

Unix Performance Fundamentals

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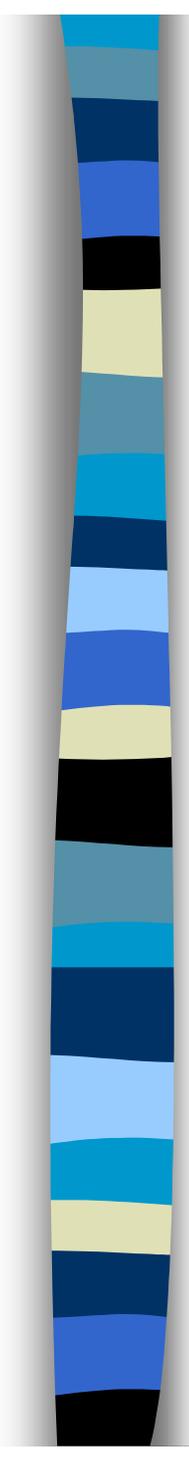
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Introduction -- What is Performance?

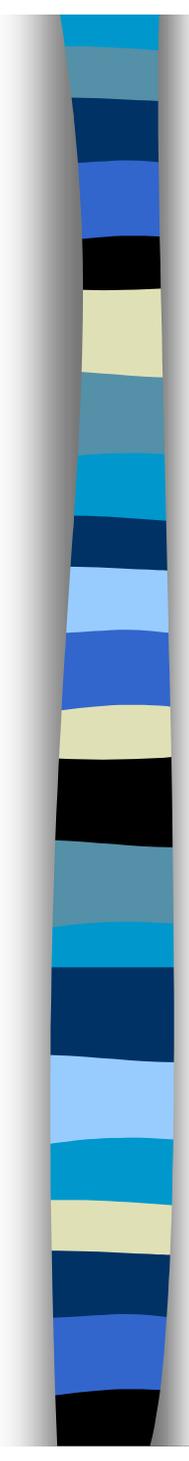


- The execution of an action, something accomplished, the fulfillment of a request,
- Good performance -- when requested actions complete within expectations. Bad is when they don't!
- Performance is important because users have expectations!



Introduction -- Why Manage Performance?

- Save money
- Prepare for change
- Prepare for growth
- Ensure adequate resources
- Solve problems
- Met SLA's
- Avoid unhappy users
- Increase system and app knowledge
- Manage crises issues
- Keep job!

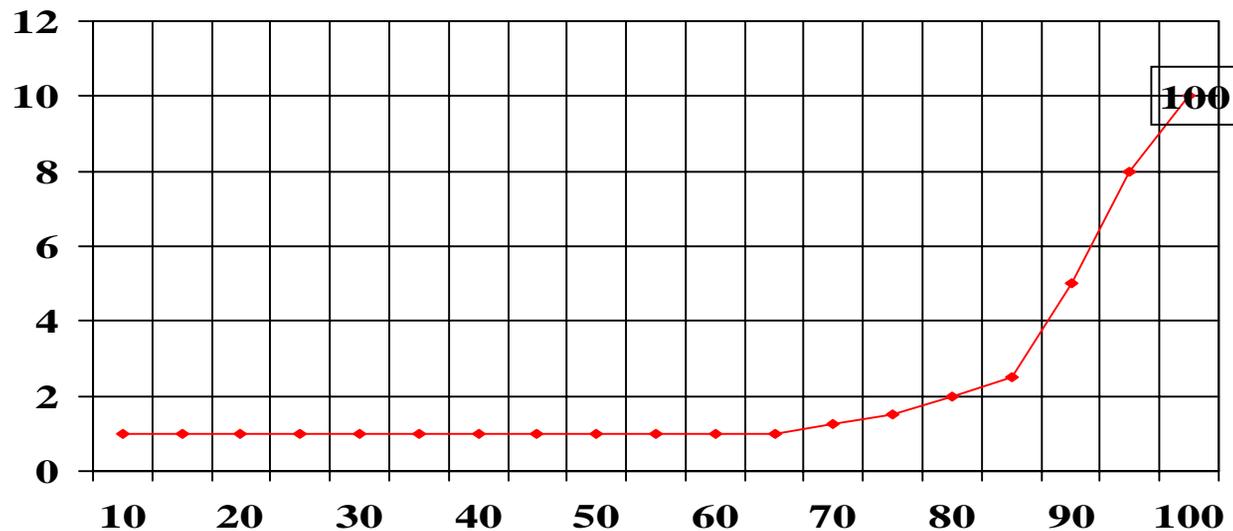


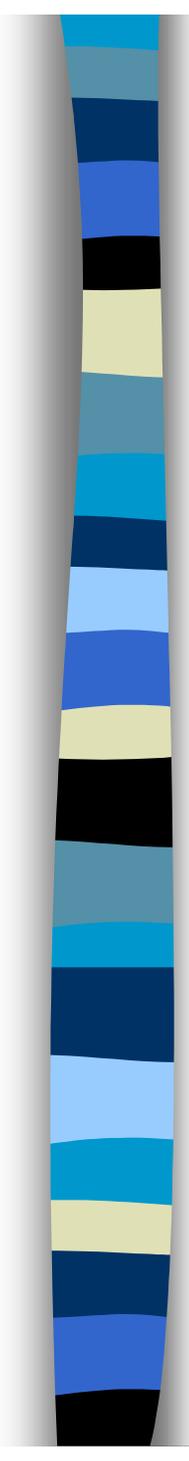
Performance Basic -- Understanding Key Concepts

- Four basic macro areas: CPU, Memory, disk, network. Several micro areas: database, application, Kernel Tuning.
- Performance Management: keeping resources adequate
- Resource restrictions are often called “bottlenecks”
- Bottlenecks are first encountered at the “Knee in the Resource Curve”

Performance Basics -- Bottleneck

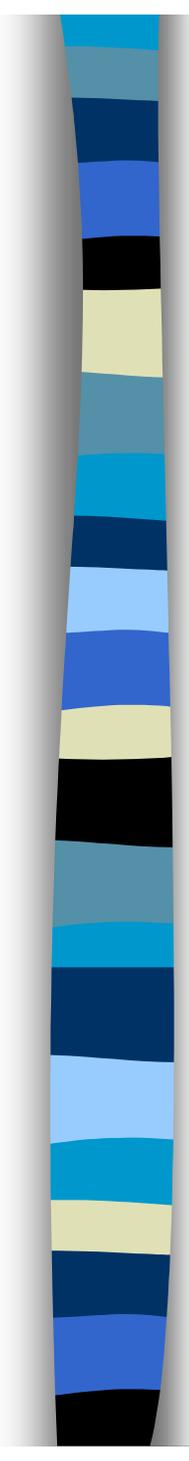
- Importance of response times.
- Avoid resource overuse or bottleneck
- Bottlenecks often called “Knee in Curve”





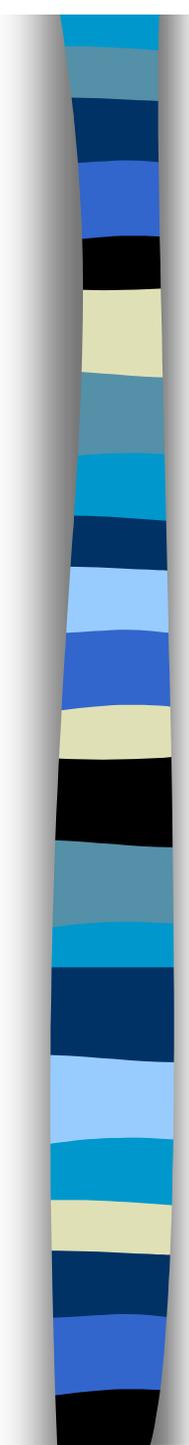
Performance Basics-- General Terms

- Resources often measured as a percentage of a whole
- Sometimes a count is the important measurement (example: the count of processes waiting in a queue)
- Averages are often the important indicator
- Performance may be acceptable until one more “straw” is added.



Performance Basics -- Definitions

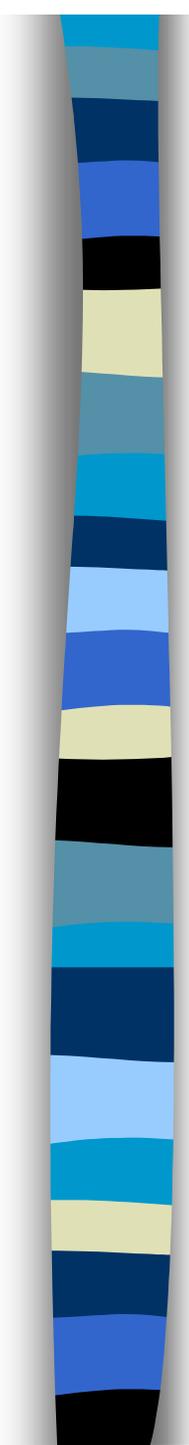
- *daemon* -- A process that performs a service on behalf of the kernel.
- *interrupt* -- A notification from a hardware device about an event that is external to the CPU.
- *I/O* -- Abbreviation of input/output. The transfer of data to and from peripheral devices.
- *I/O bound* -- A system in which the peripheral devices cannot transfer data as fast as requested.
- *kernel* -- The name for the operating system's central set of intrinsic services.
- *load average* -- The utilization of the CPU measured as the average number of processes on the run queue over a certain period of time.
- *memory bound* -- A system which is short of physical memory
- *Compute bound* - Occurs when the CPU is the limitation.



Performance Basics --

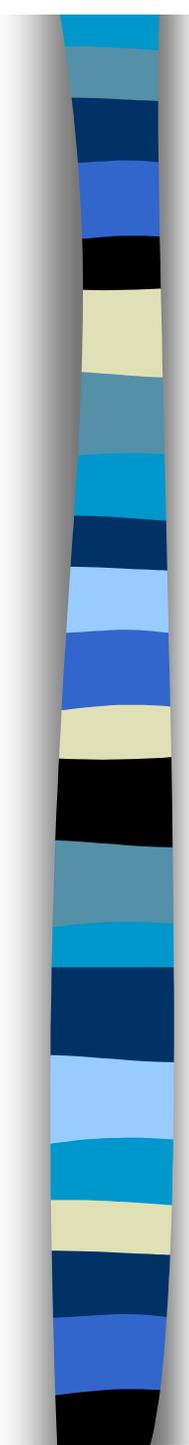
Definitions

- *Transactions per Minute (TPM)* - how many transactions of a specific type can be executed in a single minute.
- *Response Time* - This is a measurement of how long it takes from the time a transaction is issued until the server begins to issue results.
- *Bandwidth Measurements* - the amount of data that can be transmitted over a channel per unit of time.
- *Bottleneck* -- Occurs when demand for a particular resource is beyond the capacity of that resource and this adversely affects other resources.
- *Contention* -- Occurs when several CPUs or processes need to access the same resource at the same time.



Macro Area: CPU

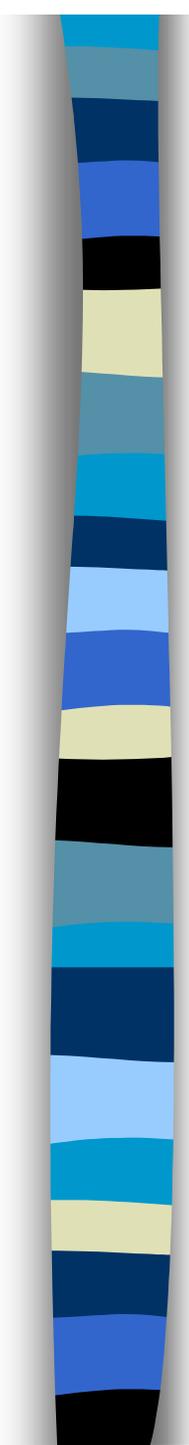
- CPU Activity
- CPU Activity States
 - Busy
 - Useful Work
 - System work
 - Work on behalf of users
 - Idle
 - CPU in the “Bank”
- CPU Run/Ready Queue



CPU: Measurement Metrics

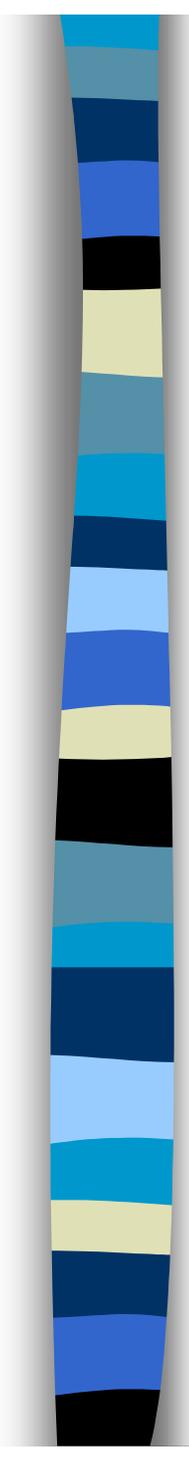
■ CPU:

- Total Busy: the resource as 0 to 100 percent utilized.
- Run Queue: the number of processes awaiting the CPU.
- Total Busy makeup: User, Real, Nice, Nnice, System, Interrupt, Context Switching, Trap, Mem, and Idle. Capture Ratio helps understand CPU usage.



Macro Area: CPU Scheduler

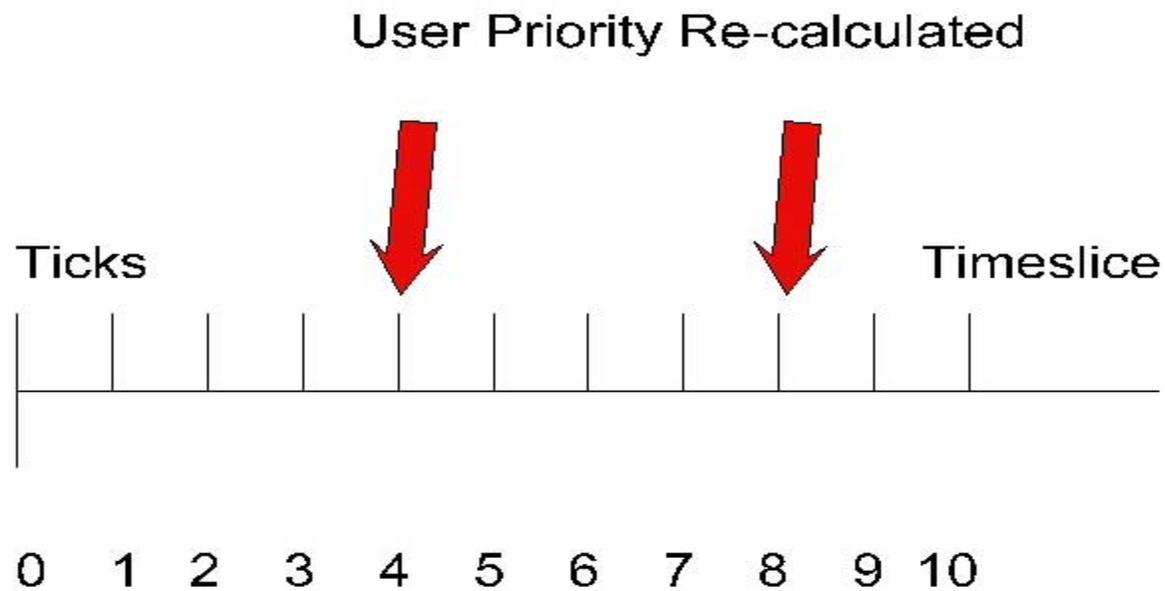
- Process activity handled by the scheduler
- Scheduler has set time slice of 1/10 of a second
- Processes assigned either Real Time or Time Share
- Priorities calculate dynamically



CPU: Measurement Metrics - Scheduler's Rules

- (R)Real Time execute at highest priority.
 - Import system proc
 - preempt low priority
 - runs until sleeps
 - Time Share are time sliced 1/10 sec.
 - Made up of sys&user
 - higher pri proc can preempt
- Round Robin scheduling
 - Priorities are recalculated dynamically
 - Nice value can be used to adjust priority calculations
 - statdaemon recalculates process priorities

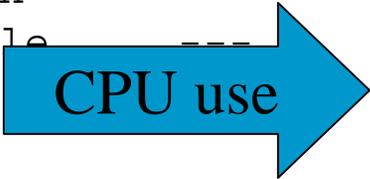
CPU: Time Slice



CPU: HP-UX Process Priority Calculation

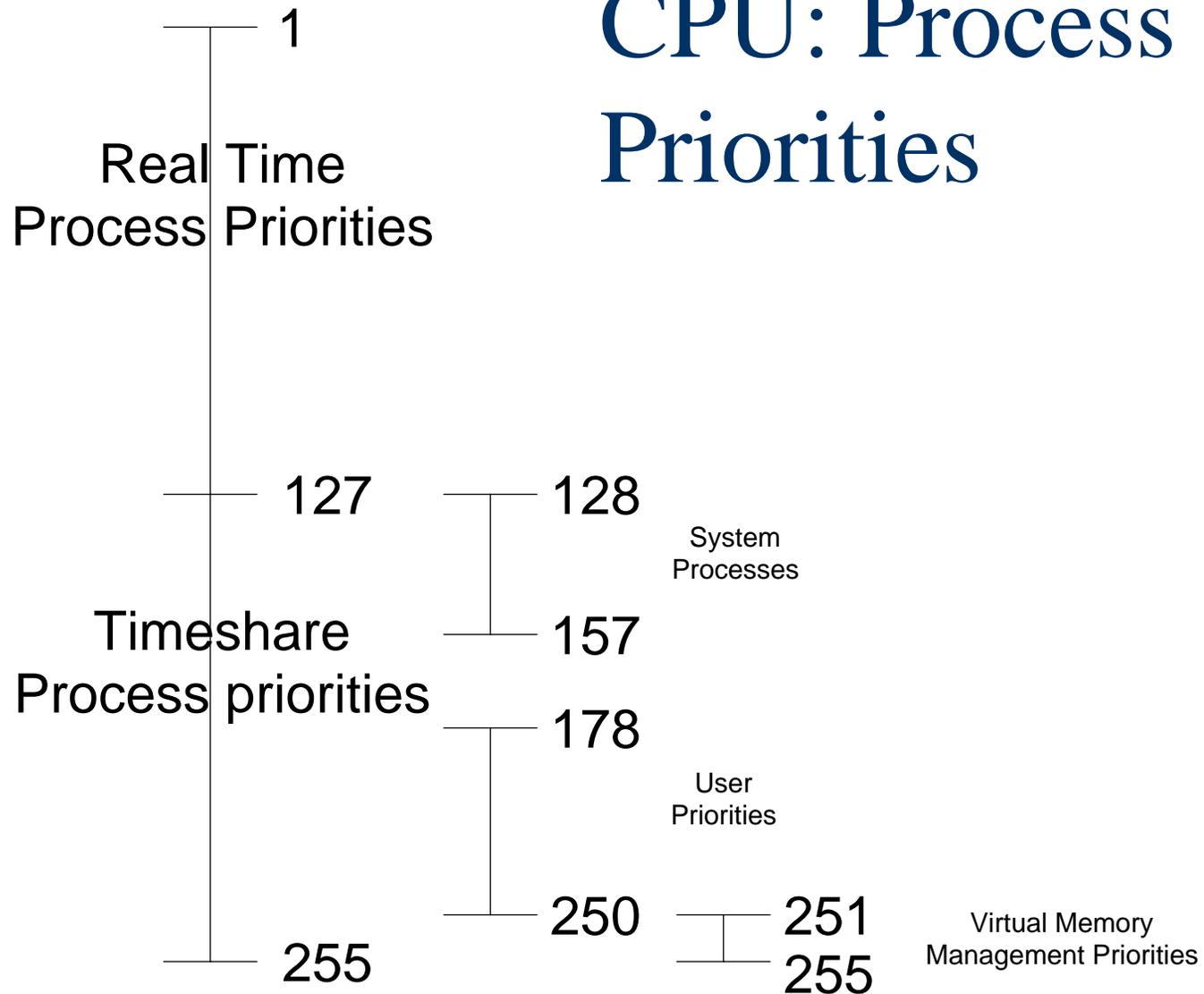
$$newpri = (\text{"recent CPU"}/const) + basepri + nice)$$

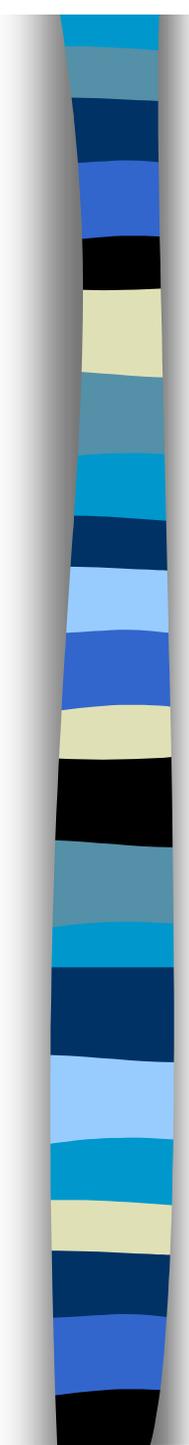
PID	Name	User Name	TTY	CPU%	Nic	Pri	RSS/Size
***** Workload:DETACH Processes *****								
16577	smx0020	ptman	---	27.0	20	154	3628/ 9m	...
16590	oracleptmn	ptman	---	23.5	20	154	131m/137m1...	
14895	oracleptmn	oracle	---	6.9	20	154	131m/137m	...
16647	oracleptmn	ptman	---	5.1	20	148	131m/137m7...	
15720	oracleptmn	oracle	---	4.5	20	154	131m/137m7...	
16315	ldupt	root		3.8	R	48	3536/4044	...



TTY	PID	USERNAME	PRI	NI	SIZE	RES	STATE	TIME	%WCPU	%CPU	COMMAND	Newpri	...
?	1730	root	235	20	448K	184K	run	420:18	65.89				...

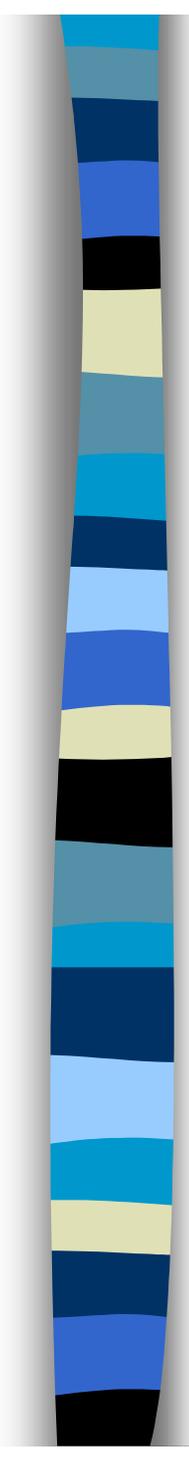
CPU: Process Priorities





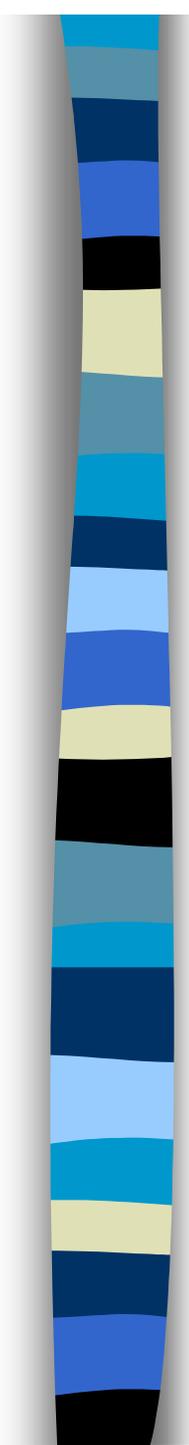
Measurement Metrics: Important Processes

- Swapper - Proc 0, works with vhand and unhashdaemon to handle swapping and paging.
- Init - proc 1, system initializations on processes /etc/inittab
- vhand - virtual memory paging.
- Statdaemon & unhashdaemon - work with swapper and vhand to check free memory and handle paging.



Measurement Metrics: Important processes

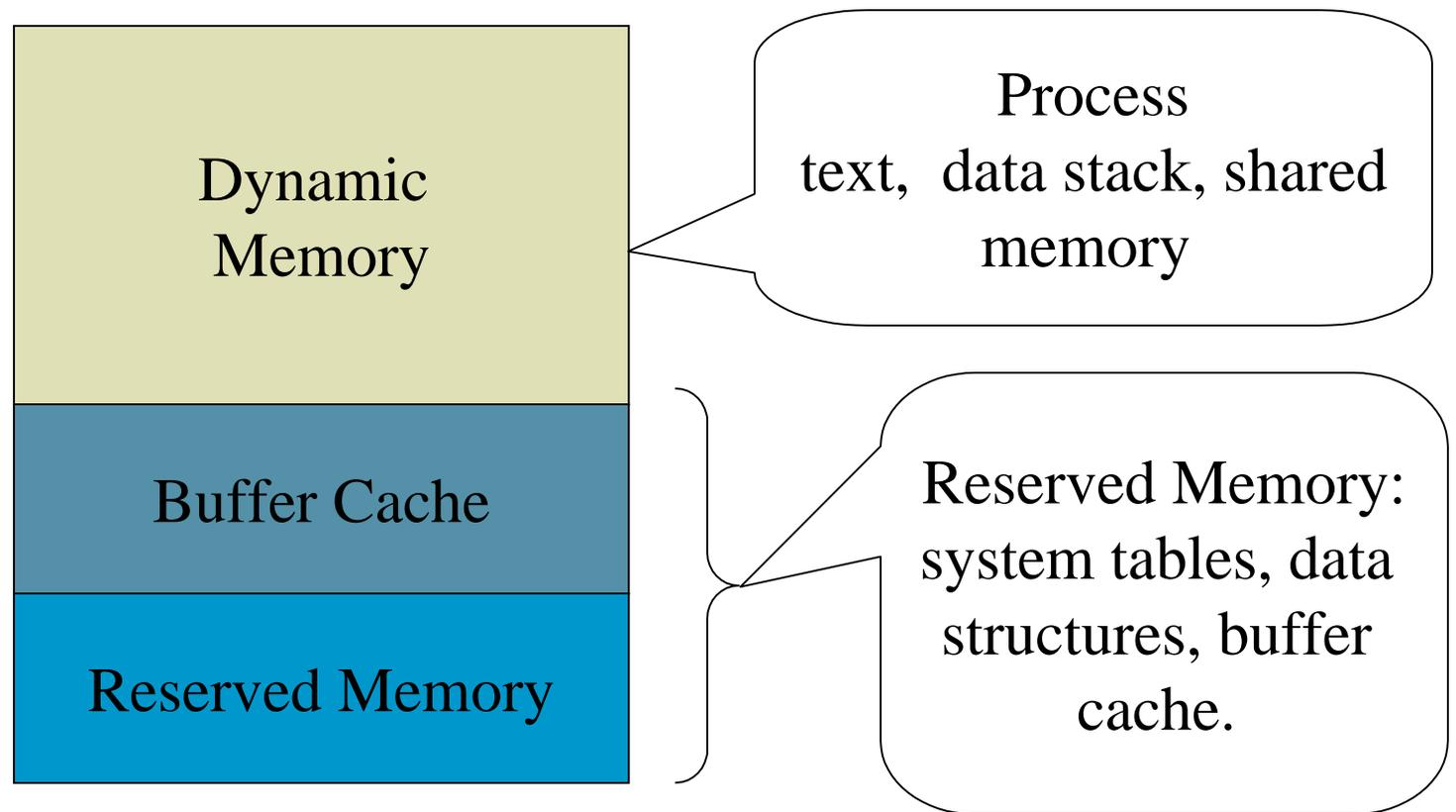
- Ttisir - kernel process handling terminal I/O.
- lvmkd - Logical Volume Manager, handles raw I/O for logical volumes.
- Vx_sched_thread & vs_*_thread - JFS process.
- Netisir - network data and calls protocol process, one per proc in SMP systems
- nvsisir - terminal network data and sends pseudo terminal info.
- Syncer - in HFS this process writes “pages” to disk.



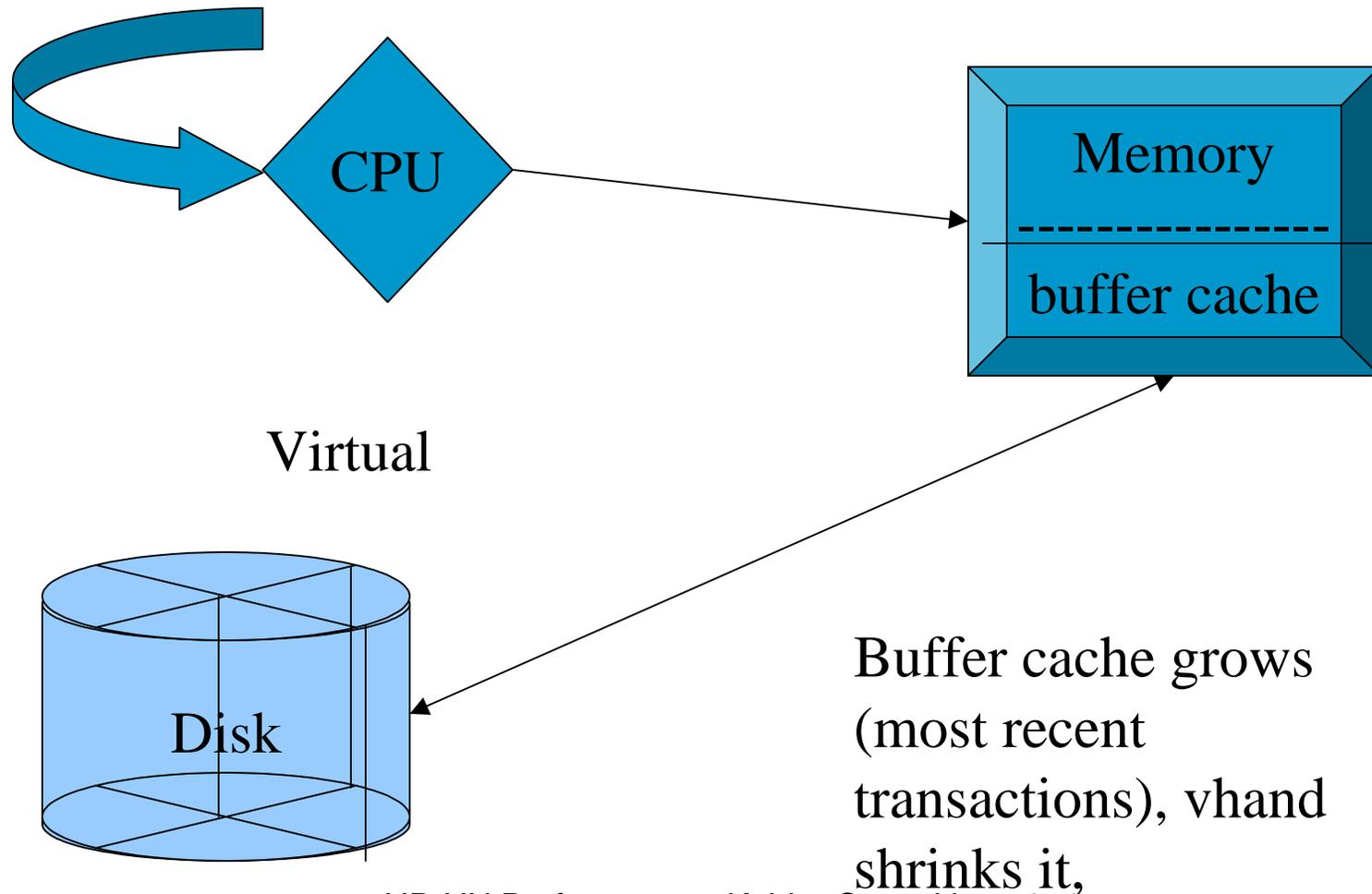
Macro Area: Memory

- Virtual Memory/Swap
 - Inexpensive means to make Main Memory look big!
- Paging - handled by the vhand process
- Swap (≤ 9.04) versus = Deactivation (≥ 10.0)
- 11.0 Supports Variable-Sized Pages (Better Performance)

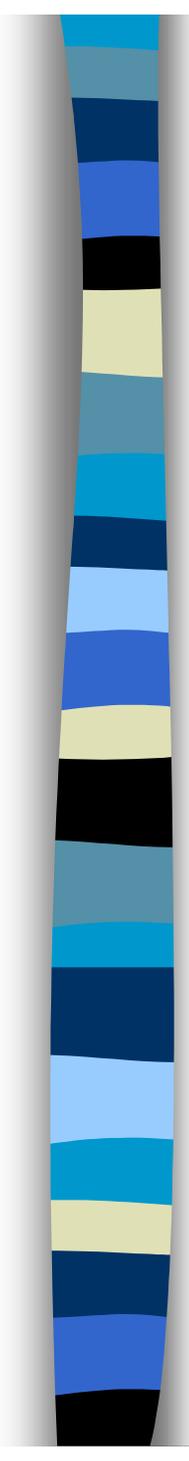
Memory: Allocation and Use



Memory: buffering and virtual



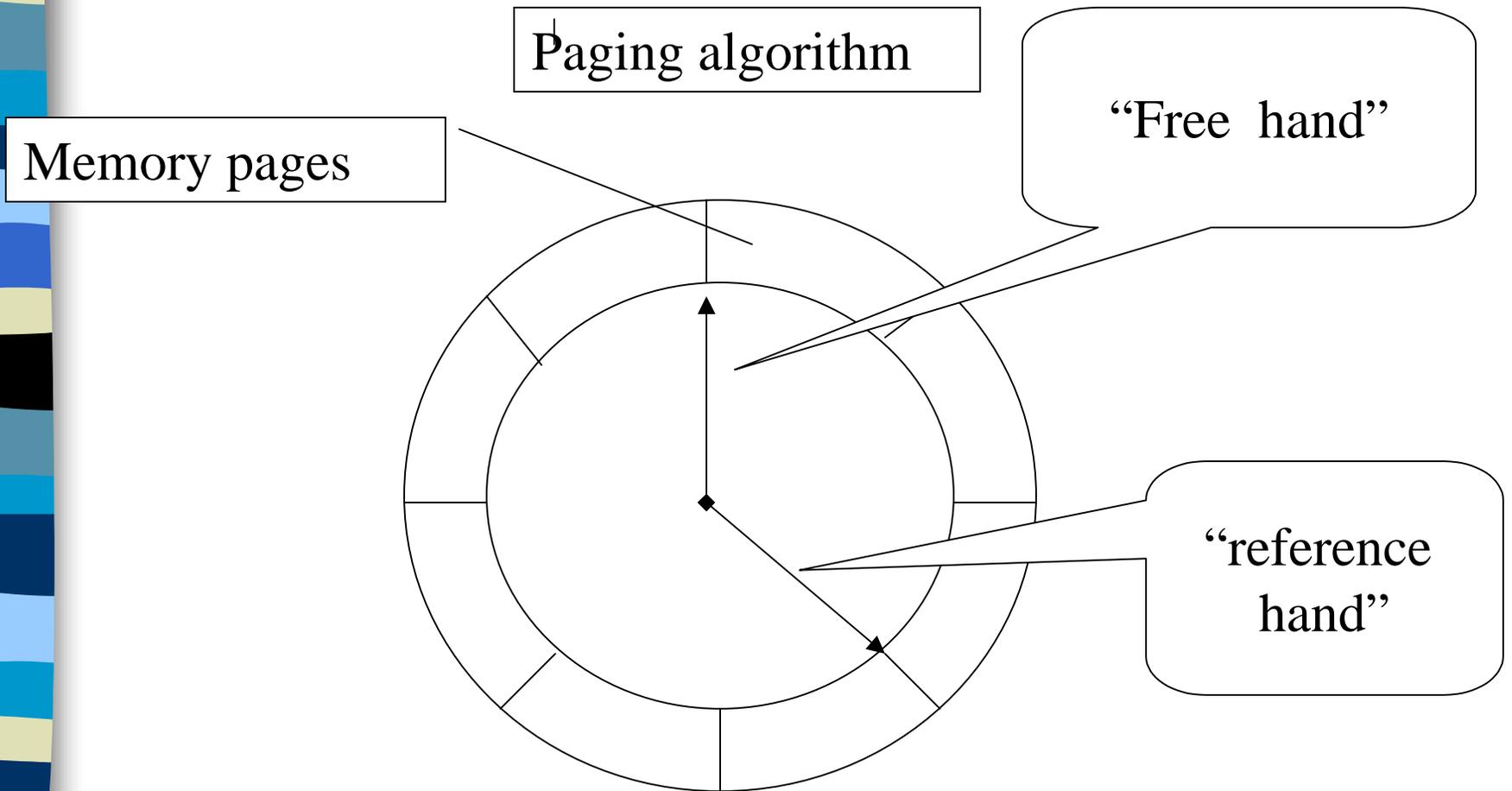
Buffer cache grows
(most recent
transactions), vhand
shrinks it,



Memory: vhand processes

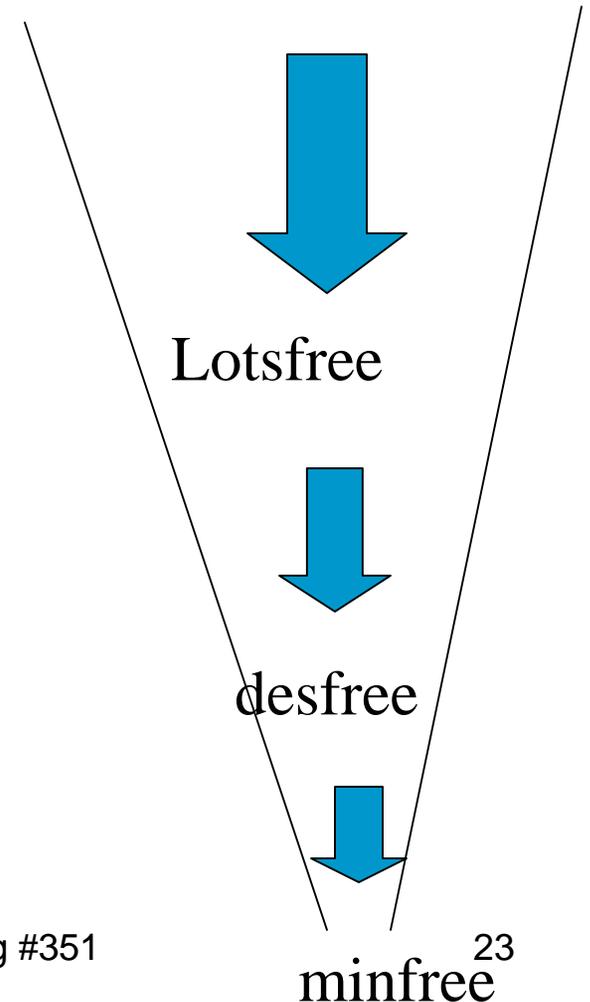
- page fault - and invalid address. This occurs when the CPU requests a page from memory and it does not find the page.
- paging - a technique which takes the pages (virtual memory address) from memory and moves them to virtual memory (on disk). This is called by the VHAND process.
- Deactivation - moving a process from the swap space on disk to main memory and from main memory to disk. This is done by the swapdaemon.
- thrashing - when a process spends more time paging than processing. A high number of page faults.

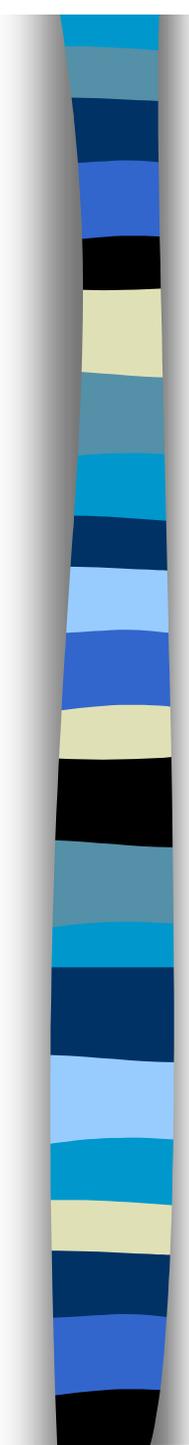
Memory:vhand process



Memory: Paging and Deactivation Thresholds

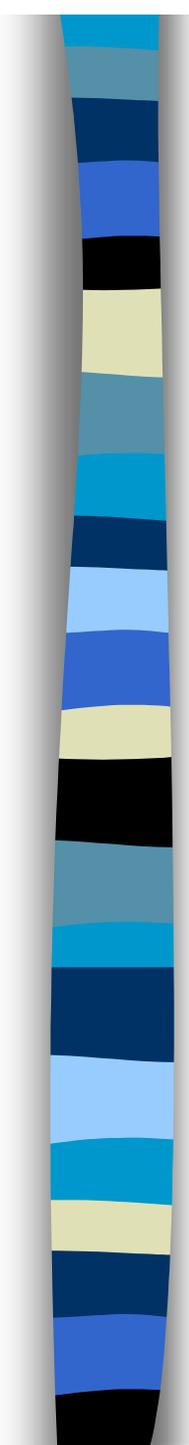
- ***Lotsfree*** - Upper threshold at which paging daemon *vhand* will begin stealing pages
- ***desfree*** - “Desired Free” - Panic button for Swapper- lower threshold for *vhand*
- ***minfree*** - Least amount of memory that is tolerable before the system begins process deactivation (*sys proc sched*)





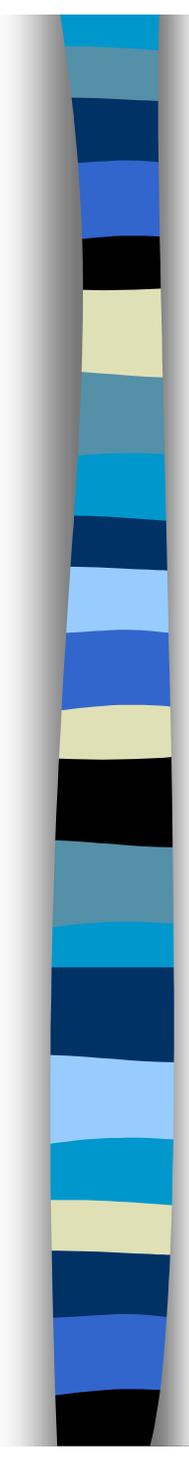
Memory: Measurement Metrics

- Memory Analysis (scratch pad for work):
 - Memory Used %, Virtual Memory %.
 - Paging (in and out), Deactivations
 - Read and write buffer cache hits.



Macro Area: Disk

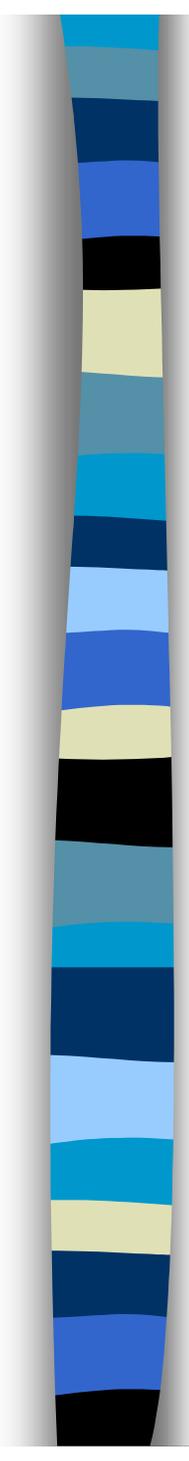
- Disk I/O (long term storage):
- Virtual Memory: allows programs with memory requirements $>$ than memory to load.
- Swap Space: function that moves pages to disk and back.



Disk: Measurement Metrics

■ Metrics:

- Disk I/O Queue Length - requests waiting for service.
- Total I/O - total reads and writes.
- Disk service time - % of time a device is used.
- Read/Write hit buffer cache efficiency - how many I/O's eliminated due to buffer



Disk: Data Locality

- Describes the location of data on disk (it is sometimes referred to as locality of reference)
- Data Locality encompasses both the issue of the placement of files on disk or on multiple disks and the issue of records within the files placed on disk.

Disk: What is Disk I/O?

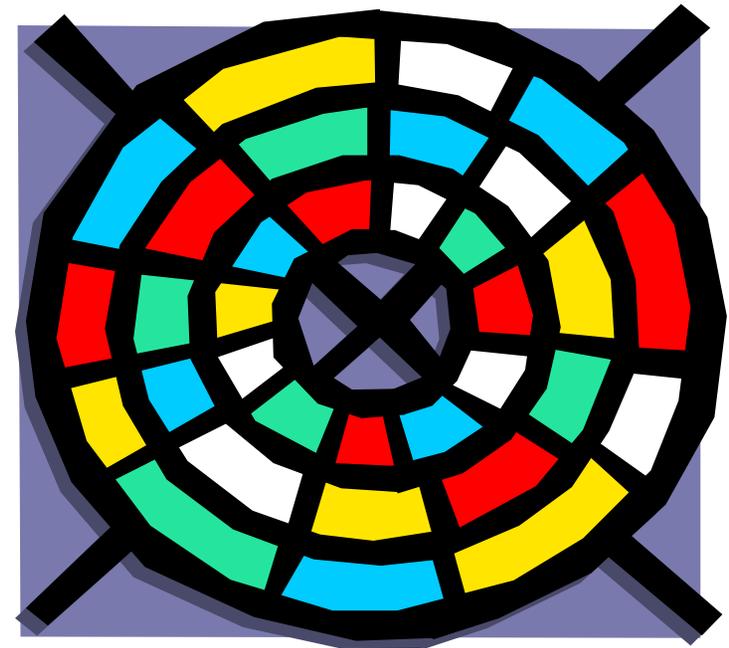
- Act of retrieving and/or updating information stored on a disk drive or in a disk environment.

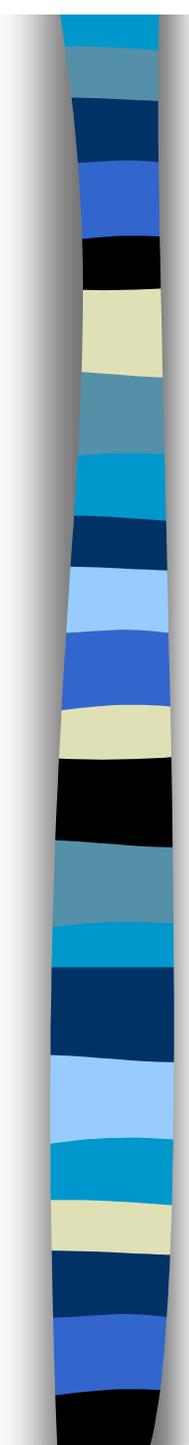
Overhead - Negotiating the controller.

Seek Time - find data

Latency - wait for data spin.

Xfr (transfer of data) - bring data over.

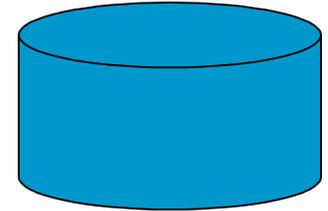




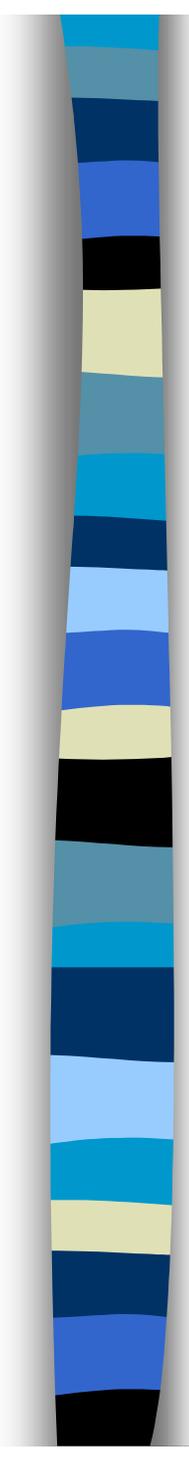
Disk: Anatomy of a Process

- All activity exists a process.
- Processes usually rely on data. Data in one of two places, in memory or on disk.
- If on disk then if updated it must be posted back to disk.
- Disk access is the slowest link.

Disk: Problem I/O Issues



- Disk I/O Imbalance
- Hardware
- Configuration issues
- Disk and File Fragmentation
- File system choices and configuration (default values in JFS favor data integrity).
- Database inefficiencies
- Buffer cache configuration and use
 - not enough causes additional I/O
 - too much and users memory storage suffers
- Stripping can become fragmentation.



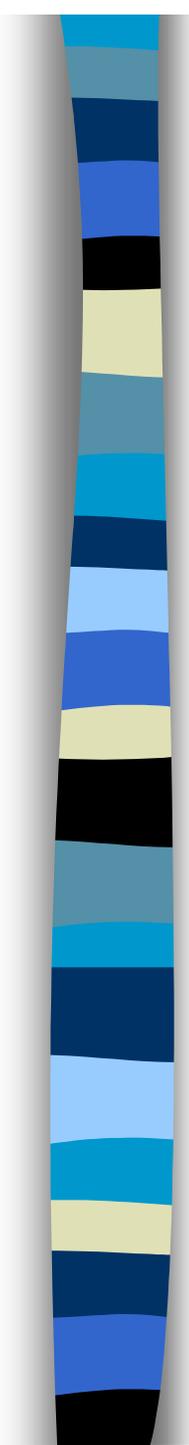
General Measurements of Disk I/O

- Disk I/O Queue Length
- Pause or Wait for I/O
- Disk Service time
- Disk Utilization
- Total I/O count
- Buffer Cache efficiency
- Response times

Macro Area: Network

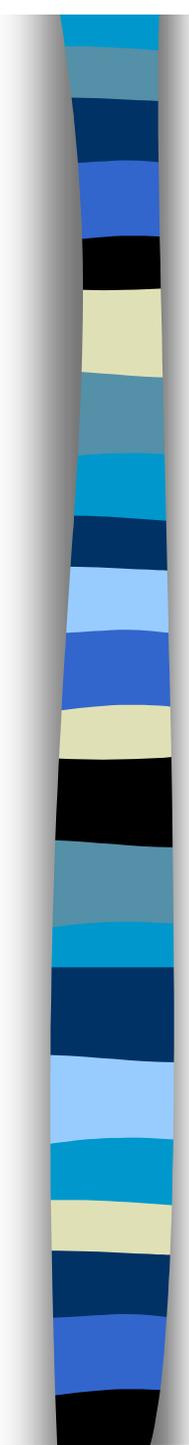


- Network (data transfer, NFS activity):
- Network traffic in packets.
- Problems:
 - Poorly planned and overtaxed networks
 - shared files on network file systems
 - inadequate hardware



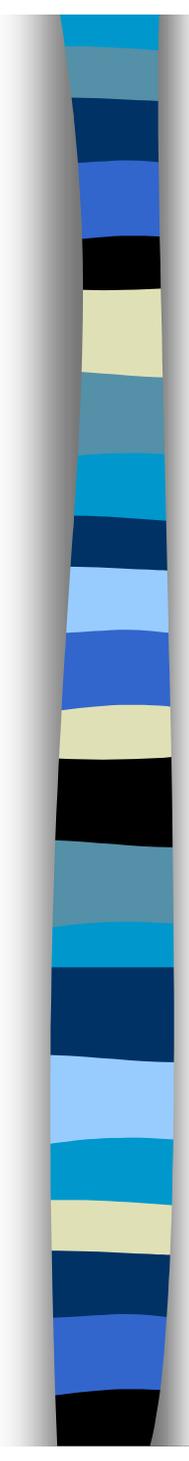
Network: Measurement Metrics

- Packets in/Packets out
- Errors in/Errors out
- % of Collisions
- Count of errors



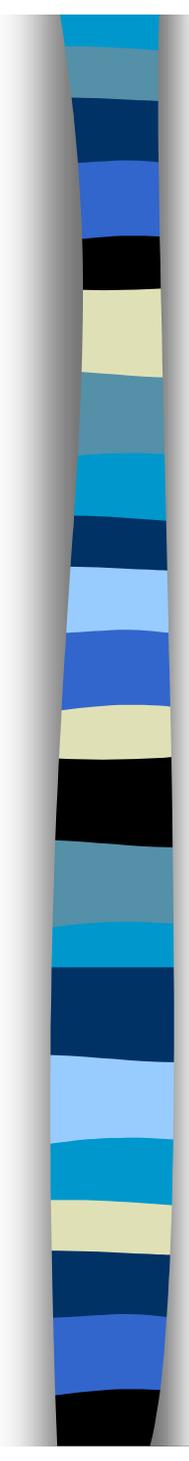
Micro: Application Analysis

- Use workload groupings when possible. Glance, SOS, etc. provide these.
- Look at individual processes. What files do they open? What wait states do they encounter?



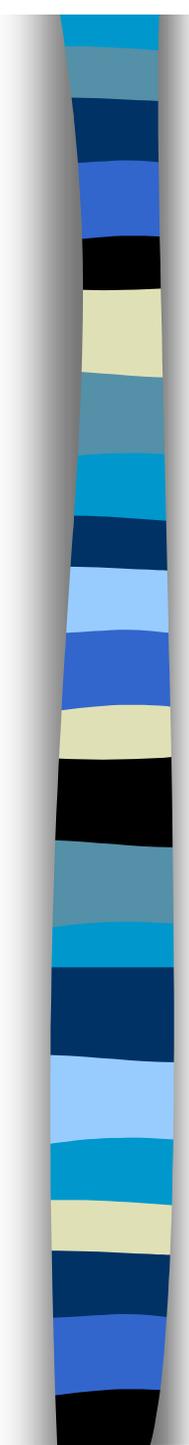
Relational Database inefficiencies

- **Example: ORACLE, INGRESS, INFORMIX, PROGRESS**
- **Consist of: Tables, Indexes, Rollback logs, and Before Image Logs**
 - **Suggestions:**
 - Optimize placement of Tables and Indexes. Place table files, indexes, and logs on separate disk drives.
 - Use supplied optimization tools



Strategies for Reducing I/O

- **Memory & Buffer Cache**
- **JBOD**
 - balance I/O, work on fragmentation,
- **Striping**
- **Raw I/O Vs. File System I/O**
- **Raid levels**



HP-UX Memory - How Much is Enough?

Kernel minimum - 7 MB

Basic OS Utilities - 10 MB

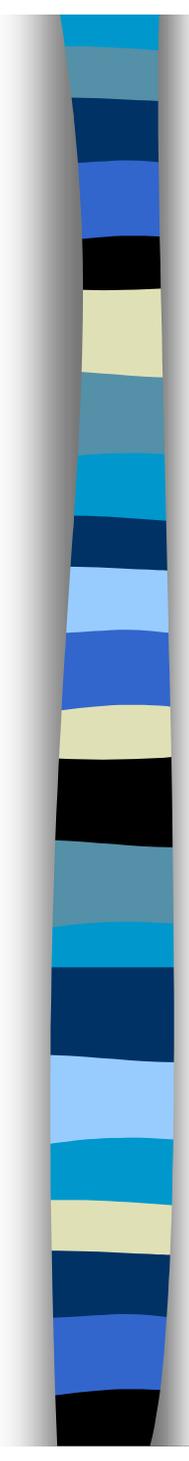
Minimum total for a few light users - 16 MB

MB per heavy users - 2 to 5 MB

X users (per user) - 10 MB

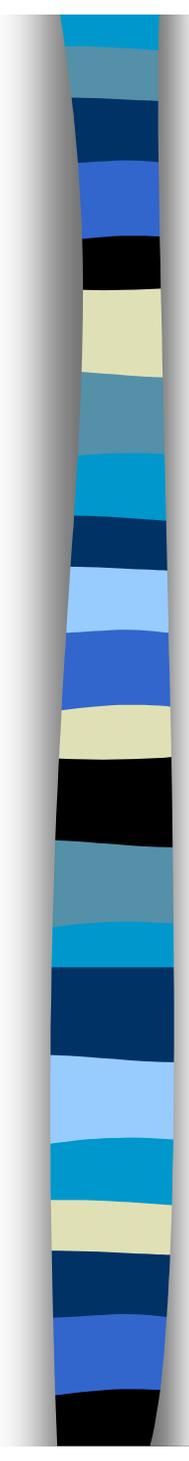
RDBMS app (server) - 10 to 25 MB

Each RDBMS user (clients) - 1 to 3 MB



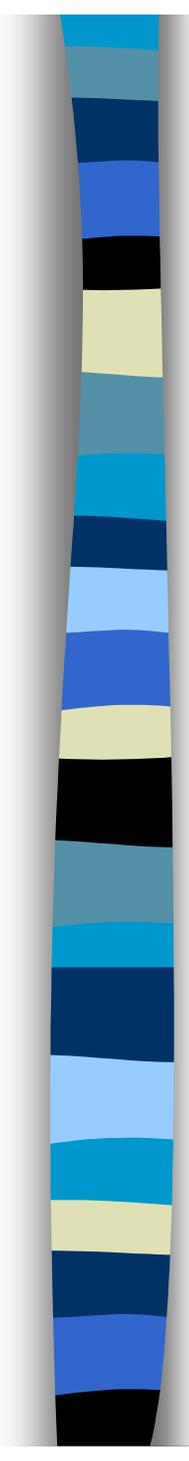
Configuration issues in the Disk Environment

- make sure you have enough -- use bdf
- avoid too many devices per channel
 - How many is too many? General rule: avoid more than 10 fast & wide per card
 - Look to any third party providers for additional info
- Too small or inappropriately placed swap space or buffer size.



Configuration Issues -CPU

- CPU's delivered in "Families", relative performance rates them in respect to members of the family and others.
- Multi-processors allow easy scalability
- The MP effect means that additional CPU's do not give the same impact as you increase



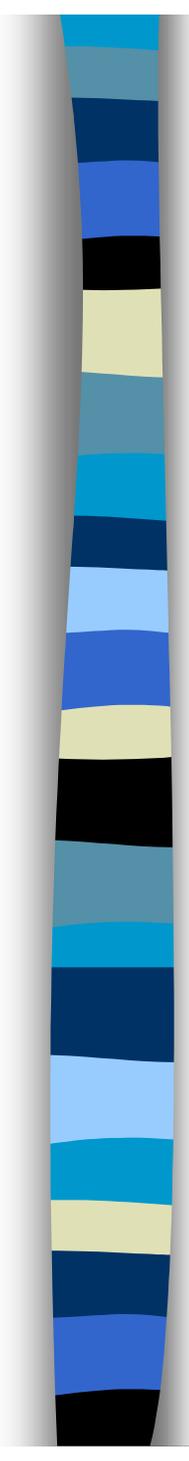
CPU: What have you got?

- CPU -- Use `uname -a`

- # `uname -a`

- HP-UX supertaz B.10.20 B 9000/867 465385211 16-user license

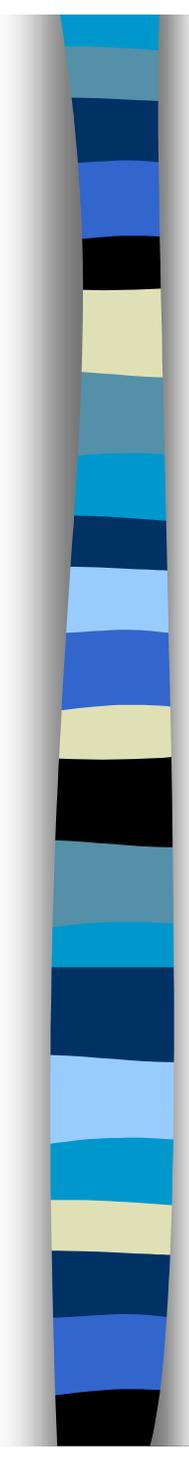
- Memory -- check on boot up, look on top screen, check glance or sos, etc.



Disk: What have you got?

■ Disk environment, use ioscan

```
# ioscan
H/W Path  Class          Description
=====
          bc
8         tty          MUX
9         tty          MUX
16        tty          HP J2094A - 16 Modem MUX
52        ext_bus     HP 28655A - SE SCSI ID=7
52.0      target
52.0.0    tape          HP          HP35470A
52.6      target
52.6.0    disk          HP          C2490AM
```

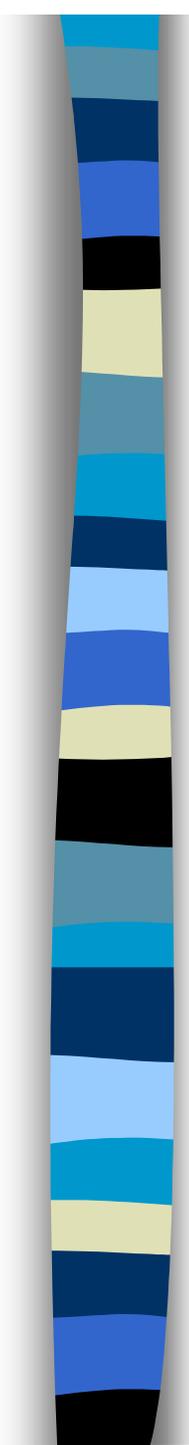


Disk: What Have You Got?

■ Disk I/O (continued) -- ioscan options

```
# ioscan -fC disk
```

Class	I	H/W Path	Driver	S/W State	H/W Type	Description
disk	0	8/4.5.0	sdisk	CLAIMED	DEVICE	SEAGATE ST32550W
disk	1	8/4.8.0	sdisk	CLAIMED	DEVICE	SEAGATE ST32550W
disk	2	8/4.9.0	sdisk	CLAIMED	DEVICE	SEAGATE ST32550W
disk	3	8/4.10.0	sdisk	CLAIMED	DEVICE	SEAGATE ST32550W
disk	10	8/4.11.0	sdisk	CLAIMED	DEVICE	SEAGATE ST34371W
disk	5	8/16/5.2.0	sdisk	CLAIMED	DEVICE	TOSHIBA CD-ROM



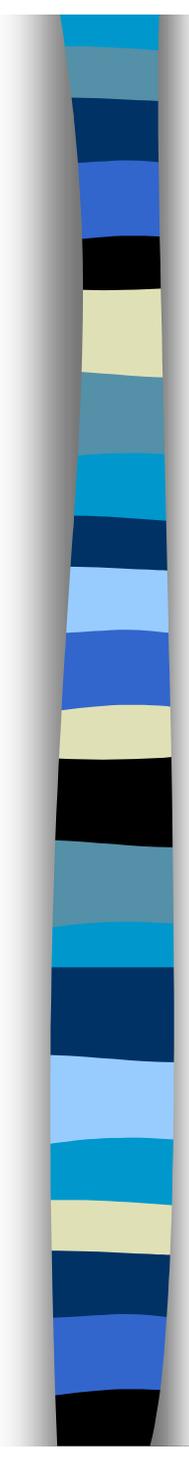
Unix Onboard commands

■ CPU

- Top - displays top 10 CPU users
- sar - gathers info on system use
- ps (-ef) - displays process info
- uptime - gives load averages

■ Memory

- vmstat (-n -s) - reports virtual memory info
- iostat (-t) - displays I/O rate for disks



Unix Onboard commands

■ Disk

- ioscand - displays I/O devices
- bdf - report free disk blocks
- swapinfo - system paging info
- LVM commands: vgscan, vgdisplay, etc.

■ Network

- netstat (-s) - display network status
- lanscan - lan device config and status
- lanadmin - lan administrator

Top Command

Load averages: 2.31, 1.74, 1.54

102 processes: 100 sleeping, 2 running

Cpu states:

LOAD	USER	NICE	SYS	IDLE	BLOCK	SWAIT	INTR	SSYS
2.31	90.8%	0.0%	9.2%	0.0%	0.0%	0.0%	0.0%	0.0%

Memory: 8272K (5988K) real, 19100K (14528K) virtual, 2184K free Page# 1/8

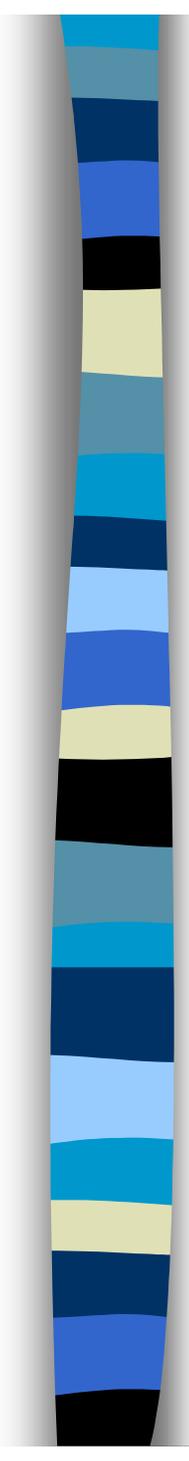
TTY	PID	USERNAME	PRI	NI	SIZE	RES	STATE	TIME	%WCPU	%CPU	COMMAND
?	1730	root	235	20	448K	184K	run	420:18	65.89	65.78	_mprosrv
?	4615	root	168	20	1272K	520K	sleep	245:01	25.25	25.20	_progres
?	1563	root	128	20	480K	216K	sleep	432:17	2.04	2.04	_mprosrv
?	6187	root	48	0	1732K	1788K	sleep	2:30	1.01	1.01	lpamid
?	961	root	154	20	8K	16K	sleep	188:53	0.93	0.93	nfsd
This process services NFS requests from remote systems.											
?	962	root	154	20	8K	16K	sleep	185:05	0.91	0.91	nfsd
?	956	root	154	20	32K	40K	sleep	185:28	0.91	0.90	nfsd
?	957	root	154	20	8K	16K	sleep	187:26	0.90	0.90	nfsd
?	7	root	-32	20	0K	0K	sleep	67:26	0.32	0.32	ttisr
d1p0	6309	root	178	20	208K	308K	run	0:00	0.33	0.29	_mprosrv
?	0	root	127	20	0K	0K	sleep	71:35	0.21	0.21	swapper
?	1407	root	154	20	180K	0K	sleep	71:35	0.22	0.22	swapper
?	2	root	128	20	0K	0K	sleep	18:55	0.21	0.21	vhand
?	1411	root	156	20	180K	68K	sleep	6:32	0.15	0.15	_mprshut

Top Command

```
HP-UX php7 B.10.20 U 9000/800 (ttypl)
System: php7                               Mon Apr 10 22:19:54 2000
Load averages: 0.68, 0.57, 0.43
157 processes: 156 sleeping, 1 running
Cpu states:
CPU    LOAD    USER    NICE    SYS    IDLE    BLOCK    SWAIT    INTR    SSYS
  0     0.63    3.2%    0.0%    1.0%   95.8%    0.0%    0.0%    0.0%    0.0%
  1     0.74    7.5%    0.0%    3.6%   88.9%    0.0%    0.0%    0.0%    0.0%
-----
avg    0.68    5.3%    0.0%    2.4%   92.3%    0.0%    0.0%    0.0%    0.0%

Memory: 35412K (17044K) real, 29672K (13300K) virtual, 790908K free Page# 1/15

CPU TTY  PID USERNAME PRI NI  SIZE  RES STATE  TIME %WCPU %CPU COMMAND
  0  ? 19002 fnsw    155 20  928K 1616K sleep  0:42  8.91  8.89 BRTs
  1  ? 18997 fnsw    155 20  268K  956K sleep  0:07  1.45  1.45 BRTs
  1  ? 19003 fnsw    155 20  284K  968K sleep  0:05  1.16  1.16 BRTs
  0  ?   76 root     100 20    0K   0K sleep 20:43  0.69  0.69 netisr
  1  ? 18765 ops     154 20  452K  904K sleep  0:02  0.62  0.62 dtterm
  0  ? 18998 fnsw    148 20  280K  992K sleep  0:02  0.59  0.59 BRTs
  0  ? 23767 root     48  0 1260K 1316K sleep 10:03  0.27  0.27 lpsmid
  1  ?   3 root     128 20    0K   0K sleep 10:25  0.22  0.22 statdaemo
  0  ? 18990 root    154 20  352K  844K sleep  0:00  0.22  0.22 EBR
  1  ?   77 root     100 20    0K   0K sleep 16:26  0.20  0.20 netisr
  0  ? 18771 ops     154 20  452K  904K sleep  0:03  0.20  0.20 dtterm
```

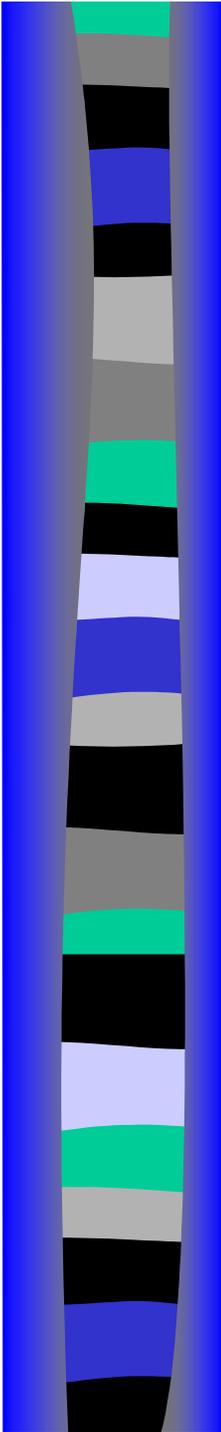


Sar (- u CPU, -b buffer, -d device, etc.)

```
# sar -u 1 10
```

```
HP-UX pointman B.10.20 E 9000/831 03/01/99
```

	%usr	%sys	%wio	%idle
21:09:44				
21:09:45	1	0	0	99
21:09:46	0	0	0	100
21:09:47	0	0	0	100
21:09:48	18	0	0	82
21:09:49	0	3	0	97
21:09:50	0	0	0	100
21:09:51	0	0	1	99
21:09:52	0	0	0	100
21:09:53	0	0	0	100
21:09:54	0	4	0	96
Average	2	1	0	97

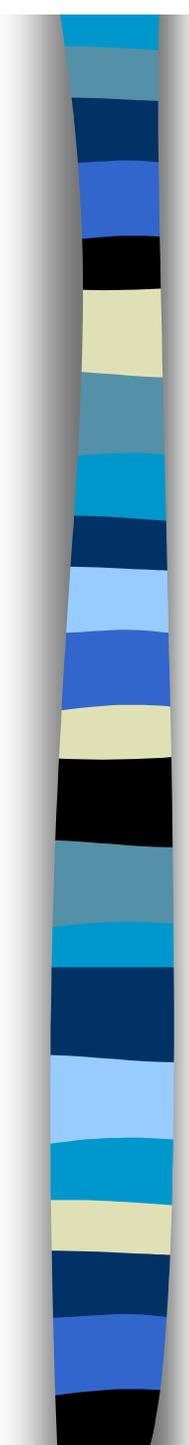


Measurement of Disk I/O - *vmstat*

```
Vmstat -d 5
```

```
|procs|  |-memory-|  |-----page-----|  |-faults-|  |-cpu--|  
r  b  w  avm   free re  at  pi  po  fr  de  sr  in  sy  cs  us  sy  id  
1 46  0 2469   466  0  0  0  0  0  0  0 108  37  25   3  2  95  
0 47  0 2140   500  1  1  0  0  0  0  0 113  65  30   2  1  97  
device      xfer/sec  
c0t6d0          0  
c0t1d0          0
```

- Procs: Running, Blocked, Swapped
- Memory: Active Virtual Pages; size of memory free
- re: Re-claims; Page Freed but Referenced Again
- pi/po: Page In/ Out Rates (per second)
- fr: pages freed rate

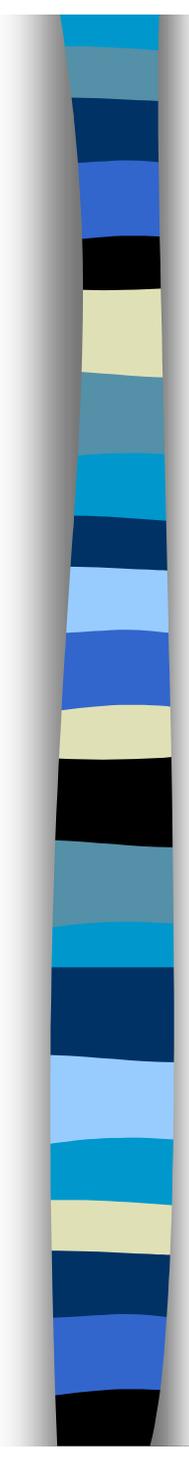


iostat

- Tin and tout-show char read and written
- CPU metrics - us, ni, sy, id
- bps - kilobytes per second, sps - seeks per second, msps - milliseconds per seek.

```
hpk460:/home/jrk$iostat -t
          tty          cpu
          tin tout      us  ni  sy  id
          1  219      2   0   2  96

device  bps    sps    msps
c2t6d0   0     0.0    1.0
c2t5d0   0     0.0    1.0
c1t0d2   0     0.0    1.0
c2t10d0  0     0.0    1.0
c2t11d0  0     0.0    1.0
```



Performance Monitoring tools

- Third party tools
 - HP products; Glance, GlancePlus, GPM, PerfRx, Perfview, Measureware.
 - Lund Tools: SOS Performance Advisor, Performance Gallery
 - TeamQuest, Sarcheck from Aurora Software.
 - BEST1 from BGS, EcoTools, BMC's Patrol, Athene, Viewpoint, Platinum.

Reflection 1 - [Untitled]

File Edit Terminal Connection Options Window Help

SOS/9000 1.12.4(c) LPS MON, MAR 15, 1999, 9:57 PM E: 00:12:44 I: 01:00

Global Statistics

CPU%	2	10	20	30	40	50	60	70	80	90	100	RunQ Len	2	10	20
RHit%	[Redacted]											Pg Out/s			
WHit%	[Redacted]											Deact b/s			
I/O/s	U	[Redacted]									US	I/O QLen			

PROCESS STATISTICS

PID	Name	User	Name	TTY	CPU%	Nic	Pri	RSS/Size	#Rd	#Wr	Wait	Resp
979	diagmond	root		---	0.2	20	154	1196/2376	0	0	SLEP	-
17563	uagentd	root		---	0.1	20	168	16/2724	0	0	DEAD	1.3
1123	uagentd	root		---	0.1	20	154	1464/2200	4	0	SLEP	-
314	syncer	root		---	0.1	20	154	1092/1720	0	6	SLEP	-
***** Workload:ATTACH Processes *****												
17557	sos	root	ttyp2		0.1	0	138	4424/5736	0	0	PRE	0
***** Workload:SYSPROCS Processes *****												
74	netisr	root		---	0.8	R	100	16/ 16	0	0	OTHR	-
7	ttisr	root		---	0.1	R	-32	16/ 16	0	0	TTY	-
3	statdaemon	root		---	0.1	20	128	16/ 16	0	0	SLEP	-

SYSTEM PERFORMANCE ADVICE

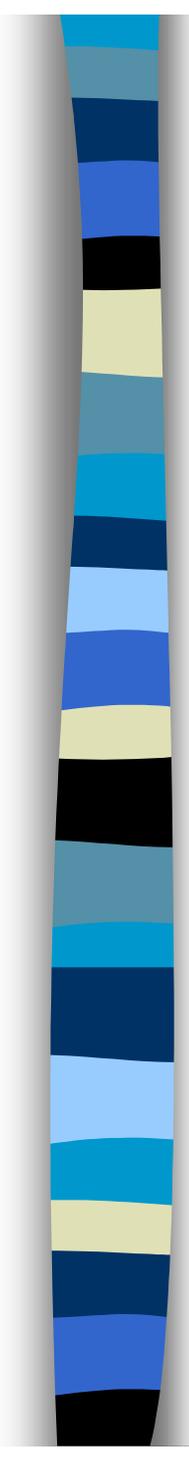
The CPU was used a total of 6.1 of its capacity during this interval <CI01>
 This interval's 'hog' process is (PID 8896) with 1.1% of the CPU <PI01>
 This interval's highest disk I/O user was (PID 17564) with 1025 I/O's <PI02>

Enter Command:

UPDATE INTERVAL RESET TOTALS SCREEN MENU HELP MORE KEYS FREEZE SCREEN PRINT SCREEN EXIT

32,15 HP70092 -- TELNET(10.100.10.3) ? Enter Insert Num Caps Stop

Start Pri... Mi... My... Di... Eu... AC... Ex... PK... R... Co... LV... 9:57 PM



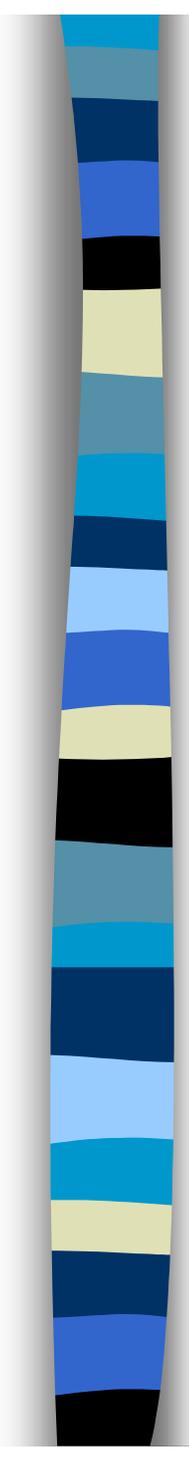
Third Party Tools -- Advantages

- Integrated
- Many useful screens
- User friendly
- Function key or letter command driven
- Contain help entries, interpretations & alarms
- Easier to use for reports and trends

Analysis Points

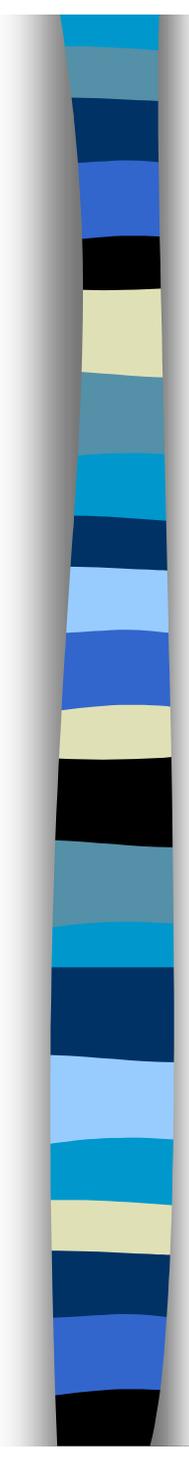


- Best with long-term evaluation
- Require “rules of Thumb”
- Move step-by-step
- Change one thing at a time to find out what is most effective



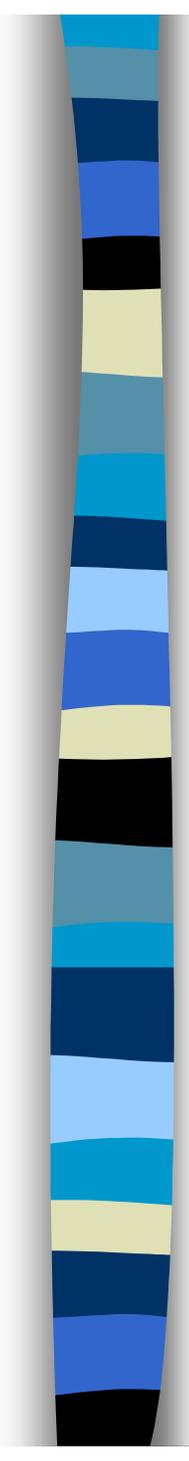
Rules of Thumb

- Commonly held theorems about levels of acceptable usage.
 - CPU - total busy above 85 % is not good
 - CPU Queue Length of 5 is going to begin to show poor performance, 15 and above is very bad.
 - Memory - buffer cache read hit rate and write hit of less than 90 % is not good.



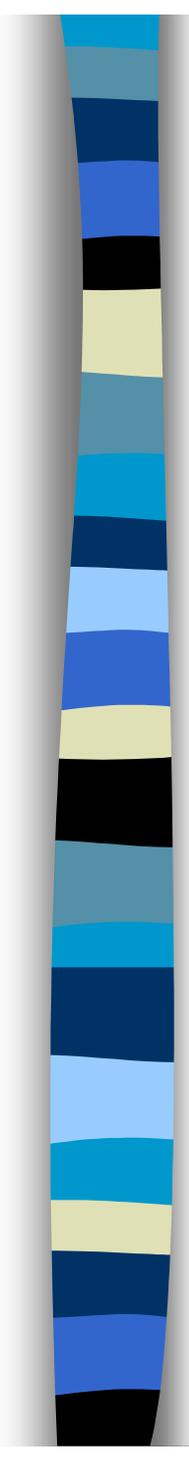
Rules of Thumb (continued)

- Capture Ratio (this is a ratio of the user processing / by system activity or (User + Real + Nice)/(System + Interrupt + Context Switch) = Capture ratio)). Should be greater than 3 and will definitely reflect a problem when 1.0.
- Real processing, System, Interrupt, Context Switching should not exceed 10 % as individual measures.



Rules of Thumb (continued)

- Memory % used should not exceed 80 to 90 %.
- Virtual % used should not exceed 50 to 80 %.
- Disk I/O Queue length should not exceed 1.0.
- Total reads & writes per drive should not exceed 50 to 60.



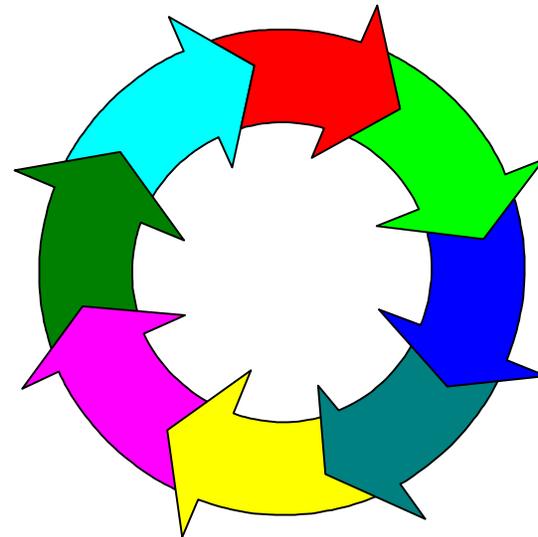
Rules of Thumb (continued)

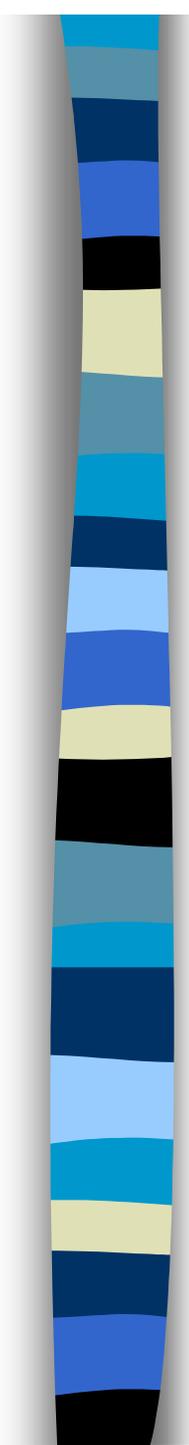
- Page out rate of 10 per second is not good and an indicator of memory shortage.
- Deactivation rate of 5 processes is an indicator of memory issues.
- Network - watch errors and collisions

Step-by-step Analysis

- Begin Macro to Micro (CPU, Memory, disk to database engine and application)

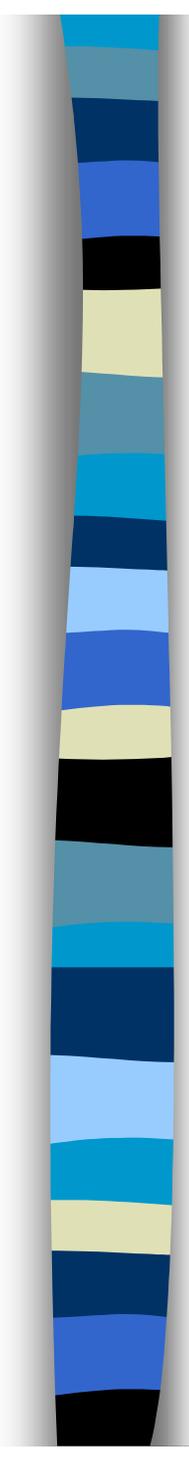
•Remember - It is not a once and you are done! It is more of a cycle.





Step by Step

- Examine CPU, than memory, than disk, network, program and database.
- Realize the prevalance of disk issues.
- Collect data.
- Get training, books, etc.
- Check system configuration.
- Kernel parameters

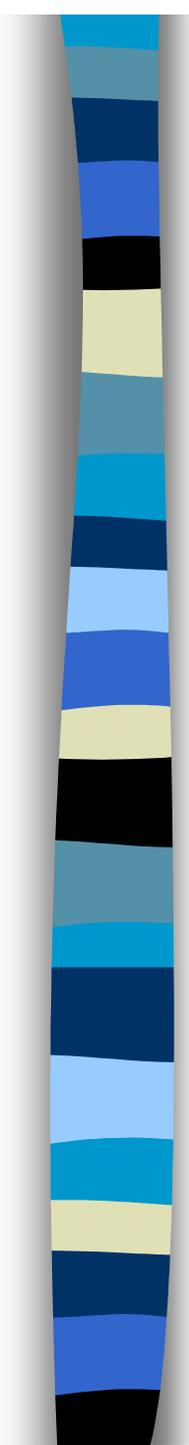


Kernel Tuning

- Larger issue, however, here are some recommendations:

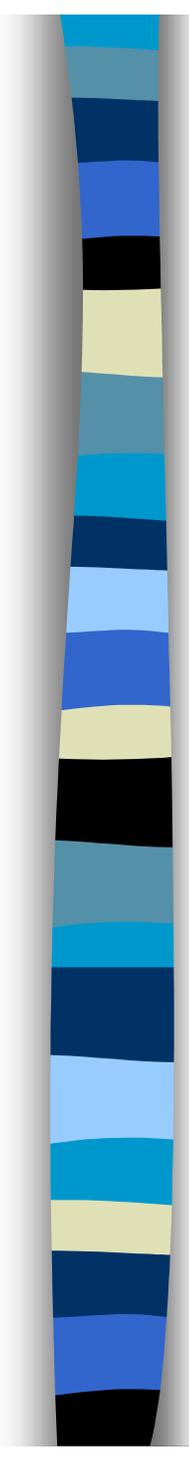
- bufpages 0
- create_fastlinks 1
- dbc_max_pct 25
- fs_async 0
- nflocks = (nfile/4)

- For more: <http://docs.hp.com/hpux/content/KCparams.OverviewAll.html>



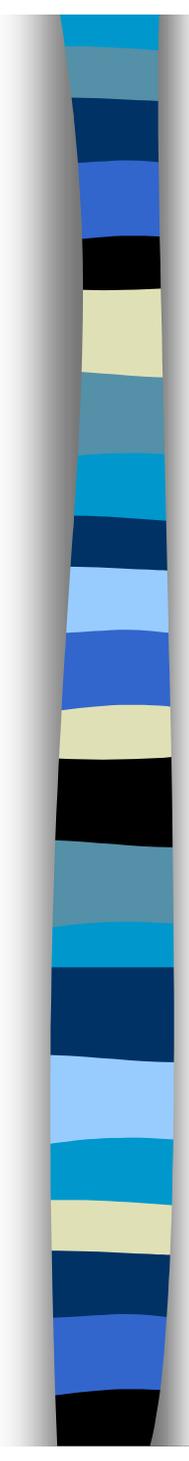
HP-UX 11.0 Features

- Variable Page size - Performance-optimized page size for up to 2.5x increase in application performance
- Kernel Threads
- 64-bit for greater performance and scalability
- Memory Windows
- Fibre Channel for high-performance storage throughput



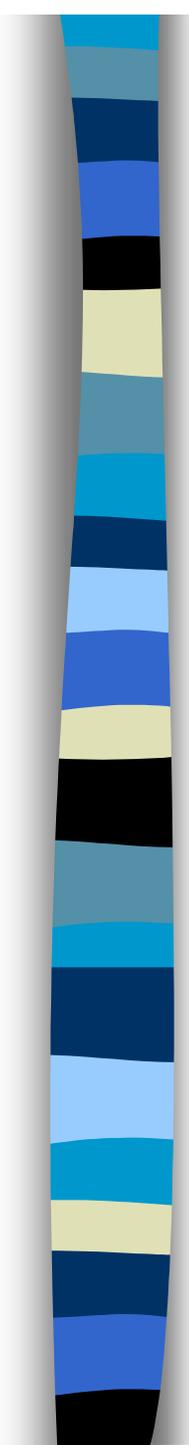
HP-UX 11.0 Features

- Gigabit Ethernet for high-performance network throughput
- SMP up to 32-way
- 64-node Hyper-Plex
- Increase in file system size from 128 GB at 10.20 to 1 TB at 11.0
- Shared memory increase from 2.75 GB to 8 GB
- Process data space increase from 1.9 GB to 4 TB
- Physical RAM increase from 3.75 GB to 4 TB



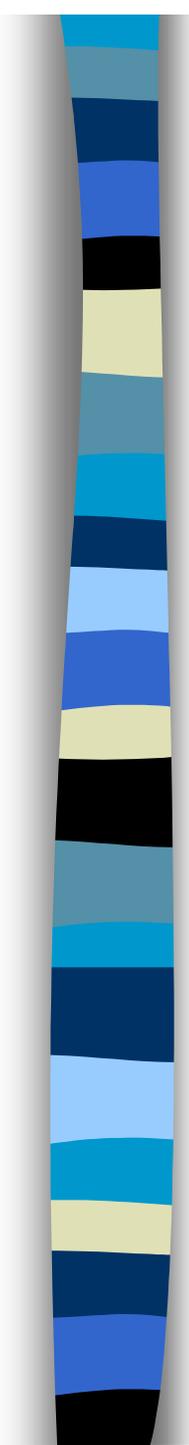
Database Engine issues

- Very significant area.
- Data loads and unloads, re-indexing, etc.
- Be sure you have the appropriate indexes.
- Understand your I/O.
- Look at vendor recommendations



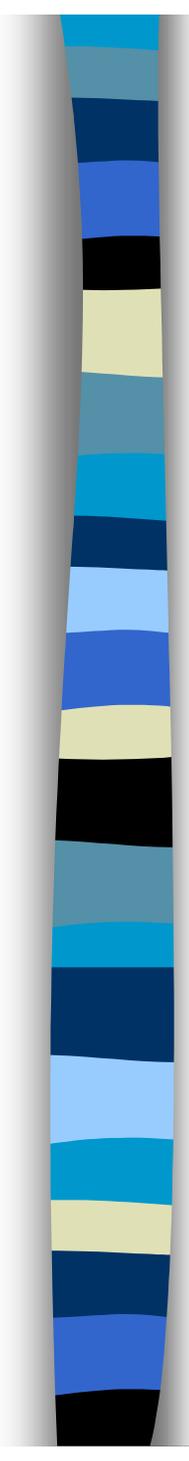
Performance Baseline

- A picture or an understanding of what performance was like when response time was defined as “good” or acceptable.
- Helpful in the identification of performance problems.



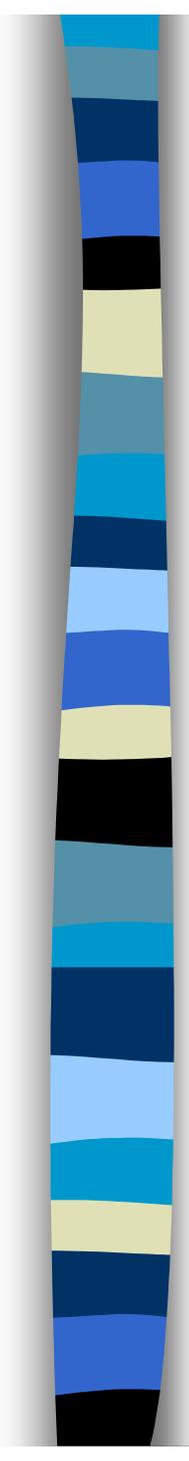
Conclusion

- Maximize investment
- Avoid rushed “bad” decisions
- Avoid the unforeseen
- Importance of performance, this area needs attention!



Performance Problems

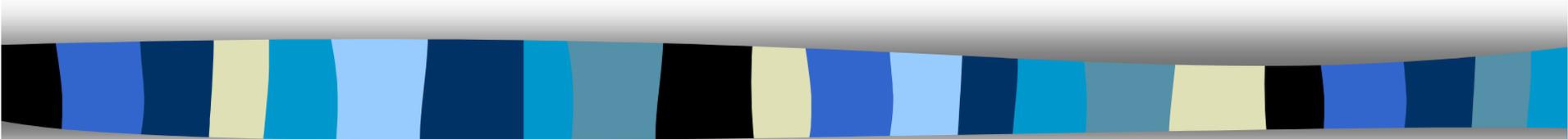
- Past, Present, and Future
- Crises, problem solving, learning & planning
- Do the following:
 - observe system usage
 - understand their meaning.
 - “rules of thumb”
 - Outline a plan
 - Make changes



Performance Resources

- [Http://docs.hp.com](http://docs.hp.com)
- <http://software.hp.com>
- <http://docs.hp.com/hpux/content/KCparameters.OverviewAll.html>
- [usenet: comp.sys.hp](mailto:comp.sys.hp)
- Interex-Netherlands: sysadmin mail list
 - echo subscribe hpux-admin | mailx -sSubscribe majordomo@dutchworks.nl

The End



Thanks for coming! My email:
jeff@kublerconsulting.com

Signup with HP-UX performance email
group: hpuxperform@interex.org

Informative URL: <http://docs.hp.com/hpux/content/KCparams.OverviewAll.html>