

SQL Server: Benchmarking and Baselining

Module 3: Performance Monitor

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Introduction

- Performance Monitor is built in to Windows
- It can be used to monitor performance real-time, or capture metrics over a period of time
- Hardware, OS and SQL Server counters can be captured
- Data collection can be automated
- Data can be processed manually or automatically

Performance Monitor Pros, Cons, and Overhead

■ Pros

- Uses functionality built in to Windows
- Capture OS, resource, and SQL Server counters
- Process can be automated
- Data can be retrieved using T-SQL

■ Cons

- Setup and execution is outside of SQL Server
- Manual adjustments may be needed for each server

■ Overhead

- Resource usage is minimal if sampling interval is greater than every 1 second
- Hard disk usage and performance based on number of counters, interval and underlying storage

Use Performance Monitor When...

- **You want to look at current system performance**
- **You need to collect OS and hardware resource counters, as well as SQL Server counters, over time**
- **You want to capture metrics to demonstrate a performance gain (or loss) based on a change**
- **Analysis using Performance Analysis of Logs (PAL) is appropriate**

Using Performance Monitor in Real-Time

- **Only the last 100 seconds of data are shown by default**
 - Not useful for historical analysis or trending
- **There are multiple views of real-time performance data available**
- **There are many settings you can tweak to change the display of information**
 - Most of them are not necessary for real-time monitoring

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News you can use on imple

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PerfMon Obje Server

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PerfMon_Counters_Dige

The current incarnation

- Perform
- Inform
- List of
- I/O no

An Excel workbook cann
knowledge of PerfMon,
documented here. As st
hopefully improved!)

Microsoft PFE Shane Cre
already available for pub
you're new to PerfMon c
you. Stay tuned for deta

I invite any insights & fe

PerfMon_Counters_Digest_w_Vital_Signs_Correlation_v6.xls

Disk I/O, Memory, CPU, Training, Performance, Fundamentals, Tools

PerfMon_JimmyMay.xls [Compatibility Mode] - Microsoft Excel							
Hardware							
A2	Counter Source	My Stat	Vital Sign	Performance object	Counter	Instance	Threshold
2	Hardware	1*	X	Kernel	Available MBytes		<10MB fatal; <100MB cause for concern
3	Hardware	2*	X	Kernel	Cache Bytes		
6	Hardware	1*	X	Kernel	Free System Page Table Entries		<5,000 bad; <3,000 very bad; <7,000 threshold to removed /3GB (per U
7	Hardware	2*		Kernel	Page Faults/sec		< a few hundred is desirable, in the thousands acceptable if other n
8	Hardware	1*	X	Kernel	Pages/sec		>2500/s bad for modern servers; much less for older servers; avg/sus
9	Hardware	2*	X	Kernel	Pool NonPaged Bytes		32-bit: 100MB-260MB; 64-bit: 1GB-128GB (depends on total physical RA
10	Hardware	2*	X	Kernel	Pool Paged Bytes		32-bit: 120MB-480MB; 64-bit: 1GB-128GB (depends on total physical RA
11	Hardware	2*	X	Kernel	System Cache Resident Bytes		
12	Hardware	2*	X	Network Interface	Bytes total/sec		<40% good; 40%-65% caution; 65%-100% critical
13	Hardware	2*	X	Network Interface	Current Bandwidth		<80%
14	Hardware	2*	X	Network Interface	Output Queue Length		0 healthy; 1-2 caution; >2 critical
19	Hardware	2*	X	PhysicalDisk/LogicalDisk	% Idle Time		
25	Hardware	1*	X	PhysicalDisk/LogicalDisk	Avg. Disk sec/Read		Disk Latency
26	Hardware	1*	X	PhysicalDisk/LogicalDisk	Avg. Disk sec/Transfer		Disk Latency
27	Hardware	1*	X	PhysicalDisk/LogicalDisk	Avg. Disk sec/Write		Disk Latency
31	Hardware	3*		PhysicalDisk/LogicalDisk	Disk Bytes/sec		
32	Hardware	3*		PhysicalDisk/LogicalDisk	Disk Read Bytes/sec		
33	Hardware	3*		PhysicalDisk/LogicalDisk	Disk Write Bytes/sec		
34	Hardware	2*	X	PhysicalDisk/LogicalDisk	Disk Reads/sec		~150 (for random)
35	Hardware	2*	X	PhysicalDisk/LogicalDisk	Disk Transfers/sec		
36	Hardware	2*	X	PhysicalDisk/LogicalDisk	Disk Writes/sec		
37	Hardware	3*		PhysicalDisk/LogicalDisk	Split IO/sec		Fewer the better
38	Hardware	2*		Process	% Processor Time	_Total, <sqlservr>	
39	Hardware	2*		Process	Page Faults/sec	_Total, <sqlservr>	
40	Hardware	1*	X	Process	Handle Count	_Total, <sqlservr>	< a few hundred is desirable, in the thousands acceptable if other n
41	Hardware	1*	X	Process	IO Data Operations/sec	_Total, <sqlservr>	
42	Hardware	1*	X	Process	IO Other Operations/sec	_Total, <sqlservr>	
43	Hardware	1*	X	Process	Private Bytes	_Total, <sqlservr>	
44	Hardware	1*	X	Process	Thread Count	_Total, <sqlservr>	
46	Hardware	1*	X	Process	Working Set	_Total, <sqlservr>	
48	Hardware	1*	X	Processor	% Privileged Time		
49	Hardware	1*	X	Processor	% Processor Time		
50	Hardware	1*	X	Processor	% User		
52	Hardware	1*		System	Context Switches/sec		SQL Server is a USER MODE app!
54	SQL Server	1*		Access Methods	Full Scans/sec		5,000/s x # of CPUs; somewhat flexible if other CPU-related counti
55	SQL Server	1*		Access Methods	Index Searches/sec		(Index Searches/sec)/(Full Scans/sec) > 1000
64	SQL Server	1*		Buffer Manager	Buffer Cache Hit Ratio		(Index Searches/sec)/(Full Scans/sec) > 1000
67	SQL Server	2*		Buffer Manager	Lazy writes/sec		98% OK, 99% better, 99.8% desirable
68	SQL Server	1*		Buffer Manager	Page Life Expectancy		baseline
69	SQL Server	1*		Buffer Manager	Procedure Cache Pages		<300s "official" threshold; >1,000 or >10,000s much tMemory Matt;h
70	SQL Server	2*		Plan Cache	Cache Pages		(2000) prefer stable values, otherwise cache thrash nMemory Matt;h
71	SQL Server	2*		Buffer Manager	Total pages		(2005) prefer stable values, otherwise cache thrash may be occurring
72	SQL Server	2*		Cache Manager	Cache Hit Ratio		baseline
74	SQL Server	2*		Databases	Log Flushes/sec		<99.9 excellent; <99 good; >98 not optimal
76	SQL Server	2*		Databases	Transactions/sec		baseline
79	SQL Server	2*		Latches	Average Latch Wait Time (ms)		baseline
80	SQL Server	1*		Latches	Latch Waits/Sec		(Total Latch Wait Time) / (Latch Waits/Sec) < 10
81	SQL Server	1*		Latches	Total Latch Wait Time (ms)		(Total Latch Wait Time) / (Latch Waits/Sec) < 10
88	SQL Server	1*		Memory Manager	Memory Grants Pending		>0 is cause for concern
90	SQL Server	1*		Memory Manager	Target Server Memory		high or rising value indicates insufficient memory
91	SQL Server	1*		Memory Manager	Total Server Memory		~Physical Ram
92	SQL Server	1*		SQL Statistics	Batch Requests/sec		OLTP workloads: server should support ~2,500/s/core
93	SQL Server	1*		SQL Statistics	SQL Compilations/sec		if compiles > 10% of Batch Requests, then app may not be caching eff
94	SQL Server	1*		SQL Statistics	SQL Recompilations/sec		Recompiles > 10% of Compilations should be investigatedCACHING whi

Counters to Capture

- Don't get overwhelmed
- Quest Software PDF: <http://bit.ly/a9juUN>
- Jimmy May's list of counters: <http://bit.ly/qnRP8O>

OS/Resource Counters to Capture

- **Processor – % Processor Time**
- **Processor – % Privileged Time**
- **Process (sqlservr) – % Processor Time**
- **Process (sqlservr) – % Privileged Time**
- **System – Processor Queue Length**

OS/Resource Counters to Capture (2)

- **Memory – Available Mbytes**
- **Memory – Pages/sec**
- **Paging File - % Usage**

OS/Resource Counters to Capture (3)

- **Physical Disk – Avg Disk sec/Read**
- **Physical Disk – Avg Disk sec/Write**
- **Physical Disk – Disk Reads/sec**
- **Physical Disk – Disk Writes/sec**

SQL Server Counters to Capture

- **SQL Server: Access Methods – Forwarded Records/sec**
- **SQL Server: Access Methods – Full Scans/sec**
- **SQL Server: Access Methods – Index Searches/sec**

SQL Server Counters to Capture (2)

- **SQL Server: Buffer Manager – Free List Stalls/sec**
- **SQL Server: Buffer Manager – Lazy Writes/sec**
- **SQL Server: Buffer Manager – Page Life Expectancy**
- **SQL Server: Buffer Manager – Page Reads/sec**
- **SQL Server: Buffer Manager – Page Writes/sec**

SQL Server Counters to Capture (3)

- **SQL Server: Memory Manager – Total Server Memory (KB)**
- **SQL Server: Memory Manager – Target Server Memory (KB)**
- **SQL Server: SQL Statistics – Batch Requests/sec**
- **SQL Server: SQL Statistics – SQL Compilations/sec**
- **SQL Server: SQL Statistics – SQL Recompilations/sec**

SQL Server Counters to Capture (4)

- **SQL Server: General Statistics – User Connections**
- **SQL Server: Latches – Latch Waits/sec**
- **SQL Server: Locks – Lock Waits/sec**
- **SQL Server: Locks – Number of Deadlocks/sec**

Counter Collection

- **Determine:**
 - The counters you want to capture
 - The interval at which you will capture the counters
 - The time period and duration for which you will capture the counters
- **Be consistent**

Data Collector Sets

- **Collector sets allow for repeated use**
 - User-defined vs. system
 - Can be exported/imported between servers
- **Collector sets can be started manually, via the built-in scheduler, or via command line with logman**
 - logman is available in Windows Server 2003+
- **Can be used to automate data collection as a result of a specific event or alert**

Processing Performance Monitor Data

- **Manually**
 - Excel
 - Not recommended
- **Database**
 - Manual import
 - relog

Processing Performance Monitor Data (2)

- **Performance Analysis of Logs (PAL)**
 - Free utility available for download from CodePlex (<http://bit.ly/187fkK>)
 - Analyzes PerfMon data based on thresholds within templates which are customizable
 - GUI interface which creates HTML output with metrics and graphs
 - Requires Chart Controls for .NET 3.5 (<http://bit.ly/KQxSGG>)

Summary

- How to use Performance Monitor
- Automate your method for capturing and processing counter data
- Choose the best counters for your solution
- Develop and verify methods to compare current performance to past performance when problems occur
- In the next module: Capturing Queries