SOLUTION BRIEF

Intel® Select Solutions
Enterprise Data Center Infrastructure
April 2019

Intel® Select Solutions for Microsoft SQL Server* Enterprise Data Warehouse

Extract powerful insights from big data using validated data warehouse solutions.

The need to digitally transform is a given in today's business world. What isn't always so obvious is that digital transformation requires organizations to grow and make use of their data assets. This requirement, in turn, necessitates an infrastructure that can handle exponential growth in datasets and that can make data available for analysis within seconds of creation. Ideally, organizations need an infrastructure that can scale and grow with their data volumes and their ongoing needs. Companies that meet these requirements are ready to digitally transform, uncover new ways to create and capture value, and expand into new customer segments.

A key to unlocking the value of company data more quickly and easily is available with Intel® Select Solutions for Microsoft SQL Server* Enterprise Data Warehouse (run on Windows Server*), optimized for hybrid transactional/analytical processing (HTAP). Microsoft SQL Server, running on Windows Server 2016 Standard edition or higher, offers outstanding performance for data warehouse solutions, both for small to mid-sized businesses (SMBs) and for enterprise organizations. And Intel Select Solutions for SQL Server Enterprise Data Warehouse ensure that a company has validated hardware and software stacks that provide a fast path for taking advantage of big data—both structured and unstructured—massive data volumes, and rapid data analysis.

Intel Select Solutions for SQL Server Enterprise Data Warehouse (Run on Windows Server*)

Organizations of all sizes, and across all vertical industries, are awash in data. The data warehousing capabilities in SQL Server allow these organizations to take advantage of big data assets. SQL Server offers support for a range of business needs, from small data marts to large enterprise data warehouses, while reducing storage needs with enhanced data compression. It can easily scale for enterprise-grade relational data warehousing—and it can integrate with non-relational sources. By using SQL Server for data warehousing, organizations can gain fast, actionable insights and predictions from structured and unstructured data while protecting their data with layers of security.

Intel Select Solutions for SQL Server Enterprise Data Warehouse, running on Windows Server, are approved under the Microsoft Data Warehouse Fast Track* for SQL Server program. The Data Warehouse Fast Track program is a joint effort between Microsoft and hardware partners. Its goal is to help enterprise customers deploy data warehouse solutions with a recommended hardware configuration appropriate for the requirements of the workload with reduced risk, cost, and complexity.

Intel Select Solutions for SQL Server Enterprise Data Warehouse can help reduce the amount of time IT organizations spend evaluating, selecting, and purchasing optimized combinations of hardware components. They can also minimize the time required to deploy new infrastructure and deliver data warehousing performance that is optimized to a specific threshold across compute, storage, and networking resources on trusted Intel® technologies. Intel Select Solutions for SQL Server are optimized by Intel, Microsoft, and the server vendor, so IT organizations can deploy them with confidence.

Hardware Selections

Intel Select Solutions for SQL Server Enterprise Data Warehouse combine the Intel® Xeon® Scalable processor platform, Intel® Optane™ DC solid state drives (SSDs), the Intel® SSD Data Center Family, and the Intel® Ethernet 700 Series, so your business can quickly harness a reliable, comprehensive SQL Server Enterprise Data Warehouse deployment built on a performance-optimized infrastructure.

Intel and Microsoft chose the Intel Xeon Gold processor for the solutions because it provides an optimized balance of price and performance. Solutions incorporating the latest Intel Xeon Gold 6230 processors and Intel Xeon Gold 6248 processors deliver the same performance or incremental performance gains as compared to similarly configured solutions based on previous-generation Intel Xeon Scalable processors.

Low latency is paramount in a data warehouse solution; for this reason, both configurations use all-flash drives. The solutions feature the Intel SSD DC P4500 Series for the data drive and the Intel SSD DC P4600 Series with NVM Express* (NVMe*) or the Intel SSD DC S4600 Series (Serial ATA [SATA]) for the log drive. The higher performing solution exclusively features NVMe drives, with the Intel SSD DC P4500 Series for the data drive and the Intel® Optane™ SSD DC P4800X Series for the log drive.

Intel chose the Intel Ethernet 700 Series as the network interface for the Intel Select Solutions for SQL Server Enterprise Data Warehouse. The Intel Ethernet 700 Series of products delivers validated performance, is ready to meet high-quality thresholds for data resiliency and service reliability for most media types and port speeds, and is backed by extensive testing, validation, and worldwide product support.[1,2,3,4]

Verified Performance through Benchmark Testing

All Intel Select Solutions are verified to meet a specified minimum level of workload-optimized performance capabilities. For Intel Select Solutions for SQL Server Enterprise Data Warehouse, Intel and Microsoft chose the Data Warehouse Fast Track for SQL Server program benchmark method to validate the solutions' performance.

What Are Intel® Select Solutions?

Intel Select Solutions are verified hardware and software stacks that are optimized for specific software workloads across compute, storage, and network. The solutions are developed from deep Intel experience with industry solution providers, in addition to extensive collaboration with the world's leading data center and service providers.

To qualify as an Intel Select Solution, solution providers must:

1. Follow the software and hardware stack requirements outlined by Intel
2. Replicate or exceed Intel's reference benchmark-performance threshold
3. Publish a detailed implementation guide to facilitate customer deployment

Solution providers can develop their own optimizations to add further value to their solutions.

The Data Warehouse Fast Track for SQL Server program benchmark measures how efficiently a server extracts insights from big data and data warehouses—reporting the enterprise data warehouse capacity, in addition to the measured throughput for both rowstore and columnstore. In order to provide a meaningful representation of performance, results are reported as comparative queries per hour per terabyte of database size. See http://download.microsoft.com/download/F/8/6/F8654654-6784-48F5-83C0-2D46186EEC66/Data_Warehouse_Fast_Track_Reference_Guide_for_SQL_Server_2016_EN_US.pdf for further details.

Base and Plus Configurations

Intel Select Solutions for SQL Server Enterprise Data Warehouse are available in two configurations: "Base" and "Plus," as shown in Table 1. The Base configuration specifies the minimum required performance capability for an Intel Select Solution for SQL Server Enterprise Data Warehouse, and the Plus configuration provides one example of how system builders, system integrators, and solution and service providers can further optimize to achieve higher performance and capabilities. For example, businesses can realize up to 45 percent faster query performance per terabyte with 2.8x more data warehouse capacity per two-socket server when using the Plus configuration compared to using the Base configuration.[5]

Table 1. The Base and Plus configurations for Intel® Select Solutions for Microsoft SQL Server* Enterprise Data Warehouse (run on Windows Server*), optimized for HTAP

INGREDIENT	INTEL® SELECT SOLUTIONS FOR MICROSOFT SQL SERVER* ENTERPRISE DATA WAREHOUSE (RUN ON WINDOWS SERVER*) **BASE CONFIGURATION** FOR DATABASES UP TO 25 TB	INTEL SELECT SOLUTIONS FOR MICROSOFT SQL SERVER ENTERPRISE DATA WAREHOUSE (RUN ON WINDOWS SERVER) **PLUS CONFIGURATION** FOR DATABASES UP TO 70 TB
PROCESSOR	2 x Intel® Xeon® Gold 6132 processor (2.60 GHz, 14 cores/28 threads), Intel Xeon Gold 6230 processor (2.1 GHz. 20 cores), or a higher number Intel Xeon Scalable processor	2 x Intel Xeon Gold 6150 processor (2.70 GHz, 18 cores/36 threads), Intel Xeon Gold 6248 processor (2.5 GHz, 20 cores), or a higher number Intel Xeon Scalable processor
MEMORY	384 GB (24 x 16 GB 2,666 MHz DDR4 RDIMM)	768 GB (24 x 32 GB 2,666 MHz DDR4 RDIMM)
BOOT DRIVE	1 x Intel® Solid State Drive (SSD) DC S3520 Series, greater than or equal to 240 GB M.2 or 2.5-inch**	1 x Intel SSD DC S3520 Series, greater than or equal to 240 GB M.2 or 2.5-inch**
LOG DRIVE	2 x Intel SSD DC P4600/P4610 Series, 1.6 TB, NVM Express* (NVMe*) or 2 x Intel SSD DC S4600/S4610 Series, SATA	2 x Intel® Optane™ SSD DC P4800X Series, 375 GB, NVMe
DATA DRIVE	4 x Intel SSD DC P4500/P4510 Series, 2 TB, NVMe	6 x Intel SSD DC P4500/P4510 Series, 4 TB, NVMe
DATA NETWORK	10 Gb Intel® Ethernet Connection X722 with Intel Ethernet Connection OCP X527-DA2/DA4 or 10 Gb Intel® Ethernet Converged Network Adapter X710-DA2/DA4 or 40 Gb Intel Ethernet Converged Network Adapter XL710-QDA2	10 Gb Intel Ethernet Connection X722 with Intel Ethernet Connection OCP X527-DA2/DA4 or 10 Gb Intel Ethernet Converged Network Adapter X710-DA2/DA4 or 40 Gb Intel Ethernet Converged Network Adapter XL710-QDA2
MANAGEMENT NETWORK	Integrated 1 gigabit Ethernet (GbE)	Integrated 1 GbE
SOFTWARE	Windows Server 2016 Standard edition or higher SQL Server 2017 (.NET Framework 4.5* installed as part of SQL Server 2017)	Windows Server 2016 Standard edition or higher SQL Server 2017 (.NET Framework 4.5 installed as part of SQL Server 2017)
TRUSTED PLATFORM MODULE (TPM)	TPM 2.0 or Intel® Platform Trust Technology (Intel® PTT)	TPM 2.0 or Intel PTT
FIRMWARE AND SOFTWARE OPTIMIZATIONS	Intel® Hyper-Threading Technology (Intel® HT Technology) enabled Intel® Turbo Boost Technology enabled Intel® Speed Shift technology, Hardware P-states (HWP) native Intel® Rapid Storage Technology enterprise (Intel® RSTe) for SATA** Intel NVMe drivers** C-states disabled Operating system power management and plan set for performance	Intel HT Technology enabled Intel Turbo Boost Technology enabled Intel Speed Shift technology, HWP native Intel RSTe for SATA** Intel NVMe drivers C-states disabled Operating system power management and plan set for performance

MINIMUM PERFORMANCE STANDARDS	Verified to meet or exceed the results below as measured by the Microsoft Data Warehouse Fast Track* for SQL Server program: • 25 TB user data capacity • 220 rowstore measured throughput (queries/hour/TB) • 2,670 columnstore measured throughput (queries/hour/TB)	Verified to meet or exceed the results below as measured by the Data Warehouse Fast Track for SQL Server program: • 70 TB user data capacity • 320 rowstore measured throughput (queries/hour/TB) • 3,440 columnstore measured throughput (queries/hour/TB)
BUSINESS VALUE OF CHOOSING A PLUS CONFIGURATION INSTEAD OF A BASE CONFIGURATION	Up to 45% faster query performance per TB with 2.8x more data warehouse capacity per two-socket server[5]	

**Recommended, not required

Technology Selections for Intel Select Solutions for SQL Server Enterprise Data Warehouse

In addition to the Intel hardware foundation, additional technologies provide further performance and security gains:

- **Intel® Platform Trust Technology (Intel® PTT) or a discrete TPM 2.0**: Protects the system start-up process by ensuring the boot hardware is tamper-free before releasing system control to the operating system. TPM 2.0 also provides secured storage for sensitive data, such as security keys and passwords, and performs encryption and hash functions.
- **Intel® Hyper-Threading Technology (Intel® HT Technology)**: Enables multiple threads to run on each core, which ensures that systems use processor resources more efficiently. Intel HT Technology also increases processor throughput, improving overall performance on threaded software.
- **Intel® Turbo Boost Technology**: Accelerates processor and graphics performance for peak loads, automatically allowing processor cores to run faster than the rated operating frequency when operating below power, current, and temperature specification limits.
- **Intel® Speed Shift technology**: Allows the processor to quickly select its best operating frequency and voltage for optimal performance and power efficiency without intervention from the operating system.
- **Power-management settings**: Operating system power-management settings are tuned for performance in Intel Select Solutions for SQL Server Enterprise Data Warehouse.

Intel® Xeon® Scalable Processors

Intel Xeon Scalable processors:

- Offer high scalability for enterprise data centers
- Deliver performance gains for virtualized infrastructure compared to previous-generation processors
- Achieve exceptional resource utilization and agility
- Enable improved data and workload integrity and regulatory compliance for data center solutions

The Intel Select Solutions for SQL Server Enterprise Data Warehouse feature Intel Xeon Gold processors.

Fast Track Your Data Warehouse with Intel Select Solutions for SQL Server Enterprise Data Warehouse

Intel Select Solutions for SQL Server Enterprise Data Warehouse, optimized for HTAP, are designed to simplify and accelerate the extraction of value from corporate data by using a modern data warehouse. Proven to scale with Intel Xeon Scalable processors, these pre-tuned and tested configurations are workload-optimized and let organizations deploy the optimum data warehouse infrastructure quickly and with less tuning.

Visit intel.com/selectsolutions to learn more, and ask your infrastructure vendor for Intel Select Solutions.

Learn More

Data warehousing with SQL Server: **microsoft.com/en-us/sql-server/data-warehousing**

Intel Select Solutions: **intel.com/selectsolutions**

Intel Xeon Scalable processors: **intel.com/xeonscalable**

Intel SSD Data Center Family:
intel.com/content/www/us/en/products/memory-storage/solid-state-drives/data-center-ssds.html

Intel Ethernet 700 Series: **intel.com/ethernet**

Intel and Microsoft alliance: **intel.com/content/www/us/en/big-data/intel-microsoft-partnership.html**

Discover how advanced analytics can help transform your business: **intel.com/analytics**

Intel Select Solutions are supported by Intel® Builders: **http://builders.intel.com**. Follow us on Twitter: **#IntelBuilders**

[1] The Intel® Ethernet 700 Series includes extensively tested network adapters, accessories (optics and cables), hardware, and software, along with broad operating system support. A full list of the product portfolio's solutions is available at intel.com/ethernet. Hardware and software is thoroughly validated across Intel® Xeon® Scalable processors and the networking ecosystem. The products are optimized for Intel® architecture and a broad operating system ecosystem: Windows*, Linux* kernel, FreeBSD*, Red Hat* Enterprise Linux (RHEL*), SUSE*, Ubuntu*, Oracle Solaris*, and VMware ESXi*.

[2] Intel® Ethernet 700 Series network adapters are backed with global support infrastructure for customers pre- and post-sales.

[3] Intel® Ethernet 700 Series network adapters' supported connections and media types are direct-attach copper and fiber SR/LR (QSFP+, SFP+, SFP28, XLPPI/CR4, 25G-CA/25G-SR/25G-LR), twisted-pair copper (1000BASE-T/10GBASE-T), and backplane (XLAUI/XAUI/SFI/KR/KR4/KX/SGMII). Note that Intel is the only vendor offering the QSFP+ media type.

[4] Intel® Ethernet 700 Series network adapters' supported speeds include 1 GbE, 10 GbE, 25 GbE, and 40 GbE.

[5] Intel internal testing as of July 7, 2018. **Base configuration**: one node, 2 x Intel® Xeon® Gold 6132 processor, Intel® Server Board S2600WFT, total memory: 384 GB, 24 slots/16 GB/2,666 megatransfers per second (MT/s) DDR4 RDIMM, Intel® Hyper-Threading Technology (Intel® HT Technology) enabled, Intel® Turbo Boost Technology enabled; storage (boot): 240 GB Intel® SSD 540s Series M.2 SATA III, storage (data drive): 4 x 2 TB Intel SSD DC P4500 Series Peripheral Component Interconnect Express* (PCIe*) with NVM Express* (NVMe*), storage (log drive): 2 x 1.6 TB Intel SSD DC P4600 Series PCIe with NVMe, 2 x 480 GB Intel® SSD DC S4600 Series Serial ATA (SATA); network devices: 1 x dual-port 10 Gb Intel® Ethernet Converged Network Adapter X710, network speed: 10 GbE, ucode: 0x043, OS/software: Windows Server 2016* Data Center edition with SQL Server 2017* Enterprise edition. **Plus configuration**: one node, 2 x Intel Xeon Gold 6150 processor, Intel Server Board S2600WFT, total memory: 768 GB, 24 slots/32 GB/2,666 MT/s DDR4 RDIMM, Intel HT Technology enabled, Intel Turbo Boost Technology enabled; storage (boot): 240 GB Intel SSD 540s Series M.2 SATA III, storage (data drive): 6 x 4 TB Intel SSD DC P4500 Series PCIe with NVMe, storage (log drive): 2 x 375 GB Intel® Optane™ SSD DC P4800X Series PCIe with NVME; network devices: 1 x dual-port 10 Gb Intel Ethernet Converged Network Adapter X710, network speed: 10 GbE, ucode: 0x043, OS/software: Windows Server 2016 Data Center edition with SQL Server 2017 Enterprise edition.

Performance results are based on testing as of July 7, 2018, and may not reflect all publicly available security updates. See configuration disclosure for details. No product can be absolutely secure.

Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark* and MobileMark*, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. For more complete information visit intel.com/benchmarks.

Cost reduction scenarios described are intended as examples of how a given Intel- based product, in the specified circumstances and configurations, may affect future costs and provide cost savings. Circumstances will vary. Intel does not guarantee any costs or cost reduction.

Results have been estimated or simulated using internal Intel analysis or architecture simulation or modeling, and provided to you for informational purposes. Any differences in your system hardware, software or configuration may affect your actual performance.

Intel does not control or audit third-party benchmark data or the web sites referenced in this document. You should visit the referenced web site and confirm whether referenced data are accurate.

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