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.

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The Intel® Xeon® processor D-1500 product family provides up to 5.4x the networking performance and up to 6x the storage performance of the Intel® Atom™ processor C2000 family.

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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 improvement² 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 improvement¹ over the Intel Atom processor C2758 on Layer 3 packet forwarding. And for security appliances, they offer up to 5.4x performance improvement³ 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 improvement⁵ 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 improvement⁴ over the Intel Atom processor C2758. And for iSCSI SAN, they offer an up to 6.06x performance improvement⁶ 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 node⁷,⁸ and up to 1.7x estimated better performance per watt⁹,¹⁰ 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\(^8\) and up to 6.0x the storage performance\(^6\) 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

<table>
<thead>
<tr>
<th>Processor Number (Standard SKUs)</th>
<th>CPU Cores</th>
<th>Memory Speed</th>
<th>CPU Speed</th>
<th>Max. DRAM Capacity</th>
<th>Intel Ethernet</th>
<th>Power</th>
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<td>2 x 10 GbE</td>
<td>35 W</td>
</tr>
</tbody>
</table>

On the Intel® Xeon® processor D product family, visit www.intel.com/xeond.
Up to 4.7x faster on Packet Forwarding under VM using OpenvSwitch. New Configuration: Intel® Xeon® Processor D-based reference platform with one Intel® Xeon® D-1548 (28C, 2.2GHz, Turbo Boost disabled, Hyper-Threading Disabled, 32 GB memory (2x16GB DDR4-2400 RDIMM ECC), 2x10T WD SATA 64MB cache, 1x LSI 9207 HBA, 2x10GBE Bonded, Ubuntu 14.04.2 (3.16.0-30-generic x86_64), Swift 2.2.2, COSBench 4.x, 512 Workers - 4 Drivers - 1000E - 1000 Objects per container, 175000 IO/s, 2242 MB/s Read, 2242 MB/s Write.

Up to 3.26x faster on Packet Forwarding with one Intel® Xeon® Processor D-based reference platform with one Intel® Xeon® Processor D-1541 (24C, 2.0GHz, 2x10T WD SATA 64MB cache, 1x LSI 9207 HBA, 2x10GBE Bonded, Ubuntu 14.04.2 (3.16.0-30-generic x86_64), Swift 2.2.2, COSBench 4.x, 512 Workers - 4 Drivers - 1000E - 1000 Objects per container, 175000 IO/s, 2242 MB/s Read, 2242 MB/s Write.

Up to 3.16x faster on Large I/O with one Intel® Xeon® Processor D-based reference platform with one Intel® Xeon® Processor D-1548 (32C, 1.9GHz, 2x10T WD SATA 64MB cache, 1x LSI 9207 HBA, 2x10GBE Bonded, Ubuntu 14.04.2 (3.16.0-30-generic x86_64), Swift 2.2.2, COSBench 4.x, 512 Workers - 4 Drivers - 1000E - 1000 Objects per container, 175000 IO/s, 2242 MB/s Read, 2242 MB/s Write.

Up to 3.14x faster on Small I/O with one Intel® Xeon® Processor D-based reference platform with one Intel® Xeon® Processor D-1548 (32C, 1.9GHz, 2x10T WD SATA 64MB cache, 1x LSI 9207 HBA, 2x10GBE Bonded, Ubuntu 14.04.2 (3.16.0-30-generic x86_64), Swift 2.2.2, COSBench 4.x, 512 Workers - 4 Drivers - 1000E - 1000 Objects per container, 175000 IO/s, 2242 MB/s Read, 2242 MB/s Write.

Up to 2.66x faster on packet forwarding rate under Virtual Machine (256 packet size) with one Intel® Xeon® Processor D-based reference platform with one Intel® Xeon® Processor D-1548 (32C, 2.0GHz, Turbo Boost disabled, Hyper-Threading Disabled, 32 GB memory (2x16GB DDR4-2400 RDIMM ECC), 2x10T WD SATA 64MB cache, 1x LSI 9207 HBA, 2x10GBE Bonded, Ubuntu 14.04.2 (3.16.0-30-generic x86_64), Swift 2.2.2, COSBench 4.x, 512 Workers - 4 Drivers - 1000E - 1000 Objects per container, 175000 IO/s, 2242 MB/s Read, 2242 MB/s Write.

Up to 2.54x faster on packet forwarding rate under Virtual Machine (256 packet size) with one Intel® Xeon® Processor D-based reference platform with one Intel® Xeon® Processor D-1548 (32C, 2.0GHz, Turbo Boost disabled, Hyper-Threading Disabled, 32 GB memory (2x16GB DDR4-2400 RDIMM ECC), 2x10T WD SATA 64MB cache, 1x LSI 9207 HBA, 2x10GBE Bonded, Ubuntu 14.04.2 (3.16.0-30-generic x86_64), Swift 2.2.2, COSBench 4.x, 512 Workers - 4 Drivers - 1000E - 1000 Objects per container, 175000 IO/s, 2242 MB/s Read, 2242 MB/s Write.

Up to 2.32x faster on packet forwarding rate under Virtual Machine (256 packet size) with one Intel® Xeon® Processor D-based reference platform with one Intel® Xeon® Processor D-1548 (32C, 2.0GHz, Turbo Boost disabled, Hyper-Threading Disabled, 32 GB memory (2x16GB DDR4-2400 RDIMM ECC), 2x10T WD SATA 64MB cache, 1x LSI 9207 HBA, 2x10GBE Bonded, Ubuntu 14.04.2 (3.16.0-30-generic x86_64), Swift 2.2.2, COSBench 4.x, 512 Workers - 4 Drivers - 1000E - 1000 Objects per container, 175000 IO/s, 2242 MB/s Read, 2242 MB/s Write.

Up to 2.07x faster on packet forwarding rate under Virtual Machine (256 packet size) with one Intel® Xeon® Processor D-based reference platform with one Intel® Xeon® Processor D-1548 (32C, 2.0GHz, Turbo Boost disabled, Hyper-Threading Disabled, 32 GB memory (2x16GB DDR4-2400 RDIMM ECC), 2x10T WD SATA 64MB cache, 1x LSI 9207 HBA, 2x10GBE Bonded, Ubuntu 14.04.2 (3.16.0-30-generic x86_64), Swift 2.2.2, COSBench 4.x, 512 Workers - 4 Drivers - 1000E - 1000 Objects per container, 175000 IO/s, 2242 MB/s Read, 2242 MB/s Write.