WebSphere Application Server I/O Performance

Michele Calcavecchia (macalcav@us.ibm.com)
WebSphere Application Server L2 Support Engineer
January 2013

WebSphere® Support Technical Exchange

ON DEMAND BUSINESS

Agenda

- Definition of I/O
- Example of I/O
- Considerations for WebSphere I/O Related Problems
- "Optimal Hardware Configuration"
- WebSphere Support/Collecting the data
- Reviewing Data – vmstat
- Diagnosis/Reviewing Data – vmstat
- Underlying Cause of Performance Issues
- Application Specific Information
- Tools
- Next Step Tools
- Avoid Performance Problems
- Summary

Definition of I/O

- I/O (input/output) occurs everywhere in a computer system where input is followed by an output of information
- I/O occurs between computer systems
- I/O is not a single event, it is comprised of different parts and operations

  ▶ Network

  ▶ File System

  ▶ Database

  ▶ Internet

- There could be differing views of I/O as one can look at I/O in terms of queuing systems or CPU registers. However in this presentation we are speaking in terms of file and socket operations and the general transfer of data between computer components.

An Example of I/O Components
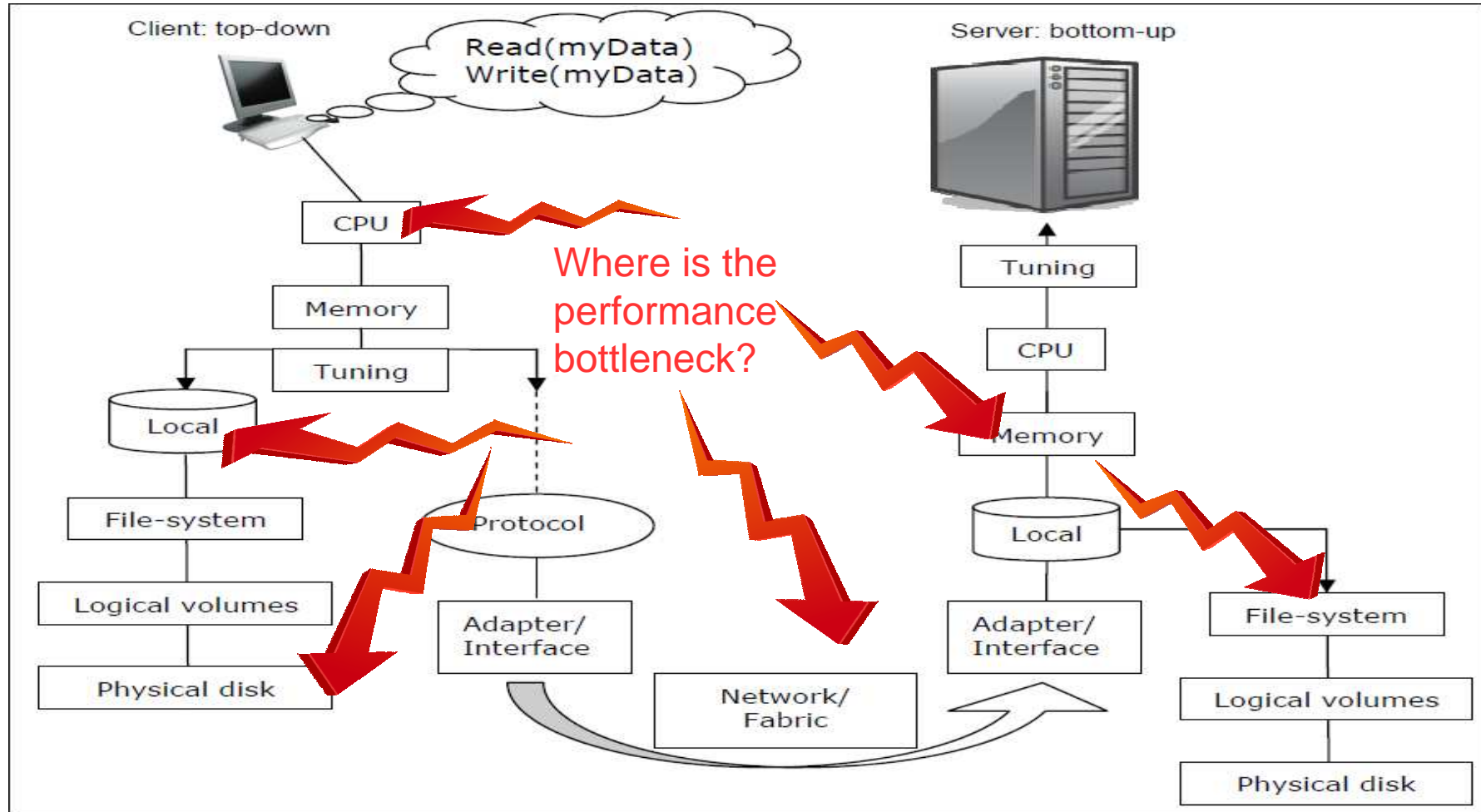
Considerations for WebSphere I/O Related Problems

- A request will only perform as fast as it's slowest component.
- Parts to consider for I/O:

  ▸ Number of requests

  ▸ Type of file system

    • Network Attached Storage

    • Virtualized

  ▸ RAM

  ▸ Disk latency

- The idea behind strategic I/O tuning is to avoid the slowest components (disk) and opt to use the fastest (cache).

"Optimal Hardware Configuration"

In the WebSphere Application Server Information Center section "Tuning the application serving environment" asks that you check these items for "optimal hardware configuration":

- Optimize Disk Speed
- Increase Processor Speed
- Increase System Memory
- Run Network Cards and Network Switches at Full Duplex

WebSphere L2 Support

- WebSphere Support is responsible for identifying WebSphere Application Server performance issues reported as possible defects
- Client is asked to collect performance data during the time of the poor performance
MustGather: Performance, hang, or high CPU issues with WebSphere Application Server on AIX
http://www-01.ibm.com/support/docview.wss?rs=180&uid=swg21052641

- It is very important that the data be collected during the time of poor performance and that all the data be collected during that same time frame.
- By correlating the information from the different logs, WebSphere Support can identify the areas of performance concern.

WebSphere Support – Collecting the Data

- Data collection by
  - ▸ ISA

  - ▸ "Collecting Data Manually" - (script included)

- Important logs for Support's review of I/O related issues:

  - ▸ Vmstat

  - ▸ Javacores or thread dumps

  - ▸ Also:

    - Garbage collection data (rule out Java memory problems)
    - WebSphere Application Server logs:
      - – SystemOut
      - – systemErr
      - – native_stdout
      - – native_stderr

Diagnosis

In the upcoming slides we will look at ways to identify I/O related performance problems that affect WebSphere performance.

Reviewing Data: vmstat

vmstat

- available on
  - ▶ AIX
  - ▶ Linux
  - ▶ Solaris
- Not available on Windows
  - ▶ *use other tools defined later in presentation

vmstat example

This is output from AIX vmstat

```
kthr        memory              page                  faults        cpu
----     ----------  ------------------------  ------------  -----------
 r  b    avm    fre   re  pi  po  fr  sr  cy   in    sy   cs   us sy id wa
 0  0   3456  27743    0   0   0   0   0   0  131   149   28    0  1 99  0
 0  0   3456  27743    0   0   0   0   0   0  131    77   30    0  1 99  0
 1  0   3498  27152    0   0   0   0   0   0  153  1088   35    1 10 87  2
 0  1   3499  26543    0   0   0   0   0   0  199  1530   38    1 19  0 80
 0  1   3499  25406    0   0   0   0   0   0  187  2472   38    2 26  0 72
 0  0   3456  24329    0   0   0   0   0   0  178  1301   37    2 12 20 66
 0  0   3456  24329    0   0   0   0   0   0  124    58   19    0  0 99  0
 0  0   3456  24329    0   0   0   0   0   0  123    58   23    0  0 99  0
```

- Columns of interest for I/O related issues:

  - ▶ b – "blocked"

    - Average number of kernel threads placed in the Virtual Memory Manager (VMM) wait queue (awaiting resource, awaiting input/output) over the sampling interval

  - ▶ wa - "wait"

    - Processor idle time during which the system had outstanding disk/NFS I/O request(s)

vmstat example (cont.)

- pi - "page in"

  ▶ Number of pages paged in from paging space. Paging space is the part of virtual memory that resides on disk. It is used as an overflow when memory is over committed. Paging space consists of logical volumes dedicated to the storage of working set pages that have been stolen from real memory. When a stolen page is referenced by the process, a page fault occurs, and the page must be read into memory from paging space. It is likely that a page-in will force a different page to be stolen and, therefore, paged out.

- po - "page out"

  ▶ Number (rate) of pages paged out to paging space. Whenever a page of working storage is stolen, it is written to paging space

- fr - "free memory pages"

  ▶ Average number of free memory pages. A page is a 4 KB area of real memory. The system maintains a buffer of memory pages, called the free list, that will be readily accessible when the VMM needs space.

- sr - "scan rate"

  ▶ Number of pages that were examined per second by the page-replacement algorithm during the interval. The higher the sr value compared to the fr value, the harder it is for the page-replacement algorithm to find eligible pages to steal.

vmstat example (cont.)

```
kthr      memory              page                   faults          cpu
----    ----------  ------------------------  ------------  -----------
r  b    avm    fre  re  pi  po  fr  sr  cy   in    sy   cs  us sy id wa
0  0   3456 27743   0   0   0   0   0    0  131   149   28   0   1 99  0
0  0   3456 27743   0   0   0   0   0    0  131    77   30   0   1 99  0
1  0   3498 27152   0   0   0   0   0    0  153  1088   35   1  10 87  2
0  1   3499 26543   0   0   0   0   0    0  199  1530   38   1  19  0 80
0  1   3499 25406   0   0   0   0   0    0  187  2472   38   2  26  0 72
0  0   3456 24329   0   0   0   0   0    0  178  1301   37   2  12 20 66
0  0   3456 24329   0   0   0   0   0    0  124    58   19   0   0 99  0
0  0   3456 24329   0   0   0   0   0    0  123    58   23   0   0 99  0
```

- High values in the "wa" column (in the absence of other high values like pi) is an indicator that the contention is a source on the other side of the Application Server (database? network?).
- Investiagte why the system is idle while there are pending requests.

- This system may also just be showing signs of underutilization. Perhaps WebSphere has been so efficient in completing tasks that it spends more time waiting than doing work?

  - Vmstat data should not be considered unless there has already been a performance issue identified.

  - Vmstat is a quick way to identify where possible performance problems are and is not the last stop in identifying the underlying cause.

Underlying Cause of Performance Issues Identified by vmstat

- **Disk Latency**
- **System Memory Shortage**
  - ▶ not to be confused with java heap memory

Disk Latency
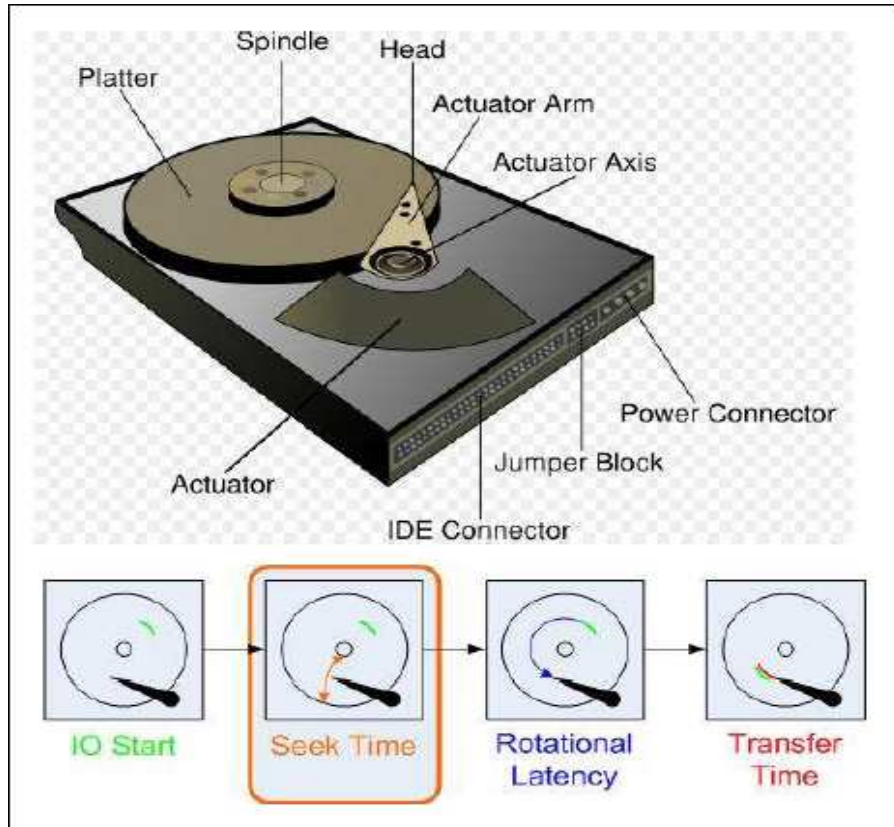
- Number of I/Os
- Data layout
- Type of disk
- Speed of disk
- Disk speed and configuration have a dramatic effect on the performance of application servers running applications that are heavily dependent on the database support, using extensive messaging, or processing workflow
- ★ Avoid disk I/O

vmstat suspect: disk latency

Linux Example:

```
procs ——-memory——------------  swap- —-io—-       -system- —-cpu—
r  b  swpd    free    buff   cache   si so   bi     bo    in    cs   us sy id wa st

1  8  5888 140136 167700 1506440  0  0  6783 17333  1738  16648   6  2  9 83  0
1  6  5888 140136 167700 1506440  0  0  6885 18353  1831  18658   8  4  9 77  0
1  6  5888 140136 167700 1506440  0  0  6482 12323  1534  17632  16 12  9 63  0
```

"wa" shows high percentage waiting on i/o while a number of threads are "b" blocked waiting on...disk i/o?

vmstat suspect: disk latency

AIX Example:

```
kthr     memory              page            faults          cpu        disk xfer
---- ----------- ------------------ ------------ ----------- ------
r  b  avm    fre re pi po fr sr cy   in    sy   cs us sy id wa 1   2 3 4
0  0 3456 27743  0  0  0  0  0  0  131  149   28  0  1 99  0 0   0
0  0 3456 27743  0  0  0  0  0  0  131   77   30  0  1 99  0 0   0
1  0 3498 27152  0  0  0  0  0  0  153 1088   35  1 10 87  2 0  11
0  1 3499 26543  0  0  0  0  0  0  199 1530   38  1 19  0 80 0  59
0  1 3499 25406  0  0  0  0  0  0  187 2472   38  2 26  0 72 0  53
0  0 3456 24329  0  0  0  0  0  0  178 1301   37  2 12 20 66 0  42
0  0 3456 24329  0  0  0  0  0  0  124   58   19  0  0 99  0 0   0
0  0 3456 24329  0  0  0  0  0  0  123   58   23  0  0 99  0 0   0
```

- "wa" shows high percentage waiting on i/o
- "disk xfer":
  - number of transfers per second to the specified physical volumes that occurred in the sample interval. The count only represents requests to the physical device and not the amount of data requested.

vmstat suspect: disk latency

Solaris Example:

```
procs           memory              page                      disk         faults         cpu
 r      b w    swap    free    re   mf pi po fr de sr s5 s1 s3 s4   in     sy    cs us sy id
 0    39918 0 55724136 3595152 209 126  4  0  0  0  0  0  0  0  1 1141   5007 3253 12  2 85
 0 16401004 0 55636368 3354576 639 424  0  0  0  0  0  0  0  0  0 1409   5655 3546 27  6 66
 0 16401492 0 55610824 3328832 55 1205  0  0  0  0  0  0  0  0  0 1303  10084 3235 38  6 56
 0 16401591 0 55595112 3313160 463 529  0  0  0  0  0  0  0  0  0 1352   2518 3583 30  6 64
 0 16401615 0 55584992 3303016 771 420  0  0  0  0  0  0  0  0 11 1314   2013 3046 33  6 60
```

- b - the number of blocked kernel threads that are waiting for resources I/O, paging, etc.
- w - (different meaning than Linux and AIX) the number of swapped out lightweight processes (LWPs) that are waiting for processing resources to finish
- disk - number of disk operations per second. There are slots for up to four disks. The letter indicates the type of disk, the number is the logical unit number.

System Memory

- ## Avoid paging

  - ▶ Heap sizing problems
    http://publib.boulder.ibm.com/infocenter/javasdk/v6r0/topic/com.ibm.java.doc.diagnostics.60/diag/understanding/mm_heapsize_problems.html

    - ...The java heap should not be more than 70% occupied. The maximum heap size should, if possible, be able to be contained in physical memory to avoid paging. For the best performance, try to ensure that the heap never pages.

- ## Consider memory access speed

  - ▶ Platform 2015: Intel® Processor and Platform -Evolution for the Next Decade
    http://epic.hpi.uni-potsdam.de/pub/Home/TrendsAndConceptsII2010/HW_Trends_borkar_2015.pdf
    "the advantages of higher clock speeds are in part negated by memory latency, since memory access times have not been able to keep pace with increasing clock frequencies."

⭐ One way to determine the appropriate amount of RAM for a system is to look at the largest value for avm as reported by the vmstat command. Multiply that by 4 K to get the number of bytes and then compare that to the number of bytes of RAM on the system. Ideally, avm should be smaller than total RAM
http://publib.boulder.ibm.com/infocenter/pseries/v5r3/index.jsp?topic=/com.ibm.aix.prftungd/doc/prftungd/mem_usage_vmstat.htm

Vmstat AIX – system memory

```
kthr      memory              page                  faults          cpu
---- ----------- ------------------------ --------------- -----------
r b   avm   fre  pi   po    fr      sr cy   in    sy   cs us sy id wa
1 0 144059 61061  0    0     0       0  0   14   154  149  1  3 97  0
1 0 144057 61063  0    0     0       0  0   12   285  145  1  3 96  0
2 0 219258  7451  0    0 21589  202426  3   20 10251  212 74 26  0  0
0 2 276288  4632 51 22219 57551 353503  6 6756 10341 2794 27 68  2  2
1 4 318982  4571 31 20527 21412   24771  0 4847  3279 1076 20 72  3  4
0 8 341294  4717 37 21518 22285   24563  0 6212  3642 1166 21 72  3  5
0 6 357028  4819 29 15234 15415   17132  0 4216  2290  784 22 70  3  5
```

- Every time a computational page (CP) has to be paged-in means that a running application is blocked until the CP is written back into memory from the paging space

- The ratio (sr/fr) between sr (scanned pages) and fr (freed pages) defines how many file pages were scanned in order to find one that could be freed.

- The higher the sr value compared to the fr value, the harder it is for the page-replacement algorithm to find eligible pages to steal.

Vmstat Linux: system memory

```
procs-----------memory----------- --swap-- --io--- --system-- ----cpu----
 r  b   swpd   free  buff  cache   si   so    bi    bo    in      cs us sy id wa
 1  0   1921    113     6   2157    0    0   296   136   1598    3865 82  8  9  1
 2  0   1921    108     6   2176    0    0    16     0   1453    3130 74  5 21  0
 0  2   1931    119     6   2178    0  9668   568  9868   6855   3748 69 12  0 19
 5  2   1931     98     6   2202    0    0  2604     8   4958    3125 66  8  3 24
 1  4   1932     96     6   2204    0  1096  3112  1100   4035   2679 48  8  1 43
 2  4   1932    119     4   2188    0    0  2364    36  15909   2754 57 12  9 22
 0  4   1937     97     4   2206    0  4968  3464  4968   3889   3085 55 10  1 35
 7  3   1937    101     0   2212    0    0  3168   160  12122   2931 63 11  1 26
 1  4   1942    104     0   2210    0  4932  3348  5232  16944   3087 66 12  3 20
```

- swpd – virtual memory used in KB
- free – idle memory in KB
- If the virtual memory used (memory-swpd) remains high and the free memory (memory-free) remains low, then the system may be memory constrained and can benefit from additional RAM.

vmstat Solaris: system memory

procs			memory				page					disk			faults			cpu		
r	b	w	swap	free	re	mf	pi	po	fr	de	sr	s1	s2	s3	in	sy	cs	us	sy	id
0	0	0	644688	28240	0	1263	608	5	5	0	0	103	2	5	762	4440	714	26	40	33
1	0	0	532216	18940	7	2281	226	8	8	0	0	9	2	53	511	2892	600	14	62	24
6	0	0	528912	7652	15	2159	44	232	818	3072	302	7	3	8	611	2488	613	32	61	6
5	0	0	521648	7112	10	2369	94	222	330	1640	44	35	8	2	781	2569	742	30	70	0
6	0	0	525804	7136	21	2381	1310	672	1840	1500	599	24	5	21	637	2741	634	31	69	0
2	0	0	527992	7880	9	1349	3405	557	2066	1100	684	7	4	133	675	1457	643	16	45	39
1	0	0	530208	6780	13	1261	3553	1170	3580	1220	1079	32	4	165	725	1375	661	12	43	46
1	0	0	526996	7028	7	855	36	181	530	1576	149	10	2	4	569	4596	539	66	23	11
0	0	0	527548	8440	16	541	65	114	250	1408	55	14	1	1	505	2002	559	44	20	36
0	0	0	530664	11008	2	499	25	2	0	1032	0	16	6	1	383	1209	511	6	15	79
1	0	0	531460	35916	0	370	130	0	0	756	0	4	6	0	367	866	519	3	24	73

- de - anticipated short-term memory shortfall in KB, which gives the page scanner a target number of pages to free up. Any activity in this column should be considered a problem as this implies that the system feels need to prepare to page out active pages.
- As is true with AIX, the scanned page (sr) count should not exceed the freed page (fr) count.

Application Specific Information

- If an I/O problem is suspected look for further clues in the WebSphere logs:

  ▶ Javacores/Thread Dumps

  ▶ System Logs

Javacores and Thread Dumps

```
"WebContainer : 48" (TID:0x000000013D7B6D00,
  sys_thread_t:0x000000013D7867B0, state:CW, native ID:0x0000000002570099)
  prio=5
    at java/io/FileOutputStream.open(Native Method)
    at java/io/FileOutputStream.<init>(FileOutputStream.java:205(Compiled
Code))
    at java/io/FileOutputStream.<init>(FileOutputStream.java:157(Compiled
Code))...
```

- If the javacore shows many threads in `java/io/` or a thread that does not move beyond this state over time, then I/O could be the source of the performance issue.

Javacores and Thread Dumps (cont.)

```
at java.net.SocketInputStream.socketRead0(Native Method)
at java.net.SocketInputStream.read(SocketInputStream.java:155)
at java.io.BufferedInputStream.fill(BufferedInputStream.java:229)
at java.io.BufferedInputStream.read(BufferedInputStream.java:246)
…
```

- Threads in "socketRead" for an extended period of time, mean that the work has left WebSphere and the thread will wait indefinitely for the work to return in order to continue.
- Check the database (slow? Huge query? Not available?)
- Check the network (Saturated? Blocked? Not available?)

- Other "I/O" related stack data may include similar:

  "java.nio.channels.SocketChannel.write"

WebSphere Logs: "Too Many Open Files" message

- "IOException: Too many open files"
- Check the OS ulimits to see what the value is for "NOFILE"

```
    User Limits (in bytes except for NOFILE and NPROC)
-------------------------------------------------------------
type                          soft limit          hard limit
RLIMIT_AS                     unlimited           unlimited
RLIMIT_CORE                           0           unlimited
RLIMIT_CPU                    unlimited           unlimited
RLIMIT_DATA                   unlimited           unlimited
RLIMIT_FSIZE                  unlimited           unlimited
RLIMIT_LOCKS                  unlimited           unlimited
RLIMIT_MEMLOCK                    32768               32768
RLIMIT_NOFILE                      8192               65536
RLIMIT_NPROC                    1064960             1064960
RLIMIT_RSS                    unlimited           unlimited
RLIMIT_STACK                   10485760           unlimited
```

- General suggested value is 10000 for WebSphere Application Server although many stack products require this number to be higher.

  Too Many Open Files error message
      http://www-01.ibm.com/support/docview.wss?uid=swg21067352

  Guidelines for setting ulimits
      http://www-01.ibm.com/support/docview.wss?uid=swg21469413

Identify I/O Problems: Analysis Tools

- **WAIT- IBM Whole-system Analysis of Idle Time**
  http://researcher.watson.ibm.com/researcher/view_project.php?id=1332
- **TMDA – Thread and Monitor Dump Analyzer**
  https://www.ibm.com/developerworks/mydeveloperworks/groups/service/html/communityview?communityUuid=2245aa39-fa5c-4475-b891-14c205f7333c
- **Java Health Center**
  http://www.ibm.com/developerworks/java/jdk/tools/healthcenter/

⭐ All above tools can be used with Windows as well as AIX, and Linux. Java Health Center is not available for Solaris.

Tools: WAIT

- IBM Whole-system Analysis of Idle Time (WAIT)
  https://wait.researchlabs.ibm.com/
- Input multiple javacores from same process taken over the period of time where poor performance has occurred
- Output shows where threads are spending their time based on the tops of the thread stacks

Waiting Threads | LOCK CONTENTION: 62 THREADS | DELAYED BY REMOTE REQUEST: 3 THREADS | DELAYED BY DISK: 3 THREADS
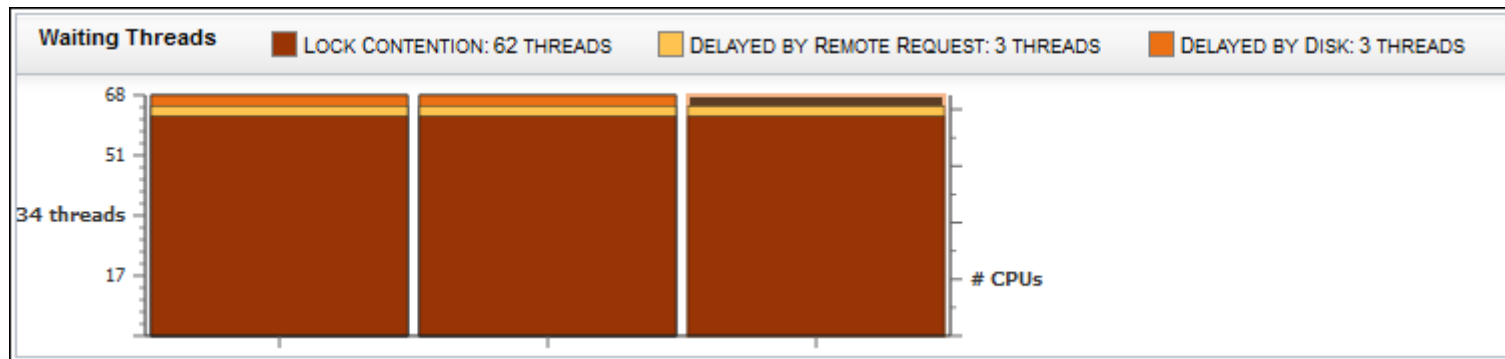
Tools: WAIT (cont.)

- Looking at the "Delayed by Disk" threads, you can identify the code that may be delayed by I/O

Stack Viewer

5 stack clusters, across all thread samples

%	Wait State	Thread Pool	Work Unit	Thread Stack	
				File System Manipulation +	java/io/ FileOutputStream.open() native method new java/io/ FileOutputStream() line 157
				WebSphere Internals +	com/ibm/wsspi/configarchive/ DefaultFileAccessor.getOutputStrea com/ibm/ws/sca/internal/admin/ SCACommandHelper$2.run() lin
				Security	java/security/ AccessController.doPrivileged() line 192
				WebSphere Internals +	com/ibm/ws/sca/internal/admin/ SCACommandHelper.discardSe com/ibm/ws/sca/internal/proxy/impl/ ProxyInvocationHandlerImpl.i
33%	Delayed by Disk	HTTP Worker Threads	WebServicesServlet	Reflective Proxies	$Proxy313.processMessage() bytecode 18
				WebSphere Internals +	com/ibm/wsspi/sca/webservice/bean/impl/ WebServiceBeanImpl.pr com/ibm/ws/webservices/engine/ WebServicesEngine.invoke() lin

Tools:TMDA(Thread Monitor Data Analyzer)

https://www.ibm.com/developerworks/community/groups/service/html/communityview?communityUuid=2245aa39-fa5c-4475-b891-14c205f7333c

WebContainer : 48
snapshot:
(1)java/io/FileOutputStream.open(Native Method)
(2)java/io/FileOutputStream.open(Native Method)
(3)java/io/FileOutputStream.open(Native Method)

WebContainer : 52
snapshot:
(1)com/ibm/ws/sca/internal/admin/SCACommandHelper.findChildComponent(SCACommandHelper.java:169)
(2)java/io/UnixFileSystem.createDirectory(Native Method)
(3)java/io/UnixFileSystem.createDirectory(Native Method)

| Thread ▲	javacore.20120921.095256.4063688.0001.txt [Sep 21 ...	javacore.20120921.095302.4063688.0002.txt [Sep 21 ...	javacore.20120921.095307.4063688.0003.txt [Sep 21 ...	Waiting Th
WebContainer : 48	java/io/FileOutputStream.open(Native Method)	java/io/FileOutputStream.open(Native Method)	java/io/FileOutputStream.open(Native Method)	
WebContainer : 49	com/ibm/ws/sca/internal/admin/SCACommandHelp...	com/ibm/ws/sca/internal/admin/SCACommandHelp...	com/ibm/ws/sca/internal/admin/SCACommandHelp...	
WebContainer : 5	com/ibm/ws/sca/internal/admin/SCACommandHelp...	com/ibm/ws/sca/internal/admin/SCACommandHelp...	com/ibm/ws/sca/internal/admin/SCACommandHelp...	
WebContainer : 50	com/ibm/ws/sca/internal/admin/SCACommandHelp...	com/ibm/ws/sca/internal/admin/SCACommandHelp...	com/ibm/ws/sca/internal/admin/SCACommandHelp...	
WebContainer : 51	com/ibm/ws/sca/internal/admin/SCACommandHelp...	com/ibm/ws/sca/internal/admin/SCACommandHelp...	com/ibm/ws/sca/internal/admin/SCACommandHelp...	
WebContainer : 52	com/ibm/ws/sca/internal/admin/SCACommandHelp...	java/io/UnixFileSystem.createDirectory(Native Method)	java/io/UnixFileSystem.createDirectory(Native Method)	
WebContainer : 53	com/ibm/ws/sca/internal/admin/SCACommandHelp...	com/ibm/ws/sca/internal/admin/SCACommandHelp...	com/ibm/ws/sca/internal/admin/SCACommandHelp...	

Compare Threads : javacore.20120921.095256.4063688.0001.txt javacore.20120921.095302.4063688.0002.txt javacore.20120921.095307.4063688.0003.tx

TMDA output

● This tool is also available in ISA

Download IBM Support Assistant (ISA) Lite for WebSphere Application Server
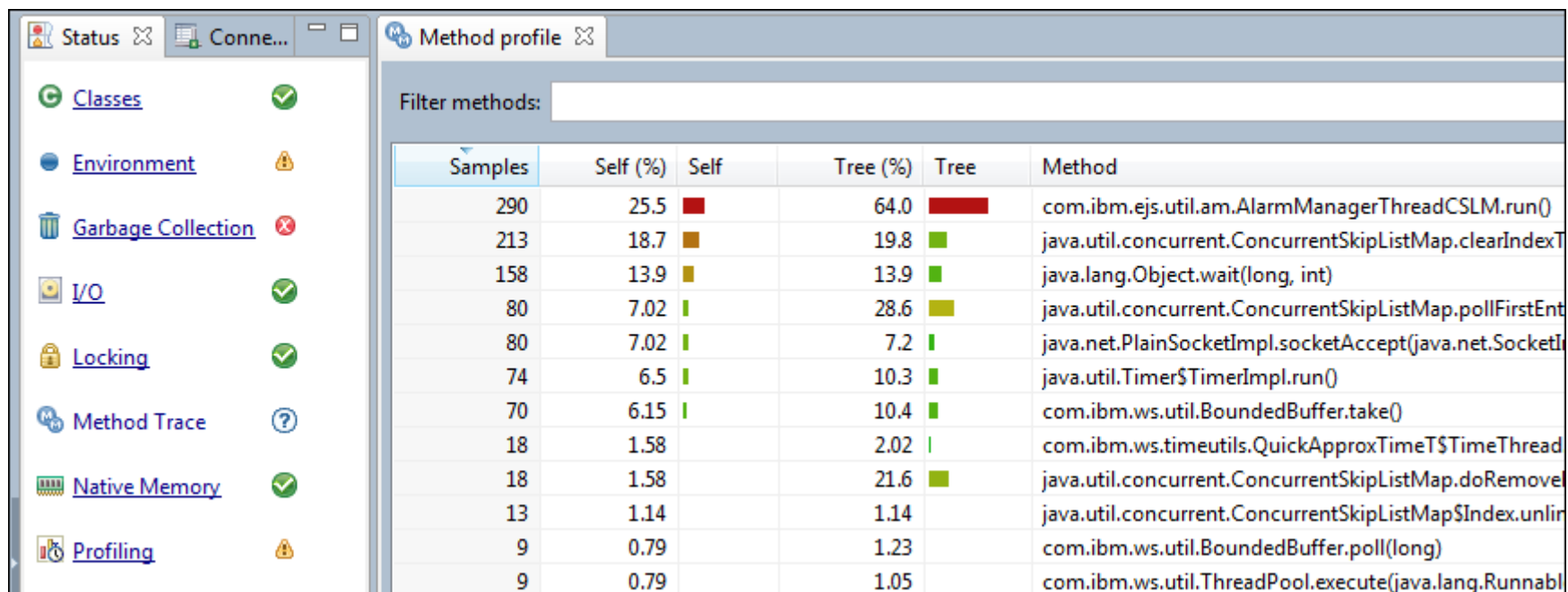http://www-01.ibm.com/support/docview.wss?uid=swg24020502

Tools: Health Center - I/O

- Java Health Center monitors I/O for a Java application
- Only for opening and closing of files
- May not be particularly useful for performance monitoring
- Health Center as a whole is useful for monitoring application health
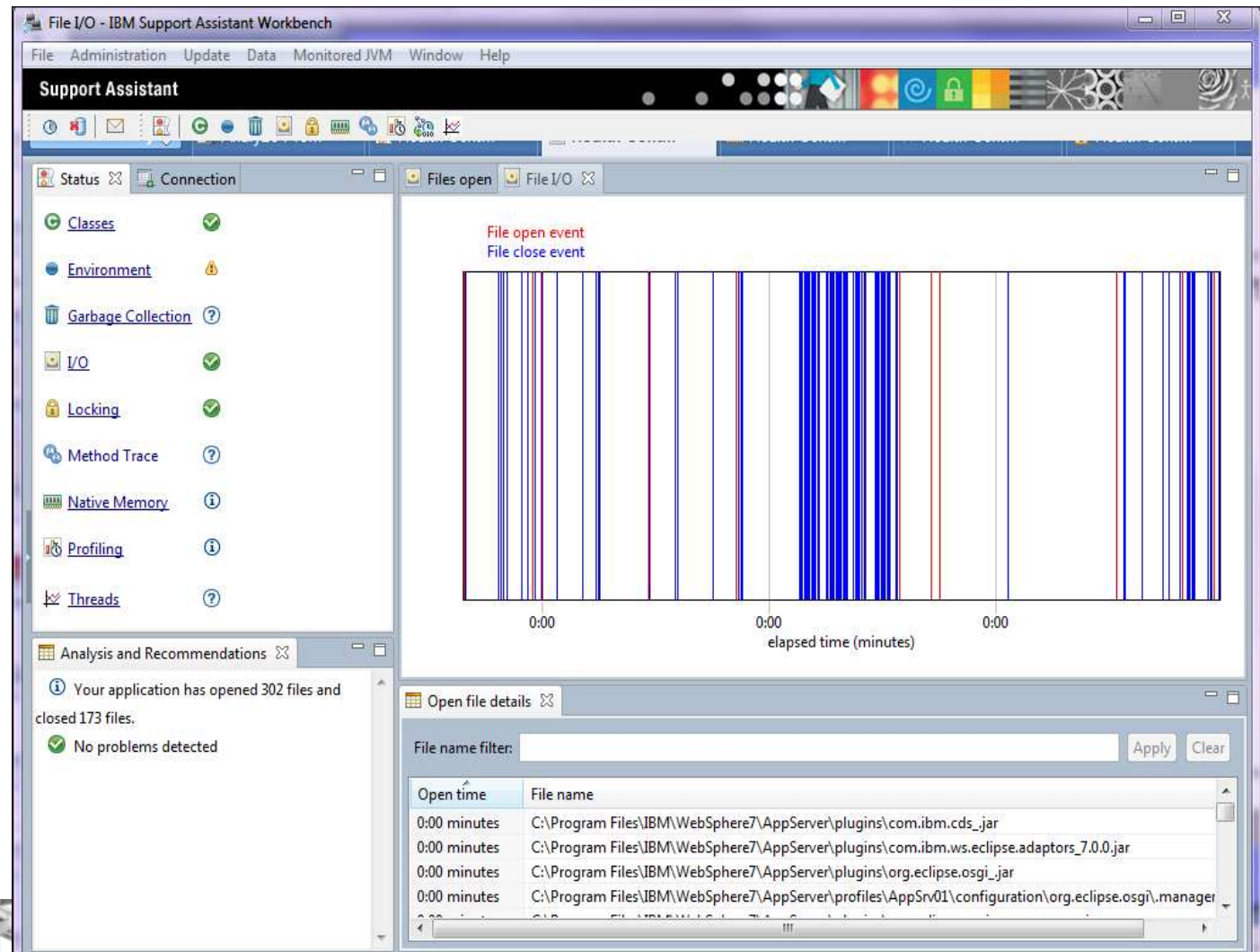
Tools: Health Center - Profiling

- Also available in Java Health Center is Method Profiling.
- Although this is based on CPU usage, the pictorial output may easily highlight where I/O activity is contentious.

Samples	Self (%)	Self	Tree (%)	Tree	Method
290	25.5		64.0		com.ibm.ejs.util.am.AlarmManagerThreadCSLM.run()
213	18.7		19.8		java.util.concurrent.ConcurrentSkipListMap.clearIndexT
158	13.9		13.9		java.lang.Object.wait(long, int)
80	7.02		28.6		java.util.concurrent.ConcurrentSkipListMap.pollFirstEnt
80	7.02		7.2		java.net.PlainSocketImpl.socketAccept(java.net.SocketI
74	6.5		10.3		java.util.Timer$TimerImpl.run()
70	6.15		10.4		com.ibm.ws.util.BoundedBuffer.take()
18	1.58		2.02		com.ibm.ws.timeutils.QuickApproxTimeT$TimeThread
18	1.58		21.6		java.util.concurrent.ConcurrentSkipListMap.doRemove
13	1.14		1.14		java.util.concurrent.ConcurrentSkipListMap$Index.unlir
9	0.79		1.23		com.ibm.ws.util.BoundedBuffer.poll(long)
9	0.79		1.05		com.ibm.ws.util.ThreadPool.execute(java.lang.Runnabl

Status ⊠ Conne...

- Classes ✓
- Environment ⚠
- Garbage Collection ✕
- I/O ✓
- Locking ✓
- Method Trace ?
- Native Memory ✓
- Profiling ⚠

Method profile ⊠

Filter methods:

**This is not an example of high CPU caused by I/O. Example above is to show what the method profile output looks like.

Next Step Tools

- Once the performance issue has been identified as related to I/O, the system administrator can use the following tools to inspect closer:

  ▶ iostat: Reports CPU statistics, AIO and input/output statistics for the entire system, adapters, TTY devices, disks CD-ROMs, tapes and file systems.
  Iostat Command:

  http://pic.dhe.ibm.com/infocenter/aix/v6r1/topic/com.ibm.aix.cmds/doc/aixcmds3/iostat.htm

  ▶ nmon: Displays local system statistics in interactive mode and records system statistics in recording mode.

  http://pic.dhe.ibm.com/infocenter/aix/v6r1/topic/com.ibm.aix.cmds/doc/aixcmds4/nmon.htm

  ▶ mpstat: Collects and displays performance statistics for all logical processors in the system

  http://pic.dhe.ibm.com/infocenter/aix/v6r1/topic/com.ibm.aix.cmds/doc/aixcmds3/mpstat.htm

Avoid Performance Problems

WebSphere Application Server provides several tunable parameters and options to match the application server environment to the requirements of your application:

- Review the hardware and software prerequisites for WebSphere Application Server.
- Install the most current refresh pack, Fix Pack, and recommended interim fixes.
- Check the hardware configuration and settings.
- Review your application design.
- Tune the Solaris Operating System.
- Tune the Java Virtual Machine settings.
- Use a Type-4 (or pure Java) JDBC driver.
- Tune WebSphere Application Server JDBC resources and associated connection pools.
- Enable the Pass by Reference option, if applicable.
- Ensure that the transaction log is on a fast disk.
- Tune related components, such as data bases, messaging providers, and so on.
- Disable functions that are not needed.

Summary

- WebSphere Application Server, like any other application can only be as robust as the environment in which it resides
- Using the available tools, we can identify areas of contention and seek streamlined methods of resolution
- Sometimes we need to look beyond the application server and application to resolve performance bottlenecks

Resources

Assessing disk performance with the vmstat command
http://pic.dhe.ibm.com/infocenter/aix/v7r1/topic/com.ibm.aix.prftungd/doc/prftungd/assess_disk_perf_vmstat.htm

Basic Monitoring of I/O on AIX
http://www-03.ibm.com/support/techdocs/atsmastr.nsf/5cb5ed706d254a8186256c71006d2e0a/380d85576e3b900a8625755900805026/$FILE/Basic_Monitoring_of_IO_on_AIX.pdf

Checking hardware configuration and settings
http://www14.software.ibm.com/webapp/wsbroker/redirect?version=compass&product=was-base-dist&topic=tprf_tunehdwcap

Disk IO Tuning in AIX 6.1
http://www.ibm.com/developerworks/wikis/download/attachments/104533522/AIX_Disk_IO_Tuning_093011.pdf

File system caching configurations
http://publib.boulder.ibm.com/infocenter/db2luw/v9r5/topic/com.ibm.db2.luw.admin.dbobj.doc/doc/c0051304.html

Guidelines for setting ulimits
http://www-01.ibm.com/support/docview.wss?uid=swg21469413

Memory usage determination with the vmstat command
http://pic.dhe.ibm.com/infocenter/aix/v7r1/index.jsp?topic=%2Fcom.ibm.aix.prftungd%2Fdoc%2Fprftungd%2Fmem_usage_vmstat.htm

Resources (cont.)

MustGather: Performance, hang, or high CPU issues with WebSphere Application Server on AIX
http://www-01.ibm.com/support/docview.wss?rs=180&uid=swg21052641

Optimizing AIX 7 performance
http://www.ibm.com/developerworks/aix/library/au-aix7optimize1/index.html

Optimizing AIX 7 performance: Part 2, Monitoring logical volumes and analyzing the results
http://www.ibm.com/developerworks/aix/library/au-aix7optimize2/index.html

Platform 2015: Intel® Processor and Platform -Evolution for the Next Decade
http://epic.hpi.uni-potsdam.de/pub/Home/TrendsAndConceptsII2010/HW_Trends_borkar_2015.pdf

Reading vmstat in linux – Part 2
http://www.helpmehost.com/tag/linux-performance/

Too Many Open Files error message
http://www-01.ibm.com/support/docview.wss?uid=swg21067352

Under the Hood: Of POWER7 Processor Caches
http://www-03.ibm.com/systems/resources/systems_power_software_i_perfmgmt_underthehood.pdf

User space memory access from the Linux kernel
http://www.ibm.com/developerworks/linux/library/l-kernel-memory-access/index.html

vmstat Command
http://pic.dhe.ibm.com/infocenter/aix/v7r1/index.jsp?topic=%2Fcom.ibm.aix.cmds%2Fdoc%2Faixcmds6%2Fvmstat.htm

Tools

IBM Whole-system Analysis of Idle Time (WAIT)

http://researcher.watson.ibm.com/researcher/view_project.php?id=1332

IBM Thread and Monitor Dump Analyzer for Java

https://www.ibm.com/developerworks/mydeveloperworks/groups/service/html/communityview?communityUuid=2245aa39-fa5c-4475-b891-14c205f7333c

IBM Monitoring and Diagnostic Tools for Java - Health Center

http://www.ibm.com/developerworks/java/jdk/tools/healthcenter/

Contact Me

- **Michele Calcavecchia**
- **Email:**

  macalcav@us.ibm.com

- **On Connections:**

  https://w3-connections.ibm.com/profiles/html/profileView.do?userid=6f63d140-ea64-102b-87fa-a1760d15112d&lang=en_us

- **WebSphere Application Server L2 Support on Connections:**

  https://w3-connections.ibm.com/communities/service/html/communityview?communityUuid=2e920240-407d-471c-8c0a-358f89ab3448

Additional WebSphere Product Resources

- Learn about upcoming WebSphere Support Technical Exchange webcasts, and access previously recorded presentations at:
http://www.ibm.com/software/websphere/support/supp_tech.html

- Discover the latest trends in WebSphere Technology and implementation, participate in technically-focused briefings, webcasts and podcasts at:
http://www.ibm.com/developerworks/websphere/community/

- Join the Global WebSphere Community:
http://www.websphereusergroup.org

- Access key product show-me demos and tutorials by visiting IBM® Education Assistant:
http://www.ibm.com/software/info/education/assistant

- View a webcast replay with step-by-step instructions for using the Service Request (SR) tool for submitting problems electronically:
http://www.ibm.com/software/websphere/support/d2w.html

- Sign up to receive weekly technical My Notifications emails:
http://www.ibm.com/software/support/einfo.html

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