

Lenovo HA Database Configuration for Microsoft SQL Server 2016 – 60TB

Data Warehouse Fast Track Solution with High Availability

Data Warehouse problem and a solution

The rapid growth of technology means that the amount of available data and the ability to collect that data increased to a level unthinkable as little as five years ago. As the volume and velocity of data increased, however, extracting meaningful insight in a timely manner became more complex. Therefore, opportunities are being missed and effort is being wasted. To compete, businesses in the 21st century are demanding the tools to derive true value from their data.

This Microsoft Data Warehouse Fast Track (DWFT) configuration for SQL Server 2016 on the System x3650 M5 is a High Availability (HA) solution from Lenovo that improves time-to-value for data warehousing needs with a new scalable architecture to solve SQL database warehouse needs up to 60 TB in size.

This advanced solution uses two high-performance System x3650 M5 servers in a Windows Server Failover Cluster (WSFC) connected by Emulex 16Gb (Gen 6) Fibre Channel (FC) HBAs to IBM FlashSystem V9000 all flash storage through the IBM SAN24B-5 16Gb FC Switches to solve the data warehouse needs of a 60 TB SQL Server database. IBM SAN24B-5 16Gb FC Switches facilitate simple server and storage scale out.

The Microsoft Data Warehouse Fast Track program makes it easy to reduce costs, save time, and reduce risk with reliable, pretested hardware and best practices for data warehousing. This solution features the following highlights:

- Reduce time to value with pretested hardware configurations.
- Reduce hardware testing and reduce tuning immediately.
- Reduce total cost of ownership through better price and performance, rapid deployment, and advanced hardware.
- Optimize performance with pretested System x3650 M5 hardware configurations.
- Consolidate storage and match IT investment-to-information-value with IBM FlashSystem V9000 All Flash Storage.
- Increase solution availability and simplify scalability with low latency, multi-pathing, and ports-on-demand 16 Gb FC network.

This configuration has the following Microsoft certified performance rating:

- Fast Track Row Store rated I/O: 6,256 MBps
- Column Store throughput: 1,792 Queries/Hr/TB

HIGHLIGHTS

- Advanced 60 TB SQL DWFT HA solution from Lenovo
- High Performance IBM V9000 all flash storage
- Emulex 16Gb (Gen 6) Fibre Channel HBAs
- IBM SAN24B-5 16Gb Fibre Channel switches
- Balanced and Optimized configuration
- Certified by Microsoft
- Reduced time to value
- Ready for rapid server and storage scale out



CONFIGURATION BRIEF

Lenovo Database Configuration for Microsoft SQL Server 2016 – 60TB



Reference configurations for DWFT for SQL Server bring together the right mix of technology and software, integrating the latest powerful Lenovo M5 Rack Servers, robust System Storage and the data warehouse capabilities of SQL Server 2016 Enterprise Edition. Each offering, from Basic (<10 TB DW) to Standard (10–40 TB DW) to Advanced (>40 TB DW), consists of:

- Pretested server and in-server flash storage configuration, specifically balanced and optimized for data warehousing
- Microsoft SQL Server 2016 Enterprise Edition for a scalable enterprise data warehouse platform

Enterprise data warehouse with faster time-to-value

DWFT for SQL Server 2016 for Lenovo M5 Rack Server offerings are methodically tested and tuned to save you months of configuration, setup, testing, and tuning. With these offerings from Lenovo, you can now complete the following tasks:

- Buy all the hardware that you need from only one vendor including servers, storage, and networking.
- Build, tune, and deploy with confidence by using established data warehouse best practices.
- Select from different levels of performance, scalability, and price to suit your business needs.
- Choose from 4 to up to 120 Intel Xeon processor cores.
- Run targeted query workloads that are patterned for large sequential data sets rather than small random transactions.
- Eliminate bottlenecks with optimized rapid data reads and query aggregations

Microsoft SQL Server 2016

Microsoft® SQL Server 2016 has made significant improvements in data warehousing technologies and performance, including column-store features as well as many other improvements. Column-store indices offer great advantages over traditional row stores for analytics and data warehousing queries. They are ideally suited for the star schemas, and tables with billions of rows which are commonly seen. Among their advantages for analytics are:

- **Up to 10X compression in data size** - Data warehouses are very large by nature, and the compression offered by column store index technologies offers both space and cost savings, but also significantly increased performance, due to the dramatically reduced IO requirements given by the compression, coupled by the ability to only scan the specific columns required by each query. Compression also reduces the amount of memory required to hold a given number of rows from the source data warehouse.
- **Additional Indices** - SQL Server 2016 adds the capability to add additional (B-Tree) indices to column store-based tables, which enables efficient single-row lookup.

In addition to these architectural features, query processing in column-store indices is further optimized in the following ways:

- **Operator Pushdown** - Pushdown refers to moving both filter and aggregation query operations closer to the data, so that many of the filters and calculations can be done in the scan operators, dramatically reducing the volume of data which needs to be handled further on in query processing.
- **Batch Mode Processing** - SQL Server 2016 includes enhancements in batch-mode processing which processes many rows at a time rather than serially doing calculations on each individual row. These batch operations are further optimized by leveraging Single Instruction Multiple Data (SIMD) vector processing CPU instructions in the Intel® architectures.

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Powered by Lenovo System x3650 M5, IBM FlashSystem V9000 All Flash Storage and Emulex 16Gb (Gen 6) Fibre Channel HBAs

Lenovo System x3650 M5 servers feature the latest Intel Xeon E5-2600 v4 series processors. With more cores and more memory, the new M5 family is fast. The greatly increased processing power is provided by the latest Intel Xeon E5-2600 v4 processors. These Lenovo M5 rack servers include the following features:

- Twice the memory capacity of previous platforms with 24 DIMM slots.
- Support for 64 GB TruDDR4 Memory LRDIMMs, up to 1.5 TB of memory.
- Support for latest Emulex 16Gb (Gen 6) Fibre Channel HBAs for Lenovo M5 Rack Servers.

This DWFT configuration for Microsoft SQL Server 2016 features two System x3650 M5 servers connected to IBM FlashSystem V9000 storage Area Network (SAN) with Emulex 16Gb Gen6 FC HBAs through two IBMSAN24B-5 16Gb Fibre Channel switches to create a Highly Available solution that improves productivity through data consolidation, availability performance, and scalability.

The Emulex Gen 6 HBAs meet the high I/O requirements of flash storage arrays and large Data Warehouse workloads, delivering 1.6M IOPS on a single port. These HBAs also maximize the performance of flash-based systems by prioritizing mission critical traffic in congested networks with the exclusive easy-to-use ExpressLane™ feature.

The reference configuration is a 2-socket system that uses the DWFT V4 methodology.

This configuration features the following main components:

- Servers: Two Lenovo System x3650 M5 servers each with
 - Processors: Two E5-2690 v4 14C 2.6 GHz
 - Memory: 768 GB of DDR4 memory
 - OS Storage: Two 300 GB SAS HDDs for the operating system (RAID 1)
 - Adapters: Four Emulex 16Gb (Gen 6) Dual-Port FC HBAs for Lenovo M5 Rack Servers
- Storage: One IBM FlashSystem V9000 for data storage, tempdb and log.
- Network: Two IBMSAN24B-5 16Gb FC switches

Lenovo System x3650 M5 High Performance Rack Server and IBM Flash System V9000 all flash storage



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Lenovo Database Configuration for Microsoft SQL Server 2016 – 60TB

Reference Architecture Certification

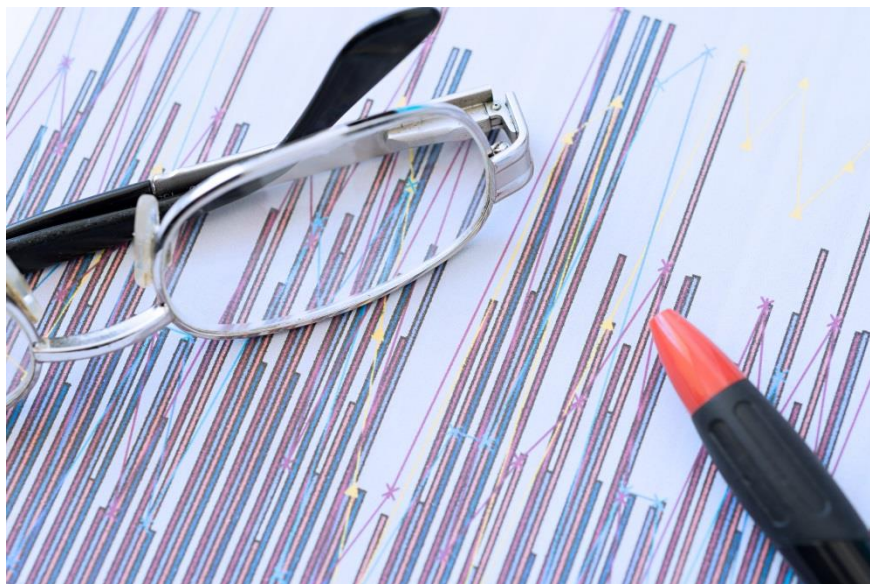
DWFT Certification #2016-006	Lenovo 60TB with System x3650 M5 High Availability			Report Date:7/15/2016																			
DWFT Rev. 5.4	DWFT Reference Architecture																						
System Provider	System Name	Processor Type			Memory																		
	Lenovo System x3650 M5 (2 Systems)	Intel Xeon E5-2690 v4 2.6 GHz (2/28/56)			768 GB																		
Operating System		SQL Server Edition																					
Windows Server 2012 R2 Standard Edition		SQL Server 2016 Enterprise Edition																					
Storage Provider	Storage Information																						
	2x 300 GB SAS HDDs for OS (RAID 1) IBM FlashSystem Storage V9000 - 29TB Flash Storage																						
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¹ Assumes a data compression ratio of 5:1																							
² Percent ratio of the throughput to the row store throughput of the reference configuration.																							
³ Percent ratio of the throughput to the column store throughput of the reference configuration.																							
* Reported metrics are based on the qualification configuration which specifies database size and SQL Server memory.																							

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Bill of materials

Feature code	Description	Quantity
8871-AC1	60TBDWFT: Lenovo System x3650 M5	1
A5G6	x3650 M5 8x 2.5" HS HDD Assembly Kit (Single RAID)	1
5977	Select Storage devices; no IBM configured RAID required	1
ATDY	System x3650 M5 24x 2.5" Base without Power Supply BDW	2
A5EW	System x 900W High Efficiency Platinum AC Power Supply	2
9206	No Preload Specify	1
ATCA	16 GB TruDDR4 Memory (2Rx4, 1.2 V) PC4-19200 CL17 2400 MHz LP RDIMM	24
ATZV	Emulex 16Gb (Gen 6) FC Host Bus Adapter (LPe31002)	4
ATL3	System Documentation and Software-US English	1
ATEP	Intel Xeon Processor E5-2690 v4 14C 2.6 GHz	1
ATFE	Addl Intel Xeon Processor E5-2690 v4 14C 2.6GHz	1
AT89	300 GB 10K 12 Gbps SAS 2.5" G3HS HDD	2
6311	2.8 m, 10A/100-250V, C13 to IEC 320-C14 Rack Power Cable	1
A3YZ	ServeRAID M5210 SAS/SATA Controller	1
A5FW	Lenovo System Gen-II Universal Slides Kit	1
ATG5	Lenovo System x3650 M5 WW Packaging	1
A5R6	System x3650 M5 PCIe Riser 2 (2 x8 FH/FL + 1 x8 FH/HL Slots)	1
ATE4	System x3650 M5 Planar BDW	1
A59E	Lenovo System x3550 M5 Label GMB	1
A5FP	System x3650 M5 PCIe Riser 1 (2 x8 FH/FL + 1 x8 FH/HL Slots)	1
01GX-366	null : 3YR Tech Install Parts 24x7x4	1



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High Performance at low cost with Lenovo x3650 M5 servers and IBM FlashSystem V9000 storage



Why FlashSystem V9000 solid state storage from IBM

The IBM FlashSystem® V9000 is a comprehensive all-flash enterprise storage solution. FlashSystem V9000 delivers the full capabilities of IBM FlashCore™ technology plus a rich set of storage virtualization features. The FlashSystem V9000 delivers industry-leading value to enterprises along three dimensions: Scalable Performance, Enduring Economics, and Agile Integration.

Why Lenovo System servers for Microsoft SQL DWFT

Lenovo offers a wide range of servers and options. The Lenovo reference configurations for DWFT for SQL Server bring together the right mix of technology and software. The configurations integrate the latest powerful Lenovo System rack servers, robust Lenovo Storage options and the data warehouse capabilities of SQL Server 2016 Enterprise Edition.

Why Lenovo

Lenovo is a leading provider of x86 servers for the data center. Featuring rack, tower, blade, dense and converged systems, the Lenovo server portfolio provides excellent performance, reliability and security. Lenovo also offers a full range of networking, storage, software, solutions, and comprehensive services supporting business needs throughout the IT lifecycle. With options for planning, deployment, and support, Lenovo offers expertise and services needed to deliver better service-level agreements and generate greater end-user satisfaction.

For More Information

To learn more about the Lenovo Database Configuration for Microsoft SQL Server 2016 – 60 TB solution, contact your Lenovo Business Partner or visit:

<http://shop.lenovo.com/us/en/systems/solutions/database/>



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