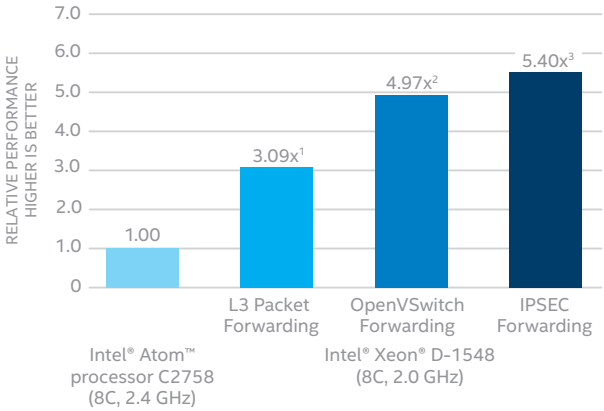
PRODUCT BRIEF
Intel® Xeon® Processor D-1500 Product Family

EXTENDING INTELLIGENCE TO THE EDGE

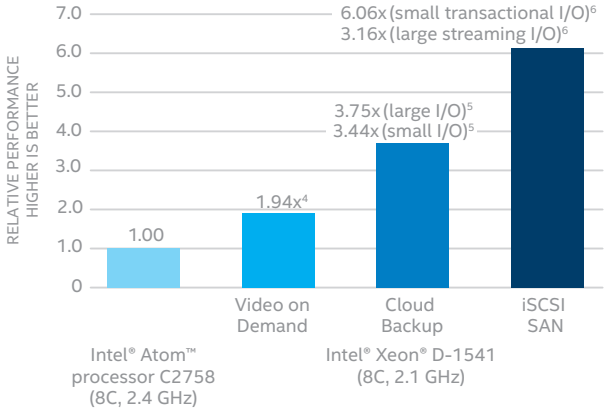
As communication service providers, enterprise IT, and cloud service providers seek to speed new service delivery and handle exponential growth in the number of users accessing their services, it is essential that they optimize infrastructure for density and cost, both in the data center and at the network edge. Inefficient data center scaling drives up space and cost and increases environmental impact, while fixed function, proprietary devices at the network edge hinder the ability of IT to rapidly deploy and manage new services.

The Intel® Xeon® processor D family offers new options for infrastructure optimization, by bringing the performance and advanced intelligence of Intel® Xeon® processors into a dense, lower-power system-on-a-chip. The Intel Xeon processor D family is Intel's 3rd generation 64-bit System-on-a-Chip (SoC) and the first SoC based on Intel Xeon processor technology. It can be deployed for a variety of workloads including network routing, wireless base stations, warm storage, industrial Internet of Thing (IoT), dynamic web serving, and more.

Network Performance



Storage Performance



UP TO 5.4X BETTER NETWORK AND 6X BETTER STORAGE PERFORMANCE THAN INTEL® ATOM™ PROCESSOR C2000 FAMILY

The Intel® Xeon® processor D-1500 product family provides up to 5.4x the networking performance[3,7] and up to 6x the storage performance[6,9] of the Intel® Atom™ processor C2750.

Based on Intel's industry-leading 14 nm silicon technology, the Intel® Xeon® processor D-1500 product family is the first offering of a line of processors that will address a broad range of low-power, high-density infrastructure needs.

Currently available with 4 and 8 cores—with 12 and 16 core version coming in the first quarter of 2016—and 128 GB of addressable memory, this system on a chip (SoC) has an integrated platform controller hub (PCH), integrated I/O, two integrated 10 Gigabit Intel® Ethernet ports, and a thermal design point (TDP) of 20 watts to 45 watts. It can run the same instruction set as more robust Intel Xeon processors to provide software consistency from the data center to the network edge. It also provides advanced server-class capabilities, including:

- **Built-in Hardware Virtualization** to enable dynamic provisioning of services as communication service providers extend network functions virtualization (NFV) to the network edge.
- **Intel x86 64-bit Software Support** for scalable performance and broad application compatibility.
- **Enhanced Reliability, Availability, and Serviceability (RAS) features**, including support for error-correcting code (ECC) memory and platform-level error management and resilience.
- **Intel® Platform Storage Extensions** to enable smarter and more cost-effective storage solutions through integrated technologies that accelerate data movement, protect data, and simplify data management.
- **Fast Encryption and Decryption** Intel® Advanced Encryption Standard New Instructions (Intel® AES-NI) accelerates data encryption and decryption for secure web sites.

Extending Intelligence to the Network Edge

As Network traffic volume and complexity increases, operators must both optimize their infrastructure and increase value-added services to drive revenue. This requires more compute capability at all points of the network including the edge.

These highly scalable, compact, and energy efficient SoCs are an ideal solution for equipment makers seeking the best performance per watt. The high level of integration including two integrated 10 GbE Ethernet ports and support for hardware-assisted virtualization makes this a very attractive option for wireless base stations, routers and switches, security and network appliances, as well as the build-out of Software Defined Networking (SDN) and Network Functions Virtualization (NFV).

For switching, they offer an up to 4.97x performance improvement[2] over the Intel Atom processor C2758 on packet forwarding under virtual machines using the OpenVSwitch benchmark. For routers, they offer up to 3.09x performance improvement[1] over the Intel Atom processor C2758 on Layer 3 packet forwarding. And for security appliances, they offer up to 5.4x performance improvement[3] over the Intel Atom processor C2758 on IP Security Forwarding (IPSEC).

Intelligent, High-Efficiency Storage for the Data Center and Beyond

With Intel® Platform Storage Extensions, the Intel Xeon processor D family offers new intelligence for dense, low-power storage solutions that can be deployed in or out of the data center. Non-transparent bridging (NTB) enables high-speed connectivity among Intel Xeon processor-based platforms for failover support; Asynchronous DRAM Self-Refresh (ADR) helps to protect data in the event of a power outage; and Intel® QuickData technology offloads memory accesses to the SoC for fast data movement with low processor overhead.

For cloud backup, they offer an up to 3.44x performance improvement[5] over the Intel Atom processor C2758 on small I/O and up to 3.75x for large I/O. For video on demand (VOD), they offer up to 1.94x performance improvement[4] over the Intel Atom processor C2758. And for iSCSI SAN, they offer an up to 6.06x performance improvement[6] over the Intel Atom processor C2758 on small transactional I/O and up to 3.16x for large I/O.

Ideal for Lightweight Hyperscale Workloads

The Intel Xeon processor D family provides excellent performance and software compatibility in a low-power SoC, for microservers that can efficiently process lightweight, hyperscale workloads in cloud service provider data centers and dedicated hosting company data centers.

These SoCs offer a significant step up from the Intel® Atom™ processor C2750 SoC, delivering up to 3.4 times the performance per node[7,8] and up to 1.7x estimated better performance per watt.[9,10] With exceptional node performance, up to 12 MB of last level cache, and support for up to 128 Gigabytes of high-speed DDR4 memory, these SoCs are ideal for emerging lightweight hyper-scale workloads, including memory caching, dynamic web serving, and dedicated hosting.

More to Come

The 4- and 8-core SoCs of the Intel Xeon processor D-1500 product family are available today with 12 core, 16 core, and extended temperature versions coming in the first quarter of 2016. Visit www.intel.com/xeond for the latest information.

INTEL® XEON® PROCESSOR D PRODUCT FAMILY OVERVIEW

Intel® Xeon® Processor Intelligence in a Low-Power SoC	Up to 5.4x the networking performance[8,3] and up to 6.06x the storage performance[8,6] of the Intel® Atom™ processor C2750. Includes up to 16 cores (coming first quarter 2016), two integrated ports of 10 Gigabit Intel® Ethernet, plus support for up to 128 GB of memory. Also includes Intel® 64-bit software support,[9] L1 cache (32K data, 32K instructions per core), L2 cache (256K per core), LLC cache (1.5 MB per core), Intel® Turbo Boost Technology,[9] and Intel® Hyper-Threading Technology.[9]
Industry-Leading 14 nm Process Technology	Enables dense, low power system designs with thermal design points of ~20W to 45W and system level performance per watt of up to 1.7x that of Intel Atom processor C2750-based solutions[7,10].
Built-In Intel® Virtualization Technology	Delivers near-native compute and I/O performance in virtualized data centers, network infrastructure, and cloud computing, with advanced monitoring of cache and memory bandwidth for better service level and infrastructure management.
Server-Class Reliability, Availability, and Serviceability (RAS)	Provides high system reliability and data integrity with support for error correction code (ECC) memory, single device data correction (SDDC), memory demand and patrol scrubbing, and much more.
Hardware-Enhanced Security and Compliance	Intel Advanced Encryption Standard New Instructions (Intel AES-NI) provide integrated support for fast, low-overhead encryption and Intel® Trusted Execution Technology (Intel® TXT) provides platform verification (through authenticated boot) to enable strong security with reduced performance impact.
Server-Class Manageability	Includes Intel® Node Manager Base for adaptive power management.
Intel® Platform Storage Extensions	Enables fast data movement and high availability through integrated support for non-transparent bridging (NTB), asynchronous DRAM self-refresh (ADR), and Intel® QuickData technology, which provides a direct memory access (DMA) engine within the SoC.

INTEL® XEON® PROCESSOR D-1500 PRODUCT FAMILY SKU LIST

Processor Number (Standard SKUs)	CPU Cores	Memory Speed	CPU Speed	Max. DRAM Capacity	Intel Ethernet	Power
Intel® Xeon® processor D-1577	16	DDR4-2400	1.30 GHz	128 GB	2 x 10 GbE	45 W
Intel® Xeon® processor D-1571	16	DDR4-2400	1.30 GHz	128 GB	2 x 10 GbE	45 W
Intel® Xeon® processor D-1567	12	DDR4-2400	2.10 GHz	128 GB	2 x 10 GbE	65 W
Intel® Xeon® processor D-1557	12	DDR4-2400	1.50 GHz	128 GB	2 x 10 GbE	45 W
Intel® Xeon® processor D-1548	8	DDR4-2400	2.00 GHz	128 GB	2 x 10 GbE	45 W
Intel® Xeon® processor D-1541	8	DDR4-2400	2.10 GHz	128 GB	2 x 10 GbE	45 W
Intel® Xeon® processor D-1537	8	DDR4-2133	1.70 GHz	128 GB	2 x 10 GbE	35 W
Intel® Xeon® processor D-1531	6	DDR4-2133	2.20 GHz	128 GB	2 x 10 GbE	45 W
Intel® Xeon® processor D-1528	6	DDR4-2133	1.90 GHz	128 GB	2 x 10 GbE	35 W
Intel® Xeon® processor D-1527	4	DDR4-2133	2.20 GHz	128 GB	2 x 10 GbE	35 W
Intel® Xeon® processor D-1521	4	DDR4-2133	2.40 GHz	128 GB	2 x 10 GbE	45 W
Intel® Xeon® processor D-1518	4	DDR4-2133	2.20 GHz	128 GB	2 x 10 GbE	35 W

[1] Up to 3.09x on L3 Packet Forwarding. New Configuration: Intel® Xeon Processor D-based reference platform with one Intel® Xeon® D-1548 (8C, 2.0GHz), Turbo Boost disabled, Hyper-Threading enabled, 16GB memory (2x8GB DDR4-2400 RDIMM ECC), 2x Quad port X520 (8x10GbE), Ubuntu* 12.04 (3.2.553.2.0-23-generic), Intel DPDK 1.7.0, 64B L3 forwarding=92.6MPackets/s, 1518B L3 forwarding=80Gb/s. Base Configuration: Intel Atom Processor C2000-reference platform based platform with one Intel Atom Processor C2758 (8C, 2.4GHz), 32GB memory (4x8GB DDR3-1600 SO-DIMM ECC), 2x Dual port X520 (4x10GbE), Fedora* Core 16 (Verne) x86_64 (3.1.0-7.fc16.x86_64), Intel DPDK 1.3.0-183, 64B L3 forwarding=30MPackets/s, 1518B L3 forwarding=40Gb/s

[2] Up to 4.97x on Packet Forwarding under VM using OpenVSwitch. New Configuration: Intel® Xeon Processor D-based reference platform with one Intel® Xeon® D-1548 (8C, 2.0GHz), Turbo Boost disabled, Hyper-Threading enabled, 32GB memory (2x16GB DDR4-2400 RDIMM ECC, Integrated X522 (2x10GbE) ports, Fedora core 21 x86_64, OVS Release 2.4 with DPDK acceleration. Forwarding rate under Virtual Machine (256B packet size)= 3.8 MPackets/s. Base Configuration: Intel Atom Processor C2000-reference platform based platform with one Intel Atom Processor C2758 (8C, 2.4GHz), 16GB memory (2x8GB DDR3-1600 DIMM), 1x Dual port X520 (2x10GbE), Fedora* Core 21 x86_64, , OVS Release 2.4 with DPDK acceleration. Forwarding rate under Virtual Machine (256B packet size= 0.76 MPackets/s

[3] Up to 5.4x on IPSEC Forwarding. New Configuration: Intel® Xeon Processor D-based reference platform with one Intel® Xeon® D-1548 (8C, 2.0GHz), Turbo Boost disabled, Hyper-Threading enabled, 16GB memory (2x8GB DDR4-2133 RDIMM ECC), 2x Quad port X520 (8x10GbE), Intel® Quick Assist Adapter 8950-SCCP, Fedora* Core 16 (Verne) x86_64, Wind River INP-3.4, Quickassist L1.3.0_90, DPDK Revision L.1.4.0-30. IPSec forwarding rate (1024B Ethernet clear text packet size)= 37.4 Gbits/s. Base Configuration: Intel Atom Processor C2000-reference platform based platform with one Intel Atom Processor C2758 (8C, 2.4GHz), 4GB memory (2x2GB DDR3-1600 DIMM), 1x Dual port X520 (4x10GbE), Fedora* Core 16 (Verne) x86_64, Wind River INP-3.4, Quickassist L1.3.0_90, DPDK Revision L.1.4.0-30. B IPSec forwarding rate (1024B Ethernet clear text packet size) =6.975 Gbits/s

[4] Up to 1.94x on Video on Demand. New Configuration: Intel® Xeon® processor D product family-based reference platform with one Intel Xeon processor D-1541 (8 cores, 2.1 GHz, 45 W), Turbo Boost Disabled, Hyper-Threading Enabled, 32 GB memory (2x16GB DDR4-2400 RDIMM ECC), 20x 4TB WD SATA 64MB cache, 2x LSI 9207 HBA, 2x 10GbE Bonded, Ubuntu 14.04.2 (3.16.0-30-generic x86_64), Swift 2.2.x, COSBench 4.2.x, 512 Workers- 4 Drivers- 1000C- 1000 Objects per container, 32MB 90%Reads 10% Writes= 943 MB/s Base Configuration: Intel® Atom processor C2000 reference platform with one Intel Atom processor C2750 (8C, 2.4GHz, 20W), Turbo Boost Disabled, Hyper-Threading Disabled, 16 GB memory (2x8GB DDR3-1600 RDIMM ECC), 10x 3TB WD SATA 64MB cache, 1x LSI 9207 HBA, 1x 10GbE, Ubuntu 14.04.2 (3.16.0-30-generic x86_64), Swift 2.2.x, COSBench 4.2.x, 512 Workers- 4 Drivers- 1000C- 1000 Objects per container, 32MB 90%Reads 10% Writes= 484 MB/s

[5] Up to 3.44x (small I/O) and up to 3.75x (large I/O) on Cloud Backup. New Configuration: Intel® Xeon® processor D product family-based reference platform with one Intel Xeon processor D-1541 (8 cores, 2.1 GHz, 45 W), Turbo Boost Disabled, Hyper-Threading Enabled, 32 GB memory (2x16GB DDR4-2400 RDIMM ECC), 20x 4TB WD SATA 64MB cache, 2x LSI 9207 HBA, 2x 10GbE Bonded, Ubuntu 14.04.2 (3.16.0-30-generic x86_64). Large I/O: Swift 2.2.x, COSBench 4.2.x, 512 Workers- 4 Drivers- 1000C- 1000 Objects per container, 32MB 10%Reads 90% Writes= 1480 MB/s. Small I/O: Ceph hammer , FIO 2.2.9, FIO- 40 RBDs- 4 Clients- 32 Queue Depth per RBD- 1 worker per RBD volume, 1MB Sequential10% Reads 90% Writes = 1359 MB/s. Base Configuration: Intel® Atom processor C2000 reference platform with one Intel Atom processor C2750 (8C, 2.4GHz, 20W), Turbo Boost Enabled, Hyper-Threading Disabled, 16 GB memory (2x8GB DDR3-1600 RDIMM ECC), 10x 3TB WD SATA 64MB cache, 1x LSI 9207 HBA, 1x 10GbE, Ubuntu 14.04.2 (3.16.0-30-generic x86_64). Large I/O: Swift 2.2.x, COSBench 4.2.x, 512 Workers- 4 Drivers- 1000C- 1000 Objects per container) 32MB 10%Reads 90% Writes)= 430 MB/s. Small I/O: Ceph hammer , FIO 2.2.9, FIO- 40 RBDs- 4 Clients- 32 Queue Depth per RBD- 1 worker per RBD volume, 1MB Sequential10% Reads 90% Writes = 361 MB/s

[6] Up to 3.16x (large streaming I/O) and up to 6.06x (small transactional I/O) on iSCSI SAN. New Configuration: Intel® Xeon® processor D product family-based reference platform with one Intel Xeon processor D-1541 (8 cores, 2.1 GHz, 45 W),Turbo Boost Disabled, Hyper-Threading Enabled, 32 GB memory (2x16GB DDR4-2400 RDIMM ECC), 4x Intel P3700 800 GB SSDs, 40GbE add-in network adapter (Intel XL710) + 20GbE, Ubuntu 14.04.2 (3.16.0-30-generic x86_64), FIO- 32 Queue Depth per iSCSI LUN- 8 connections per 10GbE- 1 connection per LUN- 1 worker per target, 4KB 100% Reads= 1060000 IO/s, 512KB 100% Reads= 7076 MB/s Base Configuration: Intel® Atom processor C2000 reference platform with one Intel Atom processor C2750 (8C, 2.4GHz, 20W), Turbo Boost Disabled, Hyper-Threading Disabled, 16 GB memory (2x8GB DDR3-1600 RDIMM ECC), 2x Intel P3700 800GB SSDs, 2x10GbE, Ubuntu 14.04.2 (3.16.0-30-generic x86_64), FIO- 32 Queue Depth per iSCSI LUN- 8 connections per 10GbE- 1 connection per LUN- 1 worker per target, 4KB 100% Reads= 175000 IO/s, 512KB 100% Reads= 2242 MB/s

[7] 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.

[8] Up to 3.4x better performance on Dynamic Web Serving. New Configuration: Intel® Xeon Processor D-based reference platform with one Xeon Processor D (8C, 1.9GHz, 45W, ES2), Turbo Boost Enabled, Hyper-Threading enabled, 64GB memory (4x16GB DDR4-2133 RDIMM ECC), 2x10GBase-T X552, 3x S3700 SATA SSD, Fedora* 20 (3.17.8-200.fc20.x86_64, Nginx* 1.4.4, Php-fpm* 15.4.14, memcached* 1.4.14, Simultaneous users=43844. Base Configuration: Supermicro SuperServer* 5018A-TN4 with one Intel Atom Processor C2750 (8C, 2.4GHz,20W), Turbo Boost Enabled, 32GB memory (4x8GB DDR3-1600 SO-DIMM ECC), 1x10GBase-T X520, 2x S3700 SATA SSD, Ubuntu* 14.10(3.16.0-23 generic), Nginx* 1.4.4, Php-fpm* 15.4.14, memcached* 1.4.14, Simultaneous users=12896.

[9] Intel technologies may require enabled hardware, specific software, or services activation. Check with your system manufacturer or retailer.

[10] Up to 1.7x (estimated) better performance per watt on Dynamic Web Serving. New Configuration: Intel® Xeon Processor D-based reference platform with one Xeon Processor D (8C, 1.9GHz, 45W, ES2), Turbo Boost Enabled, Hyper-Threading enabled, 64GB memory (4x16GB DDR4-2133 RDIMM ECC), 2x10GBase-T X552, 3x S3700 SATA SSD, Fedora* 20 (3.17.8-200.fc20.x86_64, Nginx* 1.4.4, Php-fpm* 15.4.14, memcached* 1.4.14, Simultaneous users=43844, Estimated wall power based on microserver chassis, power=90W, Perf/W=487.15 users/W. Base Configuration: Supermicro SuperServer* 5018A-TN4 with one Intel Atom Processor C2750 (8C, 2.4GHz,20W), Turbo Boost Enabled, 32GB memory (4x8GB DDR3- 1600 SO-DIMM ECC), 1x10GBase-T X520, 2x S3700 SATA SSD, Ubuntu* 14.10 (3.16.0-23 generic), Nginx* 1.4.4, Php-fpm* 15.4.14, memcached* 1.4.14, Simultaneous users=12896. Maximum wall power =46W, Perf/W=280.3 users/W.

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