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6-7 OTT '16 / MILANO
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Ottimizzare le prestazioni di SQL Server con la configurazione

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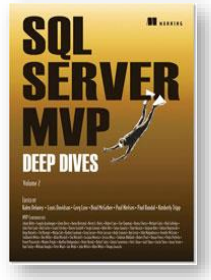
Vice Presidente



www.manning.com/books/sql-server-mvp-deep-dives-volume-2

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Agenda

- Common misconfigured options
  - Hypervisor level
    - Balloon Driver
  - OS & Storage level
    - Power Profile
    - Network Card Optimizations
    - Block Alignment
    - Instant File Initialization
  - Instance level
    - Memory settings
    - Tempdb data files
    - Cost threshold of parallelism

Hypervisor

Memory Ballooning

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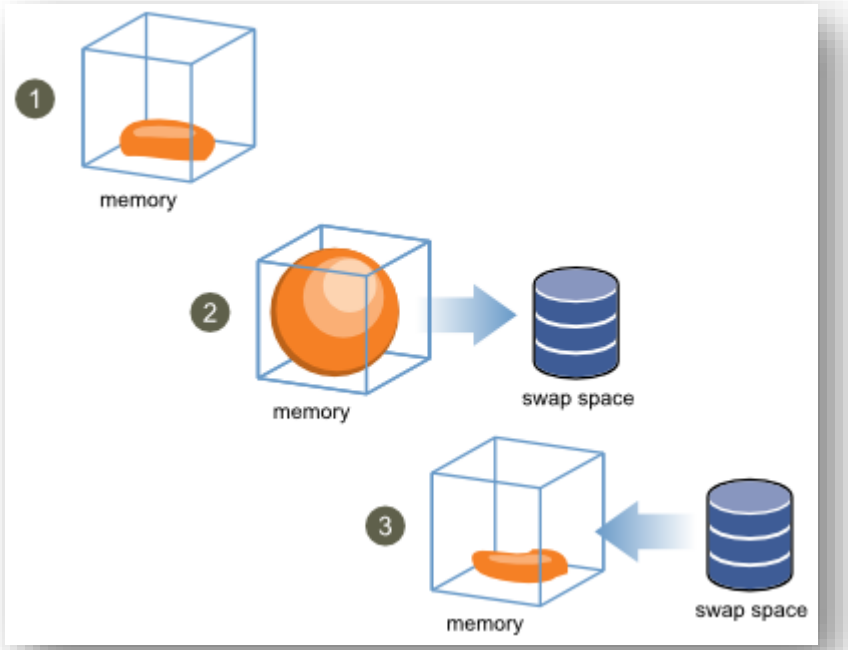
Ballon Driver

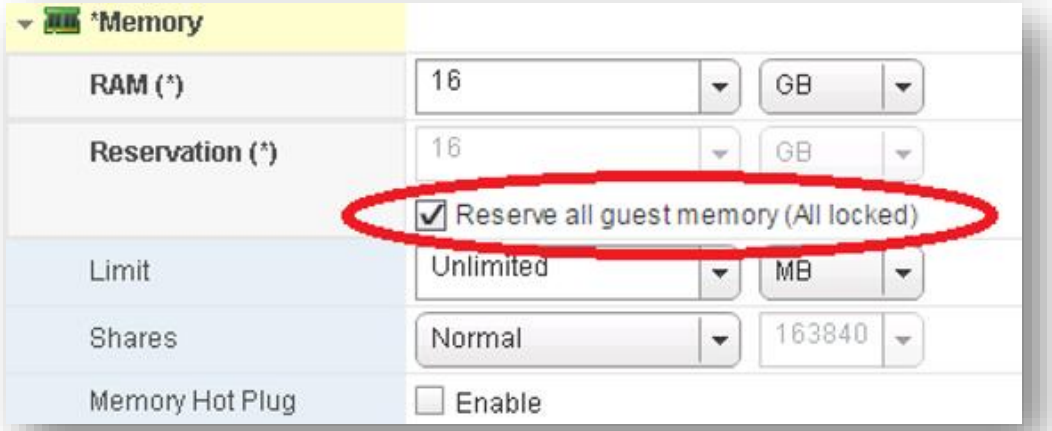
- Balloon driver is loaded into the guest operating system as a “pseudo-device” driver
- No external interfaces to the guest operating system
- It communicates with the hypervisor through a private channel

Memory Ballooning

- Hypervisor is not aware of the guest OS memory management (used or free)
- When memory pressure occurs on the hypervisor, it requires reclaiming some memory from VMs, it will utilize the “Balloon Driver”
- Memory is paged to disk in guest OS

Memory Ballooning





Memory Ballooning

- If your SQL Server is designed for performance, we have to eliminate any chance of paging memory to disk!
- Setting Memory Reservation
  - Hypervisor won't be able to reclaim memory from the guest OS
  - SQL Server on VMware: Best Practices Guide
  - SQL Server on Hyper-V: Best Practices Guide
- Leave the Balloon Driver installed to manage memory pressure and prevent loss of service

OS & Storage

Power Profile, Network Optimizations, Block Alignment, IFI

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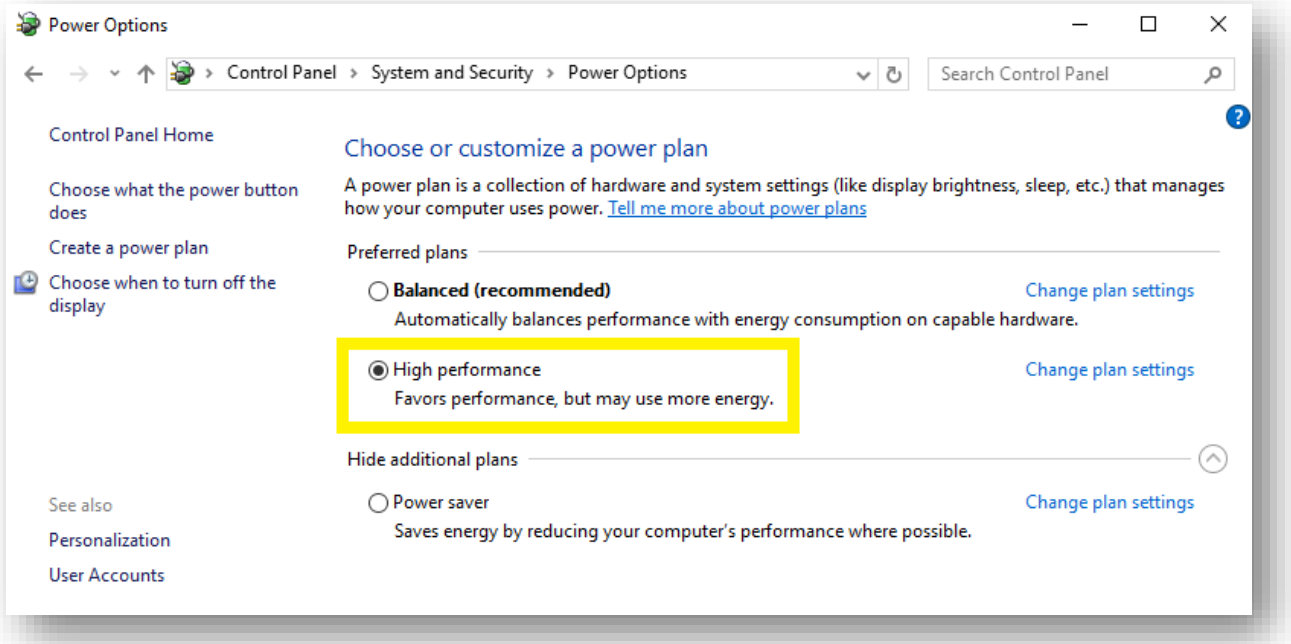
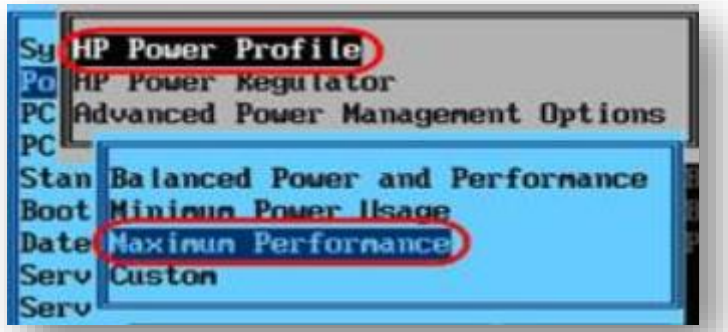
Power Profile

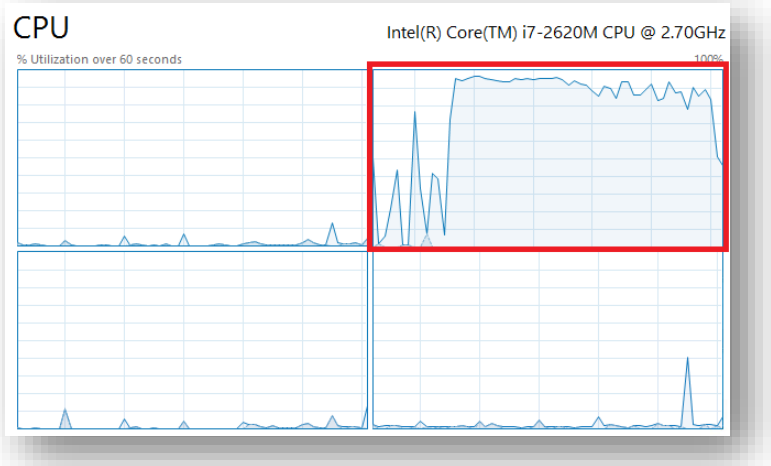
- "Balanced" or "Power Saved" by default
- "High Performance" is better for SQL Server ☺





Network Card Optimizations

- Speed & Duplex
  - Don’t use “Auto Negotiation” (default), set speed explicitly
  - Whole network must supports the speed you have chosen
- Jumbo packets
  - They are extra-size network packets, reduce network protocol overhead
    - Normal: 4096 bytes
    - Jumbo frames: ~9000 bytes
- Receive Side Scaling (RSS)
  - Disabled by default
  - It allows to better distribute workload over CPUs



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Network Card Optimizations
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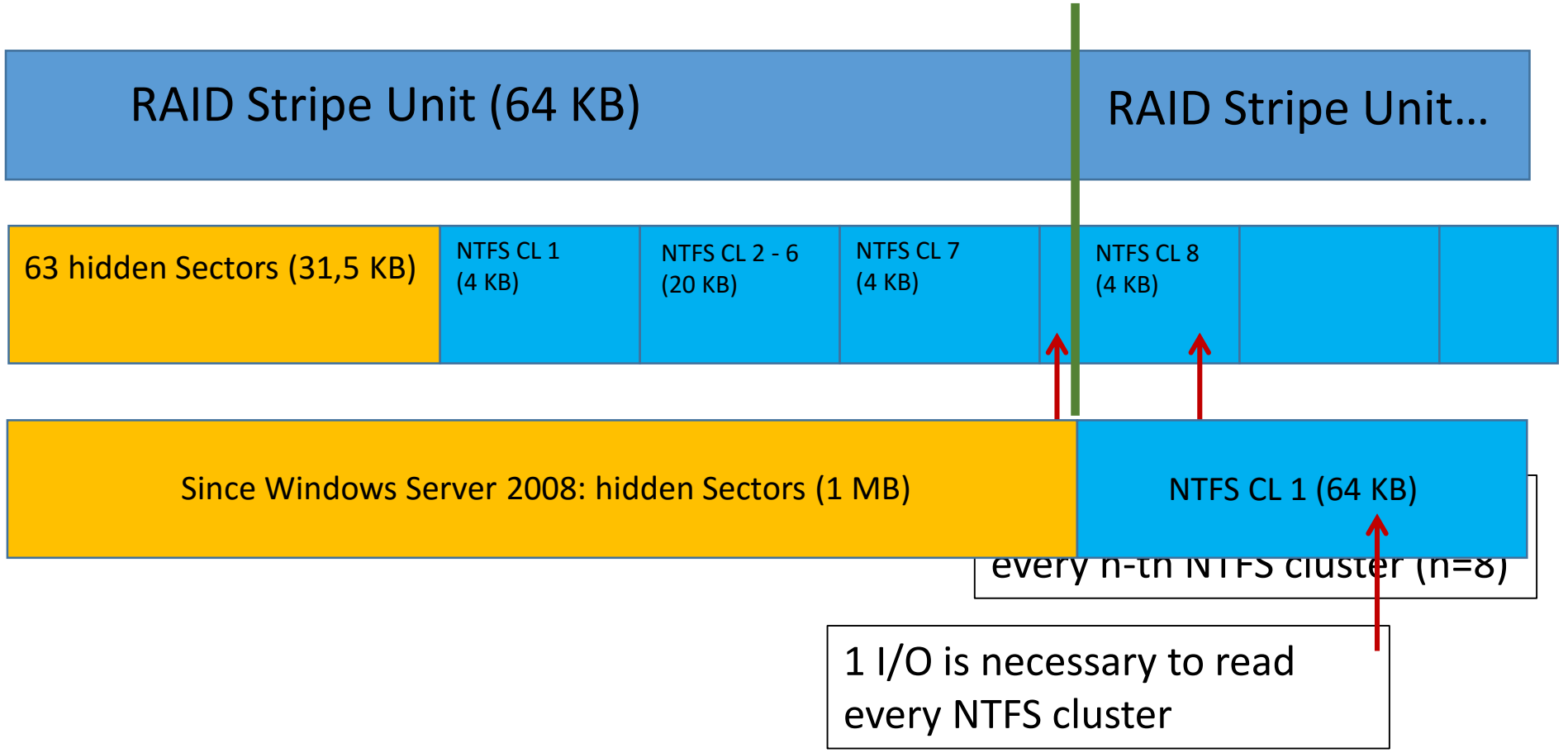
Block Alignment

- On particular workload, can improve I/O performance up to 100%
  - RAID Stripe Unit is misaligned with NTFS Cluster Units
  - Accessing an NTFS Cluster Unit needs access to more than one RAID Stripe Unit
- Before Windows Server 2008
  - 63 hidden Sectors (31,5 KB)
- Windows Server 2008 and higher
  - Default offset: 1MB
  - Alignment by default

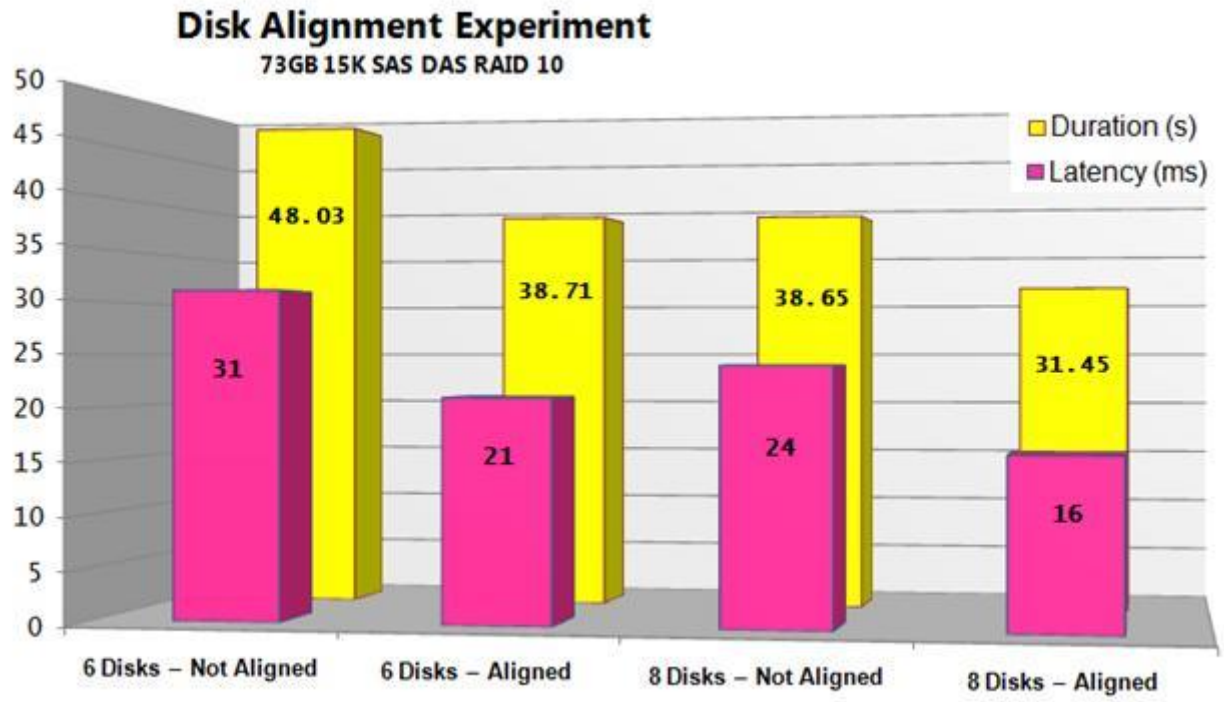
Misalignment – 4 KB



Block Alignment

- Must be done
  - When the disk is formatted
- OS
  - Windows Server 2003: diskpart.exe
  - Windows Server 2008 (R2) and later: Automatic
- Best practices
  - NTFS cluster size = RAID stripe size
  - RAID stripe unit size = 64KB (1 extent, 8 data pages)
  - Partition_Offset / Stripe_Unit_Size must be a whole integer (8, 16, ..)

Disk Alignment Case Study



[Disk Partition Alignment Best Practices for SQL Server]

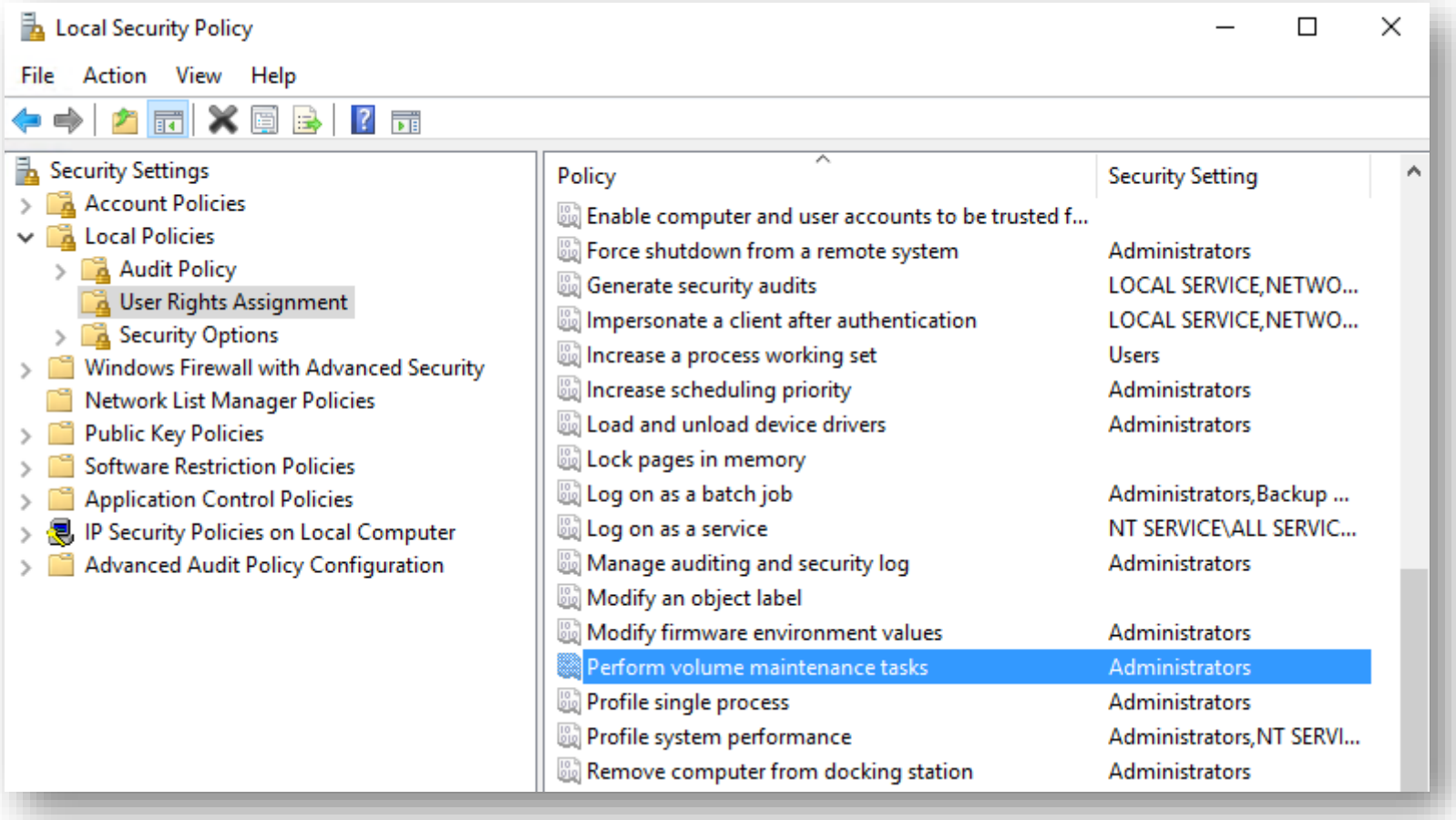
Database File Initialization

- By default, for security reasons, Data and Log files are first initialized by filling the space with zeros when SQL Server performs a
  - CREATE or ALTER DATABASE
  - RESTORE
  - AUTOGROW
- Zero-initialization takes lots of time, especially for large space allocation

Database Instant File Initialization

- If you don't need SQL Server is doing zero-initialization on data file, you can configure the "Performance Volume Maintenance Task" privileges at OS level
- It works only for Data file allocation
- Log file are always zero-initialized, no way around that
- Service restart is required

Database Instant File Initialization



Database Instant File Initialization

> Performance considerations

Performance Test with Zero Initialization
Hardware: Dell Precision 670 Dual Proc (x64) with Dual Core, 4 GB Memory, RAID 1+0 array w/4-142 GB, 15000rpm disks
- CREATE DATABASE with 20 GB Data file = **14:02 minutes**
- ALTER DATABASE BY 10 GB = **7:01 minutes**
- RESTORE 30 GB DATABASE (EMPTY Backup) = **21:07 minutes**
- RESTORE 30 GB DATABASE (11GB Backup) = **38:28 minutes**

Performance Test with Instant Initialization
Hardware: Dell Precision 670 Dual Proc (x64) with Dual Core, 4 GB Memory, RAID 1+0 array w/4-142 GB, 15000rpm disks
- CREATE DATABASE with 20 GB Data file = **1.3 seconds**
- ALTER DATABASE BY 10 GB = **.4 seconds**
- RESTORE 30 GB DATABASE (EMPTY Backup) = **5 seconds**
- RESTORE 30 GB DATABASE (11GB Backup) = **19:42 minutes**

Instant Initialization – What, Why and How? (Kimberly Tripp)

Database Instant File Initialization

> Security Considerations from BOL http://bit.ly/1dK32Dc

- Deleted disk content is overwritten only as new data is written to the files
  - Deleted content might be accessed by an unauthorized principal
- While the database file is attached to the instance, this information disclosure threat is reduced by the discretionary access control list (DACL)
- When the file is detached or backed up, it may be accessed by a user or service that does not have SE_MANAGE_VOLUME_NAME

Demo

Instant File Initialization

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Instance

Memory settings, Tempdb data files, Cost threshold of parallelism

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Memory settings

- SQL Server hasn't a memory configuration by default (Min and Max server memory)
- Setting the Maximum Server Memory is a good thing for the OS
  - Max Memory = (Max Physical Memory – 3 GB)
  - Based on the services you have on the server
  - Take care to other services such as SSIS, SSRS, SSAS, etc..

Tempdb Overview

- It stores
  - User objects
  - Work objects (worktable for Sort and Spool, …)
  - Version Store (Row Versioning)
- It's always recreated after SQL Server restart
- It uses Simple recovery model
- One tempdb for the entire instance = It's a **bottleneck by design**!!

User Objects

- Local temporary tables
  - Prefix “#”, Scope limited to the local session
  - Auto dropped after the session is closed
- Global temporary tables
  - Prefix “##”, Visible in all sessions
  - Auto dropped after the session is closed
- Table variables
- Tables returned from the “Table Valued Functions”

Latch Contention

- Latch
  - It's a synchronization object used to protect physical pages
  - Every time a page is accessed, a latch is needed
  - Other threads can't access the page in the mean time
- Occurs when many objects (table variables, temp table, …) are created/destructed
- Latch Contention on
  - PFS page
  - GAM/SGAM page

Creating a temporary table means..

- Reading the SGAM page (2:1:3) to find an extent with free space
  - An exclusive latch is active during the update
- Reading the PFS page (2:1:1) to find a free page within the extent
  - An exclusive latch is active during the update
- A PAGELATCH wait type occurs
  - 2:1:3 (SGAM page)
  - 2:1:1 (PFS page)

How to reduce Latch Contention

- Multiple tempdb data files
  - From ¼ to ½ data files of the CPU cores, including HT cores
  - New objects will be allocated using round-robin algorithm
  - All data files must have the same size!
- Don't use the Microsoft recommendation: one-to-one mapping between data files and CPU cores
  - http://bit.ly/1f9sQYZ

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Reduce Latch Contention on tempdb
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Cost threshold of parallelism

- Specify the threshold at which SQL Server Query Optimizer creates and runs parallel plans for queries
- Determines which queries are considered “short”, so they should be run using “serial” plans
- The default value is 5, queries above that cost are executed with parallelism
  - Is it a good thing or not?

Parallelism

- Parallelism in an OLTP system is not so good!
  - CXPACKET: Parallelism issue through Parallel Execution Plan, threads are not given equal amount of work to do
- Cost threshold for parallelism
  - Set it to a much higher value than the default (5)
  - Usually, values from 10 to 40 are good values
- MAXDOP
  - Set it to 1 **is not the "wizard solution"**
  - Limit it to the max core in the NUMA node KB 2806535

Demo
Cost threshold of parallelism
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Resources

- SQL Server in a virtual environments
  - SQL Server on VMware: Best Practices Guide
  - SQL Server on Hyper-V: Best Practices Guide
- Disk Alignment
  - Disk Partition Alignment Best Practices for SQL Server
- Database Instant File Initialization
  - What, Why and How?
  - Misconceptions around IFI

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Thanks!

Thanks for attending this session and the entire event!

Have a nice day!

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