Solution Brief

Intel® Xeon® D-2700 Processors
Intel® Xeon® D-1700 Processors

Optimized Performance, Efficiency, and Density for Enterprise Storage Servers

Intel® Xeon® D-2700 and D-1700 processors help modernize network storage infrastructures for throughput, flexibility, and cost-efficiency. Highly integrated system-on-chip (SoC) designs reduce power consumption and are ideally suited to dense storage environments, inside or outside the data center.

As enterprise data volumes continue to rise dramatically, organizations are compelled to improve the performance, flexibility, and cost-efficiency of their storage infrastructures. Such innovation is critical as the installed base of storage capacity grows at a projected annual rate of about 19 percent,[1] which corresponds to the global data storage capacity doubling in size roughly every four years.

Open-standards storage servers based on Intel® architecture deliver advanced functionality to improve storage throughput, availability, and security. The Intel Xeon D-2700 and D-1700 SoCs target density-optimized server implementations, including enterprise storage. The platform's two package variants provide varying levels of resources that improve dramatically on predecessor platforms and enable storage architects to balance performance, cost, and power consumption for specific implementations.

- **High Core Count: Intel Xeon D-2700 processors**. With 4 to 20 cores, this SoC targets dense storage implementations with demanding requirements such as high data throughput and advanced data handling. Operating at a thermal design power (TDP) of 64 to 125 watts, the package supports higher memory capacity, more memory channels, and more PCIe lanes than Intel Xeon D-1700 processors. Intel Xeon D-2700 processors are an upgrade to Intel Xeon D-2100 processors.
- **Low Core Count: Intel Xeon D-1700 processor**. With 2 to 10 cores, this SoC is optimized for cost-effective storage deployments that have moderate throughput and data-handling requirements. The package operates at a TDP of 25 to 85 watts, providing substantially lower power consumption than Intel Xeon D-2700 processors. Intel Xeon D-1700 processors are an upgrade to Intel Xeon D-1500 and D-1600 processors.

Performance Optimized (High Core Count)

Intel® Xeon® D-2100 processors (52.5 mm x 45 mm package)

Ethernet Throughput from 40GbE (Intel® Xeon® D Processor D-2100) to 100GbE (Intel® Xeon® Processor D-2700)

Ethernet Connectivity from 4x 10GbE (Intel® Xeon® D Processor D-2100) to 2x 100GbE (Intel® Xeon® Processor D-2700)

Memory Bandwidth from 2900 Mtps (Intel® Xeon® D Processor D-2100) to 3200 Mtps (Intel® Xeon® Processor D-2700)

PCIe Throughput from PCIe 3.0 (Intel® Xeon® D Processor D-2100) to PCIe 4.0 (Intel® Xeon® Processor D-2700)

Intel® Xeon® D-2700 processors (52.5 mm x 45 mm package)

Cost and Power Optimized (Low Core Count)

Intel® Xeon® D-1500 & D-1600 processors (37.5 mm x 37.5 mm package)

Ethernet Throughput from 20GbE (Intel® Xeon® D Processor D-1500) to 25GbE (Intel® Xeon® Processor D-1700)

Ethernet Connectivity from 2x 10GbE (Intel® Xeon® D Processor D-1500) to up to 2x 25GbE (Intel® Xeon® Processor D-1700)[2]

Memory Bandwidth from 2400 Mtps (Intel® Xeon® D Processor D-1500) to 2933 Mtps (Intel® Xeon® Processor D-1700)

PCIe Throughput from PCIe 3.0 (Intel® Xeon® D Processor D-1500) to PCIe 4.0 (Intel® Xeon® Processor D-1700)

Intel® Xeon® D-1700 processors (45 mm x 45 mm package)

The Intel Xeon D-2700 and D1700 processors have compatible instruction set architectures, both with each other and with other Intel platforms, including Intel Xeon Scalable processors. This factor allows for compatibility of storage software across the enterprise, helping ensure operational efficiency for development organizations.

Complementary Intel® Architecture for the Storage Subsystem

The Intel® Xeon® D-2700 and D-1700 processors are engineered in conjunction with other Intel® technologies, including storage hardware. The Intel® SSD Data Center Family enhances TCO for local storage, reducing performance bottlenecks and providing long-term reliability and endurance.

SoC Integration for Modernized Enterprise Storage

The highly integrated design of the Intel Xeon D-2700 and D-1700 processors is well suited to density-optimized storage implementations, delivering advanced capabilities for data protection and high processor throughput while helping reduce system complexity and power consumption. The SoC package incorporates system components directly on the chip, enabling faster data transfers compared to the system bus.

Hardware Acceleration for Storage Encryption and Compression

Cryptographic and compression/decompression workloads that are common in enterprise storage implementations typically consume significant processing resources that could otherwise be applied to other work. Accelerating those functions therefore increases overall processor throughput. Intel® QuickAssist Technology (Intel® QAT) offloads computations associated with crypto and compression to dedicated hardware acceleration engines that accelerate operations and free up processor resources.

Intel QAT is integrated into the Intel Xeon D-2700 and D-1700 processors for enhanced efficiency compared to implementations on discrete hardware devices such as PCIe cards. Integrated Intel QAT gen 3 with in-line IPsec processing[2] in the Intel Xeon D-2700 processors provides up to 100 Gbps crypto and up to 70 Gbps compression. Integrated Intel QAT gen 2 in the Intel Xeon D-1700 processors provides up to 20 Gbps crypto and up to 15 Gbps compression.

Intel® AES New Instructions (Intel® AES-NI) enhance the speed and security of encryption and decryption operations on bulk storage data that use the advanced encryption standard (AES). The instructions enable developers to accelerate key parts of the AES algorithm in hardware and to improve security by eliminating the use of software lookup tables and reducing code size, both of which reduce the attack surface.

Protecting Secrets with Intel® Software Guard Extensions (Intel® SGX)

The Intel® Xeon® D-2700 and D-1700 processors protect application secrets such as encryption keys, passwords, and restricted data in secure execution enclaves. These protected memory regions are encrypted using hardware-resident keys that are inaccessible by software, making the data they contain viewable in cleartext only within the enclave itself, beyond the reach of untrusted code, processors, or users, regardless of their security level.

Integrated Intel® Ethernet

The integration of Intel® Ethernet into the Intel Xeon D-2700 and D-1700 processor package enhances power efficiency, with up to 100 Gbps of throughput and connectivity links that can effortlessly scale from 1 to 100 Gbps. The platform enhances storage networking with Remote Direct Memory Access (RDMA) to bypass the OS during memory transfers between systems, increasing throughput and reducing processor overhead and latency.

RDMA capabilities include support for both Internet Wide Area RDMA Protocol (iWARP) and RoCEv2 (RDMA over Converged Enhanced Ethernet). This flexibility of transport protocols enables storage architects to implement their topologies of choice with high efficiency. Additional integrated Intel Ethernet features that explicitly benefit storage platforms include the following:

- **Application Device Queues (ADQ)** enable an application to reserve any number of dedicated Intel Ethernet hardware queues, helping ensure predictable performance for storage workloads.
- **Dynamic Device Personalization (DDP)** supports multiple profiles that each specify optimizations and packet-handling parameters for specific traffic types, for increased throughput and enhanced traffic prioritization.

Intel® Platform Storage Extensions for Stability, Efficiency, and Performance

Intel® Platform Storage Extensions is a set of hardware technologies that work together to accelerate data movement, protect data, and simplify data management. This section describes the specific features and capabilities that are included under that umbrella, which add intelligence and flexibility to enterprise storage.

Asynchronous DRAM Refresh (ADR)

To preserve critical transient and in-flight data, ADR stores all pending writes from the memory controller on non-volatile memory such as a flash device in the event of a power failure. When the technology detects system power loss, it automatically triggers a hardware interrupt to the memory controller that flushes the processor's write-protected data buffers and protects that data.

Non-transparent Bridge (NTB)

To provide real-time data mirroring and fast failover, NTB binds storage nodes together using high-bandwidth PCIe connections over an internal backplane using the nodes' NTB ports. Each node has a window into its redundant node's memory space that enables dynamic data redundancy without incurring processor overhead. NTB helps enterprises protect quality of service (QoS) for critical transactions with minimal resource requirements.

Intel® QuickData Technology

To speed up memory accesses and reduce computational overhead, Intel QuickData technology uses a dedicated direct memory access (DMA) engine to move data directly between I/O devices and system memory, bypassing the processor. Freeing up compute resources during read/write operations makes them available for other work, increasing overall processor throughput. Intel QuickData Technology enables fast memory mirroring between compute nodes.

PCIe Dual Cast

To optimize the use of PCIe bandwidth, PCIe dual cast technology enables a network switch to duplicate packets and deliver them to two destinations simultaneously, so the original source makes just one transmission instead of two. This feature improves efficiency of mirrored data scenarios, for example. PCIe dual cast enhances the effective throughput from the 32 and 16 lanes of PCIe 4.0 respectively supported by the Intel Xeon D-2700 and D-1700 processors.

Intel® Volume Management Device (Intel® VMD) 2.0

To enable direct control and management of NVMe SSDs from the PCIe bus, Intel VMD uses x16 groupings of PCIe lanes to emulate integrated host bus adapters (HBAs). Intel VMD supports enterprise-class SSD management such as error isolation from the host OS, SSD hot-pluggability, standardized LED management, and bootable RAID. It aggregates storage devices and maximizes processor access to data without disrupting the operation of enterprise storage.

Intel® Virtual RAID on CPU (Intel® VROC) 7.x

To extend RAID functionality to processor-attached NVMe SSDs without additional hardware, Intel VROC directly connects those SSDs to the platform using existing PCIe lanes and Intel VMD. Creating RAID arrays without HBAs reduces component costs, system complexity, and power requirements. This topology also improves RAID performance in terms of reduced transfer latency by removing the HBA hop from the critical I/O path.

IDC Calls for More Storage to Store Data[3]

The 2021 IDC StorageSphere forecast notes that the data created in the next five years will be double the amount created since the advent of digital storage, but the proportion of that data that is stored and retained is moving steadily downward. The study recommends that organizations deploy more storage to achieve three main goals:

- **Resiliency**, to adapt to business disruptions and benefit from changing conditions.
- **Innovation**, to affirm business direction and identify new potential revenue streams.
- **Awareness**, to maintain trust and empathy with employees, partners, and customers.

Optimized Performance for Storage Software

To realize the throughput and latency advantages of high-speed SSD media relative to mechanical hard disk drives, enterprises must make corresponding increases in storage software performance. To enable solutions that benefit from the full Intel stack of processor, storage, and networking technologies, Intel created a set of drivers and reference architectures that are collectively known as the Storage Performance Development Kit (SPDK). Available to the open source community, the SPDK helps storage solutions increase I/O operations per second without additional hardware.

The SPDK runs driver code at the user level, rather than in the kernel, eliminating the performance overhead associated with kernel context switches and interrupts. That streamlining accelerates critical storage algorithms such as deduplication, encryption, and compression by avoiding kernel operations that target general-purpose computing use cases and are not required in a dedicated storage environment. The SPDK also implements poll mode drivers (PMDs), which enable applications to perform other work while reads and writes are completed, rather than sleeping during those operations and being woken by overhead-inducing processor interrupts.

The Intel® Intelligent Storage Library (Intel® ISA-L) provides tools for developers to accelerate and optimize storage applications on Intel platforms, including the Intel Xeon D-2700 and D-1700 processors. The library helps minimize disk space use and maximize storage throughput, security, and resilience. Optimized functions for storage applications accelerate operations for RAID, erasure code, cyclic redundancy check (CRC) functions, cryptographic hash, encryption, and compression.

Conclusion

The Intel Xeon D-2700 and D-1700 processors optimize performance, cost, and power consumption for enterprise storage servers, with the flexibility to scale to the needs of individual implementations. The highly integrated SoC platform helps reduce system complexity and increase efficiency. It helps improve storage solutions with hardware-based workload acceleration, advanced data handling, and an updated set of Intel Platform Service Extensions to enhance workload stability, efficiency, and throughput. Intel Xeon D-2700 and D-1700 processors are the foundation for forward-looking enterprise storage infrastructure.

More Information: www.intel.com/xeond

[1] Statista, June 7, 2021. "Volume of data/information created, captured, copied, and consumed worldwide from 2010 to 2025." https://www.statista.com/statistics/871513/worldwide-data-created/, retrieved December 2, 2021.

[2] Availability varies by SKU.

[3] FutureCIO, March 26, 2021. "IDC calls for more storage to store data." https://futurecio.tech/idc-calls-for-more-storage-to-store-data/, retrieved December 2, 2021.

Features, SKUs, and frequencies are preliminary and subject to change.

Performance varies by use, configuration, and other factors. Learn more at https://www.intel.com/PerformanceIndex.

Performance results are based on testing as of dates shown in configurations and may not reflect all publicly available updates. See configuration disclosure for configuration details. No product or component can be absolutely secure.

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