SQL Server 2012
Memory Management

DBA-312

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Confio

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Speaker Bio: Neil Hambly

Permanent Roles
Confio (UK/EMEA) Oct 2012 - Present
Senior System Engineer & DBA

SQLnextSteps (London)
Founder - SQL Consulting Services

MDSL   (London)   July 2010 – Sept 2012
DB Architect
Editions: SQL 2005 – 2008 R2 Log-shipping,
Service Broker, SSRS, SSAS

iProfile   (London)   Oct 2004 – June 2010
DB Architect | DBA | DB Developer (Database Lead)
Editions: SQL 2000 – 2005;Clustering, Service
Broker, Replication, SSRS

Accenture (Dublin)   June 1999– Oct 2004
DBA | DB Developer (Global BI - Team Leader)
Editions: SQL6.5 – 2000, Replication, DTS, OLAP

Contractor Roles
BBC   14 Months (DB Support)
ABN AMRO   16 Months (DB Developer)

SQL London Chapter Leader

Regular UK & International speaker @ User-Groups & SQL conferences

15 year 's SQL Professional
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Session Agenda

Memory – Why is it Important ?

- SQL Server Memory
  - Quick Memory architecture primer
  - 2012 memory re-architecture changes | impact
  - Memory DMV's
  - Memory Clerks

Out **O**f **M**emory

Demo's

Virtualization

Trace Flags

Questions and Answers

Memory is Important

SQL Runs in Memory (VAS)
- Buffer Pages
- Cached Procedures
- Workspace
- SPA & MPA – now "**A**ny **S**ize **P**age **A**llocator"
  Note: SPA & MPA columns have been replaced with ASPA
- Memory ALSO needed for OS & other non SQL Server Apps

Memory directly affects "Performance"
- Buffer Page {pagable}
- Locked Pages in Memory {non-pagable}
- Memory Configuration's | Locked Pages in Memory
  - gpedit.msc > User Rights Assignments > "Lock Pages in memory" for SQL Server account
- LPA LargePagesAllocator - use TF834
- NUMA – local & foreign memory impact
  - NUMA Buffer Pool Page Ownership – Foreign Page access
    - TCP/IP Port – NUMA Nodes mapping

"Memory" Changes in SQL Server 2012

32-Bit {limited usage}

- Limited to max 4GB
- Removed Add-Hot & AWE support - YES these have been deprecated
- New Lower limit @ 64MB

64-Bit

Single memory manager now handle all page allocations

Consistent **O**ut-**O**f-**M**emory management (across all internal components)

- True dynamic memory support in Standard editions and higher
- Predictable sizing and governing SQL memory consumption:
  - sp_configure 'max server memory'
    Now limits ALL memory committed by SQL Server
    .....was only <8KB prior versions
- Resource Governor governs all SQL memory (other than some special cases)
- Scalability of complex queries using >8K allocations
- Enhanced CPU & NUMA locality for memory accesses
- New Lower Limit @ 128MB
- **DBCC Memorystatus** has changed

Memory DMVs

- **Sys.dm_os_sys_memory**
- **Sys.dm_os_sys_info**

- **Sys.dm_os_memory_clerks**
- **Sys.dm_os_memory_cache_counters**
- Sys.dm_os_memory_cache_clock_hands
- Sys.dm_os_memory_cache_entries
- Sys.dm_os_memory_cache_hash_tables
- **Sys.dm_os_memory_brokers**
- Sys.dm_os_memory_pools
- **Sys.dm_os_memory_objects**
- Sys.dm_os_memory_nodes

- **Sys.dm_os_ring_buffers**
- **Sys.dm_os_performance_counters**
- **Sys.dm_os_buffer_descriptors**

Memory Clerks

Memory Distributions

- Memory Resources Balanced ?
- Different Buffers
  - What is "normal"
  - Stealing from other buffers
    - Determine the cause internal | external pressure
    - Resolving memory pressure

VirtualAlloc

- Controls the non Bpool memory
  - -g switch

OOM {Out of Memory}

Error logs

WARNING: Failed to reserve contiguous memory of Size=<x>

Applications

Information warning's of OOM conditions

So what can we do to prevent OOM occurring

The answer to this is <u>partially answered</u> in this presentation....

Demo's

MENU

Today's specials

DBCC MEMORYSTATUS
PERFMON
DMV Memory Queries
sp_server_diagnostic

All served with **CHIPS** !

Demo #1

DBCC MEMORYSTATUS

Demo #2

Perfmon & DMV performance counters

PASS

Demo #3

Memory DMV's

Demo #4

sp_server_diagnostics {Extended Events}

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Virtualization
(Hyper-V Memory Best Practices)

Do Use LPIM

Total VMs 'Min Server Memory' < Physical

Perfmon to track resources across VMs

Keep memory buffering low @ 5%

Use Memory weight to give a VM higher priority

Live VM Migrations

- NUMA spanning disabled
- Reduce max server memory before migration
- Increase memory weight of VM being migrated

Running SQL Server 2008 in a Hyper-V Environment

  Best Practices and Performance Recommendations

  http://sqlcat.com/sqlcat/b/whitepapers/archive/2008/10/03/running-sql-server-2008-in-a-hyper-v-environment-best-practices-and-performance-recommendations.aspx

Trace Flags

TF 836 (32-bit Editions)

- Use the max server memory option for the buffer pool

TF 834 (64-bit Editions)

- Use Microsoft Windows large-page allocations for the buffer pool
  - Memory is allocated @ startup and does not grow/shrink

TF 845 (64-bit Editions) * {only needed pre 2012 versions}

- Use the max server memory option for the buffer pool

TF 8020

- Disable working set monitoring

Further Resources links

Running SQL Server with Hyper-V Dynamic Memory Best Practices & Considerations {July 2011}
http://sqlcat.com/sqlcat/b/whitepapers/archive/2011/08/02/running-sql-server-with-hyper-v-dynamic-memory-best-practices-and-considerations.aspx

How to reduce paging of buffer pool memory in the 64-bit version of SQL Server
http://support.microsoft.com/kb/918483

Support for Locked Pages on SQL Server 2008 R2 Standard Edition x64
Also SQL Server 2005 Standard Edition 64-bit & SQL Server 2008 Standard Edition 64-bit
http://support.microsoft.com/kb/970070

Hyper-V Dynamic Memory Configuration Guidance
http://technet.microsoft.com/en-us/library/ff817651(WS.10).aspx

Aaron Bertrand - Upgrading to SQL Server 2012 with Lock Pages in Memory
http://sqlblog.com/blogs/aaron_bertrand/archive/2012/02/06/upgrading-to-sql-server-2012-with-lock-pages-in-memory.aspx

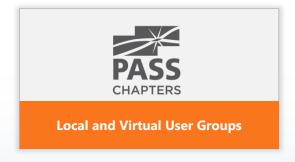# Questions

"Thanks for the Memory"

any further Questions

PASS Resources

Free SQL Server and BI training	**Free 1-day Training Events**	**Regional Event**
Local and Virtual User Groups	**Free Online Technical Training**	**This is Community**

Aa **Learning Center**

Thank you

for attending this session and
the 2012 PASS Summit in Seattle

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