IBM TRAINING

A26

AIX Performance Tuning

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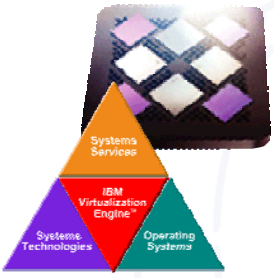
AIX Performance Tuning

Updated Presentation will be at:
http://www.circle4.com/papers/pseries-a26-aug06.pdf



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Mainline Information Systems

Agenda

- AIX v5.2 versus AIX v5.3
- 32 bit versus 64 bit
- Filesystem Types
- DIO and CIO
- AIX Performance Tunables
- Oracle Specifics
- Commands
- References

Mainline INFORMATION SYSTEMS

New in AIX 5.2

- P5 support
- JFS2
- Large Page support (16mb)
- Dynamic LPAR
- Small Memory Mode
  - Better granularity in assignment of memory to LPARs
- CuOD
- xProfiler
- New Performance commands
  - vmo, ioo, schedo replace schedtune and vmtune
- AIX 5.1 Status
  - Will not run on p5 hardware
  - Withdrawn from marketing end April 2005
  - Support withdrawn April 2006

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AIX 5.3

- New in 5.3
  - With Power5 hardware
    - SMT
    - Virtual Ethernet
    - With APV
      - Shared Ethernet
      - Virtual SCSI Adapter
      - Micropartitioning
      - PLM

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AIX 5.3

- New in 5.3
  - JFS2 Updates
    - Improved journaling
    - Extent based allocation
    - 1tb filesystems and files with potential of 4PB
    - Advanced Accounting
    - Filesystem shrink for JFS2
    - Striped Columns
      - Can extend striped LV if a disk fills up
    - 1024 disk scalable volume group
      - 1024 PVs, 4096 LVs, 2M pps/vg
    - Quotas
    - Each VG now has its own tunable pbuf pool
      - Use lvmo command

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AIX 5.3

- New in 5.3
  - NFSv4 Changes
    - ACLs
  - NIM enhancements
    - Security
    - Highly available NIM
    - Post install configuration of Etherchannel and Virtual IP
  - SUMA patch tool
  - Last version to support 32 bit kernel
  - MP kernel even on a UP
  - Most commands changed to support LPAR stats
  - Forced move from vmtune to ioo and vmo
  - Page space scrubbing
  - Plus lots and lots of other things

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32 bit versus 64 bit

- 32 Bit
- Up to 96GB memory
- Uses JFS for rootvg
- Runs on 32 or 64 bit hardware
- Hardware all defaults to 32 bit
- JFS is optimized for 32 bit
- 5.3 is last version of AIX with 32 bit kernel

- 64 bit
- Allows > 96GB memory
- Current max is 256GB (arch is 16TB) except 590/595 (1TB & 2TB)
- Uses JFS2 for rootvg
- Supports 32 and 64 bit apps
- JFS2 is optimized for 64 bit

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Filesystem Types

- **JFS**
  - 2gb file max unless BF
  - Can use with DIO
  - Optimized for 32 bit
  - Runs on 32 bit or 64 bit
  - Better for lots of small file creates and deletes
- **JFS2**
  - Optimized for 64 bit
  - Required for CIO
  - Can use DIO
  - Allows larger file sizes
  - Runs on 32 bit or 64 bit
  - Better for large files and filesystems

GPFS

Clustered filesystem
Use for RAC
Similar to CIO – noncached, nonblocking I/O

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DIO and CIO

- DIO
  - Direct I/O
  - Around since AIX v5.1
  - Used with JFS
  - CIO is built on it
  - Effectively bypasses filesystem caching to bring data directly into application buffers
  - Does not like compressed JFS or BF (lfe) filesystems
    - Performance will suffer due to requirement for 128kb I/O
  - Reduces CPU and eliminates overhead copying data twice
  - Reads are synchronous
  - Bypasses filesystem readahead
  - Inode locks still used
  - Benefits heavily random access workloads

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DIO and CIO

- CIO
  - Concurrent I/O
  - Only available in JFS2
  - Allows performance close to raw devices
  - Use for Oracle dbf and control files, and online redo logs, **not for binaries**
  - No system buffer caching
  - Designed for apps (such as RDBs) that enforce write serialization at the app
  - Allows non-use of inode locks
  - Implies DIO as well
  - Benefits heavy update workloads
  - **Not all apps benefit from CIO and DIO – some are better with filesystem caching and some are safer that way**

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Performance Tuning

- CPU
  - vmstat, ps, nmon
- Network
  - netstat, nfsstat, no, nfso
- I/O
  - iostat, filemon, ioo, lvmo
- Memory
  - lsps, svmon, vmstat, vmo, ioo

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New tunables

- Old way
  - Create rc.tune and add to inittab
- New way
  - /etc/tunables
    - lastboot
    - lastboot.log
    - Nextboot
  - Use –p –o options
    - ioo –p –o options
    - vmo –p –o options
    - no –p –o options
    - nfso –p –o options
    - schedo -p –o options

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Tuneables 1/3

- minperm%
  - Value below which we steal from computational pages - default is 20%
  - We lower this to something like 5%, depending on workload
- Maxperm%
  - default is 80%
  - This is a soft limit and affects ALL file pages (including those in maxclient)
  - Value above which we always steal from persistent
  - Be careful as this also affects maxclient
  - We no longer tune this – we use lru_file_repage instead
  - Reducing maxperm stops file caching affecting programs that are running
- maxclient
  - default is 80%
  - Must be less than or equal to maxperm
  - Affects NFS, GPFS and JFS2
  - Hard limit by default
  - We no longer tune this – we use lru_file_repage instead
- numperm
  - This is what percent of real memory is currently being used for caching ALL file pages
- numclient
  - This is what percent of real memory is currently being used for caching GPFS, JFS2 and NFS
- strict_maxperm
  - Set to a soft limit by default – leave as is
- strict_maxclient
  - Available at AIX 5.2 ML4
  - By default it is set to a hard limit
  - We used to change to a soft limit – now we do not

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Tuneables 2/3

- maxrandwrt
  - Random write behind
  - Default is 0 – try 32
  - Helps flush writes from memory before syncd runs
    - syncd runs every 60 seconds but that can be changed
  - When threshhold reached all new page writes are flushed to disk
  - Old pages remain till syncd runs
- Numclust
  - Sequential write behind
  - Number of 16k clusters processed by write behind
- J2_maxRandomWrite
  - Random write behind for JFS2
  - On a per file basis
  - Default is 0 – try 32
- J2_nPagesPerWriteBehindCluster
  - Default is 32
  - Number of pages per cluster for writebehind
- J2_nRandomCluster
  - JFS2 sequential write behind
  - Distance apart before random is detected
- J2_nBufferPerPagerDevice
  - Minimum filesystem bufstructs for JFS2 – default 512, effective at fs mount

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Tuneables 3/3

- minpgahead, maxpgahead, J2_minPageReadAhead & J2_maxPageReadAhead
  - Default min =2 max = 8
  - Maxfree – minfree >= maxpgahead
- lvm_bufcnt
  - Buffers for raw I/O. Default is 9
  - Increase if doing large raw I/Os (no jfs)
- numfsbufs
  - Helps write performance for large write sizes
  - Filesystem buffers
- pv_min_pbuf
  - Pinned buffers to hold JFS I/O requests
  - Increase if large sequential I/Os to stop I/Os bottlenecking at the LVM
  - One pbuf is used per sequential I/O request regardless of the number of pages
  - With AIX v5.3 each VG gets its own set of pbufs
  - Prior to AIX 5.3 it was a system wide setting
- sync_release_ilock
  - Allow **sync** to flush all I/O to a file without holding the i-node lock, and then use the i-node lock to do the commit.
  - Be very careful – this is an advanced parameter
- minfree and maxfree
  - Used to set the values between which AIX will steal pages
  - maxfree is the number of frames on the free list at which stealing stops (must be >=minfree+8)
  - minfree is the number used to determine when VMM starts stealing pages to replenish the free list
  - On a memory pool basis so if 4 pools and minfree=1000 then stealing starts at 4000 pages
  - 1 LRUD per pool, default pools is 1 per 8 processors
- lru_file_repage
  - Default is 1 – set to 0
  - Available on >=AIX v5.2 ML5 and v5.3
  - Means LRUD steals persistent pages unless numperm < minperm
- lru_poll_interval
  - Set to 10
  - Improves responsiveness of the LRUD when it is running

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NEW

Minfree/maxfree

- On a memory pool basis so if 4 pools and minfree=1000 then stealing starts at 4000 pages
- 1 LRUD per pool
- Default pools is 1 per 8 processors
- Cpu_scale_memp can be used to change memory pools
- Try to keep distance between minfree and maxfree <=1000
- Obviously this may differ

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vmstat -v

- 26279936 memory pages
- 25220934 lruable pages
- 7508669 free pages
- 4 memory pools
- 3829840 pinned pages
- 80.0 maxpin percentage
- 20.0 minperm percentage
- 80.0 maxperm percentage
- 0.3 numperm percentage — All filesystem buffers
- 89337 file pages
- 0.0 compressed percentage
- 0 compressed pages
- 0.1 numclient percentage — Client filesystem buffers only
- 80.0 maxclient percentage
- 28905 client pages
- 0 remote pageouts scheduled
- 280354 pending disk I/Os blocked with no pbuf — LVM – pv_min_pbuf
- 0 paging space I/Os blocked with no psbuf — VMM – fixed per page dev
- 2938 filesystem I/Os blocked with no fsbuf — numfsbufs
- 7911578 client filesystem I/Os blocked with no fsbuf
- 0 external pager filesystem I/Os blocked with no fsbuf — j2_nBufferPerPagerDevice
- Totals since boot so look at 2 snapshots 60 seconds apart
- pbufs, psbufs and fsbufs are all pinned

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Starter Set of tunables

NB please test these before putting into production

```
no   -p -o rfc1323=1
no   -p -o sb_max=1310720
no   -p -o tcp_sendspace=262144
no   -p -o tcp_recvspace=262144
no   -p -o udp_sendspace=65536
no   -p -o udp_recvspace=655360
nfso -p -o nfs_rfc1323=1
nfso -p -o nfs_socketsize=60000
nfso -p -o nfs_tcp_socketsize=600000

vmo -p -o minperm%=5
vmo -p -o minfree=960
vmo -p -o maxfree=1088
vmo -p -o lru_file_repage=0
vmo -p -o lru_poll_interval=10

ioo -p -o j2_maxPageReadAhead=128
ioo -p -o maxpgahead=16
ioo -p -o j2_maxRandomWrite=32
ioo -p -o maxrandwrt=32
ioo -p -o j2_nBufferPerPagerDevice=1024
ioo -p -o pv_min_pbuf=1024
ioo -p -o numfsbufs=2048
ioo -p -o j2_nPagesPerWriteBehindCluster=32
```

Increase the following if using raw LVMs (default is 9)

```
Ioo –p –o lvm_bufvnt=12
```

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vmstat -I

IGNORE FIRST LINE - average since boot
Run vmstat over an interval (i.e. vmstat 2 30)

```
System configuration: lcpu=24 mem=102656MB ent=0
kthr    memory              page              faults           cpu
----- ----------- ------------------------ ------------ -----------------------
 r  b   avm         fre          re  pi  po  fr   sr  cy  in     sy       cs      us sy id  wa    pc    ec
56  1 18637043 7533530   0   0   0   0    0   0  4298 24564 9866 98   2   0   0  12.00 100.0
57   1 18643753 7526811   0   0   0   0    0   0  3867 25124 9130 98   2   0   0  12.00 100.0

System configuration: lcpu=8 mem=1024MB ent=0.50
  kthr     memory              page              faults           cpu
-------- ----------- ------------------------ ------------ -----------------------
 r  b  p   avm        fre    fi    fo    pi  po  fr     sr    in   sy   cs   us sy id  wa    pc    ec
 1  1  0 170334    968   96 163    0   0   0 190  511   11  556 662  1  4  90   5   0.03   6.8
 1  1  0 170334   1013   53  85    0   0   0 107  216    7  268 418  0  2  92   5   0.02   4.4
```

Pc = physical processors consumed – if using SPP
Ec = %entitled capacity consumed – if using SPP
Fre may well be between minfree and maxfree
fr:sr ratio 1783:2949 means that for every 1783 pages freed 2949 pages had to be examined.
ROT was 1:4 – may need adjusting
To get a 60 second average try: vmstat 60 2

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Memory and I/O problems

- iostat
  - Look for overloaded disks and adapters
- vmstat
- vmo and ioo (replace vmtune)
- sar
- Check placement of JFS and JFS2 filesystems and potentially the logs
- Check placement of Oracle or database logs
- fileplace and filemon
- Asynchronous I/O
- Paging
- svmon
  - svmon -G >filename
- nmon
- Check error logs

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ioo Output

- lvm_bufcnt = 9
- minpgahead = 2
- maxpgahead = 8
- maxrandwrt = 32 (default is 0)
- numclust = 1
- numfsbufs = 186
- sync_release_ilock = 0
- pd_npages = 65536
- pv_min_pbuf = 512

- j2_minPageReadAhead = 2
- j2_maxPageReadAhead = 8
- j2_nBufferPerPagerDevice = 512
- j2_nPagesPerWriteBehindCluster = 32
- j2_maxRandomWrite = 0
- j2_nRandomCluster = 0

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vmo Output

DEFAULTS	OFTEN SEEN
maxfree = 128	**maxfree = 1088**
minfree = 120	**minfree = 960**
minperm% = 20	**minperm% = 10**
maxperm% = 80	**maxperm% = 30**
maxpin% = 80	**maxpin% = 80**
maxclient% = 80	**Maxclient% = 30**
strict_maxclient = 1	**strict_maxclient = 0**
strict_maxperm = 0	**strict_maxperm = 0**

numclient and numperm are both 29.9
So numclient-numperm=0 above
Means filecaching use is probably all JFS2/NFS/GPFS
Remember to switch to new method using lru_file_repage

iostat

IGNORE FIRST LINE - average since boot
Run iostat over an interval (i.e. iostat 2 30)

```
tty:      tin         tout    avg-cpu: % user % sys % idle % iowait physc % entc
          0.0       1406.0                93.1    6.9    0.0      0.0    12.0    100.0

Disks:          % tm_act     Kbps      tps      Kb_read   Kb_wrtn
hdisk1          1.0          1.5       3.0      0         3
hdisk0          6.5          385.5     19.5     0         771
hdisk14         40.5         13004.0   3098.5   12744     13264
hdisk7          21.0         6926.0    271.0    440       13412
hdisk15         50.5         14486.0   3441.5   13936     15036
hdisk17         0.0          0.0       0.0      0         0
```

iostat –a Adapters

System configuration: lcpu=16 drives=15

tty:	tin	tout	avg-cpu: % user	% sys	% idle	% iowait
	0.4	195.3	21.4	3.3	64.7	10.6

Adapter:	Kbps	tps	Kb_read	Kb_wrtn
fscsi1	5048.8	516.9	1044720428	167866596

Disks:	% tm_act	Kbps	tps	Kb_read	Kb_wrtn
hdisk6	23.4	1846.1	195.2	381485286	61892408
hdisk9	13.9	1695.9	163.3	373163554	34143700
hdisk8	14.4	1373.3	144.6	283786186	46044360
hdisk7	1.1	133.5	13.8	6285402	25786128

Adapter:	Kbps	tps	Kb_read	Kb_wrtn
fscsi0	4438.6	467.6	980384452	85642468

Disks:	% tm_act	Kbps	tps	Kb_read	Kb_wrtn
hdisk5	15.2	1387.4	143.8	304880506	28324064
hdisk2	15.5	1364.4	148.1	302734898	24950680
hdisk3	0.5	81.4	6.8	3515294	16043840
hdisk4	15.8	1605.4	168.8	369253754	16323884

iostat -D

Extended Drive Report

hdisk3	xfer:	%tm_act	bps	tps	bread	bwrtn
		0.5	29.7K	6.8	15.0K	14.8K
	read:	rps	avgserv	minserv	maxserv	timeouts	fails
		29.3	0.1	0.1	784.5	0	0
	write:	wps	avgserv	minserv	maxserv	timeouts	fails
		133.6	0.0	0.3	2.1S	0	0
	wait:	avgtime	mintime	maxtime	avgqsz	qfull	
		0.0	0.0	0.2	0.0	0	

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iostat Other

iostat -A async IO

```
System configuration: lcpu=16 drives=15
aio: avgc avfc maxg maif maxr avg-cpu: % user % sys % idle % iowait
       150    0    5652    0   12288              21.4   3.3    64.7    10.6

Disks:       % tm_act     Kbps      tps    Kb_read       Kb_wrtn
hdisk6           23.4   1846.1    195.2  381485298  61892856
hdisk5           15.2   1387.4    143.8  304880506  28324064
hdisk9           13.9   1695.9    163.3  373163558  34144512
```

iostat -m paths

```
System configuration: lcpu=16 drives=15
tty:      tin         tout    avg-cpu: % user % sys % idle % iowait
          0.4        195.3                 21.4     3.3   64.7    10.6

Disks:       % tm_act     Kbps      tps    Kb_read   Kb_wrtn
hdisk0           1.6       17.0      3.7    1190873   2893501

Paths:       % tm_act     Kbps      tps    Kb_read   Kb_wrtn
Path0            1.6       17.0      3.7    1190873   2893501
```

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lvmo

- lvmo output
-
- **vgname** = rootvg (default but you can change with –v)
- **pv_pbuf_count** = 256
  - Pbufs to add when a new disk is added to this VG
- **total_vg_pbufs** = 512
  - Current total number of pbufs available for the volume group.
- **max_vg_pbuf_count** = 8192
  - Max pbufs that can be allocated to this VG
- **pervg_blocked_io_count** = 0
  - No. I/O's blocked due to lack of free pbufs for this VG
- **global_pbuf_count** = 512
  - Minimum pbufs to add when a new disk is added to a VG
- **global_blocked_io_count** = 46
  - No. I/O's blocked due to lack of free pbufs for all VGs

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lsps –a (similar to pstat)

- Ensure all page datasets the same size although hd6 can be bigger - ensure more page space than memory
  - Especially if not all page datasets are in rootvg
  - Rootvg page datasets must be big enough to hold the kernel
- Only includes pages allocated (default)
- Use lsps -s to get all pages (includes reserved via early allocation (PSALLOC=early)
- Use multiple page datasets on multiple disks
  - Parallelism

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lsps output

lsps -a

Page Space	Physical Volume	Volume Group	Size	%Used	Active	Auto	Type
paging05	hdisk9	pagvg01	2072MB	1	yes	yes	lv
paging04	hdisk5	vgpaging01	504MB	1	yes	yes	lv
paging02	hdisk4	vgpaging02	168MB	1	yes	yes	lv
paging01	hdisk3	vgpagine03	168MB	1	yes	yes	lv
paging00	hdisk2	vgpaging04	168MB	1	yes	yes	lv
hd6	hdisk0	rootvg	512MB	1	yes	yes	lv

lsps -s

Total Paging Space	Percent Used
3592MB	1%

Bad Layout above
Should be balanced
Make hd6 the biggest by one lp or the same size as the others in a mixed environment like this

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SVMON Terminology

- *persistent*
  - Segments used to manipulate files and directories
- *working*
  - Segments used to implement the data areas of processes and shared memory segments
- *client*
  - Segments used to implement some virtual file systems like Network File System (NFS) and the CD-ROM file system

- http://publib.boulder.ibm.com/infocenter/pseries/topic/com.ibm.aix.doc/cmds/aixcmds5/svmon.htm

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svmon -G

```
               size       inuse        free         pin       virtual
memory     26279936    18778708     7501792     3830899    18669057
pg space    7995392       53026

              work       pers      clnt     lpage
pin        3830890          0         0         0
in use    18669611      80204     28893         0

In GB Equates to:

               size       inuse        free         pin       virtual
memory     100.25       71.64       28.62       14.61       71.22
pg space    30.50        0.20

              work       pers      clnt     lpage
pin           14.61          0         0         0
in use        71.22       0.31      0.15         0
```

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General Recommendations

- Different hot LVs on separate physical volumes
- Stripe hot LV across disks to parallelize
- Mirror read intensive data
- Ensure LVs are contiguous
  - Use lslv and look at in-band % and distrib
  - reorgvg if needed to reorg LVs
- Writeverify=no
- minpgahead=2, maxpgahead=16 for 64kb stripe size
- Increase maxfree if you adjust maxpgahead
- Tweak minperm, maxperm and maxrandwrt
- Tweak lvm_bufcnt if doing a lot of large raw I/Os
- If JFS2 tweak j2 versions of above fields
- Clean out inittab and rc.tcpip and inetd.conf, etc for things that should not start
  - Make sure you don't do it partially
  - i.e. portmap is in rc.tcpip and rc.nfs

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Oracle Specifics

- Use JFS2 with external JFS2 logs
  (if high write otherwise internal logs are fine)
- Use CIO where it will benefit you
  - Do not use for Oracle binaries
- Leave DISK_ASYNCH_IO=TRUE in Oracle
- Tweak the maxservers AIO settings

- If using JFS
  - Do not allocate JFS with BF (LFE)
  - It increases DIO transfer size from 4k to 128k
  - 2gb is largest file size
  - Do not use compressed JFS – defeats DIO

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Tools

- vmstat – for processor and memory
- nmon
  - http://www-941.ibm.com/collaboration/wiki/display/WikiPtype/nmon
  - To get a 2 hour snapshot (240 x 30 seconds)
  - nmon -fT -c 30 -s 240
  - Creates a file in the directory that ends .nmon
- nmon analyzer
  - http://www-941.haw.ibm.com/collaboration/wiki/display/WikiPtype/nmonanalyser
  - Windows tool so need to copy the .nmon file over
  - Opens as an excel spreadsheet and then analyses the data
- sar
  - sar -A -o filename 2 30 >/dev/null
  - Creates a snapshot to a file – in this case 30 snaps 2 seconds apart
- ioo, vmo, schedo, vmstat –v
- lvmo
- lparstat, mpstat
- Iostat
- Check out Alphaworks for the Graphical LPAR tool
- Many many more

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Other tools

- filemon
  - filemon -v -o filename -O all
  - sleep 30
  - trcstop
- pstat to check async I/O
  - pstat -a | grep aio | wc –l
- perfpmr to build performance info for IBM if reporting a PMR
  - /usr/bin/perfpmr.sh 300

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lparstat

lparstat -h

System Configuration: type=shared mode=Uncapped smt=On lcpu=4 mem=512 ent=5.0

%user	%sys	%wait	%idle	physc	%entc	lbusy	app	vcsw	phint	%hypv	hcalls
0.0	0.5	0.0	99.5	0.00	1.0	0.0	-	1524	0	0.5	1542
16.0	76.3	0.0	7.7	0.30	100.0	90.5	-	321	1	0.9	259

Physc – physical processors consumed
%entc – percent of entitled capacity
Lbusy – logical processor utilization for system and user
Vcsw – Virtual context switches
Phint – phantom interrupts to other partitions
%hypv - %time in the hypervisor for this lpar – weird numbers on an idle system may be seen

http://publib.boulder.ibm.com/infocenter/pseries/index.jsp?topic=/com.ibm.aix.doc/cmds/aixcmds3/lparstat.htm

mpstat

mpstat –s

System configuration: lcpu=4 ent=0.5

	Proc1	Proc0	
	0.27%	49.63%	
cpu0	cpu2	cpu1	cpu3
0.17%	0.10%	3.14%	46.49%

Above shows how processor is distributed using SMT

Async I/O

Total number of AIOs in use
pstat –a | grep aios | wc –l
Or new way is:
ps –k | grep aio | wc -l
4205

AIO max possible requests
lsattr –El aio0 –a maxreqs
maxreqs 4096 Maximum number of REQUESTS True

AIO maxservers
lsattr –El aio0 –a maxservers
maxservers 320 MAXIMUM number of servers per cpu True

NB – maxservers is a per processor setting in AIX 5.3

Look at using fastpath
Fastpath can now be enabled with DIO/CIO
See Session A23 by Grover Davidson for a lot more info on Async I/O

Mainline INFORMATION SYSTEMS

I/O Pacing

- Useful to turn on during backups (streaming I/Os)
- Set high value to multiple of (4*n)+1
- Limits the number of outstanding I/Os against an individual file
- minpout – minimum
- maxpout – maximum
- If process reaches maxpout then it is suspended from creating I/O until outstanding requests reach minpout

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Network

- no –a & nfso -a to find what values are set to now
- Buffers
  - Mbufs
    - Network kernel buffers
    - thewall is max memory for mbufs
    - Can use maxmbuf tuneable to limit this or increase it
      - Uses chdev
      - Determines real memory used by communications
      - If 0 (default) then thewall is used
      - Leave it alone
  - TCP and UDP receive and send buffers
  - Ethernet adapter attributes
    - If change send and receive above then also set it here
  - no and nfso commands
  - nfsstat
  - rfc1323 and nfs_rfc1323

Mainline INFORMATION SYSTEMS

netstat

- netstat –i
  - Shows input and output packets and errors for each adapter
  - Also shows collisions
- netstat –ss
  - Shows summary info such as udp packets dropped due to no socket
- netstat –m
  - Memory information
- netstat –v
  - Statistical information on all adapters

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Network tuneables

- no -a
- Using no
  - rfc1323 = 1
  - sb_max=1310720 (>= 1MB)
  - tcp_sendspace=262144
  - tcp_recvspace=262144
  - udp_sendspace=65536 (at a minimum)
  - udp_recvspace=655360
    - Must be less than sb_max
- Using nfso
  - nfso -a
  - nfs_rfc1323=1
  - nfs_socketsize=60000
  - nfs_tcp_socketsize=600000
- Do a web search on “nagle effect”
- netstat –s | grep “socket buffer overflow”

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nfsstat

- Client and Server NFS Info
- nfsstat –cn or –r or –s
  - Retransmissions due to errors
    - Retrans>5% is bad
  - Badcalls
  - Timeouts
  - Waits
  - Reads

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Useful Links

- **1. Ganglia**
  - ganglia.info
- **2. Lparmon**
  - www.alphaworks.ibm.com/tech/lparmon
- **3. Nmon**
  - www.ibm.com/collaboration/wiki/display/WikiPtype/nmon
- **4. Nmon Analyser**
  - www.haw.ibm.com/collaboration/wiki/display/WikiPtype/nmonanalyser
- **5. Jaqui's AIX* Blog**
  - Has a base set of performance tunables for AIX 5.3 - www.circle4.com/blosxomjl.cgi/
- **6. vmo command**
  - publib.boulder.ibm.com/infocenter/pseries/v5r3/index.jsp?topic=/com.ibm.aix.doc/cmds/aixcmds6/vmo.htm
- **7. ioo command**
  - publib.boulder.ibm.com/infocenter/pseries/v5r3/index.jsp?topic=/com.ibm.aix.doc/cmds/aixcmds3/ioo.htm
- **8. vmstat command**
  - publib.boulder.ibm.com/infocenter/pseries/v5r3/index.jsp?topic=/com.ibm.aix.doc/cmds/aixcmds3/ioo.htm
- **9. lvmo command**
  - publib.boulder.ibm.com/infocenter/pseries/v5r3/index.jsp?topic=/com.ibm.aix.doc/cmds/aixcmds3/ioo.htm
- **10. eServer Magazine and AiXtra**
  - http://www.eservercomputing.com/
    - Search on Jaqui AND Lynch
    - Articles on Tuning and Virtualization
- **11. Find more on Mainline at:**
  - http://mainline.com/ebrochure

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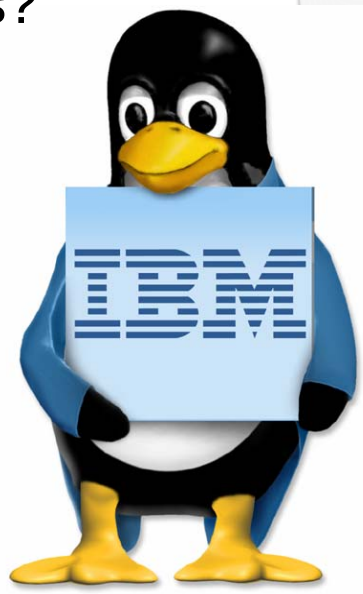
Questions?



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Supplementary Slides

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Disk Technologies

- Arbitrated
  - SCSI 20 or 40 mb/sec
  - FC-AL 100mb/sec
  - Devices arbitrate for exclusive control
  - SCSI priority based on address
- Non-Arbitrated
  - SSA 80 or 160mb/sec
  - Devices on loop all treated equally
  - Devices drop packets of data on loop

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Adapter Throughput - SCSI

	100% mby/s	70% mby/s	Bits Bus	Max Devs Width
• SCSI-1	5	3.5	8	8
• Fast SCSI	10	7	8	8
• FW SCSI	20	14	16	16
• Ultra SCSI	20	14	8	8
• Wide Ultra SCSI	40	28	16	8
• Ultra2 SCSI	40	28	8	8
• Wide Ultra2 SCSI	80	56	16	16
• Ultra3 SCSI	160	112	16	16
• Ultra320 SCSI	320	224	16	16
• Ultra640 SCSI	640	448	16	16

- Watch for saturated adapters

Courtesy of http://www.scsita.org/terms/scsiterms.html

Adapter Throughput - Fibre

	100% mbit/s	70% mbit/s
•	133	93
•	266	186
•	530	371
•	1 gbit	717
•	2 gbit	1434

- SSA comes in 80 and 160 mb/sec

RAID Levels

- Raid-0
  - Disks combined into single volume stripeset
  - Data striped across the disks
- Raid-1
  - Every disk mirrored to another
  - Full redundancy of data but needs extra disks
  - At least 2 I/Os per random write
- Raid-0+1
  - Striped mirroring
  - Combines redundancy and performance

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RAID Levels

- RAID-5
  - Data striped across a set of disks
  - 1 more disk used for parity bits
  - Parity may be striped across the disks also
  - At least 4 I/Os per random write (read/write to data and read/write to parity)
  - Uses hot spare technology

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