Peeking into Windows to Improve your SAS Performance

MP Welch Solutions Architect SAS Institute

South Central SAS Users Group

November 7, 2011



THE POWER TO KNOW。

Overview

Getting the most from SAS on the Windows platform requires understanding SAS and how it behaves in a Microsoft Windows environment.

If performance problems arise with your SAS jobs, what information sources are available to determine the cause?

From the SAS application perspective, this presentation will cover accessing the following:

- SAS Logging information
- SAS Options
- Windows System Configuration Information
- Microsoft Windows Performance Metrics

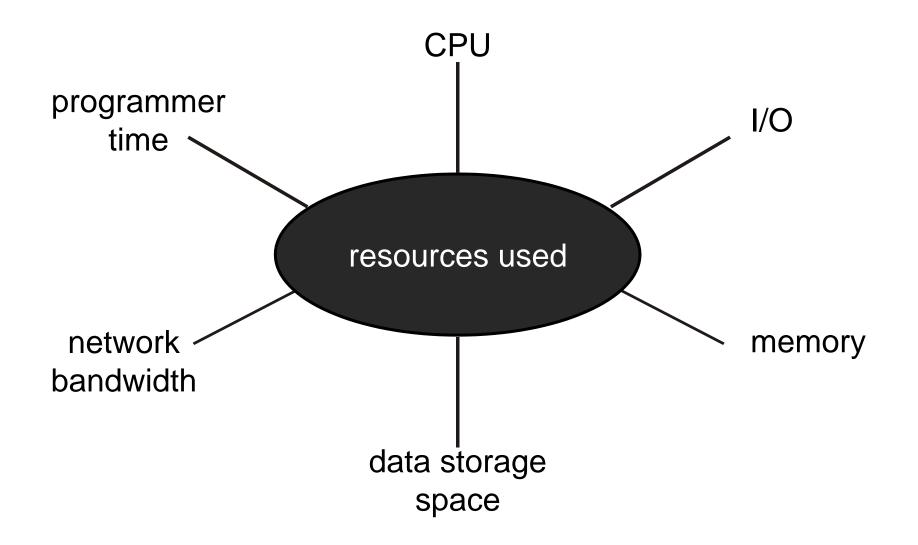
SAS is also useful for gathering and analyzing this information.

The use of newer Windows performance monitoring tools like RESMON will also be discussed.

This introductory tutorial will provide you with the tips and techniques needed to begin your journey toward a better understanding of information related to SAS performance on Windows.



Resource Overview



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Understanding Efficiency at Your Site











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Sources of Information Accessible by SAS

- Logging
- Options
- Configuration Information
- PerfMon
- Miscellaneous





SAS Logging

"C:\Program Files\SASH93\SASFoundation\9.3\sas.exe"

-CONFIG "C:\Program Files\SASH93\SASFoundation\9.3\nls\en\sasv9.cfg"

-log "c:\mpw\logdata\SASLOG_#Y#m#d_#H#M.log"

-logparm "rollover=session"

-altlog "c:\logs\sasprg1.log"

-FULLSTIMER

Name	Date modified	Туре	Size
saslog_20111103_1807.log	11/3/2011 6:07 PM	Text Document	3 KB
saslog_#Y#m#d_#H#M.log	11/3/2011 6:08 PM	Text Document	3 KB

NOTE: Log file opened at Wed, 26 Oct 2011 13:55:32.345

NOTE: SAS initialization used:

real time	3.30 seconds	lf ti
user cpu time	0.56 seconds	บรเ
system cpu time	0.68 seconds	a g
memory	5320.28k	то
OS Memory	6072.00k	
Timestamp	10/26/2011 01:55:	34

f the Real time and total CPU time are usually within 15% of each other, this is a general indication that the system is noving data well...

More about the FULLSTIMER SAS Option

http://support.sas.com/rnd/scalability/tools/fullstim/index.html



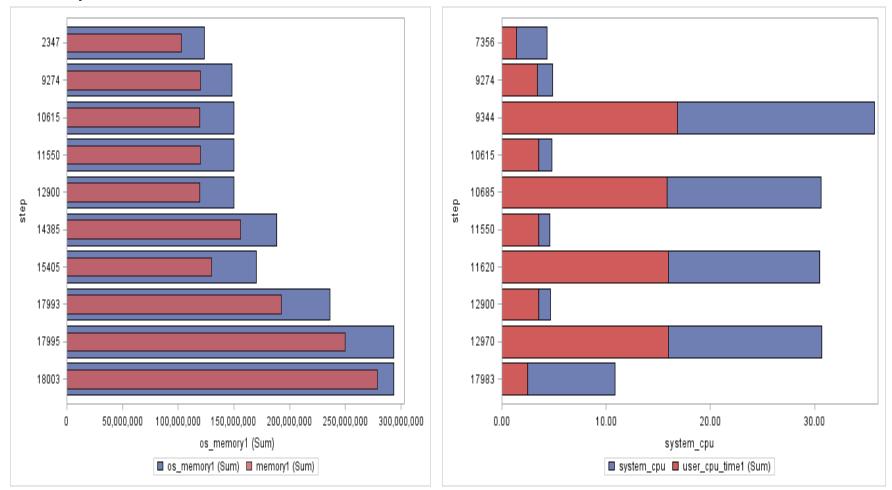
6

ΡМ

Parsing Windows SAS Log

Memory Utilization

CPU Utilization



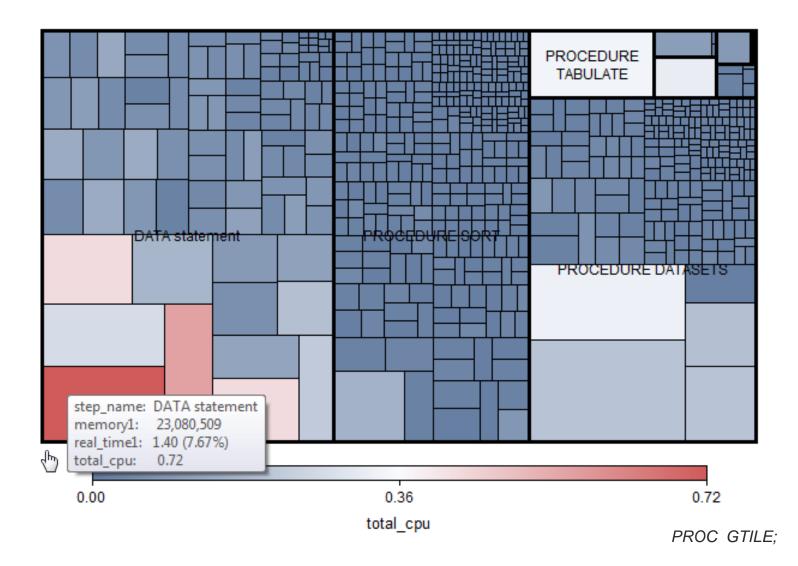
PROC SGPLOT;



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Parsing Windows SAS Log



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<u>S</u>.Sa

SAS Options

PROC OPTIONS GROUP=PERFORMANCE;

BUFNO=1Number of buffers for each SAS data setBUFSIZE=0Size of buffer for page of SAS data setCOMPRESS=YESSpecifies whether to compress observationsCPUCOUNT=8Number of processors available.NODBIDIRECTEXECDo not use SQL optimization with SAS/ACCESS enginesSORTSIZE=419430400Size parameter for sortTHREADSThreads are available for useMEMSIZE=2147483648Specifies the limit on the total amount of memory

... Also PROC OPTIONS GROUP=MEMORY;

PROC OPTIONS OPTION=COMPRESS VALUE DEFINE;

Option Value Information For SAS Option COMPRESS Value: YES Scope: DMS Process How option value set: Options Statement

Option Definition Information for SAS Option COMPRESS Group= SASFILES Group Description: Library and member file information Group= PERFORMANCE Group Description: Performance settings Description: Specifies whether to compress observations in output SAS data sets

```
data _null_;
memsize_value = getoption('memsize');
memsize_howset = getoption('memsize','howset');
memsize_howscope = getoption('memsize','howscope');
memsize_defaultvalue = getoption('memsize','defaultvalue');
memsize_startupvalue = getoption('memsize','startupvalue');
put memsize_value=;
put memsize_howset=;
put memsize_howscope=;
put memsize_startupvalue=;
run;
```

memsize_value=2147483648 memsize_howset=Config Files memsize_howscope=SAS Session memsize_startupvalue=2147483648

Also SORT and UTILLOC and more



Options Information in SAS Report Format

optname	default	startup	current	howset
bufno	1	1	1	Shipped Default
bufsize	0	0	0	Shipped Default
compress	NO	NO	YES	Options Statement
cpucount	1	8	4	Options Statement
sortsize	MAX	268435456	419430400	Options Statement
threads	THREADS	THREADS	THREADS	Options Statement
memsize	0	2147483648	2147483648	Config Files
memblksz	16777216	16777216	16777216	Shipped Default
memmaxsz	2147483648	2147483648	2147483648	Shipped Default

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Ssas

Microsoft .nfo Information File

msinfo32 /nfo syssum.nfo /categories +systemsummary

<?xml version="1.0"?>

<MsInfo>

<Metadata>

<Version>8.0</Version>

<CreationUTC>11/08/10 03:56:54</CreationUTC>

</Metadata>

<Category name="System Summary">

<Data>

```
<ltem><![CDATA[OS Name]]></ltem>
```

<Value><![CDATA[Microsoft Windows 7 Ultimate]]></Value>

</Data>

<Data>

```
<ltem><![CDATA[Version]]></ltem>
```

```
<Value><![CDATA[6.1.7600 Build 7600]]></Value>
```

</Data>

<Data>

```
<Item><![CDATA[Other OS Description ]]></Item>
```

<Value><![CDATA[Not Available]]></Value>

</Data>

. . .

Also see: MSCONFIG command



What is **Powershell**?

On 22nd October 2009 Microsoft released Windows Server 2008 R2 and Windows 7; PowerShell, version 2.0

"Windows PowerShell is one of my favorite tools to use for gathering information from my PC and network, and also for automating processes."

"I have used Windows PowerShell to automate some of my SAS-related processes, such as batch processing with SAS Enterprise Guide. **I've also used it within my development work to gather metrics about files, computers on the network, and running processes** -- all of which are interesting activities for a system administrator. Because Windows PowerShell allows you to gather different types of information and easily save it in CSV files, it's a convenient way to generate data sources for further analysis using SAS."

Running Windows PowerShell Scripts Chris Hemedinger September 12, 2011 The SAS Dummy A SAS® blog for the rest of us



Accessing Windows Objects with SAS

filename **GetChip** pipe "powershell -Command ""get-wmiobject win32_processor - ComputerName . | Select-Object -Property [a-z]* """;

data _null_; infile GetChip; input; put _infile_; run;

		Interesting System Objects
Name	: Intel(R) Core(TM) i5-2540M CPU @ 2.60GHz	
Description	: Intel64 Family 6 Model 42 Stepping 7	
CurrentClockSpeed	: 2601	win32_operatingsystem
DataWidth	: 64	gojete
DeviceID	: CPUO	
ExtClock	: 100	win32_processor
Family	: 205	-
L2CacheSize	: 256	win22 legicaldiak
L3CacheSize	: 3072	win32_logicaldisk
Level	: 6	
LoadPercentage	: 36	win32_process
MaxClockSpeed	: 2601	
NumberOfCores	: 2	
NumberOfLogicalProcessors	: 4	win32_service
Manufacturer	: GenuineIntel	
		win32_product
		—1

filename GetProc pipe "powershell -Command ""get-wmiobject win32_process -filter name=""SAS.EXE"' | Select-Object -Property [a-z]* """;

Name	:	sas.exe
OtherOperationCount	:	10574
OtherTransferCount	:	158450
PageFaults	:	47560
PageFileUsage	:	88032
ParentProcessId	:	1760
PeakPageFileUsage	:	89644
PeakVirtualSize	:	757379072
PeakWorkingSetSize	:	98384

. . .

cim_Physicalmemory

win32 quickfixengineering

System Information in SAS Report Format

OBJECT=CIM_Physicalmemory

OBJECT	token1	token2
CIM_Physicalmemory	BankLabel :	BANK 0
CIM_Physicalmemory	Capacity :	4294967296
CIM_Physicalmemory	Speed :	1333
CIM_Physicalmemory	BankLabel :	BANK 1
CIM_Physicalmemory	Capacity :	4294967296
CIM_Physicalmemory	Speed :	1333
CIM_Physicalmemory	BankLabel :	BANK 2
CIM_Physicalmemory	Capacity :	2147483648
CIM_Physicalmemory	Speed :	1333
CIM_Physicalmemory	BankLabel :	BANK 3
CIM_Physicalmemory	Capacity :	2147483848
CIM_Physicalmemory	Speed :	1333

OBJECT=win32_processor

OBJECT	token1	token2
win32_processor	L2CacheSize :	256
win32_processor	L3CacheSize :	6144
win32_processor	Name :	Intel(R) Core(TM) i7 CPU Q 740 @ 1.73G
win32_processor	NumberOfCores :	4
win32_processor	NumberOfLogicalProcessors :	8

OBJECT=Win32_quickfixenginee

OBJECT	token1	token2
Win32_quickfixenginee	HOTFIX KB2564236	NOT APPLIED

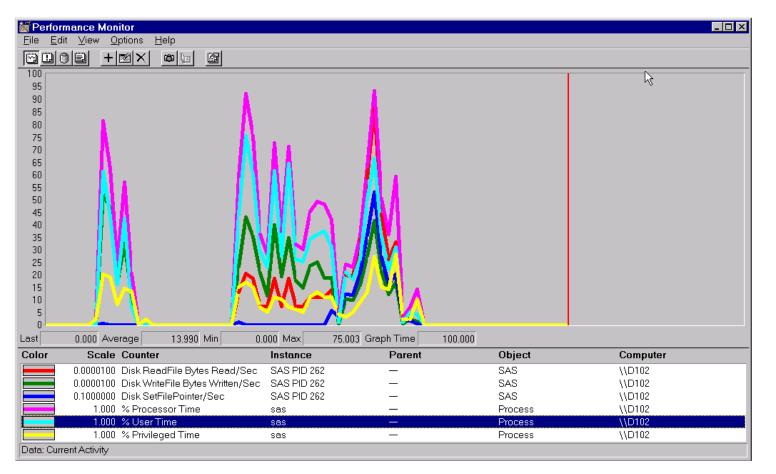
OBJECT=Win32_logicaldisk

OBJECT	token1	token2
Win32_logicaldisk	DeviceID :	C:
Win32_logicaldisk	Description :	Local Fixed Disk
Win32_logicaldisk	FileSystem :	NTFS
Win32_logicaldisk	FreeSpace :	13322514432
Win32_logicaldisk	Size :	125026955264
Win32_logicaldisk	DeviceID :	D:
Win32_logicaldisk	Description :	Local Fixed Disk
Win32_logicaldisk	FileSystem :	NTFS
Win32_logicaldisk	FreeSpace :	41162440704
Win32_logicaldisk	Size :	120031539200
Win32_logicaldisk	DeviceID :	E:
Win32_logicaldisk	Description :	Local Fixed Disk
Win32_logicaldisk	FileSystem :	NTFS
Win32_logicaldisk	FreeSpace :	127517732864
Win32_logicaldisk	Size :	500104687616
Win32_logicaldisk	DeviceID :	F:
Win32_logicaldisk	Description :	Local Fixed Disk
Win32_logicaldisk	FileSystem :	NTFS
Win32_logicaldisk	FreeSpace :	207459184640
Win32_logicaldisk	Size :	354104111104



What is PerfMon?

Performance Counters and Objects



SAS Counters in the Performance and System Monitors

Recommended Performance Counters for Windows Performance Monitor http://support.sas.com/rnd/scalability/papers/practicalperf.pdf

Accessing Perfmon Data with SAS

2.2.2,232,Thread,2011,10,27,19,36,0,339,26,60008,1,19,12,2,System,0,,00,,,,100,,,500,800,4
2.2.2,232,Thread,2011,10,27,19,36,0,339,26,60008,1,19,12,2,System,26,,00,,,,1800,,,500,800
2.2.2,232,Thread,2011,10,27,19,36,0,339,26,60008,1,19,12,2,System,28,,00,,,,1700,,,500,800
2.2.2,232,Thread,2011,10,27,19,36,0,339,26,60008,1,19,12,2,System,31,,00,,,,800,,,500,800,
2.2.2,234,PhysicalDisk,2011,10,27,19,36,0,494,26,60005,1,18,34,1,0 C: F:,00,00,12964217908
2.2.2,234,PhysicalDisk,2011,10,27,19,36,0,494,26,60005,1,18,34,1,1 D:,00,0.0075,12964217908
2.2.2,234,PhysicalDisk,2011,10,27,19,36,0,494,26,60005,1,18,34,1,2 E:,00,00,12964217908048
2.2.2,236,LogicalDisk,2011,10,27,19,36,0,494,26,60004,1,18,37,1,C:,1070,11923400,1275800,0

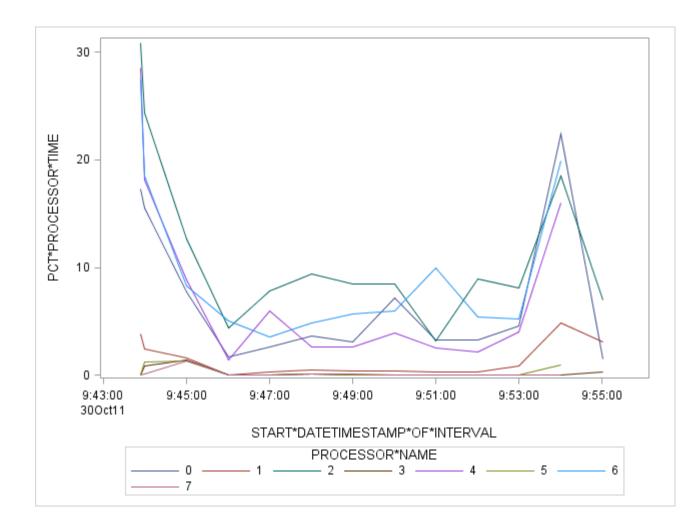
2.2.2,236,LogicalDisk,2011,10,27,19,36,0,491 2.2.2,236,LogicalDisk,2011,10,27,19,36,0,49 2.2.2,236,LogicalDisk,2011,10,27,19,36,0,49 2.2.2,238, Processor, 2011, 10, 27, 19, 36, 0, 502, 2.2.2,238, Processor, 2011, 10, 27, 19, 36, 0, 502, 2.2.2,238, Processor, 2011, 10, 27, 19, 36, 0, 502, 2.2.2,238, Processor, 2011, 10, 27, 19, 36, 0, 502, 2.2.2,238, Processor, 2011, 10, 27, 19, 36, 0, 502, 2.2.2,238, Processor, 2011, 10, 27, 19, 36, 0, 502, 2.2.2,238, Processor, 2011, 10, 27, 19, 36, 0, 502, 2.2.2,238, Processor, 2011, 10, 27, 19, 36, 0, 502, 2.2.2,262,Redirector,2011,10,27,19,36,0,494 2.2.2,330,Server,2011,10,27,19,36,0,494,26, 2.2.2,510,Network Interface,2011,10,27,19,3 2.2.2,510,Network Interface,2011,10,27,19,3 2.2.2,510,Network Interface,2011,10,27,19,3

CT*PRO	CESSOR*TIME	PCT*DPC*TIME	PCT IDLE TIME	PCT*INTERRUPT*TIME	PCT*PRIVILEGED*TIME	PCT*USER*TIME	TRA
	3	0.19		0.0473	0.28	0	
	4.08	0.14		0.24	0.95	0.43	
	4.1299999999	0		0.0473	0.8	0.61	
	2.76	0		0	0	0),
	3.75	0		0	0.8	0.24	
	2.76	0		0	0	0	1
	4.3199999999	0		0	0.76	0.85	
	2.76	0		0	0	0	- 1
	0.11	0.1		0.026	0.13	0	
	1.38	0.21		0.36	0.91	0.49	
	0.78	0		0.026	0.52	0.29	
	0	0		0	0	0	1
	0.68	0		0	0.42	0.29	
	0	0.026		0	0.026	0	
	0.42	0		0.026	0.29	0.16	
	0	0		0	0	0	
	0.6	0.42		0.16	0.57	0)(
	3.9	0.052		0.34	1.48	2.39	
	7.8799999999	0.18		0	3.38	4.47	. (
	0.0294	0		0	0	0	
	6.35	0		0	1.53	4.78	
	0.11	0.078		0	0.078	0	
	7 18	0		0	14	5 75	

2.2.2,510,Network Interface,2011,10,27,19,36,0,502,26,60005,1,18,20,1,Teredo Tunneling Pse



Processor(s) Utilization Data

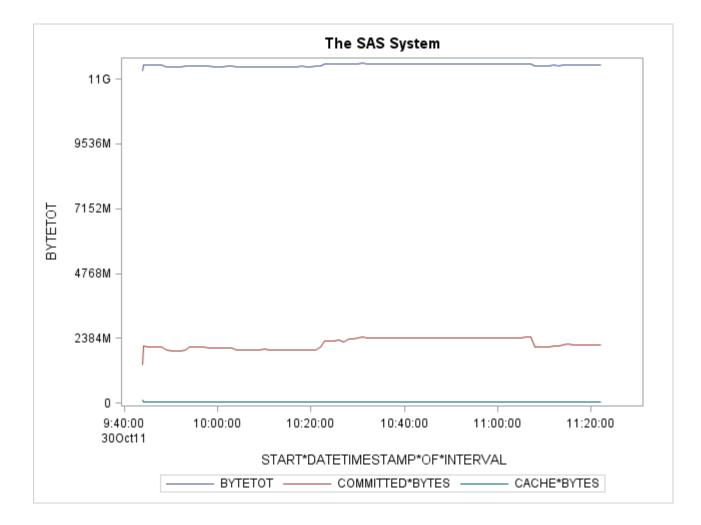


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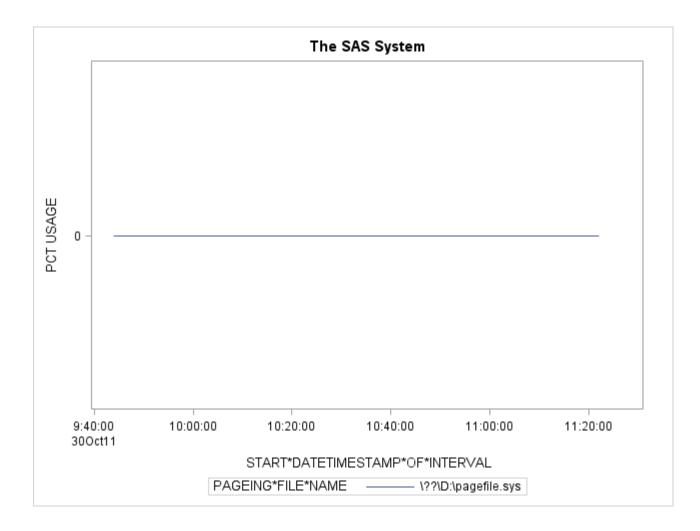
Memory Allocation





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Page File Utilization

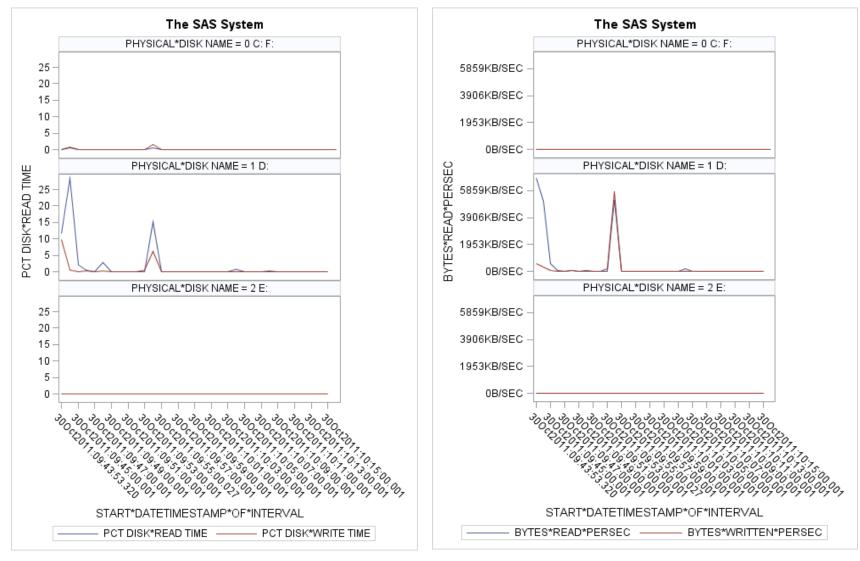


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SSAS

Disk Drive Utilization Information



PROC SGPANEL;



Miscellaneous Topics

Problem Note *39615:* Input/output performance in SAS® is degraded due to excessive memory usage on Windows

http://support.sas.com/kb/39/615.html

Apply Microsoft Hot Fix 2564236

All SAS customers who are running Windows 7 and Windows 2008 R2 should apply the Microsoft hot fix <u>http://support.microsoft.com/kb/2564236</u> "I/O throughput is low when large files are read sequentially in Windows 7 or in Windows Server 2008 R2." This Microsoft hot fix is not required for the SAS hot fix to work.

This Microsoft hot fix improves SAS I/O by improving the behavior of the Windows cache manager.

It is recommended that you apply Service Pack 1 (SP1) to Windows 7 and Windows 2008 R2. The Microsoft SP1 contains Microsoft hot fix 979149, which helps prevent Microsoft from becoming unresponsive.

Note: Support for Windows Server 2008 R2 starts with the third maintenance release for SAS 9.2 (TS2M3). If you are using an earlier release of SAS or Windows, consider upgrading so that you can apply these hot fixes. For more details about how SAS uses Windows I/O and Windows file cache, see <u>Configuration and Tuning Guidelines for SAS®9 in the Microsoft Windows Server</u> 2008.

Miscellaneous Topics

• Do not run your antivirus software in real-time mode. If you **must** run it in real-time mode, then be sure to exclude the following file types from your virus scan list:

> o SAS* o LCK* o UTL*

• Run a disk defragmentation tool often on the file systems that are used by SAS, particularly the file system that is associated with the SAS WORK library (where SAS creates the temporary files).

Configuration and Tuning Guidelines for SAS®9 in Microsoft Windows Server 2008 Margaret Crevar, SAS Institute Inc., Cary, NC Virtualization (via VMware) is supported by SAS. However, you should ensure that your guest systems on your VMware computer are properly set up with the amount of RAM, the number of cores, and I/O throughput that is required to support your peak SAS load.

Moving SAS Applications from a Physical to a Virtual VMware Environment Best Practices and Performance Expectations March 2011 http://support.sas.com/resources/papers/Movi ngVirtuaVMware.pdf



Key SAS Performance Papers

A Practical Approach To Solving Performance Problems with SAS® (2007)

Tony Brown SAS Performance Lab Host Systems R&D SAS Institute Inc. Updated December 12, 2007 http://support.sas.com/rnd/scalability/papers/solve_perf.pdf

Crevar, Margaret. 2009. "How to Maintain Happy SAS®9 Users." *Proceedings of the SAS Global Forum 2009 Conference*.

http://support.sas.com/resources/papers/proceedings09/310-2009.pdf

Solving SAS®Performance Problems: Employing Host-Based Tools (2006) Tony Brown, SAS Institute Inc., Dallas, TX <u>http://support.sas.com/rnd/scalability/papers/practicalperf.pdf</u>

Brown, Tony. 2008. "SAS® Performance Monitoring – A Deeper Discussion®. *Proceedings of the SAS Global Forum 2008 Conference*. <u>http://www2.sas.com/proceedings/forum2008/387-2008.pdf</u>

TS-684 (historical but good basic information) PC Performance and the SAS System Casey Thompson PC Systems SAS Technical Support

http://support.sas.com/techsup/technote/ts684/ts684.html



Key SAS Performance Papers

Configuration and Tuning Guidelines for SAS®9 in Microsoft Windows Server 2008 Margaret Crevar, SAS Institute Updated: August 2011 http://support.sas.com/resources/papers/WindowsServer2008ConfigurationandTuning.pdf

Best Practices for Configuring your IO Subsystem for SAS®9 Applications

Margaret A. Crevar, SAS Institute Inc. Tony Brown, SAS Institute Inc. Updated: August 2011 http://support.sas.com/md/papers/sgf07/sgf2007-iosubsystem.pdf

Frequently Asked Questions Regarding Storage Configurations Margaret Crevar and Tony Brown, SAS Institute Inc. Last Updated: July 2011 http://support.sas.com/resources/papers/proceedings10/FAQforStorageConfiguration.pdf



What is **RESMON**?

N Resource Monitor								
File Monitor Help	-					-		
	Disk 1	Vetwork						
Image		Descri	Status	Threads	CPU	Avera	-	
ACEngSvr.exe	5288	ACEng	Runn	3	0	0.00	Ξ	▲ Views ►
ACENGSVI.exe	4004	ACENG	Runn	5	0	0.00		CPU - Total 100% ¬
AcroBd32.exe	4748	Adobe		7	ő	0.00		CP0 - 18tal 100%
AcroRd32.exe	792	Adobe	Runn	15	ŏ	0.00		
AppleMobileDeviceService.exe		Mobil	Runn	11	ő	0.00		
armsvc.exe	1852	Adobe	Runn	5	ŏ	0.00		
AsLdrSrv.exe	1336	ASLDR	Runn	5	0	0.00		
ATKOSD.exe	1416	ATKOSD	Runn	1	0	0.00		
ATKOSD2.exe	4696	ATKOS	Runn	2	0	0.00		60 Seconds 0%
BatteryLife.exe	3992	Power	Runn	6	0	0.00		Service CPU Usage 100%
BluetoothHeadsetProxy.exe	4924	Blueto	Runn	1	0	0.00		
BTStackServer.exe	4772	Blueto	Runn	12	0	0.00		
BTTray.exe	4308	Blueto	Runn	8	0	0.00		
htudine ava	1100	Pluate	Dunn	7	0	0.00	*	
Services 0%	CPU Usa	ge				e	•	
Name	PID	Descri	Status	Group	CPU	Avera	^	0%
DMPerfss	1720	Perfor	Runn		0	0.05		CPU 0 100% ¬
MsMpSvc	948	Micros	Runn		0	0.03		
PlugPlay	780	Plug a	Runn	Dcom	0	0.02		
LMS	2168	Intel(R	Runn		0	0.01		
p2pimsvc	5784	Peer N	Runn	Local	0	0.01		
ProfSvc	356	User P	Runn	netsvcs	0	0.01		
AFRAgent	1300	AFRA <i>a</i>	Runn		0	0.00	*	Anno a Artha Artha
Associated Handles			Searc	h Handles	\$	0 47	•	0%
Image	PID	Туре		Handle Name	e			CPU1 - Parked 100% -
Select a	process o	r search har	ndles to s	ee results.				•

ile Monitor Help Dverview CPU Me	mory Disk	Vetwork							
rocesses	📕 31% Used P	hysical Memo	ory			<u>(</u>) ^	> _v	iews 🗸
Image	PID	Hard F	Comm	Worki	Share	Privat	*	Used Physical Memor	у 100% -
Uedit32.exe	2500	0	843,600	861,224	26,340	834,884			
firefox.exe	4468	0	167,496	194,936	44,136	150,800			
sas.exe	6200	0	154,052	189,536	75,692	113,844			
AcroRd32.exe	792	0	84,612	101,720	29,072	72,648			
MsMpEng.exe	948	0	120,484	93,188	19,064	74,124			
jproxy.exe	3788	0	200,064	91,752	16,848	74,904			
POWERPNT.EXE	4348	3	50,684	80,452	41,228	39,224		60 Seconds	0%]
Snagit32.exe	4496	0	71,332	77,984	35,408	42,576		Commit Charge	100%
explorer.exe	3656	0	47,916	65,956	35,372	30,584	-		
			AD 700	8304 MB A			-		
Physical Memory	📕 3807 MB In	use	·	5504 IVID A1	allable	6			
Hardware	In Use	Modified		indby	Free Free				0% J 100 -
Reserved	3807 MB	101 MB	184	40 MB	6464 N	ИB		Hard Faults/sec	100
76 MB									
			4 MB						
	Cacl		1 MB						
	Tota Insta		2 MB 8 MB						
	11150	1220						A CAN	
									0

Overview CPU Memory	State -									
Processes with Disk Activity		Network								Views 🗸
Timage	PID	Read (B/sec) Writ	te (B/sec)	Total (B/s	(ac)			6		Disk 1 MB/sec
										Disk I wib/sec
System svchost.exe (netsvcs)	4 356	2,799	20,218	23,0						
svchost.exe (hetsvcs)	3980	1,394	7,012	8,4 7,9					Ξ	
POWERPNT.EXE	4348	4.266	7,950	4.2						
sychost.exe (hpdevmamt)	1412	4,200	2.304	4,2						
svchost.exe (LocalServiceNet		1.229	2,504	2,3						
MsMpEng.exe	948	45	0		45				-	60 Seconds 0
Disk Activity	Activity 📕 0 KB/sec Disk I/O				0% Highest Active Time					Disk 0 (C: F:) Queue Length 1
Image	PID	File	Read	i (B/sec)	Write (B/sec)	Total (B/sec)	I/O Priority	Response Time		
POWERPNT.EXE	4348	D:\Program Files\Common Files		559	0	559	Normal	16	Ε	
svchost.exe (LocalServiceNetwo	1004	D:\Windows\System32\winevt\		1,836	0	1,836	Normal	1		
System	4	D:\Windows\System32\winevt\		3,527	228	3,755	Normal	1		
System	4	D:\data\Current\USER0001-PC		0	308	308	Normal	0		
System	4	D:\Users\User0001\AppData\Ro		0	128	128	Normal	0		
svchost.exe (LocalServiceNetwo	1004	D:\Windows\System32\winevt\		569	0	569	Normal	0		Disk1 (D:) Queue Length 0.01
svchost.exe (LocalServiceNetwo	1004	D:\Windows\ServiceProfiles\Lo		0	73	73	Normal	0		
POWERPNT.EXE	4348	D:\Program Files\Microsoft Offi		3,626	0	3,626	Normal	0		
System	4	D:\Windows\System32\drivers\		174	0	174	Normal	0	-	
U.U	040	Dubber erem Deter Missee effiktion		05	^	07	Manual	^		
Storage									•	
Logical Disk	Physica	L Disk			Active Time (%)	Available Space	Total Space (MB)	Disk Queue Le		0

System Monitoring

Both SAS and Microsoft strongly advise that you proactively and closely monitor the computer resources that are used in your Windows environment to avoid running out of resources, thereby causing poor performance. You should regularly collect and analyze the performance measures for the following areas:

Overall Server (aggregate server-level measures)

CPU (total and individual CPUs)

I/O throughput (total throughput and by file system)

Memory and system file cache

Network

ITRM - SAS IT Resource Management New Features, Super Demo, Tuesday 8am Find out what all of the excitement is about with the latest version of SAS/ITRM Solution designed to provide the power to know everything about all of your company's IT systems. This newest version was built from the ground up with all of the best features of the SAS 9.3 Platform and then added on Flash/Flex technology too. Come and see it live!

Questions?

Contact info

On the Web at http://www.sas.com/solutions/itresource/index.html

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