

SQLskills Immersion Event

IEHADR: High Availability and Disaster Recovery

Module 2: Hardware for HA/DR

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Intel Processor Family Tree

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	E5-2600 v2, E7-4800 v2	Ivy Bridge-EP, Ivy Bridge-EX (2013)
2014	22nm	E5-2600 v3, E7-4800 v3	Haswell-EP, Haswell-EX (2015)
2015	14nm	E5-2600 v4	Broadwell-EP (Q4 2015), Broadwell-EX
2016	14nm	E3-1200 v5	Skylake (Q1 2016)
2017	10nm		Cannon Lake
2018	10nm		??

Intel Haswell-EX (Xeon E7-4800/8800 v3)

- **Intel Tock release (May 2015)**
 - 22nm process, up to eighteen cores, up to 45MB L3 cache
 - PCI-E 3.0, QPI 1.1, four DDR3 memory controllers
- **Replacement for Ivy Bridge-EX (Xeon E7-4800/8800 v2 series)**
 - 20% more physical cores than Ivy Bridge-EX
 - Intel Transactional Synchronization New Instructions (TSX-NI)
- **Xeon E7-8890 v3 is “top of the line” model**
 - 2.5GHz base, Turbo Boost 2.0 to 3.3GHz, 45MB L3 cache
 - Eighteen cores, plus hyper-threading
 - DDR4 1833 support, 24 DIMMs per socket
 - DDR3 1600 support, 24 DIMMs per socket
 - 3TB of RAM with four sockets with 32GB DIMMs
 - 12TB of RAM with eight sockets with 64GB DIMMs

Preferred Haswell-EX Processors

Model	Cores/L3 Cache	Base Speed	Turbo Speed	Price
E7-8890 v3	18/45MB	2.5GHz	3.3GHz	\$7,175.00
E7-8867 v3	16/45MB	2.5GHz	3.3GHz	\$4,672.00
E7-8891 v3	10/45MB	2.8GHz	3.5GHz	\$6,841.00
E7-8893 v3	4/45MB	3.2GHz	3.5GHz	\$6,841.00

CPU Selection for HA/DR

- **The details of specific CPU models actually do matter a great deal**
 - Single-threaded performance, memory controller performance
 - Processors for four-socket servers are slower than models for two-socket servers (but gap is closing)
- **Intel Xeon E5-2600 v3 Product Family**
 - Up to eighteen cores, absolute best single-threaded performance
 - Up to 768GB of RAM in two-socket server, PCI 3.0 support
 - Released in Q3 2014
- **Intel Xeon E7-8800 v3 Product Family**
 - Up to eighteen cores, very good single-threaded performance
 - Up to 3TB of RAM in four-socket server, PCI 3.0 support
 - Released in Q2 2015

The Importance of Sequential Throughput

- **Sequential throughput is critical for many database server activities**
 - ❑ Full database backups and restores
 - ❑ Make sure to enable “Perform volume maintenance tasks”
 - ❑ Make sure to use backup compression
 - ❑ Make sure to keep your VLF counts under control
 - ❑ Index creation and rebuilds
 - ❑ Use MAXDOP option to indirectly throttle index create or rebuild I/O workload
 - ❑ Setting MAXDOP to 1 reduces index fragmentation
 - ❑ Use data compression where appropriate to reduce the I/O workload
 - ❑ DW-type large sequential scans
 - ❑ When your database does not fit into the buffer pool
 - ❑ Buffer Pool Extensions (BPE) does not help much for sequential reads

SQL Server I/O Workload Metrics

- **What is the read vs. write ratio of the workload?**
 - ❑ You can use my DMV Diagnostic Queries to determine this
 - ❑ Ratios will be different for different SQL Server file types and workloads
- **What are the typical IO rates (IOPS and throughput)?**
 - ❑ Reads/sec, writes/sec (PerfMon) is IOPS
 - ❑ Disk read bytes/sec, disk write bytes/sec (PerfMon) is throughput
- **What are the typical IO rates (IOPS and throughput)?**
 - ❑ Average disk sec/read, average disk sec/write (PerfMon) is latency
- **What is the average file-level I/O latency?**
 - ❑ You can use my DMV Diagnostic Queries to determine this for every SQL Server database file on your instance
 - ❑ <http://bit.ly/Q5GAJU>

Common DMV I/O Query Result Patterns

- **Very common to see high write latency to tempdb data files**
 - Make sure you have multiple data files (start with 4-8) that are all the same size (follow Bob Ward's guidance). Make sure you are using TF 1118
 - Consider using local flash-based storage for tempdb
- **Common to see high read latency from user database data files**
 - Look for signs of memory pressure, consider adding more RAM and doing standard workload and index tuning
 - Consider using SQL Server 2014 BPE (especially for Standard Edition)
- **Gather as much evidence as possible to show your SAN Admin**
 - Overall SAN metrics may look great, so you need to be prepared with data
 - `sys.dm_io_virtual_file_stats` are cumulative since instance was started
 - They include all file activity against your database files

SMB 3.0/3.02 File Shares

- **Server Message Block (SMB) 3.0/3.02**
 - SQL Server 2012/2014 can store user/system databases on SMB 3.0 file shares
 - SQL Server 2012/2014 can use SMB 3.0 for traditional FCI instances that require shared storage (without using a SAN)
 - Windows Server 2012 has SMB Direct, which supports the use of network adapters that have Remote Direct Memory Access (RDMA) capability
 - RDMA requires SMB Multichannel in order to be enabled
 - RDMA capable network adapters can function at full speed with very low latency while using very little CPU time on the host
 - This enables a remote file server to resemble local storage (when you have something like a 56Gbps Infiniband connection)
- Microsoft's Jose Barreto is a great resource about SMB file shares
 - <http://blogs.technet.com/b/josebda/>

Negotiated Versions of SMB

OS	Windows 8.1 WS 2012 R2	Windows 8 WS 2012	Windows 7 WS 2008 R2	Windows Vista WS 2008	Previous Versions
Windows 8.1 WS 2012 R2	SMB 3.02	SMB 3.0	SMB 2.1	SMB 2.0	SMB 1.0
Windows 8 WS 2012	SMB 3.0	SMB 3.0	SMB 2.1	SMB 2.0	SMB 1.0
Windows 7 WS 2008 R2	SMB 2.1	SMB 2.1	SMB 2.1	SMB 2.0	SMB 1.0
Windows Vista WS 2008	SMB 2.0	SMB 2.0	SMB 2.0	SMB 2.0	SMB 1.0
Previous Versions	SMB 1.0	SMB 1.0	SMB 1.0	SMB 1.0	SMB 1.0