SQL Server 2008 Performance Troubleshooting Part 1

Chennai SQL Server User Group

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Chennai SQL Server User Group (CSSUG) Meet – 19 Jan 2013

Reference and Courtesy

For technical accuracy
I have used some content, images and scripts from below sources.

Memory Internals:
http://channel9.msdn.com/Events/TechEd/Europe/2010/WCL401

SQL Server 2008 Performance Troubleshooting
http://msdn.microsoft.com/en-us/library/dd672789(v=sql.100).aspx

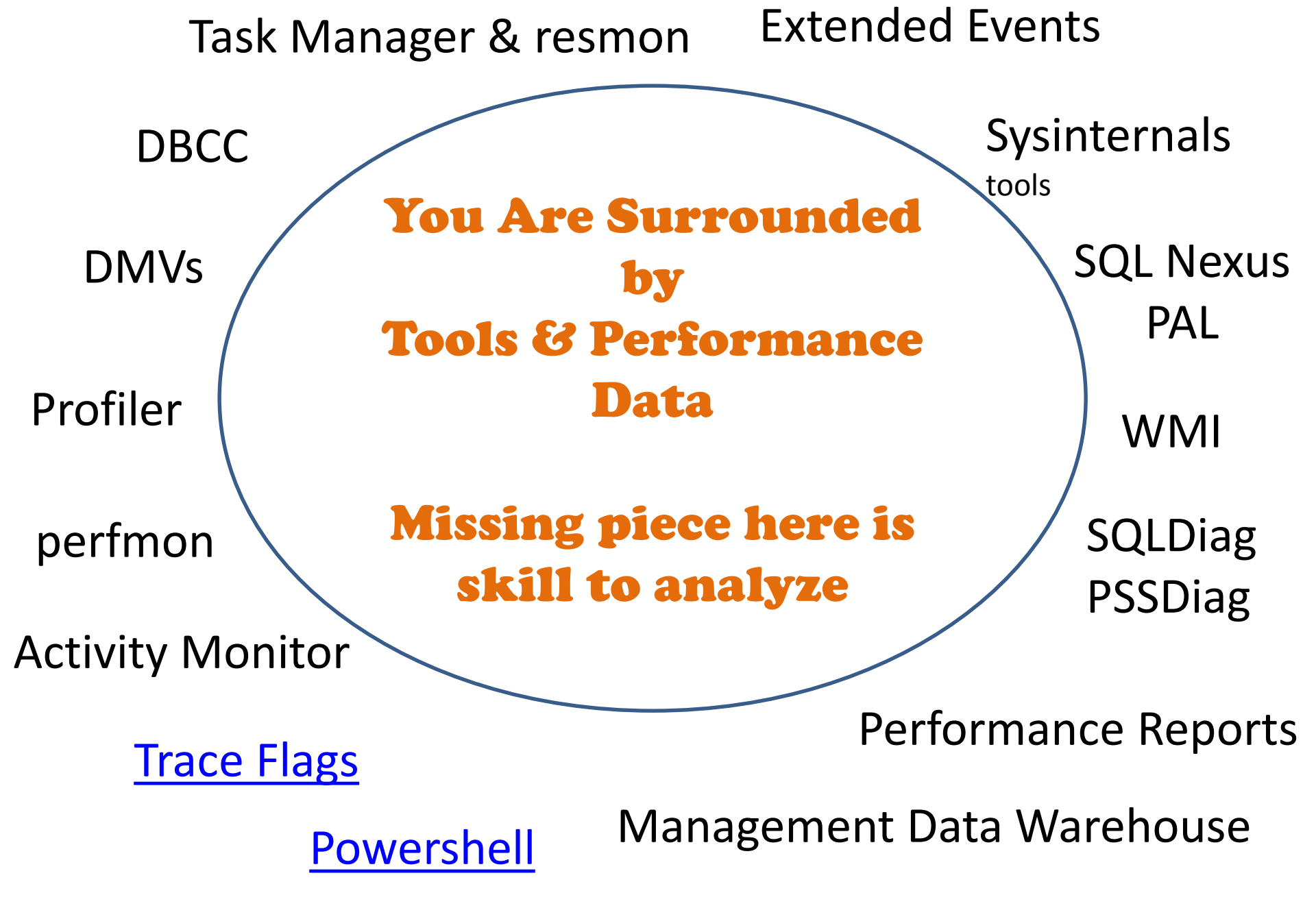
Free ebook: Troubleshooting SQL Server A Guide for the Accidental DBA
By Jonathan Kehayias and Ted Krueger
www.sqlservercentral.com/books/

SQLOS:
http://blogs.msdn.com/b/slavao/

Agenda

Part 1 (More focus on Memory Internals)

- Missing piece is not performance data
- Understand Compatibility and Limitations
- There are lot more to understand
  - Memory Internals
  - Process Explorer (Server level/Process level)
  - VMMap (Process level)
- Ugly way to understand this better (Demo)


Task Manager & resmon
Extended Events
DBCC
Sysinternals
tools
You Are Surrounded
by
Tools & Performance
Data
DMVs
SQL Nexus
PAL
Profiler
WMI
Missing piece here is
skill to analyze
perfmon
SQLDiag
PSSDiag
Activity Monitor
Performance Reports
Trace Flags
Management Data Warehouse
Powershell

Back to Basics:
32/64 bit compatibility

Hardware	OS	SQL Server	Compatibility	Memory Limitations
32 bit	32 bit	32 bit	Possible	4 GB. AWE to access > 4 GB
32 bit	32 bit	64 bit	Not Possible	
32 bit	64 bit	32 bit	Not Possible	
32 bit	64 bit	64 bit	Not Possible	
64 bit	32 bit	32 bit	Possible	4 GB. AWE to access > 4 GB
64 bit	32 bit	64 bit	Not Possible	
64 bit	64 bit	32 bit	Possible	4 GB. AWE to access > 4 GB
64 bit	64 bit	64 bit	Possible	

Note:
32 bit and 64 bit refers x86 and x64 respectively. IA64 not covered here.
Exception: SQL Server 2012 32 bit can't use more than 4 GB.

Further read: http://mikedimmick.blogspot.in/2006/03/whats-difference-between-x64-and-ia-64.html

Back to basics:
Memory Limitations

SQL Server Editions ↓	WINDOWS DATACENTER				WINDOWS ENTERPRISE				WINDOWS STANDARD			
	2008		2003 R2 SP2		2008		2003 R2 SP2		2008		2003 R2 SP2	
	32-BIT	64-BIT	32-BIT	64-BIT	32-BIT	64-BIT	32-BIT	64-BIT	32-BIT	64-BIT	32-BIT	64-BIT
Enterprise	64GB	2TB	128GB	2TB	64GB	2TB	64GB	2TB	4GB	32GB	4GB	32GB
Developer	64GB	2TB	128GB	2TB	64GB	2TB	64GB	2TB	4GB	32GB	4GB	32GB
Standard	64GB	2TB	128GB	2TB	64GB	2TB	64GB	2TB	4GB	32GB	4GB	32GB
Web	64GB	2TB	128GB	2TB	64GB	2TB	64GB	2TB	4GB	32GB	4GB	32GB
Workgroup	64GB	4GB	128GB	4GB	64GB	4GB	64GB	4GB	4GB	4GB	4GB	4GB
Express	1GB	N/A	1GB	N/A	1GB	N/A	1GB	N/A	1GB	N/A	1GB	N/A

Reference:

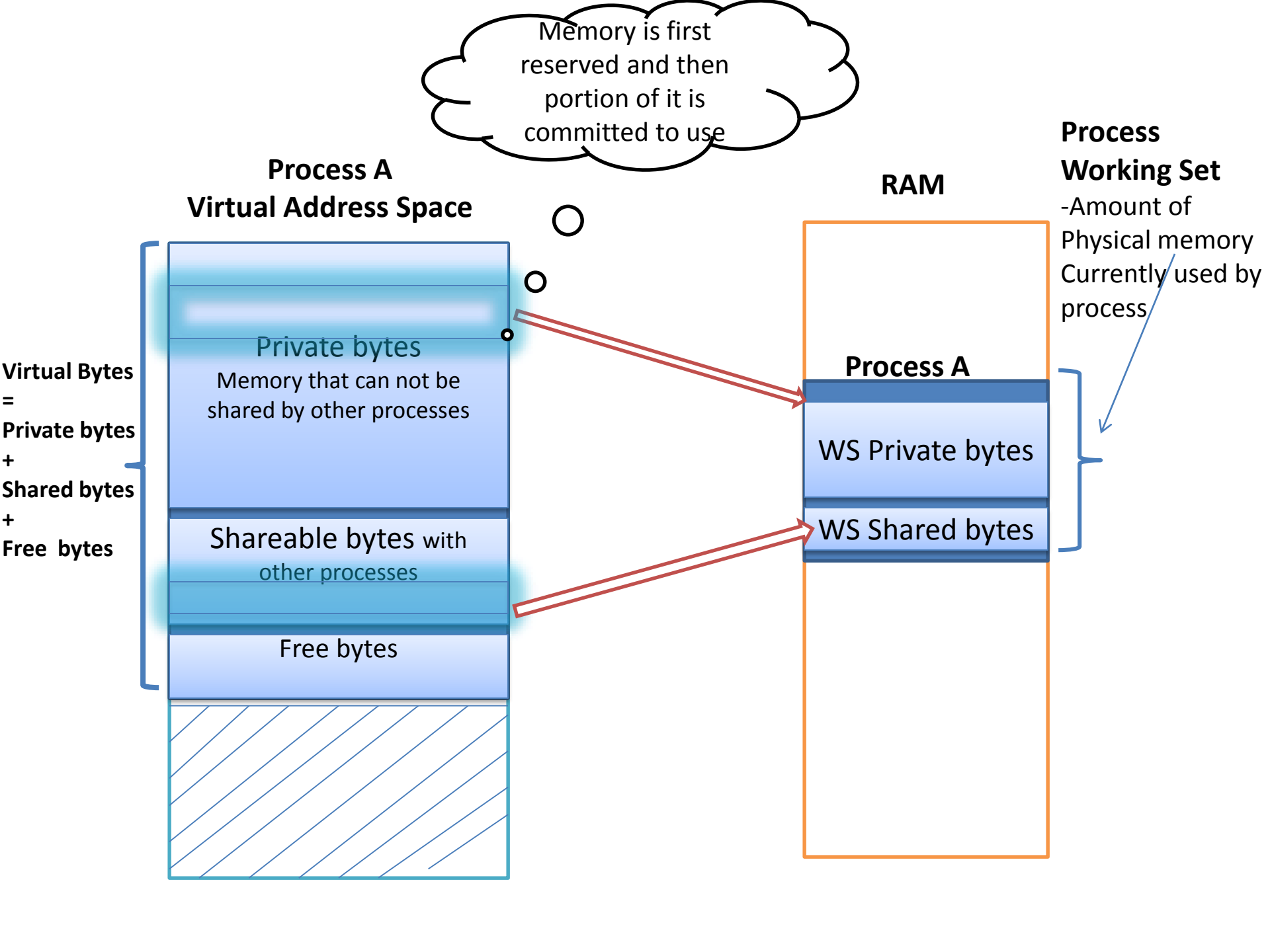
http://definitionplus.org/blog/?p=81

http://msdn.microsoft.com/en-us/library/windows/desktop/aa366778(v=vs.85).aspx

There are lot more to understand before troubleshooting

- Memory Internals
- Process Explorer
- VMMap

Sysinternals Suit Download
http://technet.microsoft.com/en-us/sysinternals/bb842062.aspx


Memory is first reserved and then portion of it is committed to use
Process A
Virtual Address Space
RAM
Process Working Set
-Amount of Physical memory Currently used by process
Private bytes
Memory that can not be shared by other processes
Shareable bytes with other processes
Free bytes
Virtual Bytes = Private bytes + Shared bytes + Free bytes
Process A
WS Private bytes
WS Shared bytes

Process VAS

Address space breakdown

- Private (e.g. process heap)
  - Reserved or committed
- Shareable (e.g. EXE, DLL, shared memory etc.)
  - Reserved or committed
- Free (not yet defined)

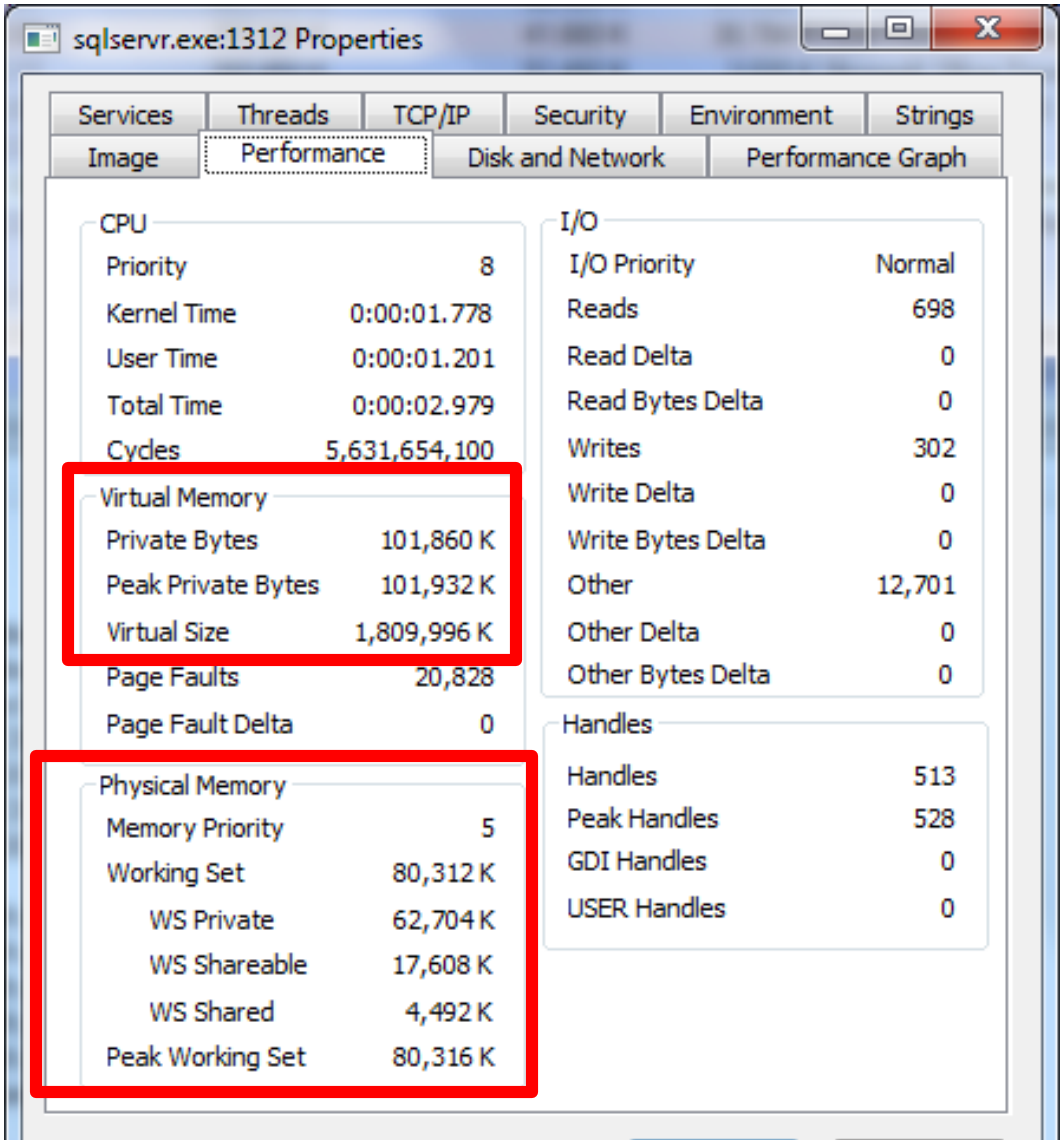
Performance counters available:

Private Bytes – committed private memory

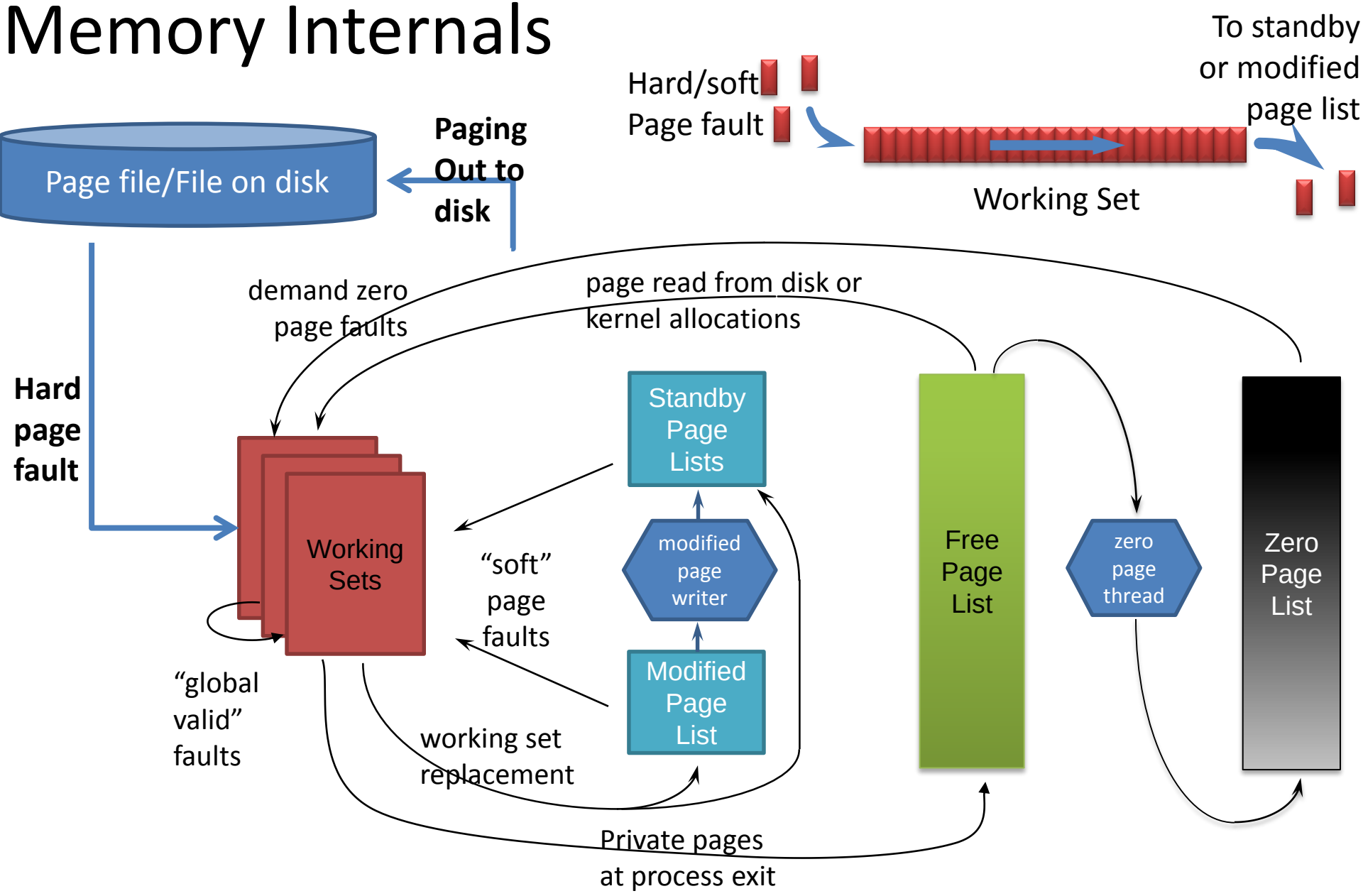
Virtual Bytes – total of shareable + private

Memory consumption by a process

Process Explorer



Memory Internals



Reference & Courtesy : Mark Russinovich

Source: Mysteries of Windows Memory Management Revealed – Tech-Ed Europe 2010

Memory Internals – Working Sets

- Working Sets
  Amount of Physical Memory currently in use by the process

- New pages are allocated to working sets from the top of the **free or zero page list**

Pages released from the working set due to working set replacement go to the bottom of:

- ✓ The modified page list (if they were modified while in the working set)
- ✓ The standby page list (if not modified)

Reference & Courtesy : Mark Russinovich
Source: Mysteries of Windows Memory Management Revealed – Tech-Ed Europe 2010

Memory Internals
Modified pages and Standby pages

- Modified pages go to **modified (dirty) list**
  Avoids writing pages back to disk too soon

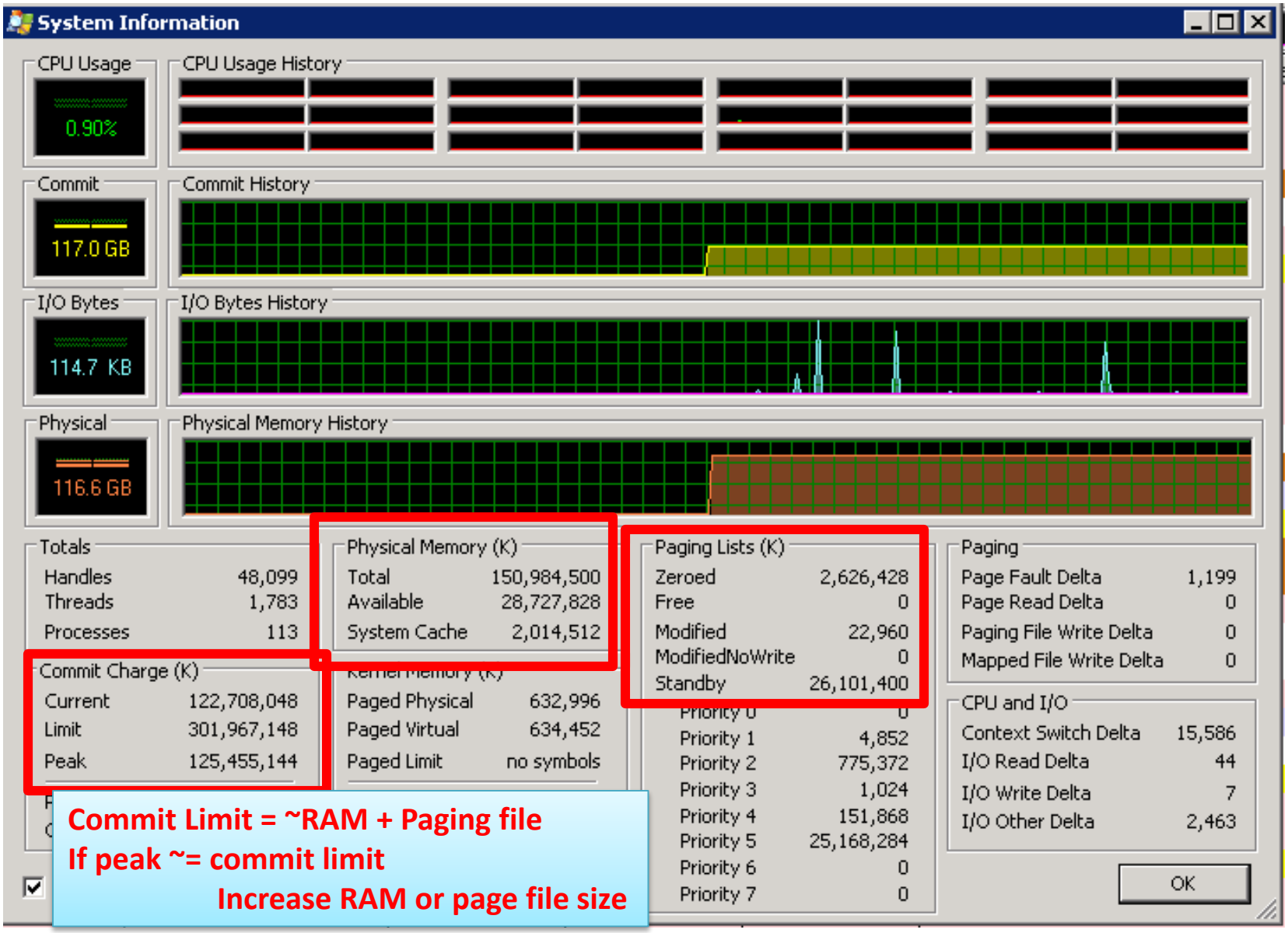
- Unmodified pages go to **standby lists**

They form a system-wide **cache** of
"pages likely to be needed again"

Pages can be faulted back into a process from
the standby and modified page list (**Soft page faults**)

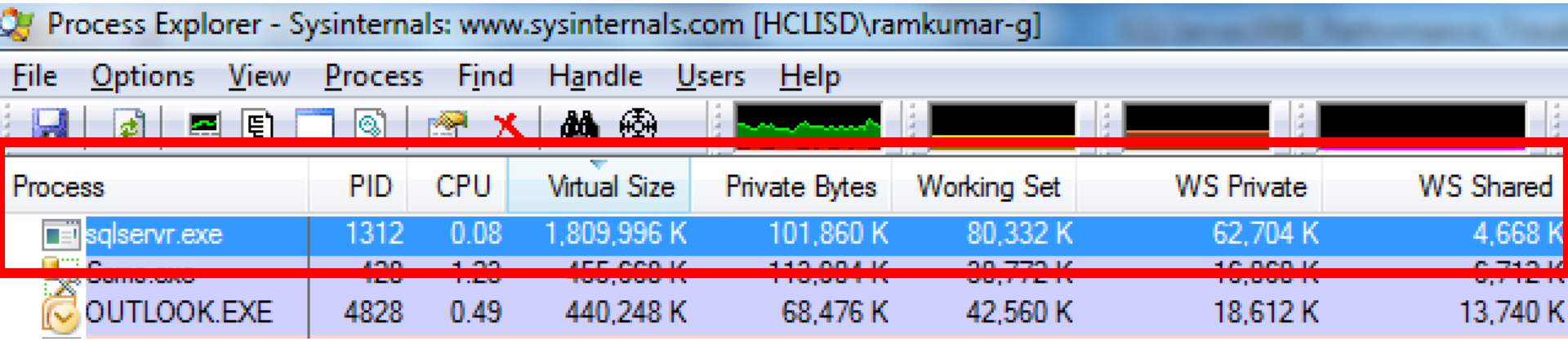
Overall Memory Condition – Healthy/Pressure?

Process Explorer



Process-wise CPU/Memory Consumption

Process Explorer - Summary



Sqlservr.exe Memory Consumption – In detail

VMMap

Type	Size	Committed	Private	Total WS	Private WS	Shareable WS	Shared WS
Total	1,815,188 K	179,364 K	102,352 K	84,772 K	67,144 K	17,628 K	4,508 K
Image	78,384 K	78,384 K	8,600 K	21,480 K	4,636 K	16,844 K	4,096 K
Mapped File	5,528 K	5,528 K		408 K		408 K	328 K
Shareable	3,892 K	1,636 K		368 K		368 K	76 K
Heap	8,512 K	3,072 K	3,008 K	1,904 K	1,900 K	4 K	4 K
Managed Heap							
Stack	25,088 K	22,668 K	22,668 K	1,700 K	1,700 K		
Private Data	1,688,856 K	63,148 K	63,148 K	53,984 K	53,980 K	4 K	4 K
Page Table	4,928 K	4,928 K	4,928 K	4,928 K	4,928 K		
Free	286,828 K						

There is an ugly way to understand this better

Run below batch
and observe process explorer

```
create table tab1(col1 char(7000))
go
set nocount on
insert into tab1 values ('a')
go 1000000
```

Questions?