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

resources used

- CPU
- I/O
- memory
- data storage
- space
- network bandwidth
- programmer time

Resources used
Understanding Efficiency at Your Site

Hardware

System Load

Operating Environment

SAS Environment
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


NOTE: SAS initialization used:

real time 3.30 seconds
user cpu time 0.56 seconds
system cpu time 0.68 seconds
memory 5320.28k
OS Memory 6072.00k
Timestamp 10/26/2011 01:55:34 PM

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

More about the FULLSTIMER SAS Option

Parsing Windows SAS Log

Memory Utilization

- os_memory1 (Sum)
- memory1 (Sum)

CPU Utilization

- system_cpu
- user_cpu_time (Sum)

PROC SGPLOT;
Parsing Windows SAS Log

PROC GTILE;

step_name: DATA statement
memory: 23,080,509
real_time: 1.40 (7.67%)
total_cpu: 0.72

PROCEDURE TABULATE
PROCEDURE SORT
PROCEDURE DATASETS
PROC OPTIONS GROUP=PERFORMANCE;
BUFNO=1            Number of buffers for each SAS data set
BUFSIZE=0          Size of buffer for page of SAS data set
COMPRESS=YES       Specifies whether to compress observations
CPUCOUNT=8         Number of processors available.
NODBIDIRECTEXEC    Do not use SQL optimization with SAS/ACCESS engines
SORTSIZE=419430400 Size parameter for sort
THREADS            Threads are available for use
MEMSIZE=2147483648 Specifies 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;

Also SORT and UTILLOC and more
<table>
<thead>
<tr>
<th>optname</th>
<th>default</th>
<th>startup</th>
<th>current</th>
<th>howset</th>
</tr>
</thead>
<tbody>
<tr>
<td>bufno</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Shipped Default</td>
</tr>
<tr>
<td>bufsize</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Shipped Default</td>
</tr>
<tr>
<td>compress</td>
<td>NO</td>
<td>NO</td>
<td>YES</td>
<td>Options Statement</td>
</tr>
<tr>
<td>cpucount</td>
<td>1</td>
<td>8</td>
<td>4</td>
<td>Options Statement</td>
</tr>
<tr>
<td>sortsize</td>
<td>MAX</td>
<td>268435456</td>
<td>419430400</td>
<td>Options Statement</td>
</tr>
<tr>
<td>threads</td>
<td>THREADS</td>
<td>THREADS</td>
<td>THREADS</td>
<td>Options Statement</td>
</tr>
<tr>
<td>memsize</td>
<td>16777216</td>
<td>2147483648</td>
<td>2147483648</td>
<td>Config Files</td>
</tr>
<tr>
<td>memmaxsz</td>
<td>2147483648</td>
<td>2147483648</td>
<td>2147483648</td>
<td>Shipped Default</td>
</tr>
</tbody>
</table>
Microsoft .nfo Information File

msinfo32 /nfo syssum.nfo /categories +systemsummary

Also see: MSCONFIG command
What is Powershell?

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

“\textit{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 \textit{Windows PowerShell} to automate some of my SAS-related processes, such as batch processing with SAS Enterprise Guide. \textit{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 \textit{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.”

\textit{Running Windows PowerShell Scripts}
\textit{Chris Hemedinger September 12, 2011}
\textit{The SAS Dummy}
\textit{A SAS® blog for the rest of us}
filename GetChip pipe "powershell -Command ""get-wmiobject win32_processor -ComputerName . | Select-Object -Property [a-z]* """";
data _null_; infile GetChip; input; put _infile_; run;

Name                        : Intel(R) Core(TM) i5-2540M CPU @ 2.60GHz
Description                 : Intel64 Family 6 Model 42 Stepping 7
CurrentClockSpeed           : 2601
DataWidth                   : 64
DeviceID                    : CPU0
ExtClock                    : 100
Family                      : 205
L2CacheSize                 : 256
L3CacheSize                 : 3072
Level                       : 6
LoadPercentage              : 36
MaxClockSpeed               : 2601
NumberOfCores              : 2
NumberOfLogicalProcessors  : 4
Manufacturer                : GenuineIntel
...

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
...
System Information in SAS Report Format

### OBJECT=CIM_PhysicalMemory

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>token1</th>
<th>token2</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIM_PhysicalMemory</td>
<td>BankLabel : BANK 0</td>
<td></td>
</tr>
<tr>
<td>CIM_PhysicalMemory</td>
<td>Capacity : 4294967296</td>
<td></td>
</tr>
<tr>
<td>CIM_PhysicalMemory</td>
<td>Speed : 1333</td>
<td></td>
</tr>
<tr>
<td>CIM_PhysicalMemory</td>
<td>BankLabel : BANK 1</td>
<td></td>
</tr>
<tr>
<td>CIM_PhysicalMemory</td>
<td>Capacity : 4294967296</td>
<td></td>
</tr>
<tr>
<td>CIM_PhysicalMemory</td>
<td>Speed : 1333</td>
<td></td>
</tr>
<tr>
<td>CIM_PhysicalMemory</td>
<td>BankLabel : BANK 3</td>
<td></td>
</tr>
<tr>
<td>CIM_PhysicalMemory</td>
<td>Capacity : 2147483648</td>
<td></td>
</tr>
<tr>
<td>CIM_PhysicalMemory</td>
<td>Speed : 1333</td>
<td></td>
</tr>
</tbody>
</table>

### OBJECT=win32_processor

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>token1</th>
<th>token2</th>
</tr>
</thead>
<tbody>
<tr>
<td>win32_processor</td>
<td>L2CacheSize :</td>
<td>256</td>
</tr>
<tr>
<td>win32_processor</td>
<td>L3CacheSize :</td>
<td>8144</td>
</tr>
<tr>
<td>win32_processor</td>
<td>Name :</td>
<td>Intel(R) Core(TM) i7 CPU Q 740 @ 1.73G</td>
</tr>
<tr>
<td>win32_processor</td>
<td>NumberOfCores :</td>
<td>4</td>
</tr>
<tr>
<td>win32_processor</td>
<td>NumberOfLogicalProcessors :</td>
<td>8</td>
</tr>
</tbody>
</table>

### OBJECT=Win32_logicaldisk

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>token1</th>
<th>token2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Win32_logicaldisk</td>
<td>DeviceID :</td>
<td>C:</td>
</tr>
<tr>
<td>Win32_logicaldisk</td>
<td>Description :</td>
<td>Local Fixed Disk</td>
</tr>
<tr>
<td>Win32_logicaldisk</td>
<td>FileSystem :</td>
<td>NTFS</td>
</tr>
<tr>
<td>Win32_logicaldisk</td>
<td>FreeSpace :</td>
<td>13322514432</td>
</tr>
<tr>
<td>Win32_logicaldisk</td>
<td>Size :</td>
<td>125026955264</td>
</tr>
<tr>
<td>Win32_logicaldisk</td>
<td>DeviceID :</td>
<td>D:</td>
</tr>
<tr>
<td>Win32_logicaldisk</td>
<td>Description :</td>
<td>Local Fixed Disk</td>
</tr>
<tr>
<td>Win32_logicaldisk</td>
<td>FileSystem :</td>
<td>NTFS</td>
</tr>
<tr>
<td>Win32_logicaldisk</td>
<td>FreeSpace :</td>
<td>41162440704</td>
</tr>
<tr>
<td>Win32_logicaldisk</td>
<td>Size :</td>
<td>120031532200</td>
</tr>
<tr>
<td>Win32_logicaldisk</td>
<td>DeviceID :</td>
<td>E:</td>
</tr>
<tr>
<td>Win32_logicaldisk</td>
<td>Description :</td>
<td>Local Fixed Disk</td>
</tr>
<tr>
<td>Win32_logicaldisk</td>
<td>FileSystem :</td>
<td>NTFS</td>
</tr>
<tr>
<td>Win32_logicaldisk</td>
<td>FreeSpace :</td>
<td>127517732864</td>
</tr>
<tr>
<td>Win32_logicaldisk</td>
<td>Size :</td>
<td>500104687816</td>
</tr>
<tr>
<td>Win32_logicaldisk</td>
<td>DeviceID :</td>
<td>F:</td>
</tr>
<tr>
<td>Win32_logicaldisk</td>
<td>Description :</td>
<td>Local Fixed Disk</td>
</tr>
<tr>
<td>Win32_logicaldisk</td>
<td>FileSystem :</td>
<td>NTFS</td>
</tr>
<tr>
<td>Win32_logicaldisk</td>
<td>FreeSpace :</td>
<td>207459184640</td>
</tr>
<tr>
<td>Win32_logicaldisk</td>
<td>Size :</td>
<td>354104111104</td>
</tr>
</tbody>
</table>

### OBJECT=Win32_quickfixenginee

<table>
<thead>
<tr>
<th>OBJECT</th>
<th>token1</th>
<th>token2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Win32_quickfixenginee</td>
<td>HOTFIX KB2584236</td>
<td>NOT APPLIED</td>
</tr>
</tbody>
</table>
What is PerfMon?

Performance Counters and Objects

SAS Counters in the Performance and System Monitors

Recommended Performance Counters for Windows Performance Monitor
## Accessing Perfmon Data with SAS

<table>
<thead>
<tr>
<th></th>
<th>PCT*PROCESSOR TIME</th>
<th>PCT*DPC TIME</th>
<th>PCT IDLE TIME</th>
<th>PCT*INTERRUPT TIME</th>
<th>PCT*PRIVILEGED TIME</th>
<th>PCT*USER TIME</th>
<th>TRA</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.2.2.232, Thread</td>
<td>0.026</td>
<td>0.026</td>
<td>0.079</td>
<td>0.026</td>
<td>0.026</td>
<td>0.026</td>
<td>0.026</td>
</tr>
<tr>
<td>2.2.2.234, PhysicalDisk</td>
<td>0.026</td>
<td>0.026</td>
<td>0.079</td>
<td>0.026</td>
<td>0.026</td>
<td>0.026</td>
<td>0.026</td>
</tr>
<tr>
<td>2.2.2.236, LogicalDisk</td>
<td>0.026</td>
<td>0.026</td>
<td>0.079</td>
<td>0.026</td>
<td>0.026</td>
<td>0.026</td>
<td>0.026</td>
</tr>
<tr>
<td>2.2.2.238, Processor</td>
<td>0.026</td>
<td>0.026</td>
<td>0.079</td>
<td>0.026</td>
<td>0.026</td>
<td>0.026</td>
<td>0.026</td>
</tr>
<tr>
<td>2.2.2.238, Process</td>
<td>0.026</td>
<td>0.026</td>
<td>0.079</td>
<td>0.026</td>
<td>0.026</td>
<td>0.026</td>
<td>0.026</td>
</tr>
<tr>
<td>2.2.2.262, Redirector</td>
<td>0.026</td>
<td>0.026</td>
<td>0.079</td>
<td>0.026</td>
<td>0.026</td>
<td>0.026</td>
<td>0.026</td>
</tr>
<tr>
<td>2.2.2.510, Network Interface</td>
<td>0.026</td>
<td>0.026</td>
<td>0.079</td>
<td>0.026</td>
<td>0.026</td>
<td>0.026</td>
<td>0.026</td>
</tr>
</tbody>
</table>
Processor(s) Utilization Data
Memory Allocation

The SAS System

memory allocation graph

BYTETOT

9:40:00
30Oct11

11G
9536M
7152M
4768M
2384M

0

START*DATETIMESTAMP*OF*INTERVAL

BYTETOT
COMMITTED*BYTES
CACHE*BYTES
Page File Utilization
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 http://support.microsoft.com/kb/2564236 "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 Configuration and Tuning Guidelines for SAS®9 in the Microsoft Windows Server 2008.
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:

- SAS*
- LCK*
- 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).

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/MovingVirtuaVMware.pdf

Configuration and Tuning Guidelines for SAS®9 in Microsoft Windows Server 2008
Margaret Crevar, SAS Institute Inc., Cary, NC
Key SAS Performance Papers

Tony Brown SAS Performance Lab
Host Systems R&D SAS Institute Inc.
Updated December 12, 2007


Tony Brown, SAS Institute Inc., Dallas, TX


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

Configuration and Tuning Guidelines for SAS®9 in Microsoft Windows Server 2008
Margaret Crevar, SAS Institute
Updated: August 2011

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

Frequently Asked Questions Regarding Storage Configurations
Margaret Crevar and Tony Brown, SAS Institute Inc. Last Updated: July 2011
What is RESMON?
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


By Phone 1-800-727-0025