

Lenovo Database Configuration

for Microsoft SQL Server DWFT – 44TB

Reduce time to value with pretested hardware configurations

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 2017 improves time-to-value for data warehousing needs with a new scalable architecture. This solution in the Lenovo portfolio uses the high performance Lenovo ThinkSystem SR650 server combined with Lenovo NVMe Enterprise Mainstream Flash Adapters to solve SQL database warehouse needs up to 44 TB in size.

Enterprise data warehouse with faster time-to-value

DWFT for SQL Server 2017 for Lenovo solution 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
- Pre-optimized system tuned and tested with Microsoft certification and deploy with confidence for your demanding data warehouse performance needs
- Select from different levels of performance, scalability, and price to suit your business needs
- Run targeted query workloads patterned for large sequential data sets rather than small random transactions
- Eliminate bottlenecks with optimized rapid data reads and query aggregations

Highlights

- Reduce time to value with pretested hardware configurations
- Microsoft Certified solution with detailed performance data
- Reduce TCO through better performance, rapid deployment and advanced hardware
- Optimize performance with pretested ThinkSystem SR650 hardware configurations
- Consolidate storage and match IT investment-to-information-value with Lenovo NVMe Enterprise Mainstream Flash Adapters





MICROSOFT SQL SERVER 2017

Microsoft® SQL Server 2017 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 – Microsoft SQL Server 2017 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 – Microsoft SQL Server 2017 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.

This configuration features the following main components:

- Server: Lenovo ThinkSystem SR650
- Processor: Intel Xeon Platinum 8176 28C 165W 2.1GHz
- Memory: 786 GB of TRUDDR4 memory
- Storage: Four 3.84TB Lenovo NVMe Enterprise Mainstream Flash Adapters for data and tempdb
- OS Storage: Two 480 GB SATA SSDs for the operating system (RAID 1)
- Logging: Four 800 GB SAS SSDs for log (RAID 10)
- Software:
 - Microsoft Windows Server 2016 Standard Edition
 - Microsoft SQL Server 2017 Enterprise Edition

This data warehouse solution with Microsoft SQL Server 2017 Enterprise Edition features the Lenovo NVMe Enterprise Mainstream Flash Adapters. These flash adapters improve productivity through data consolidation, availability performance, and scalability. Solid-state adapters simplify DWFT storage configuration and maintenance versus the use of SAN which has more parts to maintain and manage.

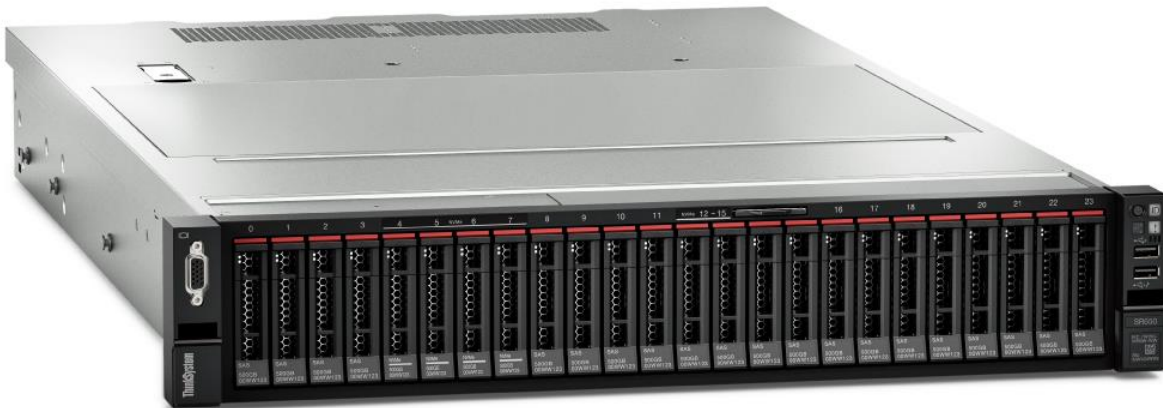


Lenovo PX04PMC NVMe Enterprise Mainstream flash adapters are engineered for greater performance and endurance in a cost-effective design

Best practices for Data Warehouse Fast Track

For a balanced and optimized Data Warehouse configuration:

- Configure UEFI settings to set Operating mode to Maximum performance.
- Configure high availability for the OS with 2-disk Raid-1.
- Configure high availability for the log drive with 2-disk Raid-1 or Raid-10 with more disks based on performance needs.
- Data files and tempdb can be on Raid 0 drives. Spread data and tempdb files evenly across all data drives for even performance.
- Configure more than one tempdb files; at least one file per data drive.
- Enable lock pages in memory option using Windows Group policy tool to prevent paging of data.
- If the server is dedicated to data warehousing:
 - Set processor affinity for SQL Server to use all the processors in the system.
 - Set SQL Server Maximum Server Memory to 90% of the total memory available on the server.
- Add -E and optionally -T834 to SQL Server Startup parameters.



Solution Benefits



- **Standard 44 TB SQL DWFT solution from Lenovo**
- **Balanced and optimized configuration**
- **Features High performance Lenovo NVMe storage**
- **Certified by Microsoft**
- **Reduced time to value**



Bill of Materials

Feature Code	Description	Qty
7X06-CTO1WW	null : ThinkSystem SR650 - 3yr Warranty	1
AUVX	ThinkSystem MS 2U 2.5" Chassis, up to 16	1
AWDH	Intel Xeon Platinum 8176 28C 165W 2.1GHz Processor	2
AUND	ThinkSystem 32GB TruDDR4 2666 MHz (2Rx4 1.2V) RDIMM	24
AUR5	ThinkSystem 2.5" AnyBay 8-Bay Backplane	1
AUNJ	ThinkSystem RAID 930-8i 2GB Flash PCIe 12Gb Adapter	1
AUR7	ThinkSystem 2U x8/X8/x8ML2 PCIe FH Riser 1	1
AURC	ThinkSystem SR550/SR590/SR650 (x16/x8)/(x16/x16) PCIe FH Riser 2 Kit	1
AUVY	ThinkSystem HHHL PX04PMC 3.84TB Mainstream NVMe PCIe 3.0 x4 Flash Adapter	4
AXCA	ThinkSystem Toolless Slide Rail	1
AURD	ThinkSystem 2U left EIA Latch Standard	1
AVWF	ThinkSystem 1100W (230V/115V) Platinum Hot-Swap Power Supply	2
6311	2.8m, 10A/100-250V, C13 to IEC 320-C14 Rack Power Cable	2
AUMD	ThinkSystem 2.5" PM1635a 800GB Mainstream SAS 12Gb Hot Swap SSD	4
AUUZ	ThinkSystem 2.5" Intel S3520 480GB Entry SATA 6Gb Hot Swap SSD	2
AURQ	Lenovo ThinkSystem 2U 3FH Riser BKT	1
AURP	Lenovo ThinkSystem 2U 2FH Riser BKT	1
AUNP	FBU345 SuperCap	1
AUQB	Lenovo ThinkSystem Mainstream MB - 2U	1
5977	Select Storage devices - no configured RAID required	1
AUSA	Lenovo ThinkSystem M3.5" Screw for EIA	4
AURR	ThinkSystem M3.5 Screw for Riser 2x2pcs and SR530/550/558 Planar 5pcs	4
B0ML	Enable TPM on MB	1
AVWK	ThinkSystem EIA plate with Lenovo logo	1
B0MJ	Enable TPM 1.2	1
AUTA	XCC Network Access Label	1
AUSZ	MS 2U Service label LI	1
AUSQ	On Board to 2U 8x2.5" HDD BP NVME Cable	1
AVEN	ThinkSystem 1X1 2.5" HDD Filler	2
AVEQ	ThinkSystem 8x1 2.5" HDD Filler	1
AWFF	ThinkSystem SR650 WW Lenovo LPK	1
AVJ0	ThinkSystem SR650/ST550/ST558 Super Cap Cable	1
AVJ2	ThinkSystem 4R CPU HS Clip	2
AUT1	ThinkSystem SR650 Lenovo Agency label	1
AUTU	Lenovo ThinkSystem 2U 24 2.5"HDD Conf HDD sequence label (4-7 NVMe)	1
AUT8	1100W RDN PSU caution label	1
9206	No Generic Preload Specify	1
AUTV	ThinkSystem large label	1
AUTD	SR650 G6 Label	1
AUTY	Lenovo ThinkSystem 2U 24 2.5"HDD Conf HDD sequence label (12-15)	1
AUTJ	ThinkSystem common Intel Label	1
AURY	Lenovo ThinkSystem PHY Module Dummy	1
AUSH	MS First 2U 8x2.5" HDD BP Cable Kit	1
AUSG	ThinkSystem SR650 6038 Fan module	1
AUSF	Lenovo ThinkSystem 2U MS CPU Performance Heatsink	2
A2HP	Configuration ID 01	1
AUSU	ThinkSystem Package for SR650	1
AWF9	ThinkSystem Response time Service label LI	1

Configuration Certification

DWFT Certification #2017-001	Lenovo ThinkSystem SR650 - 44TB DWFT Reference Architecture		Report Date: 9/20/2017		
DWFT Rev. 5.4					
System Provider	System Name	Processor Type	Memory		
	Lenovo ThinkSystem SR650	Intel Xeon Platinum 8176 (2/56/112) 2.1 GHz	768 GB		
Operating System		SQL Server Edition			
Windows Server 2016		SQL Server 2017 Enterprise Edition			
Storage Provider	Storage Information				
	4x 3.84 TB PCIe NVMe Flash adapters for data and tempdb 2x 480 GB SSD for OS (RAID 1) 4x 800 GB SSD for log (RAID 10)				
Primary Metrics					
Rated User Data Capacity ¹ (TB)	Row Store Relative Throughput ²	Column Store Relative Throughput ³	Maximum User Data Capacity ¹ (TB)		
44	342	620	54		
Row Store					
Relative Throughput ²	Measured Throughput (Queries/Hr/TB)	Measured Scan Rate Physical (MB/Sec)	Measured Scan Rate Logical (MB/Sec)	Measured I/O Throughput (MB/Sec)	Measured CPU (Avg.) (%)
342	410	8,484	11,657	10,070	92
Column Store					
Relative Throughput ²	Measured Throughput (Queries/Hr/TB)	Measured Scan Rate Physical (MB/Sec)	Measured Scan Rate Logical (MB/Sec)	Measured I/O Throughput (MB/Sec)	Measured CPU (Avg.) (%)
620	4,033	3,232	N/A	N/A	97
The reference configuration is a 2 socket system rated for 25TB using SQL Server 2014 and the DWFT V4 methodology					
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.					

High performance
and low cost with
the Lenovo
ThinkSystem
SR650 server and
Lenovo NVMe
Enterprise Flash
Adapters



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 DWFT – 44TB, contact your Lenovo Business Partner or visit:

www.lenovo.com/systems/solutions

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