SQL Server 2012: Installation and Configuration

Module 3: Pre-installation Tasks for SQL Server 2012

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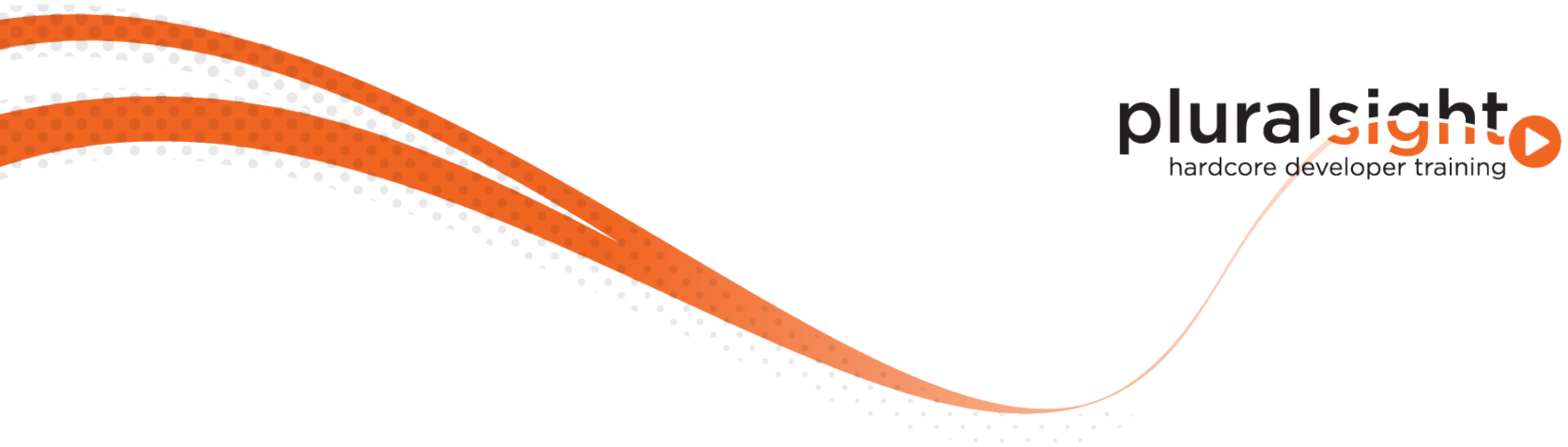

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Introduction

- Using a standardized naming scheme for disks and directories
- Considering your workload type for storage
- Choosing the storage type
- Introduction to RAID
- RAID levels and SQL Server workloads
- Provisioning your logical drives
- Testing logical drive performance

Using a Standard Naming Scheme for Disks

- This makes it easier to work with multiple database servers
- It is also very useful for database mirroring and AlwaysOn AGs
- This also makes it easier for restoring during disaster recovery
- Example naming scheme:

Drive letter and directory	Purpose
L:\SQLLogs	SQL Server log files
K:\SQLLogs	SQL Server log files
M:\SQLBackups	SQL Server backup files
P:\SQLData	SQL Server data files
Q:\SQLData	SQL Server data files
R:\SQLData	SQL Server data files
S:\SQLData	SQL Server data files
T:\TempDB	SQL Server tempdb files

Considering Your Workload for Storage

- **SQL Server can have several different workload types**
- **Three most common types:**
  - Online Transaction Processing (OLTP)
  - Relational Data Warehouse (DW)
  - Online Analytical Processing (OLAP)
- **These workload types have different I/O access patterns**
  - OLTP workload has frequent writes to data files and log file
    - Also has random reads from data files if database does not fit in memory
    - Random I/O performance is very important
  - DW workload has large sequential reads from data files
    - Sequential I/O performance is very important
  - OLAP workload has lots of random reads from cube files
    - Random I/O performance is very important

Additional Workload Considerations

- **You may have a mixed I/O workload for several reasons**
  - If you have multiple databases on the same instance
    - This complicates and randomizes the I/O workload
  - If you have multiple databases with log files on the same LUN
    - This will make the I/O workload on that LUN random instead of sequential
  - If you will be using HA/DR features that read from the transaction log
    - This will cause reads from the LUN where the log files are located
  - Index creation and maintenance will cause sequential I/O pressure
    - Reads and writes to data files, and writes to log file
  - Database backups will cause sequential I/O pressure
    - Reads from data files and log files, and writes to the backup file(s)
  - Database restores will cause sequential I/O pressure
    - Reads from backup file(s) and writes to data files and log file

Choosing the Storage Type for SQL Server

- **Depends on server usage, performance requirements, budget**
  - Existing infrastructure, employee skillset, and politics also matter
- **Four main storage types**
  - Internal drives - traditional magnetic drives or solid state drives (SSDs)
  - PCI-E storage cards
  - Direct-attached storage (DAS) - traditional magnetic drives or SSDs
  - Storage area networks (SAN) - traditional magnetic drives or SSDs
- **Internal, DAS and SAN can use hybrid or tiered-storage**
  - Mixture of magnetic storage and SSD storage
  - Good compromise between space, performance and cost
- **Storage details can make a huge difference for I/O performance**
  - 10K drives versus 15K drives, 3Gbps SAS versus 6Gbps SAS
  - Bandwidth of RAID controller, HBA or iSCSI NIC is very important

Tips for Requesting Storage

- **Don't just ask for storage based on space requirements**
  - You will be more likely to get poor performance storage
- **Specify your necessary performance requirements**
  - Sequential performance in MB/second or GB/second
  - Random performance in input/output operations per second (IOPS)
- **Specify your necessary redundancy requirements**
  - What will the storage be used for?
    - Data files, log files, backup files, etc.
- **Consider using "short-stroking" to improve I/O performance**
  - Intentionally using a smaller percentage of your available space
  - You ask for much more space than you think you will need

RAID Basics

- **Redundant array of inexpensive disks (RAID)**
  - Standardized method of managing multiple drives with a controller
  - Provides redundancy and higher performance than a single drive
  - Allows higher capacity logical drives than is possible with one drive
- **Hardware RAID controllers manage multiple drives**
  - Server RAID controllers have dedicated cache memory
  - Cache can be used for reads or writes or both
- **Several different RAID levels are commonly used**
  - RAID 1
  - RAID 5
  - RAID 50
  - RAID 10

RAID 1

- **RAID 1 is called mirroring**
  - Requires two physical drives
  - Data is copied to both drives
  - Requires 50% storage space overhead
  - Drive array can survive the loss of one drive
    - You need to replace the failed drive and allow the RAID controller to automatically rebuild the mirror as soon as possible
  - No performance impact after the loss of one drive
- **Very common to install the OS to a RAID 1 volume on a server**
  - Usually done with two internal drives in the server
  - This allows the server to operate normally after losing one drive

RAID 5

- **RAID 5 is called striping with parity**
  - Requires at least three physical drives
  - Data is striped between all drives
  - After data is written to all drives, parity information is calculated and then striped to all of the drives
    - This causes a write performance penalty
  - This allows the array to survive the loss of one drive in the array
    - Performance is severely affected after the loss of one drive
    - Failed drive must be replaced as soon as possible
  - Requires 1/(the number of drives) as storage overhead
- **RAID 5 is very popular with I.T. departments**
  - It is quite economical because of low storage overhead
  - Risk of failure goes up as you add drives to the array

RAID 50

- **RAID 50 is called striping across multiple RAID 5 data sets**
  - Requires at least six physical drives
    - Minimum of two, three-drive RAID 5 arrays
  - Requires 1/(number of drives) in each RAID 5 array for storage overhead
  - Can survive the loss of one drive in each RAID 5 array
  - Performs better than RAID 5 after the loss of one drive
  - Can be a good compromise between RAID 5 and RAID 10
    - Less expensive than RAID 10
    - More expensive than RAID 5, but provides better redundancy
  - Not all RAID controllers support RAID 50

RAID 10

- **RAID 10 is called a striped set of mirrors**
  - Data is mirrored and then striped
    - Possible to survive the loss of more than one drive
  - Requires a minimum of four physical drives
    - Must be an even number of physical drives
  - No write performance penalty
    - Very well-suited to write intensive workloads
    - Ideal for SQL Server log files
  - Requires a 50% storage space overhead
    - More expensive than RAID 5
- **RAID 10 is very popular with database administrators**
  - Provides better write performance and better redundancy than RAID 5
  - It is more expensive than RAID 5

Raid Level and SQL Server Workloads

- **The number of spindles in an array is extremely important**
  - A larger number of smaller drives will perform much better than a small number of larger drives
- **RAID 5 has a write performance handicap**
  - RAID 5 cannot survive the loss of more than one disk in an array
  - RAID 5 arrays with larger numbers of disks are more likely to lose a disk
  - Try to put infrequently accessed data on RAID 5 to save money
- **RAID 10 and RAID 1 have very good write performance**
  - RAID 10 also has more redundancy than RAID 5
  - Always try to use RAID 1 or RAID 10 for log files
- **As a DBA, don't negotiate with yourself on storage**
  - Ask for RAID 10, and then negotiate down if necessary
  - Use RAID 5 for data files and backup files if necessary

Provisioning Your Logical Drives

- **Drive arrays must be created and presented to the host**
  - This is done differently depending on the storage type
    - Internal drives
    - Internal PCI-E storage
    - Direct attached storage (DAS)
    - Storage area network (SAN)
- **Windows Disk Manager is used to initialize and format drives**
  - You also assign drive letters and name the LUN
  - Use your standardized naming scheme
- **It is a good idea to also create the directories for SQL Server**
  - This will make the SQL Server installation go more quickly

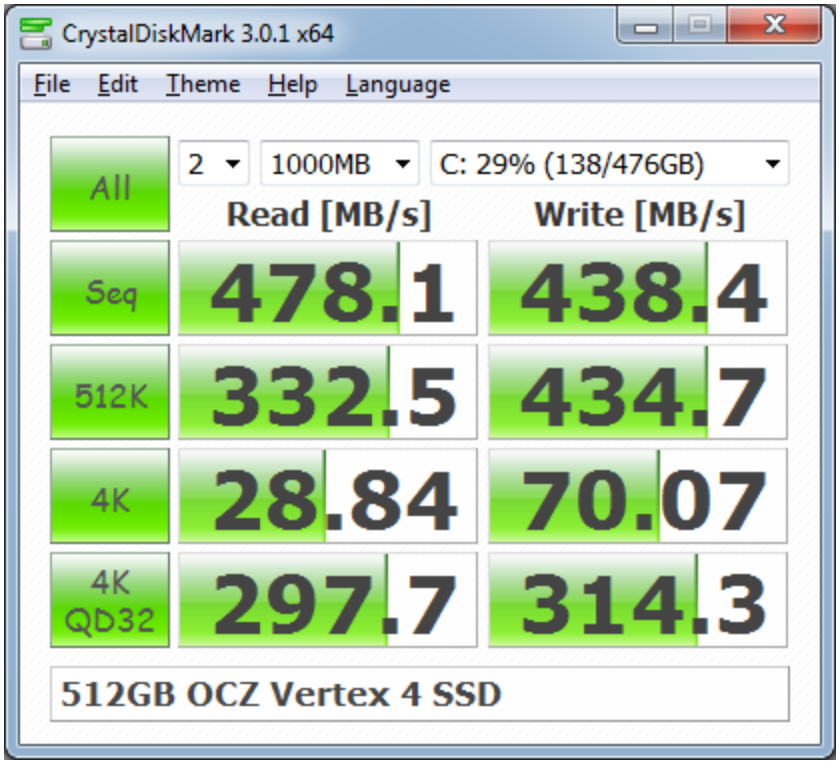
Testing Your Logical Drive Performance

- **CrystalDiskMark is a quick way to test drive performance**
  - Enables you to test each logical drive in a few minutes
  - Tests sequential and random I/O performance
  - Use for first round of testing, before you use SQLIO
- **SQLIO allows you to do much more detailed logical drive testing**
  - Does not require SQL Server to be installed
  - Does not generate a database specific workload
  - Can be much more time consuming to run comprehensive tests

CrystalDiskMark 3.0.1 x64

- **Very easy to use, no complicated configuration required**
  - You can choose the file size for the test runs
    - 50MB, 100MB, 500MB, 1000MB, 2000MB, 4000MB
  - You can choose the file type
    - Random data or non-random data
    - Some SSD controllers use compression for performance
      - Random data is not very compressible
  - You can choose the number of test runs (1-9)
- **Quickly measures sequential and random I/O performance**
  - Sequential reads and writes in MB/second
  - Large and small random reads and writes at different queue depths
    - Measured in MB/sec and IOPS
  - Free download
    - http://bit.ly/TDoGOi

CrystalDiskMark Example Output



SQLIO Disk Benchmark

- **Despite the name, it has nothing to do with SQL Server**
  - Free tool developed by Microsoft to evaluate I/O performance
  - You can use it on any server running a recent version of Windows
- **Command-line utility**
  - Requires some expertise to properly configure and run
  - Can take a long time to run a comprehensive set of tests
- **Allows you to test the limits of your I/O subsystem**
  - Measures IOPS
  - Sequential throughput in MB/second
  - Latency in milliseconds
- **Download location**
  - http://bit.ly/QxwUV8

Summary

- **Use a standardized naming scheme for drives and directories**
  - Makes it easier to work with multiple database servers
  - Makes it easier to use HA/DR features like AlwaysOn AGs
- **Consider your workload type when you think about storage**
  - Read versus write frequency
  - Sequential versus random I/O performance
- **Choose the appropriate RAID level for your logical drives**
  - This affects performance, redundancy and cost
- **Make sure your drives are provisioned and tested before you install SQL Server 2012**
  - Use CrystalDiskMark for the first round of I/O testing
  - Use SQLIO for more comprehensive I/O testing

What is Next?

- **Module 4 will cover actually installing SQL Server 2012**
  - Selecting which features to install
  - Specifying Service accounts for SQL Server Services
  - Changing SQL Server Agent to automatic start
  - Database Engine configuration tasks
  - Specifying data directories for SQL Server