SQL Server 2012: Evaluating and Sizing Hardware

Module 6: Hardware and Storage Sizing Techniques

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Introduction

- Comparing servers using TPC-E
- Comparing servers using TPC-H
- Comparing servers using Geekbench
- Adjusting benchmark scores for different processors
- Deciding how much physical memory to buy
- How much memory do you really need?
- Disadvantages of large amounts of RAM
- Comparing storage subsystems using disk benchmarks

Comparing Servers Using TPC-E

- **Very useful technique for OLTP workloads**
  - Only SQL Server results have been submitted to TPPC
- **TPC-E benchmark is CPU limited with adequate I/O performance**
  - Good way to compare different processors for OLTP performance
  - Processor selection is extremely important for SQL Server 2012
- **Hardware vendors only use top of the line processors for TPC-E**
  - You will have to adjust raw TPC-E scores upward or downward for processor differences between two systems
  - Take into account processor family and generation
  - Take into account physical core counts, logical core counts, base clock speed, turbo clock speed, L2 and L3 cache sizes

Comparing Servers Using TPC-H

- **Somewhat useful technique for DW workloads**
  - Most recent SQL Server results are from July 2010
  - No results for latest hardware platforms
- **TPC-H benchmark is sensitive to memory read performance**
  - It is also sensitive to sequential read I/O performance
  - Number of processor cores affects query performance
- **Hardware vendors only use top of the line processors for TPC-H**
  - You will have to adjust raw TPC-H scores upward or downward for processor differences between two systems
  - Take into account processor family and generation
  - Take into account physical core counts, logical core counts, base clock speed, turbo clock speed, L2 and L3 cache sizes
- **Pay attention to storage subsystem sequential read performance**

Comparing Servers Using Geekbench

- **Geekbench is quick and easy to run on a system**
  - Requires no complicated configuration
  - Only measures CPU and memory performance
  - Does not measure I/O performance
- **Geekbench correlates reasonably well to TPC-E**
  - You can use Geekbench to validate and adjust TPC-E scores
  - This allows for differences in the exact processor models
    - Clock speed, cache size, core count differences
- **You can easily run Geekbench on your lab system(s)**
  - Much more effort required to run TPC-E benchmark
- **You can search online Geekbench database for other systems**
  - Allows you to see results for systems you don't have access to

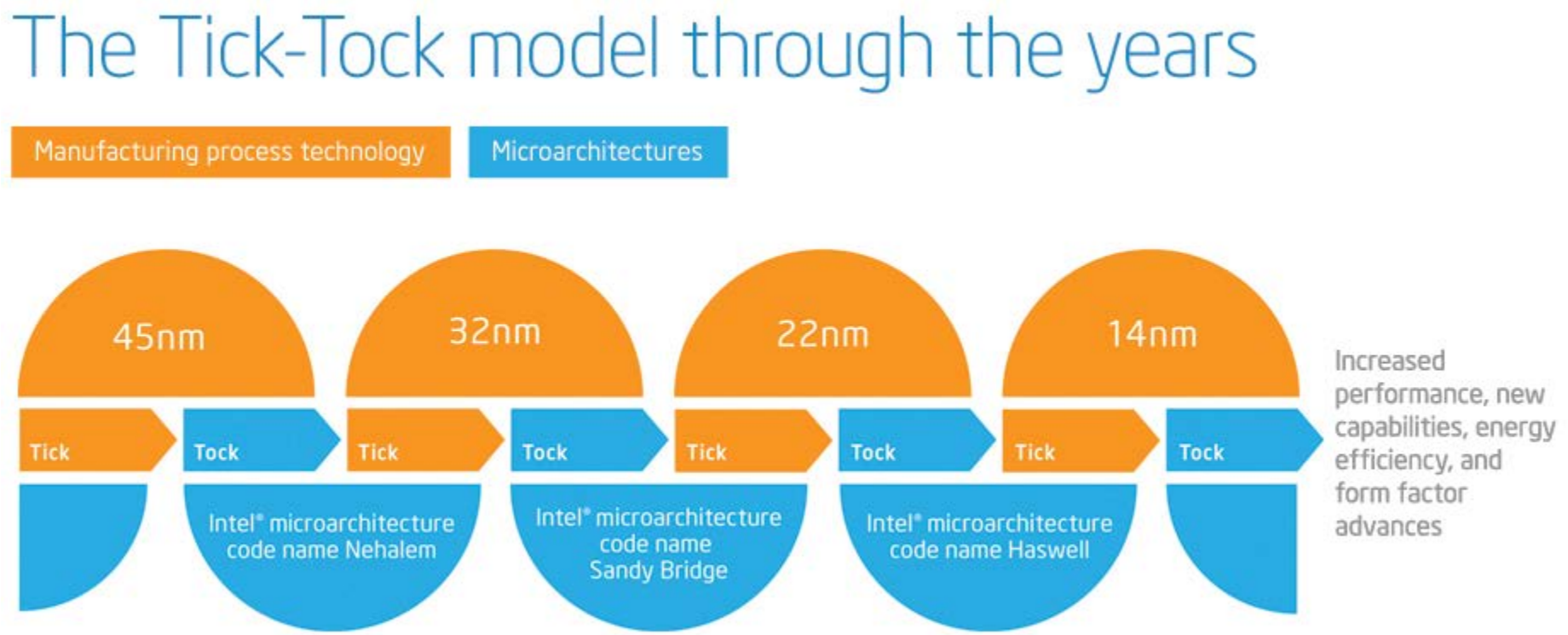
Adjusting Benchmark Scores for Different Processors

- **Make sure you are aware of the family and generation of the processor**
  - It is more complicated to compare different families and generations
  - Same family and generation is much easier to compare
- **Recent and upcoming Intel processor generations**
  - Woodcrest
  - Wolfdale
  - Nehalem
  - Westmere
  - Sandy Bridge
  - Ivy Bridge
  - Haswell
  - Rockwell

Recent Intel Processor Model Families

Year	Process	Model Families	Code Name
2006	65nm	3000, 3200, 5100, 7300	Woodcrest, Clovertown
2007	45nm	3100, 3300, 5400, 7400	Wolfdale, Harpertown
2008	45nm	3400, 3500, 5500, 7500	Nehalem-EP, Nehalem-EX (2010)
2010	32nm	3600, 5600, E7-4800	Westmere-EP, Westmere-EX (2011)
2011	32nm	E3-1200, E5-2600	Sandy Bridge, Sandy Bridge-EP (2012)
2012	22nm	E3-1200 v2, E5-2600 v2	Ivy Bridge, Ivy Bridge-EP/EX (2013)
2013	22nm	E3-1200 v3, E5-2600 v3	Haswell, Haswell-EP (2014 ?)
2014	14nm		Rockwell
2015	14nm		Skylake
2016	10nm		Skymont

Intel Tick Tock Model



Processor Adjustment Techniques

- **Within the same family and generation of processor**
  - Look at physical core counts and do simple arithmetic
  - Look at clock speeds and do simple arithmetic
  - Look at L2/L3 cache sizes and adjust up or down
    - A larger L2/L3 cache may increase performance by 10-20%
    - Look at available benchmark scores to validate this!
- **With different family or generation of processors**
  - Determine the generation difference between the processors
    - How many generations difference between the processors?
    - Are they Tock releases or Tick releases?
  - Nehalem vs. Westmere is only one Tick release difference
  - Westmere vs. Sandy Bridge is one Tock release difference
    - Validate your assumptions with benchmark results

Deciding How Much Physical Memory to Buy

- **The first consideration is what edition of SQL Server 2012**
  - Standard Edition can only use 64GB for Database Engine
  - Standard Edition can only use 64GB for SSAS
  - Business Intelligence Edition can only use 64GB for Database Engine
- **Good idea to have more than 64GB, even with these license limits**
  - This lets you set max server memory at 65536 (64GB) and still have enough extra for the OS and other SQL Server components
- **Enterprise Edition lets you use up to OS limit for RAM**
  - 2TB with Windows Server 2008 R2
  - 4TB with Windows Server 2012
- **Most DDR3 RDIMMs are very affordable (except for 32GB RDIMMs)**
  - Currently $10-15/GB

How Much Memory Do You Really Need?

- **Memory is inexpensive and much faster than any storage type**
  - This includes flash memory and storage hardware cache
  - Memory is less expensive than adding server-class storage
- **Removing possible memory pressure helps storage subsystem performance**
  - Allows a larger buffer cache size to reduce read I/O requirements
  - Reduces the need for lazy writer activity to free up memory
- **Ideally, all of your databases fit into memory**
  - This is much more realistic with current memory density and costs
- **Use a memory configuration utility to make sure you have a configuration that gives you good memory performance**
  - Dell PowerEdge memory configuration http://bit.ly/xl3qyW

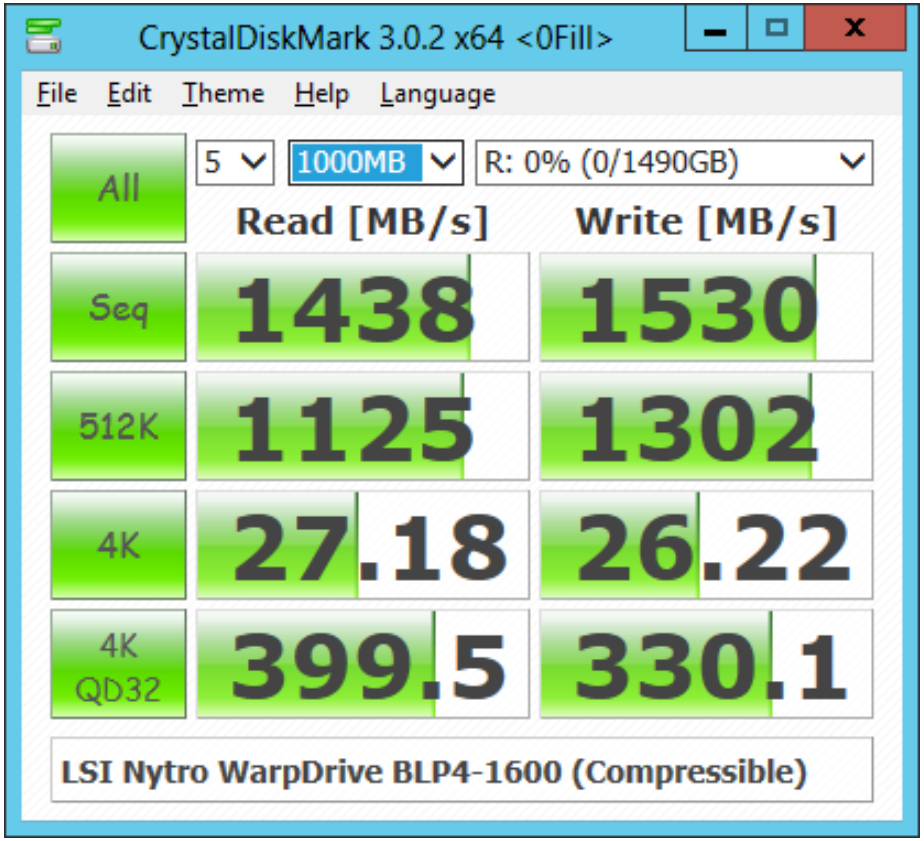
Disadvantages of Large Amounts of RAM

- **Longer POST times can affect RTO goals (longer boot times)**
  - You can disable memory testing during POST to reduce boot times
  - HA technologies can be used to reduce the importance of boot time
- **Having all slots populated can reduce memory bandwidth**
  - Reduced bandwidth memory is faster than any storage type
  - Make sure to use a memory configuration utility on your system
  - Make sure to measure your memory performance with Geekbench
- **Higher amounts of RAM will increase electrical power usage**
  - This is less of a factor with a small number of database servers
  - More important consideration with large numbers of web servers

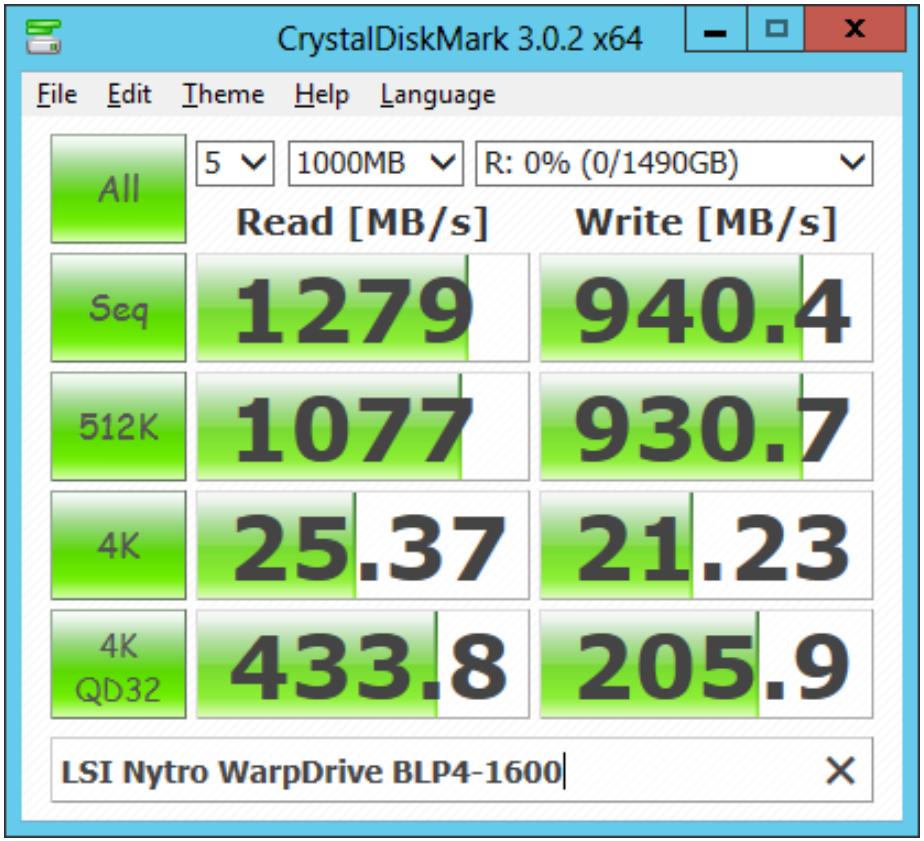
Comparing Storage Subsystems using Disk Benchmarks

- **Use CrystalDiskMark for quick initial testing of logical drives**
  - This gives you an initial idea of sequential and random I/O performance
- **Use SQLIO to do more detailed testing of logical drives**
  - This is more time consuming and complicated
- **Test with different test file sizes**
  - Helps take into account your storage hardware cache effects
  - Smaller test files may fit completely in your storage cache
- **Test with random and non-random test files**
  - Simulates the effects of data and backup compression
  - Some flash storage devices use hardware compression
    - They will have lower performance when the data is already compressed

Sample CrystalDiskMark Results



Sample CrystalDiskMark Results



Summary

- **You can use TPC-E scores to compare different processors**
- **You can use Geekbench scores to compare processors**
  - You can also use Geekbench scores to adjust TPC-E scores
- **You need to adjust benchmark scores for hardware differences**
  - Different processors, different memory amounts
  - Different storage subsystem configurations
- **Determining how much memory to buy**
  - Keep license limits in mind
- **Comparing storage subsystems using disk benchmarks**
  - CrystalDiskMark
  - SQLIO

What is Next?

- **Module 7 will cover choosing components for redundancy**
  - Choosing components for basic hardware redundancy
  - The importance of redundant components for high availability
  - Reliability, availability and servicing (RAS) features
  - HA/DR architecture and your storage choices
  - Other HA/DR effects on your hardware configuration
  - Consider all aspects of reliability