16.11 ST32171W		

The "HighLight" dialog box is open, showing the following options:

- ☒ Highlight Mirror LV's (border)
- ☐ Highlight Mirror LV's (solid)
- ☐ Highlight Non Contiguous LV's
- ☐ Highlight Free Space
- ☐ Highlight PVLINEs

Xvg - continued

Xvg

File Pointer_Usage Menus PV-Placement Collect Help

freedom 9000/897 B.10.20 Tue Sep 19 11:50:59 EDT 2000

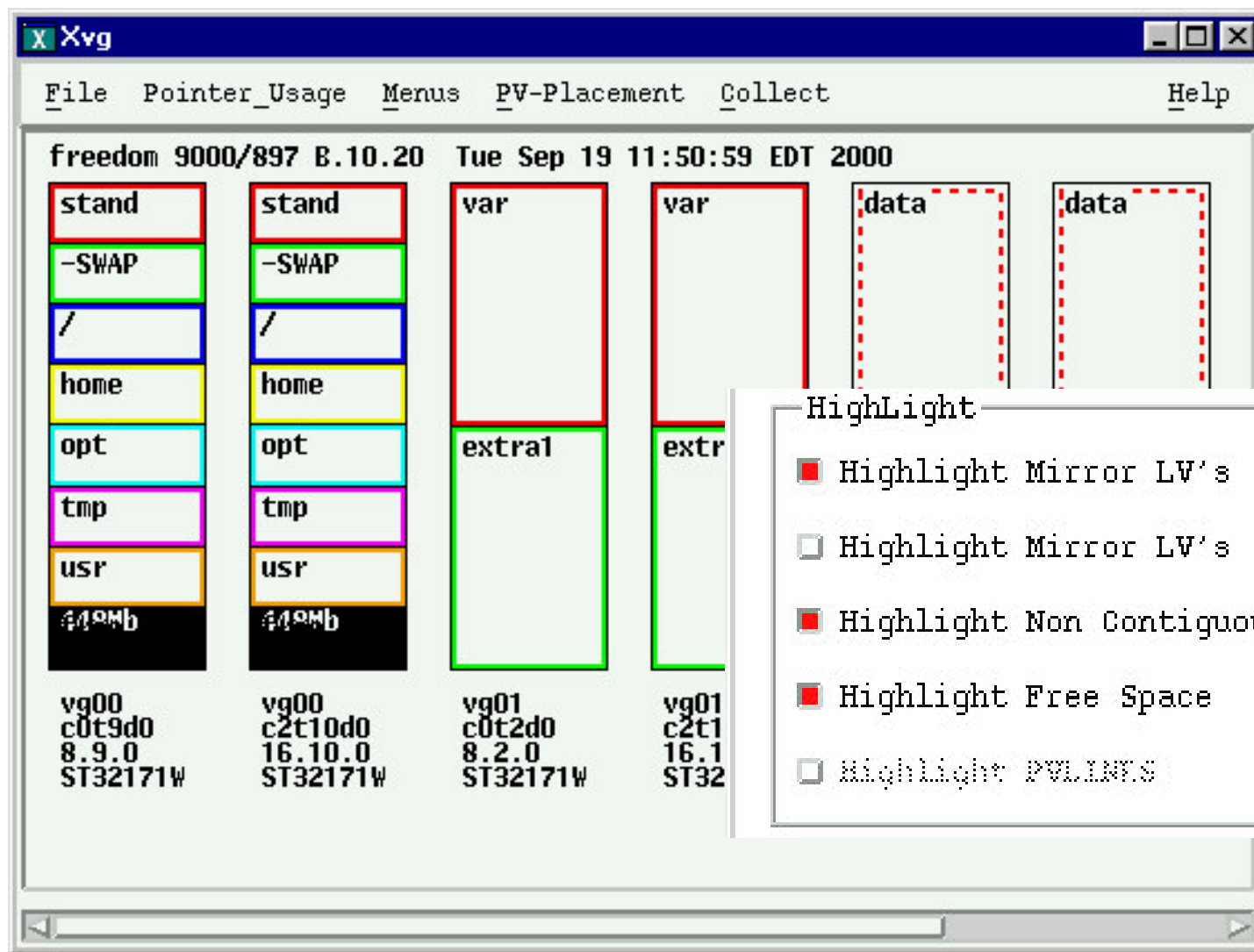
stand	stand	var	var	data	data
-SWAP	-SWAP				
/	/				
home	home				
opt	opt				
tmp	tmp				
usr	usr				
free	free	extra1	ex		

vg00 c0t9d0 8.9.0 ST32171W
 vg00 c2t10d0 16.10.0 ST32171W
 vg01 c0t2d0 8.2.0 ST32171W
 vg01 c2t16d0 16.10.0 ST32171W

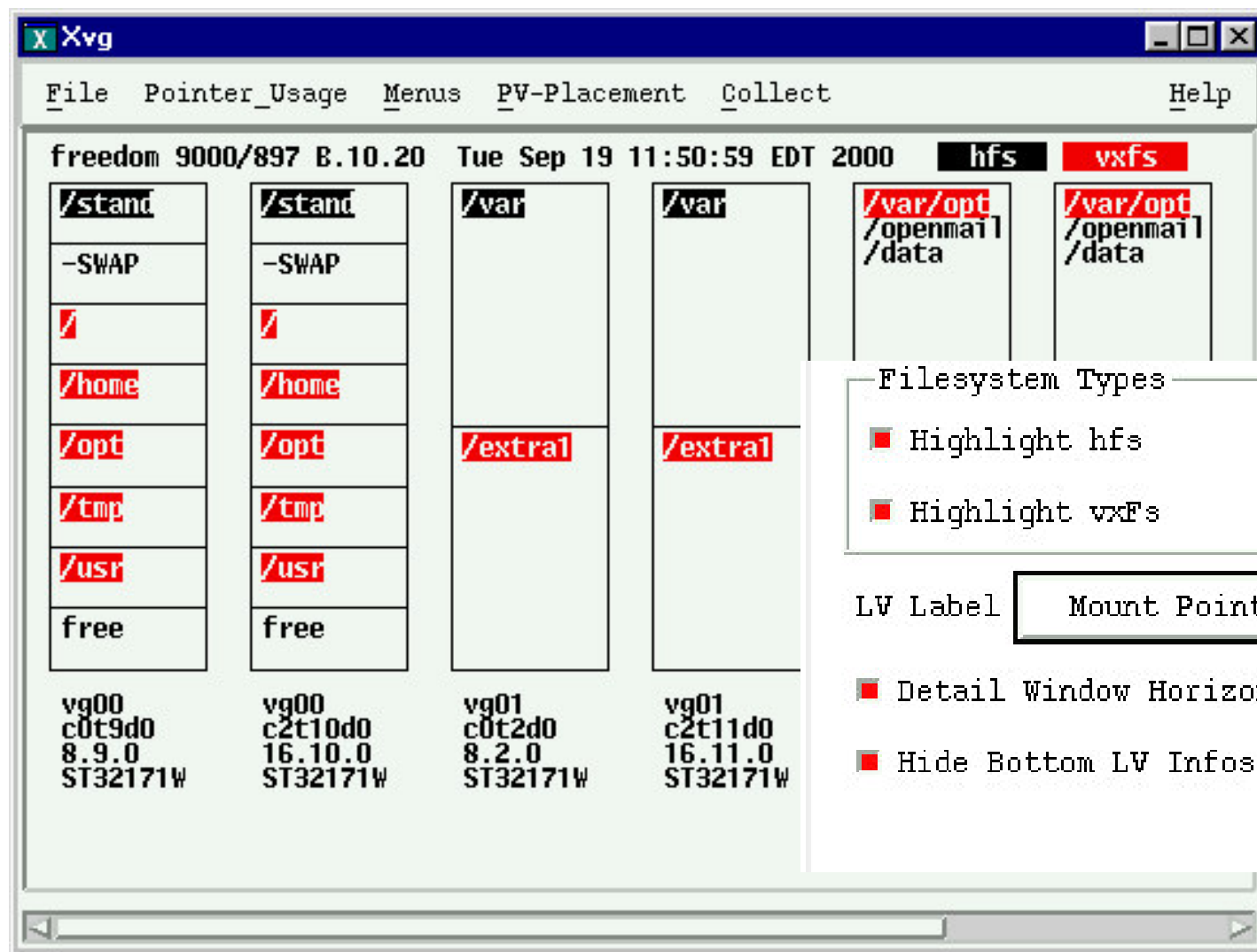
HighLight

- ☒ Highlight Mirror LV's (border)
- ☒ Highlight Mirror LV's (solid)
- ☐ Highlight Non Contiguous LV's
- ☐ Highlight Free Space
- ☐ Highlight PVLINES

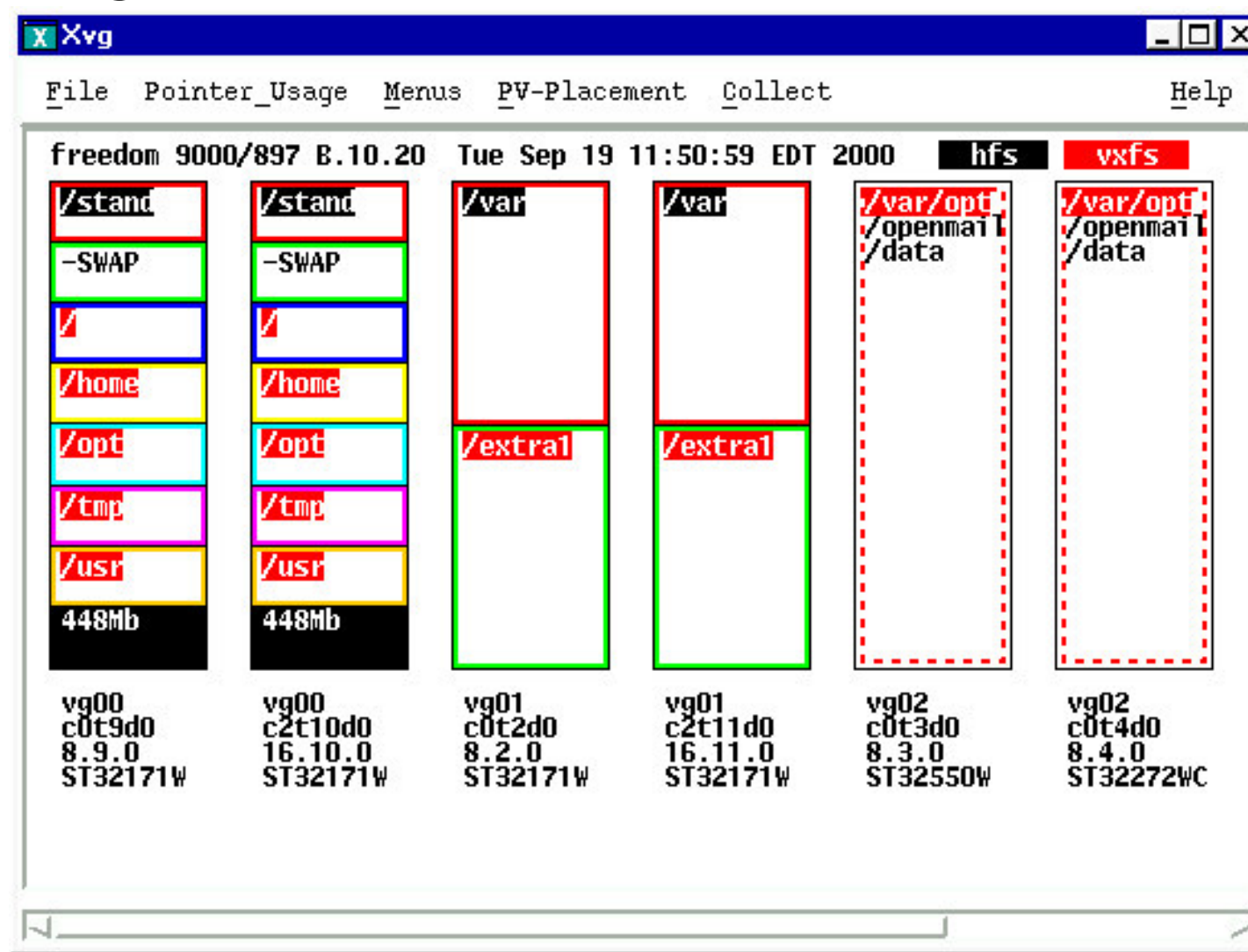
Xvg - continued



Xvg - continued



Xvg - continued



Xvg - continued

Xvg

File Pointer_Usage

freedom 9000/897 B.10

/stand	/stand
-SWAP	-SWAP
/	/
/home	/home
/opt	/opt
/tmp	/tmp
/usr	/usr
448Mb	448Mb

vg00
c0t9d0
8.9.0
ST32171W

vg00
c2t10d0
16.10.0
ST32171W

detail

LOGICAL VOLUME INFORMATION		PHYSICAL VOLUME INFORMATION		VOLUME GROUP INFORMATION	
Lvol:	/dev/vg00/lvol4	PV Name:	/dev/dsk/c2t10d0	VG Name	/dev/vg00
LV Size: (Mb)	20	VG Name:	/dev/vg00	Write Access:	read/write
Lv Chunk: (Mb)	20	PV Status:	available	VG Status:	available
Filesys Type:	vxfs	Allocatable:	yes	Max LV:	255
LV Permission:	read/write	VGDA:	2	Cur LV:	7
LV Status:	available/syncd	Cur LV:	7	Open LV:	7
Mirror copies:	1	PE Size:	4	Max PV:	16
Recovery:	MWC	Total PE:	507	Cur PV:	2
Schedule:	parallel	Free PE:	112	Act PV:	2
Bad block:	on	Allocated PE:	395	Max PE per PV:	5120
Allocation:	strict	Stale PE:	0	VGDA:	4
Current LE:	5	PV LINK:	NOPVLINK	PE Size (Mb):	4
Allocated PE:	10	TimeOut:	default	Total PE:	1014
Stripes:	0			Alloc PE:	790
Stripe SZ (Kb):	0			Free PE:	224
TimeOut:				Total PVG:	0
Mount Point:	/home			Total Spare PV:	-1
Free Blocks:	4784			Spare PV Used:	-1
BlockSize:	8192				
FragSize:	1024				

Close

ST32171W

ST32171W

ST32550W

ST32272WC

Logfiles:

Where did the space go?

- Don't look for big files!
- Look for big directories (10,000 small files)
- Use du as in:

```
du -kx /  
9      /lost+found  
1682   /etc/lvmconf  
464    /etc/hpC2400  
2      /etc/switch  
8      /etc/eisa  
18     /etc/skel/.elm  
1      /etc/skel/Mail
```

(oops...not sorted)

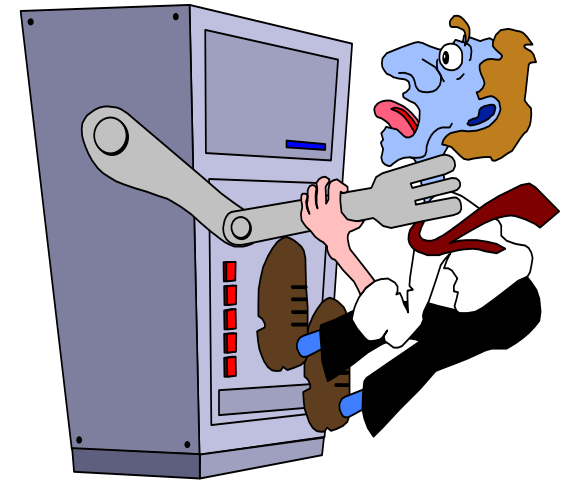
Where did the space go?

- Use du as in (sorted):

```
du -kx / | sort -rn | more
36048    /
15215    /sbin
14196    /etc
8032     /etc/lp
7927     /etc/lp/interface
6864     /etc/lp/interface/model.orig
6509     /root
3868     /sbin/fs
```

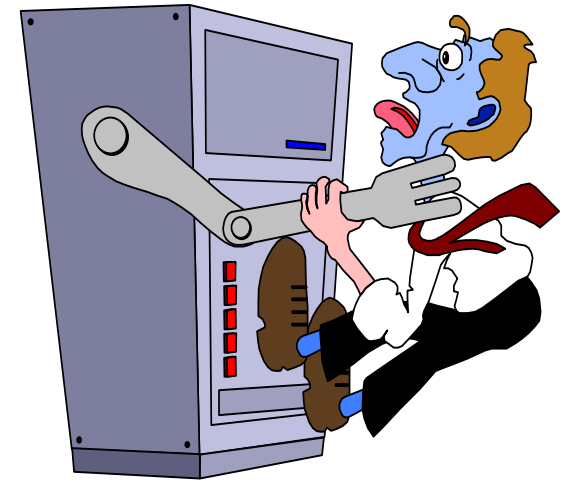

Database directories

- Databases
 - files vs raw access
 - raw: document! (**/etc/fstab**)



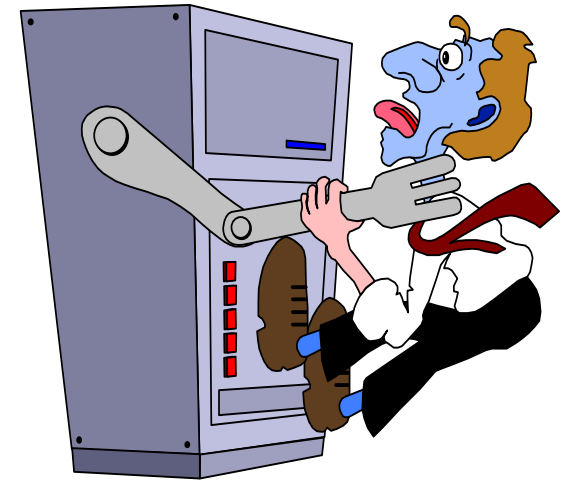
Database directories

- Databases
 - files vs raw access
 - raw: document! (**/etc/fstab**)
 - fixed file count and size
 - minfree (10% and 0%)
 - inodes (HFS only)



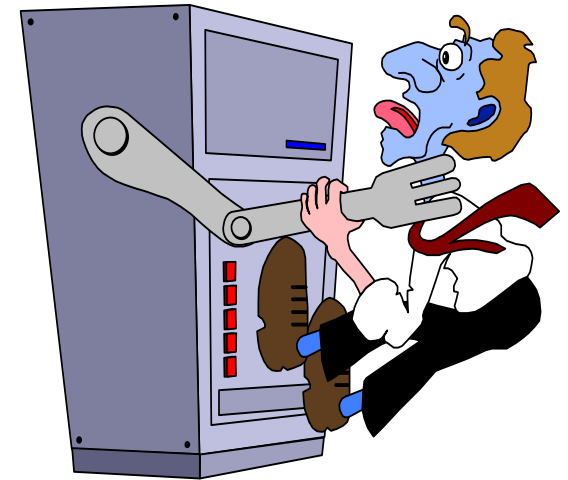
Database directories

- Databases
 - files vs raw access
 - raw: document! (**/etc/fstab**)
 - fixed file count and size
 - minfree (10% and 0%)
 - inodes (HFS only)
 - Mount options (advanced VxFS)
 - Table space (/u01 /u02 ...)
 - **minfree=direct,convosync=direct,nodatainlog**



Database directories

- Databases
 - files vs raw access
 - raw: document! (**/etc/fstab**)
 - fixed file count and size
 - minfree (10% and 0%)
 - inodes (HFS only)
 - Mount options (advanced VxFS)
 - Table space (/u01 /u02 ...)
 - **minfree=direct,convosync=direct,nodatainlog**
 - Redo logs, archived redo logs, indexes
 - executables



Growing directories

- New application installs
 - Ask vendor for inventory and size
 - Require all apps to install in /opt
 - Or create a symlink (ln -s)
- logfiles
 - Always grow
 - Require regular trim
- core (**ulimit -Sc 0**) and other files



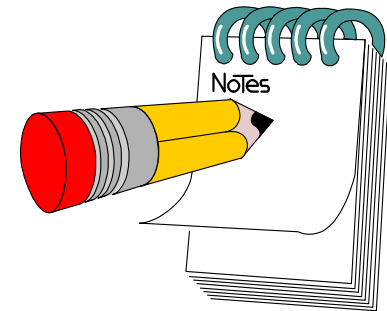
Log Files

- **var/adm:**

- acct/
- automount.log
- btmp
- crash/
- cron/
- diag/
- dmesg.log
- eisa/
- inetd.sec
- lp/
- netstat_data
- nettl.LOG00
- ps_data
- ptydaemonlog

- **/var/adm:**

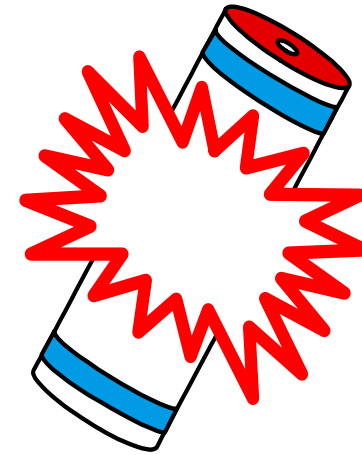
- rbootd.log
- rpc.lockd.log
- rpc.statd.log
- sbtab
- shutdownlog@ -> /etc/shutdownlog
- streams/
- sulog
- sw/
- syslog/
- vtdaemonlog
- wtmp
- wtmpold



Core Files

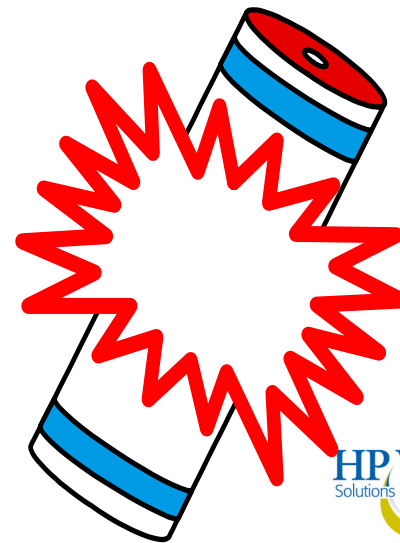
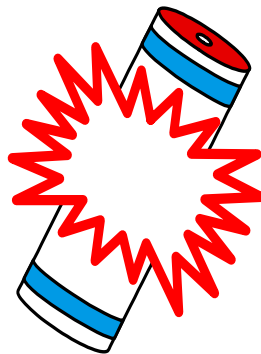
- Identify with file command:

```
# sleep 999 &  
# ps  
11244 ttyp3  0:00 sleep  
# kill -SIGQUIT 11244  
# ll core  
-rw-----1 root sys 243140 Nov 27 16:16 core  
# file core  
core: core file from 'sleep'-received SIGQUIT
```



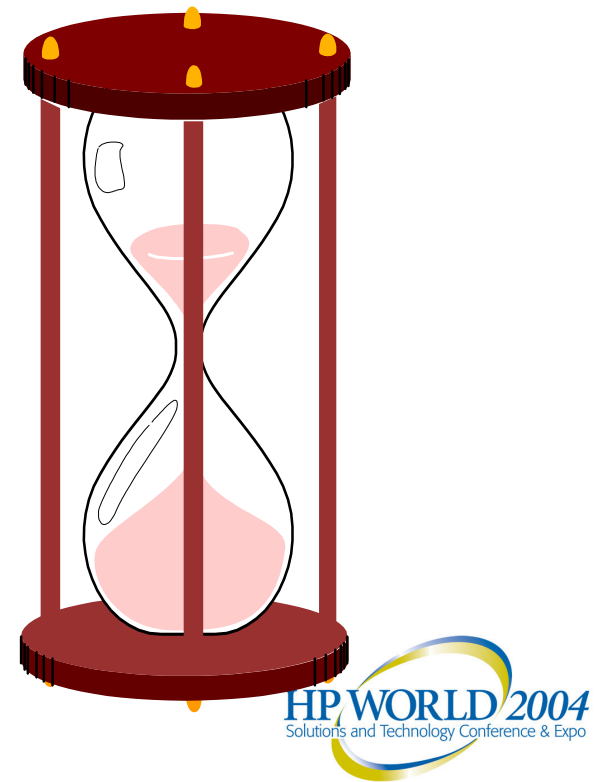
Core Files - cleanup

- Find and remove:
 - **find / -fonly vxfs -type f -name core -exec rm {} \;**
- add **-mtime** for development (save for a while)
 - mtime +3** (older than 3 days)
 - mtime -3** (newer than 3 days)



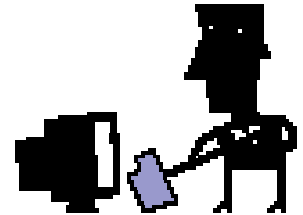
Cron Monitoring

- diskpace.sh:
 - monitors all mountpoints
 - selectable limits
 - automated notification
 - run from cron
 - Download from ftp site



Logfiles

- Characteristics and locations
- syslog, the big one
- User Activity logs (*tmp)
- Miscellaneous logs



Logfiles - what to do?

- Can't live with 'em, can't live without 'em
- Why?
- Where?
- How?
- Huh?

Filesystem Full!

- White paper (9.x and 10.x/11.x)

<ftp://contrib:9unsupp8@hprc.external.hp.com>

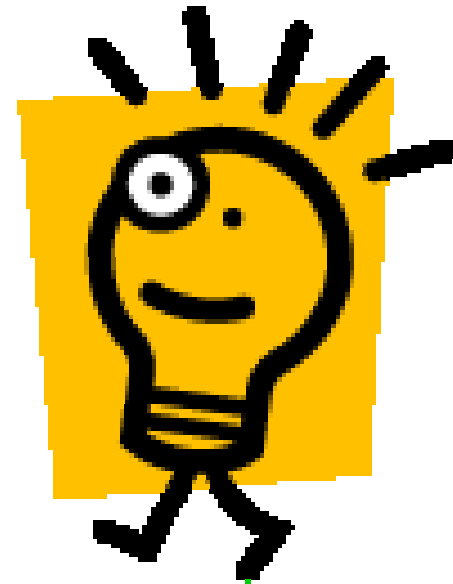
- find versus du
 - find = files only
 - du = directory sums:

du -x /home | sort -rn > /usr/tmp/du.home



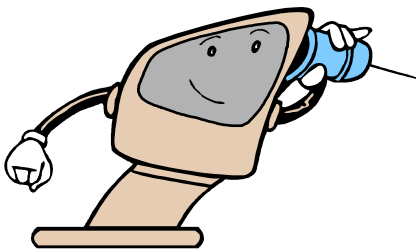
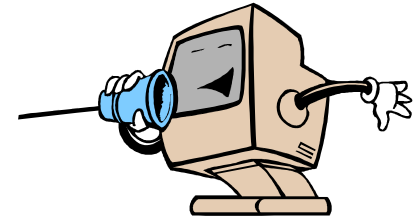
Where?

- **/var/adm**
 - Most system logfiles
 - diag logs
- **/var/adm/lp**
 - **log, lpd.log, lpana.log**
- (and others in **/var/adm**)
- applications!



Syslog - everything's here

- **/var/adm/syslog/syslog.log**
 - Bootup info
 - daemons, kernel, errors, info
 - applications
 - user-defined messages



- Example entries:

```

Jan 19 02:00:01 bambam named[3790]: reloading nameserver
      \
      \
      \
      \_Date/time
      \
      \
      \
      \_process[PID]
      \
      \
      \_machine
      \
      \
      \_message

```

syslog boot messages

- **syslogd: restart**
- **vmunix: 8/16 bus_adapter**
- **vmunix: Logical volume 64, 0x3 configured as ROOT**
- **vmunix: Memory Information:**
- **vmunix: physical page size = 4096 bytes, logical page size = 4096**
- **vmunix: Physical: 131072 Kbytes, lockable: 131072 Kbytes, available**



More syslog oneliners

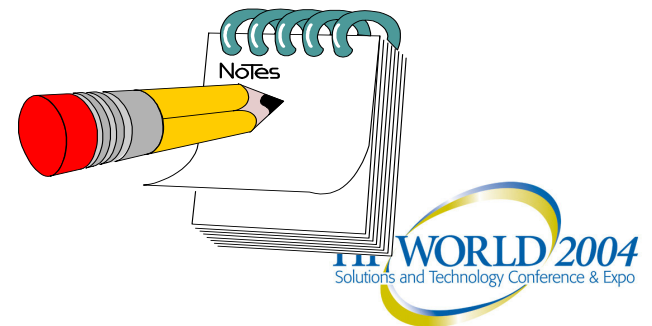
- nettl[593]: nettl starting up.
- inetd[749]: Reading configuration
- inetd[749]: ftp/tcp: Added service, server /usr/sbin/ftpd
- inetd[19760]: auth/tcp: Connection from i3125ljm
- xntpd[864]: offset -0.001348 freq -26.23103 comp 6
- ftpd[8204]: User hassell: Login incorrect
- syslogd: going down on signal 1

Still more syslog

- `snmpd[5706]: EXCEPTIONS: bad version: 1`
- `last message repeated 3 times`
- `do_timeouts() - cannot unmount XXX:/`
- `do_timeouts() check symlink on XXX`
- `fs is busy - keep the link` (automount -v msg)
- `bootpd[266]: found 15.17.186.105 e3109569`
- `bootpd[266]: request from hardware address 52415320D044`
(bootp patch or /etc/syslog.conf)

syslog.conf

- facility:
 - kern, mail, lpr, daemon, auth, local0...local7, mark
- level:
 - debug, info, notice, warning, err, alert, emerg, crit, none
- destination/action:
 - pathname/file:
/var/adm/mylogfile
 - device:
/dev/console
 - usernames (logged in)
 - * (every user)



syslog examples

- kern,mark.debug /dev/console
- mail.debug /var/adm/syslog/mail.log
- *.info;mail.none /var/adm/syslog/syslog.log
- *.alert /dev/console
- *.alert root,eric, hassell
- *.emerg *
- *.emerg @ admin.hp.com



logger

- shell script log entries:

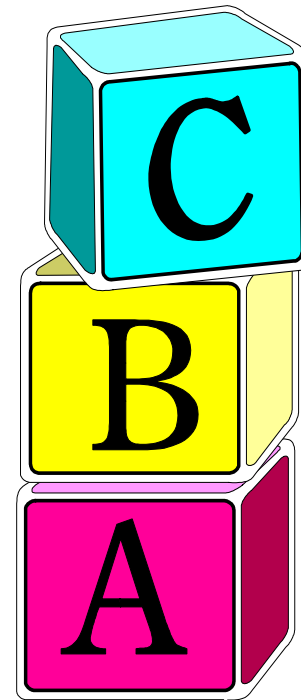
```
logger [-t tag] [-p pri] [-f file] msg
```

- logger -t MyScript -p lpr.warn Testing
- logger -t blh-cron -p kern.alert “step 3 ok”
- logger -p local3.info “News throttled”

- Test syslog.conf entries
- Debug scripts with no tty output

Facility Logging

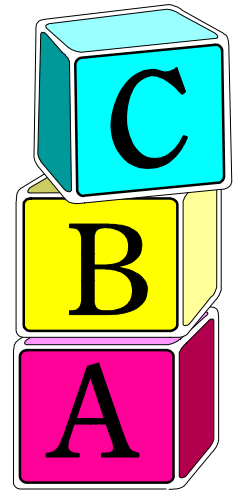
- Idea: separate syslog files
 - `syslog.kern`
 - `syslog.mail`
 - `syslog.lpr`
 - `syslog.daemon`
 - `syslog.auth`
 - etc...



Summarizing syslog

- Filtering syslog
 - skipping uninteresting messages easier to filter
 - summarize similar messages:

```
MYHOST=$(hostname)
cat /var/adm/syslog/syslog.log \
| sed -e "s/^\.*$MYHOST//" -e 's/\[[0-9]*\]//' \
| grep -v "xntpd: offset" \
| grep -v "xntpd: synchronized" \
| grep -v "sshd: Accepted" \
| grep -v "PAM_TEXT_INFO" \
| grep -v "above message repeats" \
| sort \
| uniq -c \
| sort -rn
```



Summarizing syslog

- Example summary:

```
293  ftpd: FTP session closed
32   ftpd: ANONYMOUS FTP LOGIN FROM snoopy [192.168.1.3], ftp
32   ftpd: ANONYMOUS FTP LOGIN FROM scooby [192.168.1.29], ftp
32   ftpd: ANONYMOUS FTP LOGIN FROM redbaron [192.168.1.4], ftp
32   ftpd: ANONYMOUS FTP LOGIN FROM linus [192.168.1.7], ftp
32   ftpd: ANONYMOUS FTP LOGIN FROM ghost [192.168.1.5], ftp
32   ftpd: ANONYMOUS FTP LOGIN FROM garfield [192.168.1.6], ftp
32   ftpd: ANONYMOUS FTP LOGIN FROM casper [192.168.1.8], ftp
32   LVM: /usr/sbin/lvlnboot -v
16   CM-CMD: cmgetconf -v
14   ftpd: ANONYMOUS FTP LOGIN FROM babyk [192.168.1.2], ftp
9    ftpd: FTP LOGIN FROM redbaron [192.168.1.4], root
9    ftpd: FTP LOGIN FROM ghost [192.168.1.5], root
9    ftpd: FTP LOGIN FROM babyk [192.168.1.2], root
8    vmunix:
8    ftpd: FTP LOGIN FROM snoopy [192.168.1.3], root
8    ftpd: FTP LOGIN FROM linus [192.168.1.7], root
8    ftpd: FTP LOGIN FROM casper [192.168.1.8], root
```


User Activity Logs

- `utmp` (zeroed at reboot)
- `wtmp` (cumulative!)
- `btmp` (create!)
- `last, who, write, login`
- `fwtmp` to decode (`/usr/sbin/acct/fwtmp`)

The *tmp files

- *tmp files are all in binary format
- /etc/utmp
 - active login/logout
 - rebuilt at bootup
 - needs valid logouts
 - user programs or actions can corrupt
(must login at lowest level shell...)

More *tmp files

- **/var/adm/wtmp**
 - comprehensive and cumulative:
 - logins/logouts
 - init changes
 - boot time
 - accounting
 - Always needs trimming!
 - View: **last -R -<qty> login-name**

Still more *tmp files

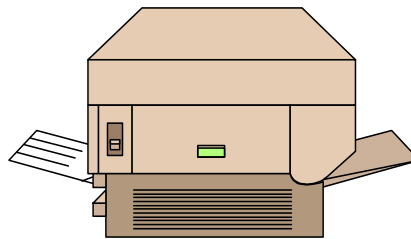
- **/var/adm/btmp**:
 - Bad logins by UID and tty port
 - Never allow group/user readable
 - **lastb** (section 1, not 1m, hence warning)
 - watch for sudden jumps in size and repeated failures for root or other users

fwtmp

- Program is hiding:
 - `/usr/sbin/acct/fwtmp`
- decodes `utmp`, `wtmp`, `btmp` into ASCII
- no errors!
- Converts either direction

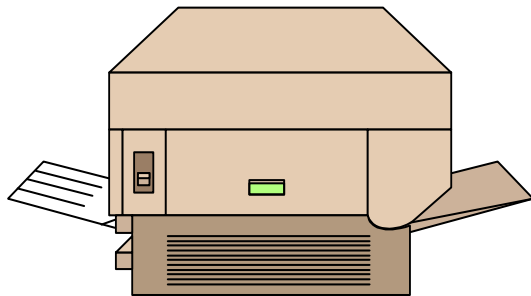
lp logfiles

- `/var/adm/lp:`
 - `log (lpsched -v` for verbose entries)
 - `lpd.log (rlpdaemon -l` to enable logging)
 - `lpana.log (lpsched -a` to add `lpana` logging)



JetDirect logfiles

- `/tmp/<queuenam>:`
 - `lp -o debugm`
 - logs the output of the printer script
- `/var/tmp/hpnpflog`
 - `hpnpf -x <ip> -N -l /some/ascii-file`
 - logs the network protocol



cron

- `/var/adm/cron/log`
- Format:
 - > CMD: command to run
 - > owner PID c/a start time
 - < owner PID c/a start time
- Sample:
 - > CMD: `/usr/sbin/dmesg - >> /var/adm/dmesg.log`
 - > root 10034 c Sun Mar 4 01:11:00 EST 2001
 - < root 10034 c Sun Mar 4 01:11:00 EST 2001
 - > CMD: `$HOME/cronfiles/bin/badboy`
 - > root 10206 c Sun Mar 4 01:15:00 EST 2001
 - < root 10206 c Sun Mar 4 01:15:01 EST 2001

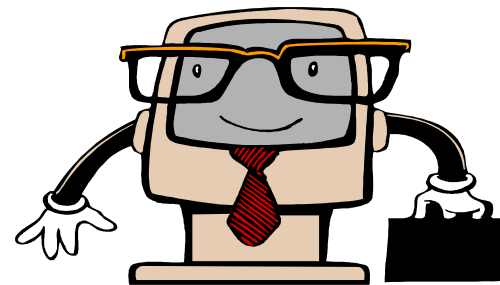
sulog

- `/var/adm/sulog`
 - logs every su change (good or bad)
 - `/etc/securetty` to force su - root
 - Use: `console` (not `/dev/console`)
 - man `login`



/etc/shutdownlog

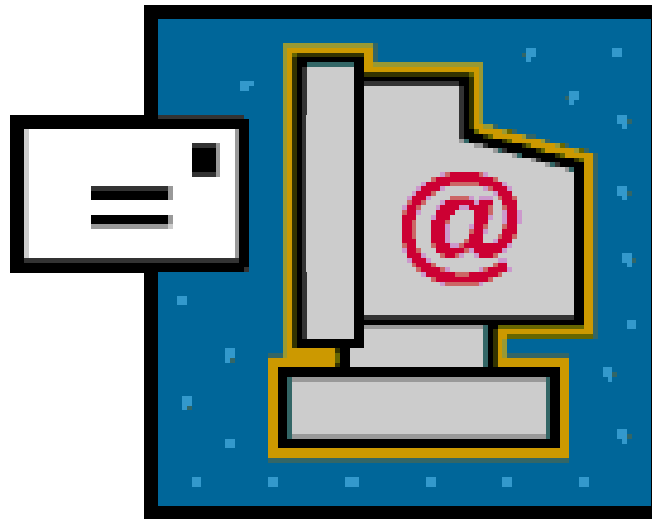
- Make sure it exists
- logs every normal shutdown
- logs abnormal restarts and can decode a panic (crash) if `/var/adm/crash` is OK



mail logs

- `/var/adm/syslog/mail.log`
 - email transactions
 - Sample:

Jan 19 22:58:28 hpuerca sendmail[2524]:
AA025201: msgid=<19980..



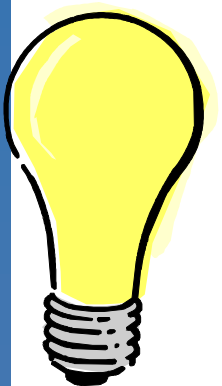
more mail logs

- from=<baae26@mpset.com.mx
- to=<rex7@bambam.atl.hp.com>, delay=00:00:05, stat=Sent, mailer=local
- to=jo_amstrong@hp.com, delay=10:00:04, stat=Deferred:
<this_is_not@my.email.address.com>... unresolvable host name my.email.address.com, check your configuration., mailer=tcp, MX host=palsmtpx.hp.com., address=[15.81.184.10]



Install/SD logs

- Software Distributor
 - `/var/adm/sw`
`swagent.log` `swconfig.log` `swinstall.log`
`swpackage.log` `swremove.log` `swagentd.log` `swcopy.log`
`swmodify.log` `swreg.log` `swverify.log`
- `cleanup` program
- `swlist -l fileset -a date -a state -a patch_state`
- `show_patches`
- `swmodify -x patch_commit=true <patch_name>`



logtrim

- Trim common logfiles
 - archive older information
 - log -> log.1
 - log.1 -> log.2 etc
 - compress the archives
 - ensure no data loss
 - correct permissions/ownerships
 - available from:

<ftp://contrib:9unsupp8@hprc.external.hp.com/coolscripts>

Useful tools (ftp site)

- autosum
- bdfmegs
- cstm-cpu
- cstm-mem
- cstm-periph
- cstm-all
- errno
- jetinfo
- laninfo
- ljdisplay
- lls
- llt
- lpinfo
- loadmedia
- mx
- psbyname
- psgrep, pslgrep
- psram
- pwgrep
- remshall (rexecall)
- restart
- syslogdecode
- viman

Additional resources

- Web help:

At: [docs.hp.com](http://docs.hp.com/hpux/onlinedocs/939/KCParms/KCparams.OverviewAll.html)
[/hpux/onlinedocs/939/KCParms/
KCparams.OverviewAll.html](http://docs.hp.com/hpux/onlinedocs/939/KCParms/KCparams.OverviewAll.html)

- [/usr/share/doc](http://usr/share/doc) (11.0, not 11i)
- itrc.hp.com docs.hp.com
- software.hp.com licensing.hp.com
- eproducts.hp.com partsurfer.hp.com
- education.hp.com
- Interex-Netherlands: sysadmin mail list
echo_subscribe_hpux-admin |
[mailx -sSubscribe majordomo@dutchworks.nl](mailto:mailx -sSubscribe_majordomo@dutchworks.nl)



HP WORLD 2004

Solutions and Technology Conference & Expo

