



# Don't Judge a CPU only by its GHz

## Quad-Core Sets New Standards for Performance



**“The value proposition for Intel® quad-core processor-based systems is clear. They outperform existing systems in all three major areas: compute performance, price performance, and performance per watt.”**

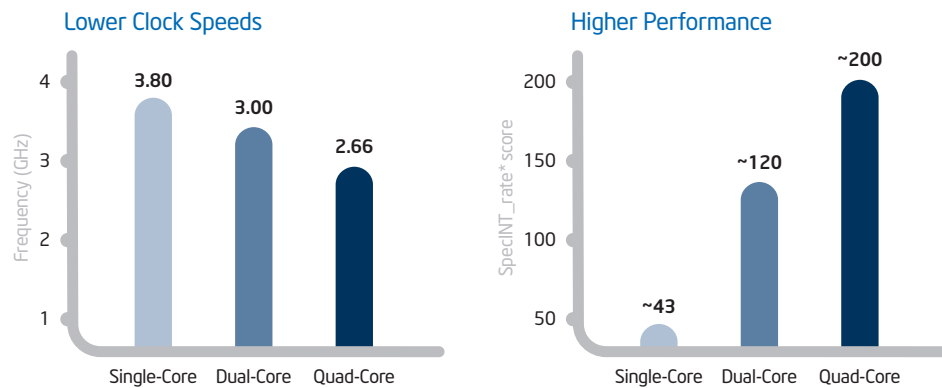
- IDC, April 2007<sup>1</sup>

Clock speed used to be considered the only measure of a processor's performance, but not anymore. New multi-core processors are defining new standards for performance and IT value – taking performance beyond the bounds of pure clock speed. In choosing server technology, it's time to think outside the clock.

### Performance is More than Speed

Instead of doing one task fast, servers today are expected to do many tasks very, very fast. Quad-Core Intel® Xeon® processors based on the Intel® Core™ microarchitecture vastly outperform previous generations of processors on the same software you run today.

**The New Performance Paradigm: Frequency is No Longer the Best Indicator of Performance**



■ Quad-Core Intel® Xeon® Processor X5355<sup>A</sup>  
■ Dual-Core Intel® Xeon® Processor 5160<sup>A</sup>  
■ Single-Core Intel® Xeon® Processor

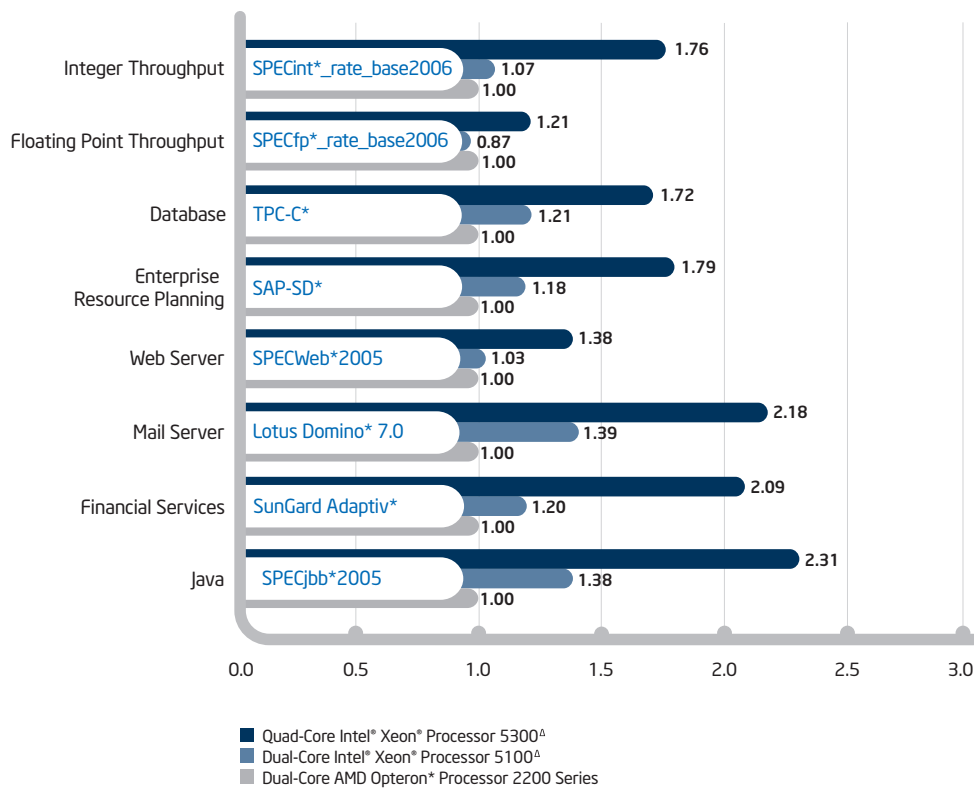
Source: www.spec.org, January 30, 2007.





As shown in these benchmarks, Quad-Core Intel Xeon processors deliver new levels of performance across not just a few but a wide range of business workloads, and they deliver up to 2.3x the performance of competitive offerings.

### Breakthrough Performance (higher is better)<sup>2</sup>






## Why Intel® Core™ Microarchitecture is Faster

- Featuring four instructions per clock (instead of the three typically found in other mainstream processors), each execution core is 33% wider and therefore more efficient at computing today's applications (Intel® Wide Dynamic Execution).
- Large on-die cache stores more data and instructions closer to the CPU so your server spends less time looking for data in system memory and more time processing it (Intel® Advanced Smart Cache).
- Out-of-Order Execution improves the performance of each core by intelligently loading or pre-fetching data in anticipation of the system's actual needs (Intel® Smart Memory Access). Learn more about Intel Core microarchitecture at [www.intel.com/technology/architecture/coremicro/index.htm](http://www.intel.com/technology/architecture/coremicro/index.htm).

Processor performance is driven by a variety of architecture features, including number of cores, instructions per clock cycle, cache size, and FSB speed, in addition to clock speed.

### Key Performance Drivers

Intel® Xeon® Processor	Intel® Architecture	# of cores per socket	Instructions per clock cycle	On-Die Cache	Clock Speeds	Maximum FSB Speed	Overall Performance	Power Efficiency
Quad-Core 5300 <sup>A</sup> Series	Intel® Core™ micro-architecture	4	4	8 MB	3.00 GHz 2.66 GHz 2.33 GHz 2.00 GHz 1.86 GHz 1.60 GHz	1,333		20-30W per core
Dual-Core 5100 <sup>A</sup> Series	Intel® Core™ micro-architecture	2	4	4 MB	3.00 GHz 2.66 GHz 2.33 GHz 2.00 GHz 1.86 GHz 1.60 GHz	1,333		32.5W per core
Single-Core	Intel NetBurst® micro-architecture	1	3	2 MB	3.80 GHz 3.60 GHz 3.40 GHz 3.20 GHz 3.00 GHz	800		110W per core

Source: [www.intel.com](http://www.intel.com), November 2006.



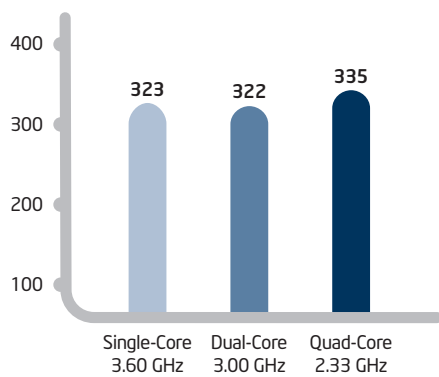
## Mainstream Value

Quad-core processors built with the Intel Core microarchitecture offer business and IT advantages beyond just raw performance.

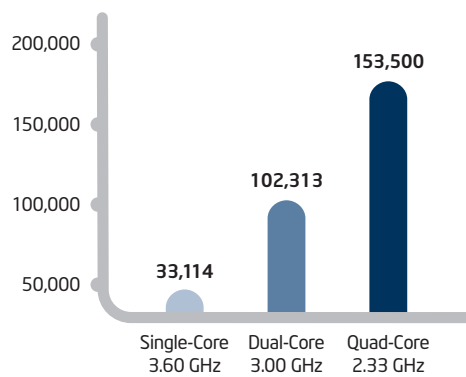
## Higher Performance per Watt

Quad-core processors deliver more performance for less power. For example, the Quad-Core Intel® Xeon® processor 5300<sup>A</sup> series gives up to 50% better performance than Dual-Core Intel® Xeon® processor 5100<sup>A</sup> series and over 4x the performance of single-core Intel Xeon processors within the same system power envelope.

**Stable System Power**  
Measured System Watts



**More System Performance**  
Business Operations per Second



- Quad-Core Intel® Xeon® Processor E5345<sup>A</sup>
- Dual-Core Intel® Xeon® Processor 5160<sup>A</sup>
- Single-Core Intel® Xeon® Processor

Source: [www.spec.org](http://www.spec.org), January 30, 2007.



## Better Price/Performance

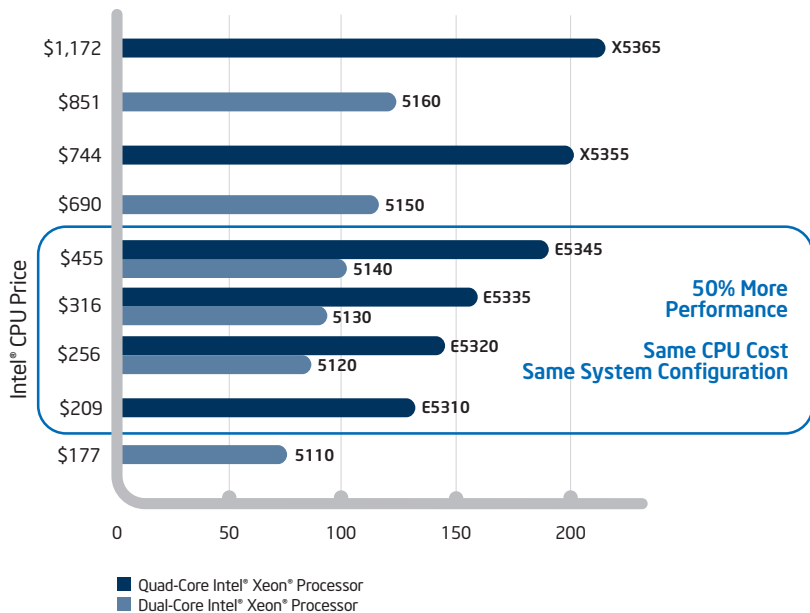
Quad-Core Intel Xeon processors have 1.5x the performance of the leading Dual-Core Intel Xeon processor 5100 series at comparable mainstream pricing.

**“Quad-core systems provide the capability to increase compute power three to five times while controlling both energy requirements and space requirements relative to single-core systems.”**

- IDC, April 2007<sup>1</sup>

### Quad-Core: More Price Performance

Integer performance: SPECint\_rate\_base2000\* on Microsoft Windows\*



Data source: Intel Xeon processor X5365 result of 214 is Intel internal measured. All other data are from published results at [www.spec.org](http://www.spec.org) as of July 6, 2007. Pricing source: Intel. As of August 13, 2007, CPU pricing in 1,000 unit quantities. Subject to change without notice.

## Lower Your Clock Speed, Not Your Expectations

For today's IT environment, speed is not enough. For unrivaled multitasking capability, faster-running server applications, and more efficient, more cost-effective computing, four cores are better than one (or even two). By comparing Quad-Core Intel Xeon processor 5300 series and Dual-Core Intel Xeon processor 5100 series, you get:

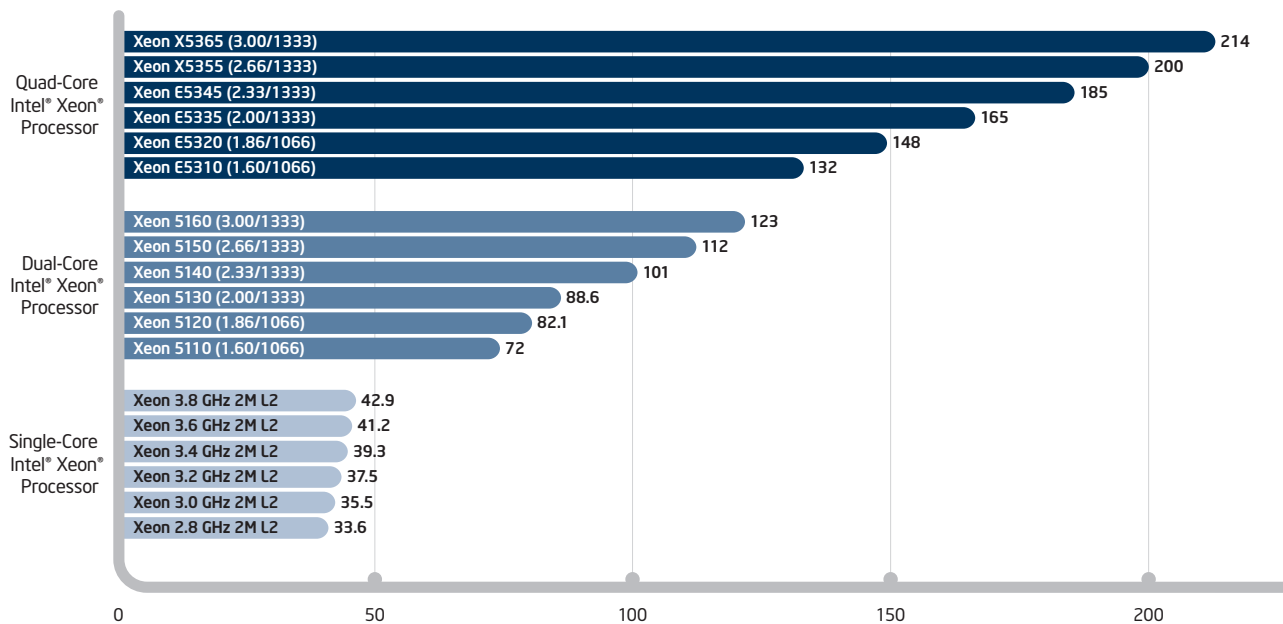
- On-average performance gains of 40-70%.
- Performance gains on the same software, no tuning required.
- Increased performance at the same CPU cost.
- Increased performance in the same power envelope.
- Same platform, same architecture (no expensive upgrades or requalification).

**“As one of the HPC users commented, ‘Moving from dual core to quad core is a no-brainer.’ And the move from single-core to quad-core is even more compelling.”**

- IDC, April 2007<sup>1</sup>

### Quad-Core Intel® Xeon® Processor 5300 Series-Based Server Platforms

SKU Comparison Using SPECint\_rate\_base2000\* on Microsoft Windows\*



Data source: Intel Xeon processor X5365 result of 214 is Intel internal measured as of July 11, 2007. All other data are from published results at [www.spec.org](http://www.spec.org) as of July 6, 2007.



### **Learn More or Buy Quad-Core Today**

To learn more about Quad-Core Intel Xeon processor 5300 series, visit [www.intel.com/business/xeon/index.htm](http://www.intel.com/business/xeon/index.htm) or contact your Intel reseller.

Combine the performance of Intel quad-core and virtualization software and dramatically reduce data center Total Costs of Ownership (TCO). Learn more at [www.intel.com/go/virtualization](http://www.intel.com/go/virtualization) or visit the Intel Quad-Core Technology site at [www.intel.com/quadcoreserver/index.htm](http://www.intel.com/quadcoreserver/index.htm)

<sup>1</sup> IDC White Paper sponsored by Intel, *Quad-Core Processors Bring Higher Performance and Lower Cost to Mainstream Computing*, Doc #206309, April 2007.

<sup>2</sup> **Benchmark information:**

**Data Source:** Published or measured results as of August 16, 2007.

**SPECint\*\_rate\_base2006:** Dual-Core Intel® Xeon® Processor 5160; ("Woodcrest 3.00 GHz"); Quad-Core Intel® Xeon® Processor X5365; ("Clovertown 3.0 GHz"); Dual-Core AMD Opteron® Model 2224SE ("3.2 GHz").

**SPECfp\*\_rate\_base2006:** Dual-Core Intel® Xeon® Processor 5160; ("Woodcrest 3.00 GHz"); Quad-Core Intel® Xeon® Processor X5365; ("Clovertown 3.0 GHz"); Dual-Core AMD Opteron® Model 2224SE ("3.2 GHz").

**SPECweb\*2005:** Dual-Core Intel® Xeon® Processor 5160; ("Woodcrest 3.00 GHz"); Quad-Core Intel® Xeon® Processor X5355; ("Clovertown 3.0 GHz"); Dual-Core AMD Opteron® Model 2220 ("2.80 GHz").

**SPECjbb\*2005:** Dual-Core Intel® Xeon® Processor 5160; ("Woodcrest 3.00 GHz"); Quad-Core Intel® Xeon® Processor X5365; ("Clovertown 3.0 GHz"); Dual-Core AMD Opteron® Model 2224SE ("3.2 GHz").

**TPC-C\*:** Dual-Core Intel® Xeon® Processor 5160; ("Woodcrest 3.00 GHz"); Quad-Core Intel® Xeon® Processor X5355; ("Clovertown 2.66 GHz"); Dual-Core AMD Opteron® Model 2220SE ("2.80 GHz").

**SAP-SD\*:** Dual-Core Intel® Xeon® Processor 5160; ("Woodcrest 3.00 GHz"); Quad-Core Intel® Xeon® Processor X5365; ("Clovertown 3.0 GHz"); Dual-Core Opteron 2220 - Dual-Core AMD Opteron® Model 2220 ("2.80 GHz").

**Lotus Domino® 7.0:** Dual-Core Intel® Xeon® Processor 5160; ("Woodcrest 3.00 GHz"); Quad-Core Intel® Xeon® Processor X5355; ("Clovertown 2.66 GHz"); Dual-Core AMD Opteron® Model 285 ("2.60 GHz").

**SunGard Adaptiv\*:** Dual-Core Intel® Xeon® Processor 5160 ("Woodcrest 3.00 GHz"); Quad-Core Intel® Xeon® Processor X5355; ("Clovertown 2.66 GHz"); Dual-Core AMD Opteron® Model 2220SE ("2.80 GHz").

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<sup>3</sup> Intel processor numbers are not a measure of performance. Processor numbers differentiate features within each processor family, not across different processor families. See [www.intel.com/products/processor\\_number/](http://www.intel.com/products/processor_number/) for details.

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