**PLATFORM BRIEF**
**Intel® Xeon® Processor C5500/C3500 Series and Intel 3420 Chipset**
Storage, Networking, and Embedded Applications

# Intel Xeon Processor C5500/C3500 Series–based Platform for Storage Applications

< View Video | Pause Video

## Product Overview

The Intel® Xeon® processor C5500/C3500 series has integrated storage features and world-class performance that make it ideal for enterprise storage applications. Based on the latest Intel microarchitecture (codenamed Nehalem), the Intel Xeon processor C5500/C3500 series represents a leap forward in Intel Xeon processor technology by lowering power, increasing performance-per-watt, and integrating key storage features. This processor series maintains the world-class performance of Nehalem while dropping power consumption and incorporating new features required by many storage applications.

The integrated storage features include non-transparent bridging (NTB), hardware redundant array of independent disks (RAID) acceleration, integrated PCI Express*, and asynchronous DRAM self-refresh (ADR). By integrating 16 lanes of PCI Express, RAID processing, and non-transparent bridging into the processor, the total number of chips required for an enterprise storage platform is reduced. As is typical with embedded Intel processors, extended lifecycle support and high TCase options for thermally constrained applications are also available.

## Integrated Storage Features

Enterprise storage solutions require high availability, which means that data must be always available, and there should be no single point of failure. The non-transparent bridging (NTB) logic inside the processor enables high availability by allowing two independent storage systems to be connected together over PCI Express. With two systems connected over NTB, data can be shared across the NTB link, enabling a situation where one system can continue operation in the event of a failure of the other system.

Another facet of high availability is implementing a RAID solution that allows a storage system to continue operation even in the event of a disk failure. RAID-5 and RAID-6 algorithms are compute intensive and can consume a majority of processor bandwidth. The Intel® Xeon® processor C5500/C3500 series integrates a hardware RAID engine that offloads the RAID calculations from the processor. By using the integrated RAID engine this frees up the processor to run other applications. Another advantage of using the integrated RAID engine is not having the processor read and write all of the storage data, which maximizes the processor cache efficiency.

Enterprise storage systems must be fault tolerant and able to recover from certain environmental issues, such as a power loss. Enterprise storage systems store data bound for disk drives into system memory (DDR), prior to writing it to disk, for performance reasons due to the fact that system memory is much faster than disk. However, system memory is volatile, which means if power is interrupted, the important data that is in system memory will be lost. The Intel Xeon processor C5500/C3500 series addresses this issue by integrating a feature called "Asynchronous DRAM Self-Refresh (ADR)," which is a feature to automatically flush memory controller buffers into system memory, and place the DDR into self-refresh mode in the event of a power failure.

With the integration of 16 lanes of Gen2 PCI Express, there is no requirement for an I/O Hub (IOH) as I/O peripherals can be directly connected to the processor. However, for some designs, 16 lanes of PCI Express is insufficient, so that addition of an IOH is desired. The Intel Xeon processor C5500 series has an Intel Quickpath link integrated that can be used to connect an Intel 5520 Chipset IOH, which will provide an additional 36 lanes of Gen2 PCI Express.

## Scalability

The Intel® Xeon® processor C5500/C3500 series offers unprecedented scalability within the Intel Xeon processor product line—ranging from 23W/single core to 85W/quad core. The Intel Celeron® P1053 processor is available for systems that do not require RAS memory features, such as scrubbing, sparing, and mirroring.

The Intel Xeon processor C5500/C3500 series is validated with the Intel 3420 chipset, a single chip offering 12 USB 2.0 ports, six SATA ports, and eight PCI Express 2.0 lanes. Figures 1 through 3 show the different configuration options for the processor, spanning for a single processor, to a system with extended I/O using the Intel 5520 IOH and finally, a system designed for high availability by connecting two processors via the Non-Transparent Bridge (NTB).

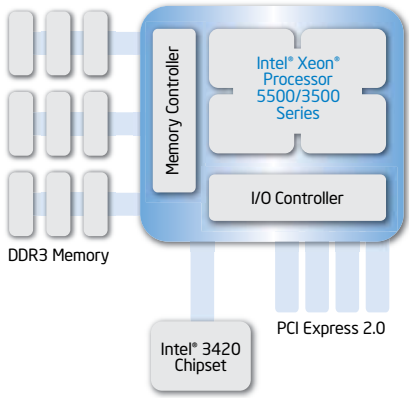


**Figure 1.** Intel Xeon processor C5500/C3500–based platform

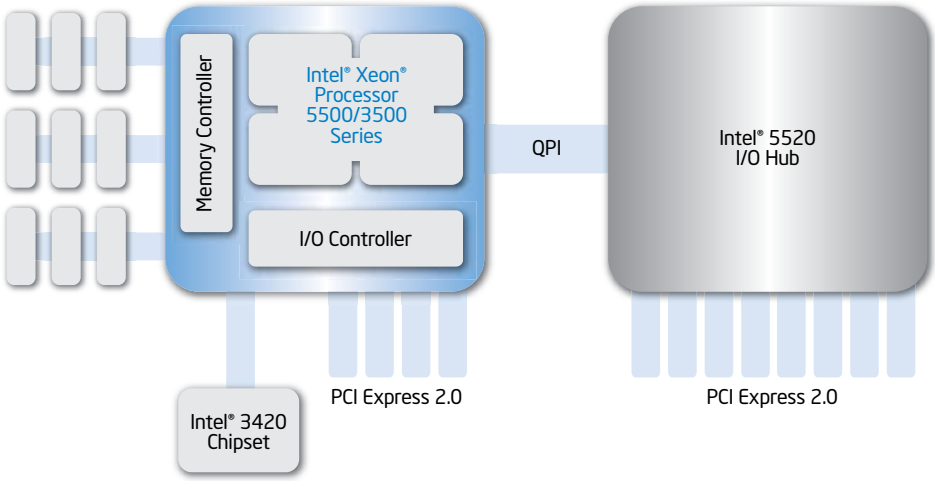


**Figure 2.** Intel Xeon C5500/3500–based platform with Intel 5520 IOH for more PCIe Lanes

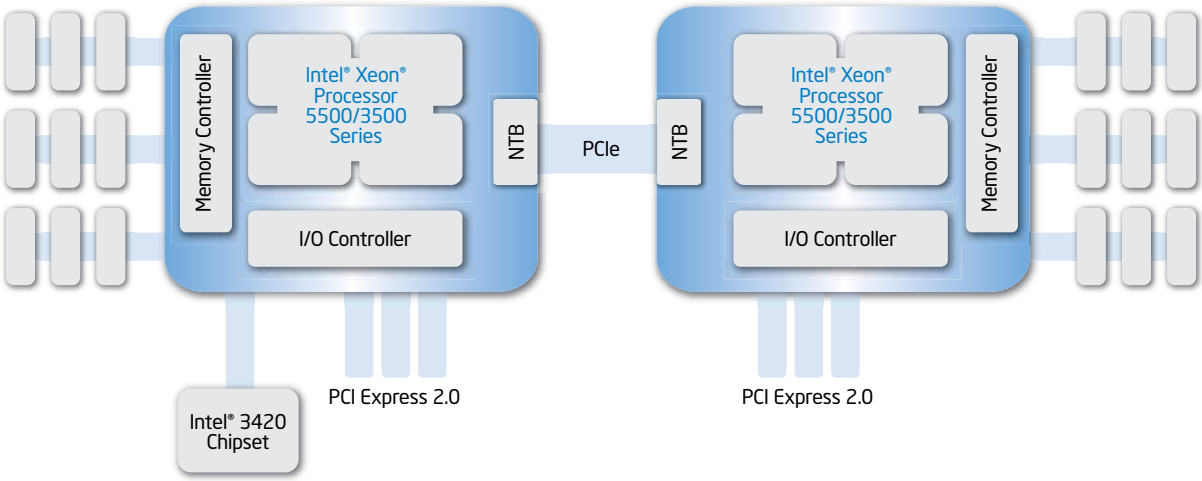


**Figure 3.** Intel Xeon processor 5500/3500 series with Non-Transparent Bridge connection

## Platform Features and Benefits

| Features | Benefits |
|---|---|
| Lowest power Intel® Xeon® processors (i.e. single-core LC3518[Δ] at 23W; dual-core LC3528[Δ] at 35W) | ▪ Meets requirements for NEBS Level 3 ambient operating temperature specifications (thermal profile).<br>▪ Ideal for smaller form factors with thermal constraints (blades). |
| I/O integrated into the processor | ▪ More available board real estate as a separate IOH chip is no longer required.<br>▪ Lower total system thermal design power.<br>▪ Ideal for solutions requiring compliance with AdvancedTCA* form factor specifications (PICMG 3.0). |
| Non-transparent bridging | ▪ Enables two systems to be connected together over PCI Express.<br>▪ Increases availability with failover capabilities. |
| Hardware RAID | ▪ Offload RAID algorithm processing from the processor—increasing cache efficiency and processor availability.<br>▪ No need for a custom ASIC to perform RAID 5 and 6 operations. |
| Asynchronous DRAM self-refresh | ▪ Reduces total system cost by providing the logic to protect DRAM during power failures. |
| Extended lifecycle product support | ▪ Protects system investment by enabling extended product availability for embedded customers. |
| Embedded ecosystem support | ▪ Along with a strong ecosystem of hardware and software vendors, including members of the Intel Embedded and Communications Alliance (intel.com/go/eca), Intel helps to cost-effectively meet development challenges and speed time-to-market. |
| Intel Turbo Boost Technology[2] | ▪ Boosts performance for specific workloads by increasing processor frequency. |
| Intel QuickPath Technology | ▪ Delivers bandwidth improvement for data-intensive applications. |
| Intel Hyper-Threading Technology[3] | ▪ Boosts performance for parallel, multi-threaded applications. |
| Intel Virtualization Technology[4] | ▪ Hardware assists boost virtualization performance by allowing OS more direct access to the hardware.<br>▪ Intel® Virtualization Technology (Intel® VT) FlexMigration enables seamless migration of running applications among current and future Intel processor-based servers.<br>▪ Intel VT FlexPriority improves virtualization performance by allowing guest OSs to read and change task priorities without Virtual Machine Monitor (VMM) intervention.<br>▪ Extended page tables provide better performance by reducing the overhead caused by page-table utilization of virtual machines.<br>▪ Intel VT for Directed I/O helps speed data movement, giving designated virtual machines their own dedicated I/O devices, thus reducing performance overhead of the VMM in managing I/O traffic. |
| Shared L3 cache | ▪ Boosts performance while reducing traffic to the processor cores. |

## Software Overview

The following independent operating system and BIOS vendors provide support for these platforms. Contact your preferred vendor or an Intel representative for operating system and BIOS solutions.

| Operating System | Contact |
|---|---|
| Microsoft Windows Server* 2003 (64-bit) | Intel provides drivers[5] |
| Microsoft Windows Server 2008 (64-bit) | Intel provides drivers[5] |
| Red Hat Enterprise Linux* 5 | Red Hat |
| Wind River VxWorks* | Wind River |
| Wind River Linux* | Wind River |

## BIOS

American Megatrends

Insyde Software

Phoenix Technologies

### Intel® Xeon® Processor C5500/C3500 Series for Storage, Networking, and Embedded Applications

| PROCESSOR NUMBER[4] | THERMAL DESIGN POWER | CORE FREQUENCY (GHZ) | INTEL TURBO BOOST TECHNOLOGY | INTEL HYPER-THREADING TECHNOLOGY | L3 CACHE | NUMBER OF CORES | ROBUST THERMAL PROFILE (HIGH TCASE) | INTEL QUICKPATH LINK SPEED[6] | DDR3 MEMORY |
|---|---|---|---|---|---|---|---|---|---|
| Intel® Xeon® processor EC5549 | 85W | 2.53 | Yes | Yes | 8 MB | 4 | Standard | 5.86 GT/s | 1333/ 1066/800 |
| Intel Xeon processor EC5509 | 85W | 2.00 | No | No | 8 MB | 4 | Standard | 4.8 GT/s | 1066/800 |
| Intel Xeon processor EC3539 | 65W | 2.13 | No | No | 8 MB | 4 | Standard | N/A | 1066/800 |
| Intel Xeon processor LC5528 | 60W | 2.13 | Yes | Yes | 8 MB | 4 | 70° C (nominal) 85° C (short) | 4.8 GT/s | 1066/800 |
| Intel Xeon processor EC5539 | 65W | 2.27 | No | No | 4 MB | 2 | Standard | 5.86 GT/s | 1333/ 1066/800 |
| Intel Xeon processor LC5518 | 48W | 1.73 | Yes | Yes | 8 MB | 4 | 77.5° C (nominal) 92.5° C (short) | 4.8 GT/s | 1066/800 |
| Intel Xeon processor LC3528 | 35W | 1.73 | Yes | Yes | 4 MB | 2 | 79.6° C (nominal) 94.6° C (short) | N/A | 1066/800 |
| Intel Xeon processor LC3518 | 23W | 1.73 | No | No | 2 MB | 1 | 79.5° C (nominal) 94.5° C (short) | N/A | 800 |
| Intel Celeron® processor P1053[7] | 30W | 1.33 | No | Yes | 2 MB | 1 | Standard | N/A | 800 |

### Intel 3420 Chipset for Embedded Computing

| Product | Package | Features |
|---|---|---|
| Intel 3420 Chipset | FC-BGA9 | PCI Express 8x1; six SATA ports; 12 USB ports, integrated Gigabit LAN controller 10/100/1000; 4.7W TDP. |

Intel in Storage,
visit **www.intel.com/go/storage**

[Δ] Intel® processor numbers are not a measure of performance. Processor numbers differentiate features within each processor series, not across different processor sequences.

See http://www.intel.com/products/processor_number for details.

[1] LC5518 benchmarking results collected by Intel Corporation, January 2010

L5408 benchmarking results collected by Intel Corporation, January 2008

Platform configurations:

- Intel® Xeon® processor LC5518, 1.73 GHz, 8 MB L3 cache, 48W plus Intel® 3420 chipset with 12 x 4GB RDIMM DDR3-1333 MHz
- Intel® Xeon® processor L5408, 2.13 GHz, 12 MB L2 cache, 40W plus Intel® 5100 chipset with 4 x 2GB RDIMM DDR2-667

Software configurations:

- Intel® Xeon® processor LC5518: OS: SuSE Linux 11 RC4; Compiler: Intel® C/C+ 11.1; Benchmark CPU2006 v1.1
- Intel® Xeon® processor E5440: OS: Red Hat Enterprise Linux 4; Compiler: Intel® C/C+ 10.1; Benchmark CPU2006 v1.0

Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance. Buyers should consult other sources of information to evaluate the performance of systems or components they are considering purchasing. For more information on performance tests and on the performance of Intel products, visit intel.com/performance/resources/benchmark_limitations.htm

[2] Intel® Turbo Boost Technology requires a PC with a processor with Intel Turbo Boost Technology capability. Intel Turbo Boost Technology performance varies depending on hardware, software and overall system configuration.

Check with your PC manufacturer on whether your system delivers Intel Turbo Boost Technology. For more information, see http://www.intel.com/technology/turboboost.

[3] Hyper-Threading Technology requires a computer system with a processor supporting Hyper-Threading Technology and an HT Technology-enabled chipset, BIOS and operating system. Performance will vary depending on the specific hardware and software you use. For more information including details on which processors support HT Technology, see http://www.intel.com/products/ht/hyperthreading_more.htm

[4] Intel® Virtualization Technology requires a computer system with an enabled Intel® processor, BIOS, virtual machine monitor (VMM) and, for some uses, certain computer system software enabled for it. Functionality, performance or other benefits will vary depending on hardware and software configurations and may require a BIOS update. Software applications may not be compatible with all operating systems. Please check with your application vendor.

[5] Drivers available at: downloadcenter.intel.com (enter processor name).

[6] GT/s = giga-transfers/second

[7] Does not support RAS features

INFORMATION IN THIS DOCUMENT IS PROVIDED IN CONNECTION WITH INTEL® PRODUCTS. NO LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE, TO ANY INTELLECTUAL PROPERTY RIGHTS IS GRANTED BY THIS DOCUMENT. EXCEPT AS PROVIDED IN INTEL'S TERMS AND CONDITIONS OF SALE FOR SUCH PRODUCTS, INTEL ASSUMES NO LIABILITY WHATSOEVER, AND INTEL DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY, RELATING TO SALE AND/OR USE OF INTEL PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT. UNLESS OTHERWISE AGREED IN WRITING BY INTEL, THE INTEL PRODUCTS ARE NOT DESIGNED NOR INTENDED FOR ANY APPLICATION IN WHICH THE FAILURE OF THE INTEL PRODUCT COULD CREATE A SITUATION WHERE PERSONAL INJURY OR DEATH MAY OCCUR.

Intel may make changes to specifications and product descriptions at any time, without notice. Designers must not rely on the absence or characteristics of any features or instructions marked "reserved" or "undefined." Intel reserves these for future definition and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to them. The information here is subject to change without notice. Do not finalize a design with this information.

The products described in this document may contain design defects or errors known as errata which may cause the product to deviate from published specifications. Current characterized errata are available on request. Contact your local Intel sales office or your distributor to obtain the latest specifications and before placing your product order. Copies of documents which have an order number and are referenced in this document, or other Intel literature, may be obtained by calling 1-800-548-4725, or by visiting Intel's Web site at www.intel.com.

Copyright © 2010 Intel Corporation. All rights reserved. Intel, the Intel logo, Intel Xeon and Celeron are trademarks of Intel Corporation in the U.S. and other countries.

*Other names and brands may be claimed as the property of others.

Printed in USA 0210/SMJ/TDA/XX/PDF Please Recycle 323306-001US