The Heart of a Flexible, Efficient Data Center
### Intel® Xeon® Processor E5-2600 Product Family

**Tick-Tock Development Model:**

*Sustained Microprocessor Leadership*

<table>
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<tr>
<th>Intel® Core™ Microarchitecture</th>
<th>Intel® Microarchitecture Codename Nehalem</th>
<th>Intel® Microarchitecture Codename Sandy Bridge</th>
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<td>New Microarchitecture</td>
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<td>New Microarchitecture</td>
<td>New Process Technology</td>
<td>New Microarchitecture</td>
<td>New Process Technology</td>
</tr>
</tbody>
</table>

**TICK** | **TOCK** | **TICK** | **TOCK** | **TICK** | **TOCK** | **TICK** | **TOCK** | **TICK** | **Future**

**New Process Technology**
**Intel® Xeon® Processor E5-2600 Product Family**

**Intel Server/Workstation Roadmap**

- **Boxboro-EX Platform**
  - Intel® Xeon® processor E7-8800/4800/2800 product families
  - Intel® 7500 chipset

- **Romley-EP 4S Platform**
  - Intel® C600 series chipset
  - Intel® Xeon® processor E7-8800/4800/2800 v2 product families

- **Tygersburg-EP Platform**
  - Intel® Xeon® processor 5600/5500 series
  - Intel® 5520 chipset

- **Romley-EP Platform**
  - Intel® Xeon® processor E5-2600 v2 product family
  - Intel® C600 series chipset

- **Tygersburg-EN Platform**
  - Intel® Xeon® processor 5600/5500 series
  - Intel® 5500 chipset

- **Romley-EN Platform**
  - Intel® Xeon® processor E5-2400 v2 product family
  - Intel® C600 series chipset

- **Bromolow Platform**
  - Intel® Xeon® processor E3-1200 product family
  - Intel® C200 series chipset

- **Denlow Platform**
  - Intel® Xeon® processor E3-1200 v3 product family
  - Intel® C220 series chipset

- **Carlow Platform**
  - Intel® Xeon® processor E3-1200 v2 product family
  - Intel® C216 chipset

- **Denlow Platform**
  - Intel® Xeon® processor E3-1200 v3 product family
  - Intel® C226 chipset

- **Intel® 7500 chipset**

- **Intel® 5500 chipset**

- **Intel® 5520 chipset**

- **Intel® C600 series chipset**

- **Intel® C200 series chipset**

- **Intel® C206 chipset**

- **Intel® C216 chipset**

- **Intel® C226 chipset**

- **Intel® C220 series chipset**

**In Planning**

- **Tylersburg-EP Platform**
  - Intel® Xeon® processor 5600/5500 series

- **Tylersburg-EN Platform**
  - Intel® Xeon® processor 5600/5500 series

- **Romley-EP Platform**
  - Intel® Xeon® processor E5-2600 v2 product family

- **Romley-EN Platform**
  - Intel® Xeon® processor E5-2400 v2 product family

- **Bromolow Platform**
  - Intel® Xeon® processor E3-1200 product family

- **Denlow Platform**
  - Intel® Xeon® processor E3-1200 v3 product family

- **Intel® 5520 chipset**

- **Intel® C600 series chipset**

- **In Planning**

**2011**

**2012**

**2013/Future**
1. Performance increase based on SPECint_rate_base2006 Estimates
Intel® Xeon® Processor E5-2600 Product Family

Historical 2S Integer Throughput Performance

Integer Throughput Performance

Baseline Score
Higher is better

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. Source: Intel Internal Assessment and Estimates.
Introducing the Intel® Xeon® Processor E5 Family

80% Performance Gain

Breakthrough I/O Innovation

Trusted Security

Best Data Center Perf per Watt

The Heart of a Flexible, Efficient Data Center Built to Scale

Software and workloads used in performance tests may have been optimized for performance only on Intel® microprocessors. Performance tests, which measure specific functionality, are not intended to measure overall system performance. They are intended to provide strategic insight into the performance of components in the context of the tested scenario. 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.

1: Performance comparison using published 2-socket server results on the SPECint® rate, base2006 benchmark as of 6 March 2012. Configuration details in backup
2: Performance comparison using SPEC_Power results published as of March 6th, 2012. See backup for configuration details. For more information go to www.intel.com/performance
Intel® Xeon® Processor E5-2600 Product Family

Product Photo’s

Die Size: 416mm²
Transistor count:

~2,263,000,000
Intel® Xeon® Processor E5-2600 Product Family

More Capabilities for a Next-Generation Data Center

- More Cores
- More Memory
- More Integration
- More Bandwidth

Other names and brands may be claimed as the property of others.
Intel® Xeon® Processor E5-2600 Product Family

Intel® Advanced Vector Extensions

Newest in a long line of processor instruction innovations

Increases floating point operations per clock up to 2X\(^1\) for technical, financial, scientific & content creation applications

Performance to solve your most complex problems

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1 : Performance comparison using Linpack benchmark. See backup for configuration details. For more legal information on performance forecasts go to http://www.intel.com/performance

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.
Intel® Xeon® Processor E5-2600 Product Family
Reduce Bottlenecks With Intel® Integrated I/O

Would you put a racecar engine in this...

...or this?

Intel® Integrated I/O

* Other names and brands may be claimed as the property of others
New Intel® Integrated I/O

1st server processor with Intel® Integrated I/O

Reduces I/O latency by as much as 30%¹

Improves IO bandwidth by as much as 2x² with PCI Express* 3.0 support

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.

¹ Intel measurements of average time for an I/O device read to local system memory under idle conditions. Improvement compares Intel Xeon processor E5-2600family vs Intel Xeon processor 5600 series
² 2 x GT/s and 128b/130b encoding in PCIe* 3.0 specification is estimated to double the interconnect bandwidth over the PCIe* 2.0 specification

* Other names and brands may be claimed as the property of others
New Intel® Data Direct I/O Technology (Intel® DDIO)

Send I/O directly to and from processor cache for all I/O traffic types

Allows system memory to remain in low power state

Reduce latency by eliminating unneeded trips to memory

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.

1 Up to 2.3x I/O performance is 1S WSM vs. 1S SNB data for L2 forwarding test using 8x10GbE ports. Configuration details in speaker notes
Intel® Xeon® Processor E5-2600 Product Family

Previous Generation Intel® Integrated I/O

1. Intel® Data Direct I/O
   Greater than 2x faster

2. Intel® Data Direct I/O
   Reduces latency by up to 30%

3. Intel® Data Direct I/O
   PCI Express* 3.0
   2x greater bandwidth

Improve I/O bandwidth up to 3X
With Intel® DDIO

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 in 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.

1. Source: Intel internal measurements of average time for an I/O device read to local system memory under idle conditions comparing Intel® Xeon® processor E5-2600 product family (230 ns) vs. Intel® Xeon® processor 5500 series (340 ns). See notes in backup for configuration details


3. Up to 2.3x I/O performance is 1.6x vs. a Xeon processor 5600 series vs. 1.5 Xeon Processor E5-2600 data for L2 forwarding test using 8x10GbE ports. See notes in backup for configuration details

4. Intel internal measurements of maximum achievable I/O R/W bandwidth (512B transactions, 50% reads, 50% writes) comparing Intel® Xeon® processor E5-2680 based platform with 64 lanes of PCI Express* 3.0 (66 GB/s) vs. Intel® Xeon® processor E5-2680.
Intel® Xeon® Processor E5-2600 Product Family

Intelligent & Adaptive Performance: Intel® Turbo Boost Technology 2.0

More Performance
Higher turbo speeds¹ maximize performance for single and multi-threaded applications

More Intelligence
Adapts to conditions by not engaging turbo when memory and I/O are the bottlenecks

More Efficiency
Manages power and thermal headroom to optimize time spent in turbo mode

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¹ Over previous generation Intel® processors. Intel internal estimate. For more legal information on performance forecasts go to http://www.intel.com/performance

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Increase Performance up to 80%

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Increased Cyber-Security Threats

“Because the BIOS loads first, there is no opportunity for anti-malware products to authoritatively scan the BIOS.”

“With cyber threats steadily increasing in sophistication, hardware can provide a game-changing foundation upon which to build tomorrow’s cyber infrastructure.”

Broad Ecosystem Adoption of Intel® Xeon® Based Solutions

Intel® TXT: Hardware Root of Trust

- HyTrust
- Parallels
- VMware
- enomaly
- OpenStack

Intel® AES-NI: Enables Ubiquitous Encryption

- Microsoft
- Oracle
- VMware
- McAfee
- Symantec


Source: https://www.fbo.gov/index?s=opportunity&mode=form&id=40161dd972cd60642eaa955e247067&tab=core&cview=1

* Other names and brands may be claimed as the property of others
Intel® Xeon® Processor E5-2600 Product Family

Faster, Stronger Security on Xeon® Processors

**Intel® Trusted Execution Technology (Intel® TXT)**

Hypervisor

Defend against attacks during launch

**Intel® Advanced Encryption Standard New Instructions (Intel® AES-NI)**

Data Encryption shows **10x speedup**¹ in AES encryption

Intel® Xeon® Processor E5-2600 Product Family

Intel® TXT: How it Works

1. Provisioning:
   Known good values for BIOS and Hypervisor provisioned into the TPM

2. At power on, measured launch of BIOS, results match?

3. Measured launch of Hypervisor, results match?

4. If mismatched, Policy action enforced, indicates untrusted status
   If matched, Platform indicates trusted status

5. Use platform trust status to enforce control and enhance visibility

Software measured and verified
Platform trust can be reported
Platform trust status can be provided to security apps

*Other names and brands may be claimed as the property of others.*
Intel® Xeon® Processor E5-2600 Product Family

Intel® TXT Use Models

1. Hardware enforced detection of launch components—reduces malware threat
2. Control VMs based on platform trust (and more) to better protect data
3. Hardware support for compliance reporting

Leadership Use Models: Hardware Trust as a Control Point

- Trusted Launch – Verified platform integrity
- Trusted Pools
- Compliance Support – enhancing auditability of cloud environment

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Intel® Xeon® Processor E5-2600 Product Family

Security Benefits of Intel Virtualization Technology

Traditional VMM-based uses
• Isolation needed for technology demonstrations, separation of development and production environments

New Security-related uses
1. Memory monitoring for malware detection
2. Device isolation for protection against DMA attacks
3. Isolation of workloads in multi-tenant cloud

Hardware Provides Stronger Isolation of VMs
Intel® Xeon® Processor E5-2600 Product Family

Leading Performance Per Watt

Improvements in energy efficiency:

- Reduced idle power
- Same performance at lower power state
- Higher peak performance at the same power level

Improved efficiency reduces operating expenses and environmental impact

X5690
6C, 3.46GHz
130W

E5-2680
8C, 2.7GHz
130W

~70%\(^1\) higher performance at same Power

Peak power under load

Performance

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1 Configuration details available in speaker notes
Manage Power and Efficiency with Intel® Node Manager & Intel® Data Center Manager Software

**Monitor**
Track actual power usage directly from the server

**Limit**
Restrict maximum node power to increase rack density with confidence

**Optimize**
Use data and power limiting to place workloads for maximum efficiency

**Survive**
Automatically reduce power to extend operations during power events

---
1. Requires servers with Intel® Node Manager and enabled monitoring or management software, such as Intel® Data Center Manager
New Technologies Reduce Total Cost of Ownership

Technical Advancements Since 2007:

- **Intel® Turbo Boost Technology 2.0**
  Higher frequencies to reduce hand workload spikes

- **Intel® AES-NI**
  Accelerate encryption by up to 10X\(^1\)

- **Intel® Trusted Execution Technology**
  Defend against attacks during launch

- **Intel® Advanced Vector Extensions**
  Increases FLOPS per clock up to 2X\(^2\)

- **Intel® Integrated I/O**
  Reduce I/O latency up to 30\%\(^3\)

- **Intel® Hyperthreading**
  Double the number of threads per core

- **Intel® Virtualization Technology**
  Platform capabilities to enhance virtualization performance

- **Intel® Node Manager 2.0**
  Power monitoring & limiting to maximize operating efficiency

- **Intel® Data Center Manager**
  Data to enable improved dynamic workload placement & migration

- **Intel® QuickPath Interconnect**
  High bandwidth processor interconnect delivering up to 3.5x the bandwidth\(^4\)

- **Integrated Power Gates**
  Enables idle cores to go to near zero power draw

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1-4: Please see speaker notes for details.
New Technologies Reduce Total Cost of Ownership

Refresh and Save:

- Power management and increased efficiency drives down power usage by up to 7kWh over a system’s life

- Significant performance gains every generation maximizes output per software license – possibly saving over $25k over a system’s life

Go to [www.intelsalestraining.com/xeonestimator](http://www.intelsalestraining.com/xeonestimator) to learn more
Intel® Xeon® Processor E5-2600 Product Family
The Heart of a Next Generation Data Center

Leading Performance
Up to 80% performance boost over Intel® Xeon® processor 5600 series-based servers

Flexible & Efficient
Advanced features automate power consumption across the platform

Best combination of performance, power efficiency, and cost

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1 Over previous generation Intel® processors. Intel internal estimate. For more legal information on performance forecasts go to http://www.intel.com/performance
Intel® Xeon® Processor E5-2600 Product Family

Product Numbering Conventions

**Brand**

- Intel® Xeon® processor

**Prod Line** (E3, E5, E7)

**Prod Family**

**Version** (v2, v3, v4, etc)

**Wayness, maximum number of CPUs in a node** (1, 2, 4, 8)

**Socket type** (2, 4, 6, 8)

**Processor SKU** (i.e. 10, 20, 30, etc...)

**Alpha Suffix**

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<th>Description</th>
<th>Designator</th>
<th>Actual Socket</th>
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<td>L</td>
<td>LS (Westmere EX)</td>
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<tr>
<td></td>
<td>R</td>
<td>R (Sandy Bridge)</td>
</tr>
<tr>
<td></td>
<td>B2</td>
<td>B2 (Sandy Bridge)</td>
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<tr>
<td></td>
<td>H2</td>
<td>H2 (Sandy Bridge)</td>
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**Proposed Brand Name**

<table>
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<tr>
<th>Proposed Brand Name</th>
<th>Former Code name</th>
<th>Socket Configuration</th>
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<tr>
<td>Intel® Xeon® processor E5-2600 product family</td>
<td>Sandy Bridge-EP processor</td>
<td>Socket R, 2S</td>
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<td>Intel® Xeon® processor E5-1600 product family</td>
<td>Sandy Bridge-EP processor</td>
<td>Socket R, 1S only</td>
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<tr>
<td>Intel® C600 series chipset</td>
<td>Patsburg PCH</td>
<td>n/a</td>
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</table>

**Socket Configuration**

**PCH segment** (entry PCH=2; datacenter PCH=6)

**Generation** (within segment)

**SKU**

Letter and hundreds digit differentiated from CPUs

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Intel® Xeon® Processor E5-2600 Product Family

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Intel® Trusted Execution Technology (Intel® TXT) requires a computer system with Intel® Virtualization Technology, an Intel TXT-enabled processor, chipset, BIOS, Authenticated Code Modules and an Intel TXT-compatible measured launched environment (MLE). Intel TXT also requires the system to contain a TPM v1.s. For more information, visit http://www.intel.com/technology/security

Requires a system with Intel® Turbo Boost Technology. Intel Turbo Boost Technology and Intel Turbo Boost Technology 2.0 are only available on select Intel® processors. Consult your PC manufacturer. Performance varies depending on hardware, software, and system configuration. For more information, visit http://www.intel.com/go/turbo

Intel® AES-NI requires a computer system with an AES-NI enabled processor, as well as non-Intel software to execute the instructions in the correct sequence. AES-NI is available on select Intel® processors. For availability, consult your reseller or system manufacturer. For more information, see http://software.intel.com/en-us/articles/intel-advanced-encryption-standard-instructions-aes-ni/

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Relative performance is calculated by assigning a baseline value of 1.0 to one benchmark result, and then dividing the actual benchmark result for the baseline platform into each of the specific benchmark results of each of the other platforms, and assigning them a relative performance number that correlates with the performance improvements reported.

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