

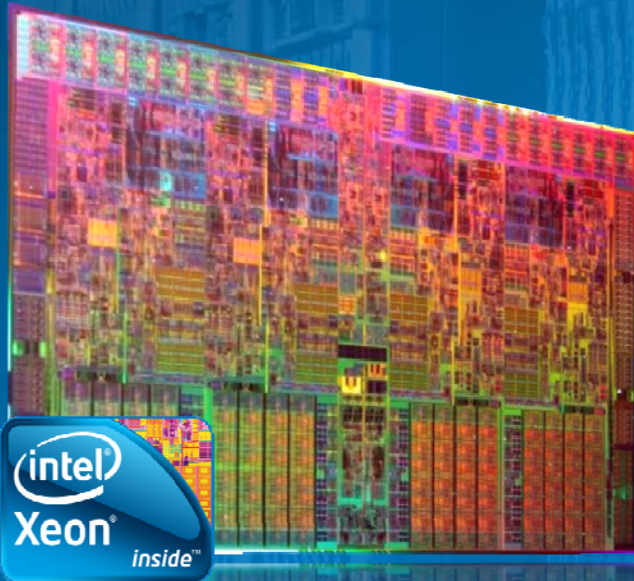
Performance & Technologies for Next Generation Data Centers

Boyd Davis
General Manger
Data Center Group Marketing
March 16, 2010



Sponsors of Tomorrow. 

2009 - Intel® Xeon® Processor 5500 Series



Up to **9x** Performance

- OR -

As low as **8 Month** Payback

Transformed Computing



Refresh Opportunities in 2010

If you delayed refresh in 2009, you're not alone

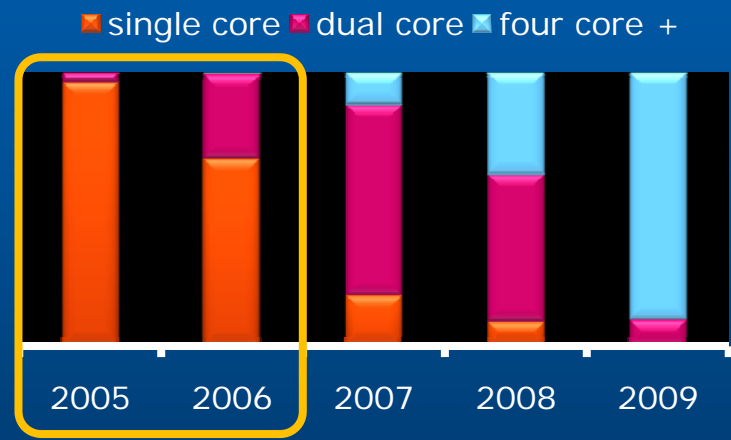
Approximately **1 million servers** have had their replacement delayed by a year.

Source: Gartner press release

2010 will mark an important **return to installed base refreshes** driven by an uptick in enterprise budgets, new technological innovations, and a return to economic growth.

Source: IDC, February 2010

80% of the server install base is up for refresh



Source: Intel® Xeon® Shipments, 2005-2009

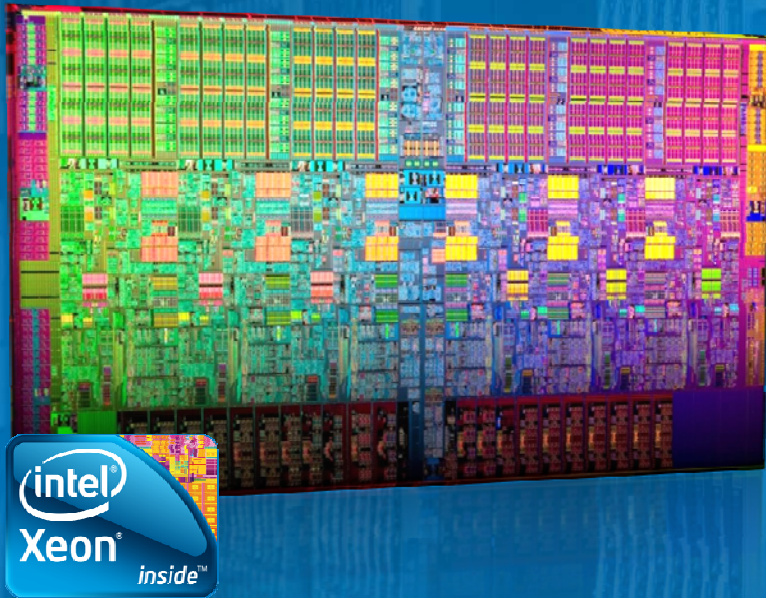
Aging Servers Limit Innovation & Growth



1 Estimated 34% single-core & 42% dual-core based on Q4'09 IDC Server Tracker¹. Source: IDC 2009 Q4 Server Tracker. Install base calculated by using this IDC data and a standard life-cycle distribution. Assumptions: 4 yr replacement cycle increases slightly when the recession hit.

Sponsors of Tomorrow:

Introducing - *Intel® Xeon® Processor 5600 Series*



Energy Efficiency

Xeon® 5500 Perf @ 30% less power
Up to 15:1 consolidation

Performance

Up to 60% performance boost
5 month refresh ROI

Secure Virtualization

Encrypt today
Measure & Enforce tomorrow

Boost Performance, Lower IT Costs, Enhance Security

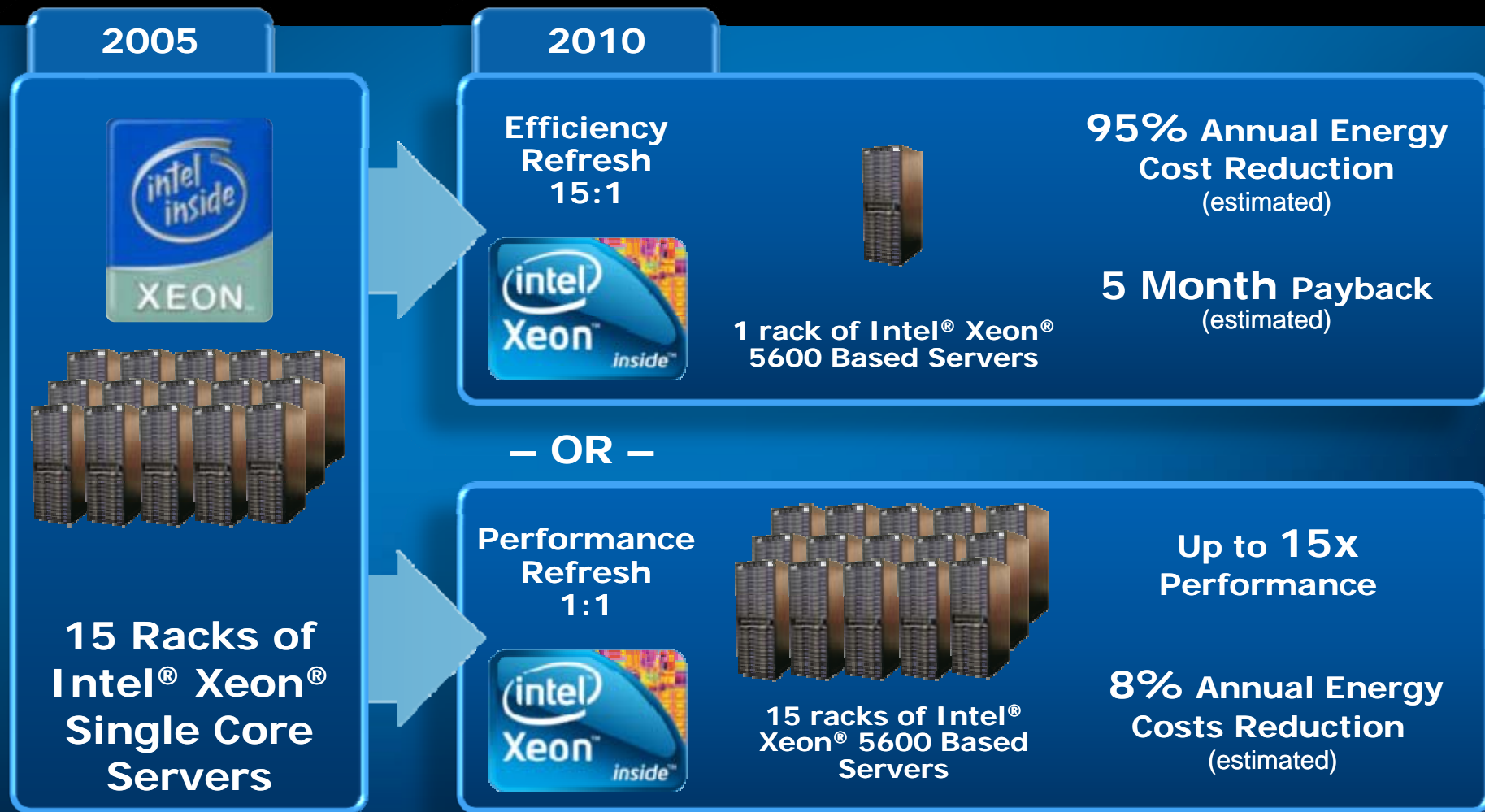
1 Source: Internal Intel estimates comparing Xeon® X5570 vs. L5640 SKUs using SPECint_rate_2006.

2 Source: Intel measurements as of Feb 2010. Performance comparison using server side java bops (business operations per second). Results have been estimated based on internal Intel analysis and are provided for informational purposes only.

3 Source: Internal Intel measurements for Xeon® X5680 vs. Xeon® X5570 on BlackScholes*.



Huge Opportunity to Refresh old Servers



Source: Intel estimates as of Jan 2010. Performance comparison using SPECjbb2005 bops (business operations per second). Results have been estimated based on internal Intel analysis and are provided for informational purposes only. Any difference in system hardware or software design or configuration may affect actual performance. For detailed calculations, configurations and assumptions refer to the legal information slide in backup.

Sponsors of Tomorrow. intel

The Cost of Waiting to Refresh in 2010

Monthly costs for **NOT** refreshing **50** Single-core Servers with **3** Intel® Xeon® 5600 Servers

Software support

\$5,092 *per month*

Utility costs

\$1,838 *per month*

Warranty costs

\$3,125 *per month*

up to **\$10,000** *per month*¹



1 Monthly Savings in utility and SW support costs determined by comparing the incremental costs associated with not refreshing 50 older single-core servers purchased back in 2005 vs. refreshing on an approximate 15:1 ratio with a Xeon 5680-based servers in Year 1. Warranty cost assumes \$750/year per server if purchased after the Initial OEM 3-year warranty period has expired. Actual total cost is \$10,075. Source: Consolidation ratio calculated using the Xeon Server Refresh Savings Estimator (www.intel.com/go/xeonestimator) and uses publicly available RHEL OS support costs, default utility settings, and SPECint*_rate_base2006 performance and power data for the Xeon® X5680 as found in the backup. See the backup for system configurations.

2 Source: Gartner <http://www.gartner.com/it/page.jsp?id=2009913>

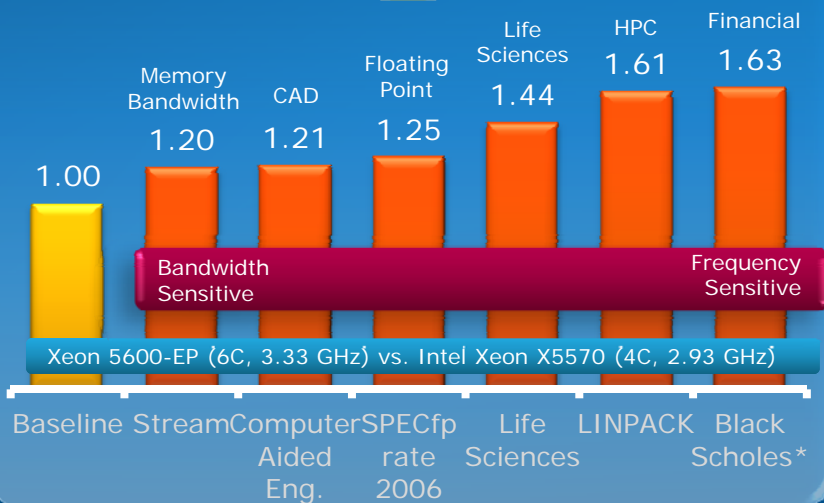


Intel® Xeon® Processor 5600 Series

Performance Summary

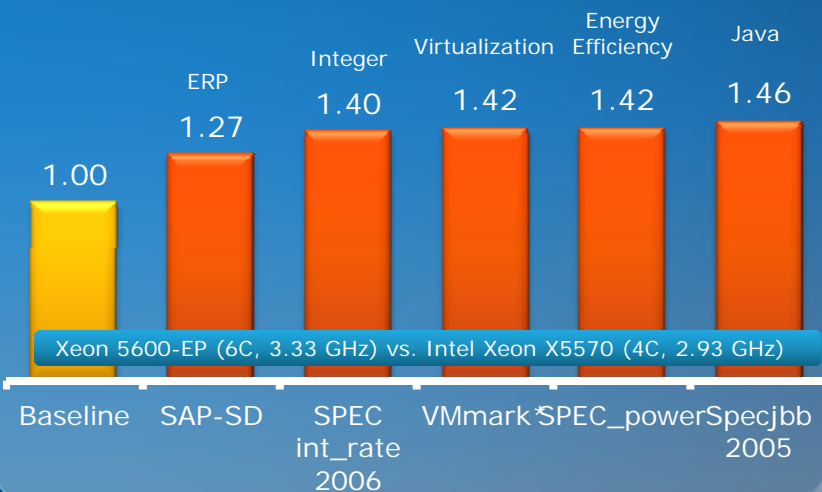
Technical Computing

Up to
63%
Performance



Mainstream Enterprise

Up to
46%
Performance



Up to 63% performance boost over Xeon® 5500



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 <http://www.intel.com/performance/resources/limits.htm>. Source: Intel Internal measurements Jan 2010. See backup for additional details.

Results are based on internal Intel measurements as of March 16, 2010. Any difference in system hardware or software design or configuration may affect actual performance. See backup foils for system configuration.



Intel® Xeon® 5600 Performance Publications

SPECjbb* 2005

928,393 BOPS (+46%)

IBM J9* JVM



VMmark*

35.83 @ 26 tiles (+42%)

ESX 4



SPECpower*_ssj2008 (single-node server)

2,927 ssj_ops/watt (+42%)

IBM J9* JVM



SPECint*_rate_base2006

Score: 355 (+40%)



SPECpower*_ssj2008 (multi-node server)

3,038 ssj_ops/watt (+31%)

IBM J9* JVM



SPECjAppServer* 2004

5185.4 JOPS (+30%)

Oracle WebLogic*
Server



SAP-SD* 2-Tier

4,860 SD Users (+27%)

SAP* ERP 6.0



SPECfp*_rate_base2006

Score: 248 (+25%)



SPECWeb* 2005

104,422 score (+25%)

Rock Web* Server



Over **NINE** New x86 2S Server & Workstation World Records!



Percentage gains shown are based on comparison to Xeon 5500 series; Performance results based on published/submitted results as of March 16, 2010. Platform configuration details are available at <http://www.intel.com/performance/server/xeon/summary.htm> *Other names and brands may be claimed as the property of others

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 Performance Benchmark Limitations](#)

Sponsors of Tomorrow.

Intel® Xeon® Processor 5600 Series

Building on Xeon® 5500 Leadership Capabilities

Lower Power CPUs

Better performance/Watt
Lower power consumption

130W

95W

80W

60W (6C)

40W (4C)

Intelligent Power Technology

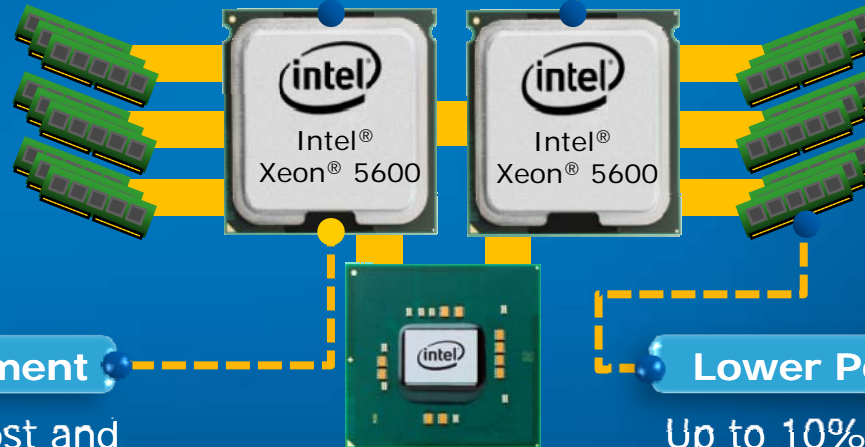
Automated Low Power States
with Six Cores

CPU Power Management

More efficient Turbo Boost and
memory power management

Lower Power DDR3 Memory

Up to 10% lower memory power ¹



Greater Platform Energy Efficiency



 New lower power CPU SKU options for Xeon® 5600

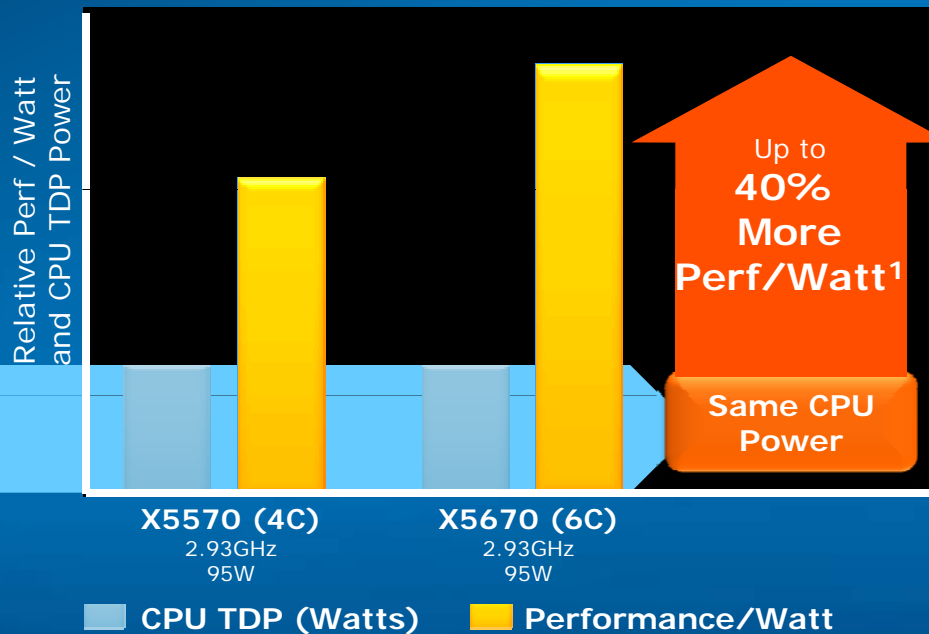
¹ Based on voltage reduction from 1.50V to 1.35V, using Power (Watts) = Current x Voltage

Sponsors of Tomorrow. 

Greater Data Center Energy Efficiency

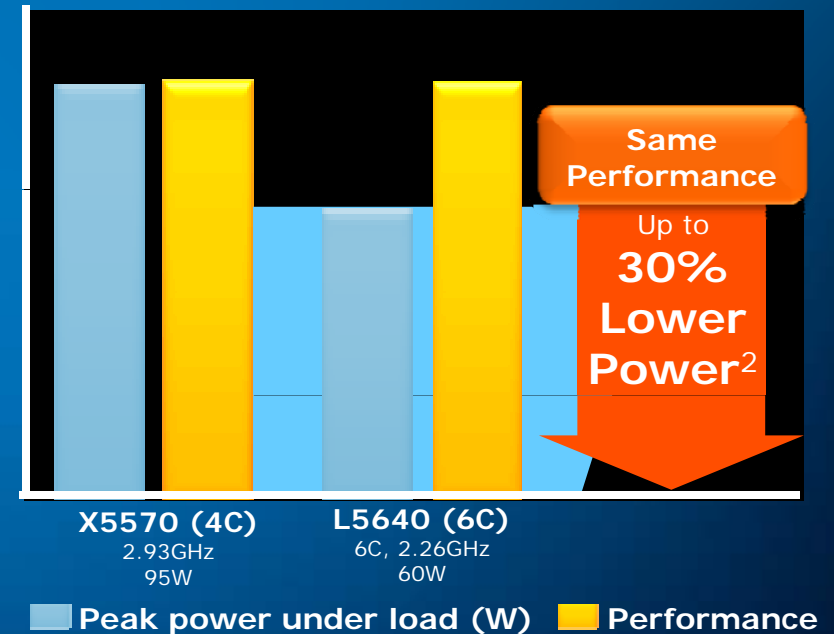
Xeon® X5570 vs. Xeon® X5670

Power and Performance Comparison



Xeon® 5570 vs. Xeon® L5640

Power and Performance Comparison



Maximize Performance or Energy Efficiency



1 Source: Internal Intel estimates comparing Xeon® X5670 vs. X5570 SKUs using SPECpower. See backup for system configurations.
2 Source: Internal Intel estimates comparing Xeon® X5570 vs. L5640 SKUs using SPECint_rate_2006. See backup for system configurations.

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Foundation for a More Secure Infrastructure

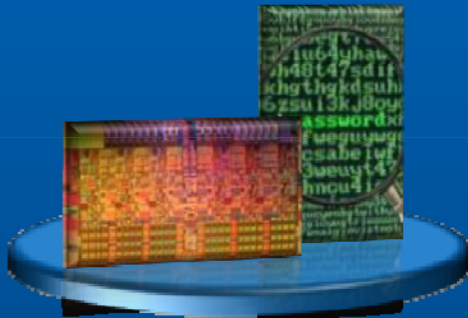
New Security Features in the Intel® Xeon® processor 5600 series

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

ORACLE

Microsoft

McAfee



Increases Encryption
Performance to Enable
Broad Usage

Ready for Today

Intel® Trusted Execution Technology (Intel TXT)

vmware

Parallels

HyTrust



Prevents the Insertion Of
Malicious Software Prior To
VMM Launch

Ready for Tomorrow



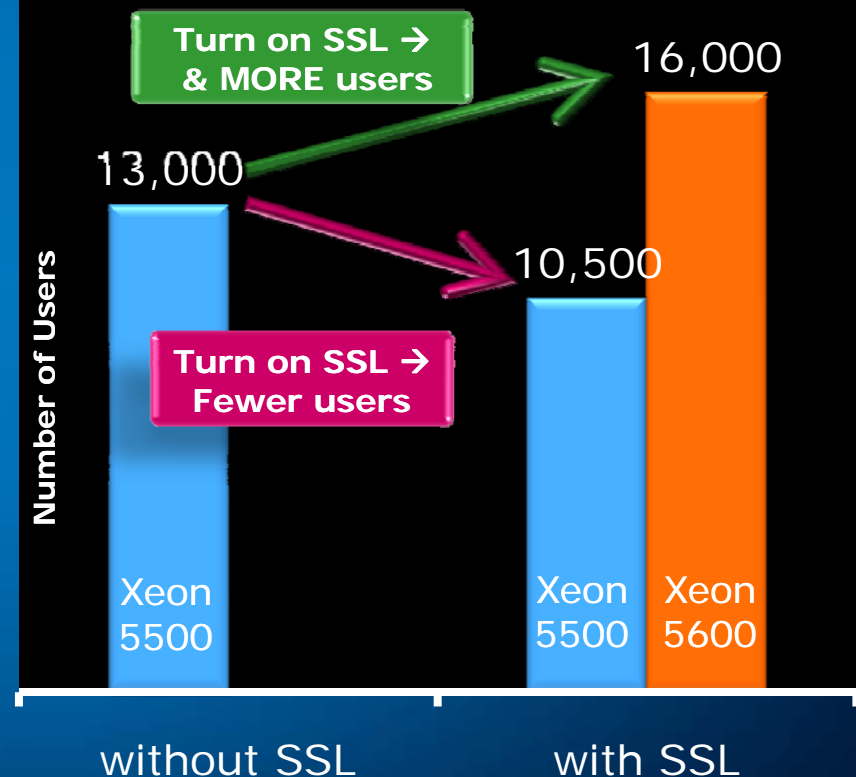
Sponsors of Tomorrow. 

Intel Xeon® Processor 5600 Series

- Support more users **plus SSL transactions**
- **Eliminate** crypto HW
- More **secure** datacenters and **cloud** environments

Web Banking Workload

Xeon® X5570 vs. Xeon® X5680 Comparison



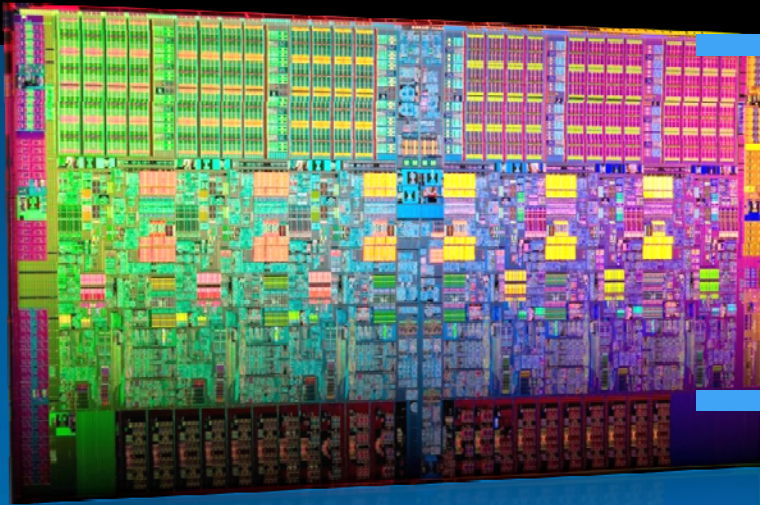
Making Data Encryption More Accessible



Source: Internal Intel measurements with a web banking workload, comparing a Intel® Xeon® X5680 (3.33 GHz) with SSL ON compared with Intel Xeon® X5570 (2.93 GHz) with SSL OFF. See backup foil for details.

Sponsors of Tomorrow: 

Summary



**Boosts Performance
Lower IT Costs
Enhance Security**

Up to 15:1 Consolidation w/ Estimated 5-month Payback¹

Up to 60% Higher Performance Over Xeon[®] 5500²

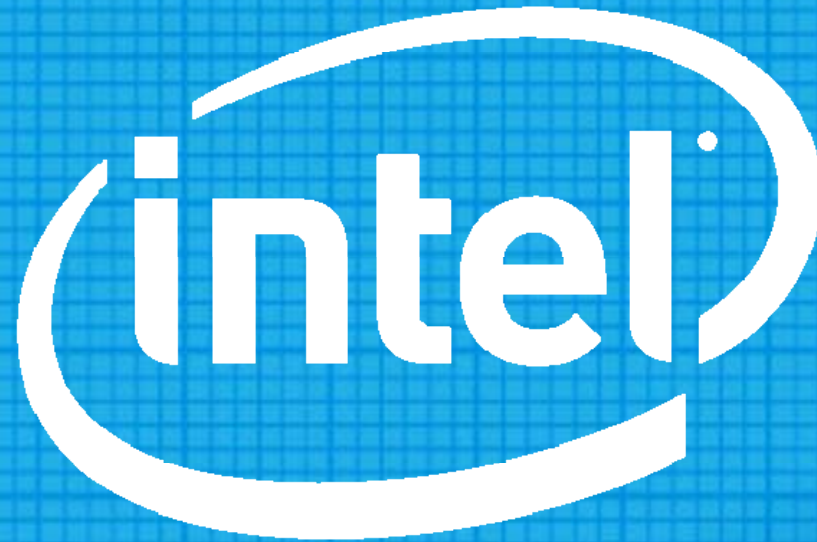
More Secure Solutions with AES-NI and Intel[®] TXT

Intel[®] Xeon[®] processor 5600 series



1 Source: Intel estimates as of Jan 2010. Performance comparison using SPECjbb2005 bops (business operations per second). Results have been estimated based on internal Intel analysis and are provided for informational purposes only. Any difference in system hardware or software design or configuration may affect actual performance. For detailed calculations, configurations and assumptions refer to the legal information slide in backup.
2 Source: Internal Intel measurements for Xeon[®] X5680 vs. Xeon[®] X5570 on BlackScholes*. See backup for system configurations.

Sponsors of Tomorrow. 



Sponsors of Tomorrow.™

This slide MUST be used with any slides removed from this presentation

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- 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 for details.
- Intel, processors, chipsets, and desktop boards 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.
- Intel Virtualization Technology requires a computer system with a processor, chipset, BIOS, virtual machine monitor (VMM) and applications enabled for virtualization technology. Functionality, performance or other virtualization technology benefits will vary depending on hardware and software configurations. Virtualization technology-enabled BIOS and VMM applications are currently in development.
- 64-bit computing on Intel architecture requires a computer system with a processor, chipset, BIOS, operating system, device drivers and applications enabled for Intel® 64 architecture. Performance will vary depending on your hardware and software configurations. Consult with your system vendor for more information.
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Performance Claim Backup

- Up to 1.6x performance compared to Xeon 5500 series claim supported by a CPU intensive benchmark (Blackscholes). Intel internal measurement. (Feb 25, 2010)
 - Configuration details: - Blackscholes*
 - Baseline Configuration and Score on Benchmark:- Intel pre-production system with two Intel® Xeon® processor X5570 (2.93 GHz, 8 MB last level cache, 6.4 GT/sec QPI), 24GB memory (6x4GB DDR3-1333), 4 x 150GB 10K RPM SATA RAID0 for scratch, Red Hat* EL 5 Update 4 64-bit OS. Source: Intel internal testing as of February 2010. SunGard v3.0 source code compiled with Intel v11.0 compiler. Elapsed time to run benchmark: 18.74 seconds.
 - New Configuration and Score on Benchmark:- Intel pre-production system with two Intel® Xeon® processor X5680 (3.33 GHz, 12 MB last level cache, 6.4 GT/sec QPI), 24GB memory (6x4GB DDR3-1333), 4 x 150GB 10K RPM SATA RAID0 for scratch, Red Hat* EL 5 Update 4 64-bit OS. Source: Intel internal testing as of February 2010. SunGard v3.0 source code compiled with Intel v11.0 compiler. Elapsed time to run benchmark: 11.51 seconds.
- Up to 40% higher performance/watt compared to Intel® Xeon® Processor 5500 Series claim supported by performance results on a server side java benchmark in conjunction with power consumption across a load line. Intel internal measurement (Jan 15, 2010)
 - Baseline platform: Intel preproduction server platform with two Quad-Core Intel® Xeon® processor X5570, 2.93 GHz, 8MB L3 cache, 6.4QPI, 8GB memory (4x2GB DDR3-1333), 1 PSU, Microsoft Windows Server 2008 Enterprise SP2. Intel internal measurement as of January 15,2010.
 - New platform: Intel preproduction server platform with two six-Core Intel® Xeon® processor X5670, 2.93 GHz, 12MB L3 cache, 6.4QPI, 8GB memory (4x2GB DDR3-1333), 1 PSU, Microsoft Windows Server 2008 Enterprise SP2. Intel internal measurement as of January 15, 2010.
- Intel® Xeon® processor 5600 series with Intel microarchitecture Nehalem delivers similar performance as previous-generation servers but uses up to 30 percent less power
 - Baseline Configuration and Score on Benchmark: Fujitsu PRIMERGY RX300 S5 system with two Intel® Xeon® processor sX5570 (2.93 GHz, 8MB L3, 6.4 GT/s, Quad-core, 95W TDP), BIOS rev. R1.09 , Turbo Enabled, HT Enabled, NUMA Enabled, 5 x Fans, 24 GB (6x4GB DDR3-1333 DR registered ECC), 1 x Fujitsu MBD2147RC 147GB 10K RPM 2.5" SAS HDD, 1x800W PSU, SLES 11 (X86_64) Kernel 2.6.27.19-5-default. Source: Fujitsu Performance Lab testing as of Mar 2010. SPECint_rate_base2006 score: 250. <http://docs.ts.fujitsu.com/dl.aspx?id=0140b19d-56e3-4b24-a01e-26b8a80cfe53>
 - New Configuration and Score on Benchmark: Fujitsu PRIMERGY RX300 S6 system with two Intel® Xeon® processors L5640 (2.26 GHz, 12MB L3, 5.86 GT/s, Hex-core, 60W TDP), BIOS rev R1.00A , Turbo Enabled, HT Enabled, NUMA Enabled, 5 x Fans, 24 GB (6x4GB DDR3-1333 LV DR registered ECC), 1 x Fujitsu MBD2147RC 147GB 10K RPM 2.5" SAS HDD, 1x800W PSU, SLES 11 (X86_64) Kernel 2.6.27.19-5-default. Source: Fujitsu Performance Lab testing as of Mar 2010. SPECint_rate_base2006 score: 250 <http://docs.ts.fujitsu.com/dl.aspx?id=4af74e10-24b1-4cf8-bb3b-9c4f5f177389>



Performance Summary Backup

Performance Summary and World Record Benchmarks

42% gain on Single Node server SPECpower*_ssj2008 at similar power level over previous generation processors supported by the following:

- Baseline Configuration and Score: Referenced as published at 2053 overall ssj_ops/watt
http://www.spec.org/power_ssj2008/results/res2009q4/power_ssj2008-20091023-00205.html
- New Configuration and Score: IBM x3650 M3 was configured with the Intel Xeon Processor X5670 (2.93GHz, 256KB L2 cache per core, 12MB L3 cache per processor—12 cores/2 chips/6 cores per chip) and 12GB of PC3L-10600R(6 x 2GB) memory and ran IBM Java™6 Runtime Environment and Microsoft® Windows® Server 2008 R2 Enterprise x64 Edition. Score: 2,927 overall ssj_ops/watt. Submitted and in review at www.spec.org

46% gain on SPECjbb2005 supported by the following:

- Baseline Configuration and Score: 632,425 bops, SPECjbb2005 bops/JVM = 158106 <http://www.spec.org/osg/jbb2005/results/res2010q1/jbb2005-20100210-00803.html>
- New Configuration and Score: Fujitsu PRIMERGY RX300 S6 system with two Intel® Xeon® processors X5680 (3.33 GHz, 12MB L3, 6.4 GT/s, Hex-core, 130W TDP), Turbo Enabled, HT Enabled, NUMA Enabled, Data Reuse Optimization disabled, all prefetchers disabled, 48 GB (12x4GB DDR3-1333 DR registered ECC), 1 x Seagate 73GB 10K RPM 2.5" SAS HDD, Microsoft Windows Server 2008 R2 Enterprise, IBM J9 VM (build 2.4, JRE 1.6.0 IBM J9 2.4 Windows Server 2008 amd64-64 jvmwa6460sr6-20090923_42924). Source: Fujitsu Performance Lab testing as of Mar 2010. SPECjbb2005 score: bops= 928393, bops/JVM= 154732 <http://docs.ts.fujitsu.com/dl.aspx?id=71488796-7a53-46b8-9163-61373214c2ef>

27% boost on SAP ERP 6.0 Unicode over previous generation supported by the following:

- Baseline Configuration and Score: 3800 Number of SAP SD benchmark users
<http://download.sap.com/download.epd?context=40E2D9D5E00EEF7C259FFE6AB54898440C838DEDED66684AFD7D58B23A917F4C0D>
- New Configuration and Score : Fujitsu PRIMERGY RX300 S6 system with two Intel® Xeon® processor X5680 (3.33 GHz, 12MB L3, 6.4 GT/s, Hex-core, 130W TDP), 88 GB main memory, Windows Server 2008 Enterprise Edition, SQL Server 2008, SAP ERP 6.0 (Unicode). Source: www.sap.com Score: 4860 Number of SAP SD benchmark users

40% gain on SPECint_rate_2006 over previous generation supported by the following:

- Baseline Configuration and Score: Score: 253
- <http://www.spec.org/cpu2006/results/res2010q1/cpu2006-20100202-09561.html>
- New Configuration and Score: Dell PowerEdge R710 system with two Intel® Xeon® processor X5680 (3.33 GHz, 12MB L3, 6.4 GT/s, six-core, 130W TDP), Maximum Performance Power Management mode, Data Reuse Disabled, C1E Enabled, Turbo Enabled, HT Enabled, 48 GB (12x4GB DDR3-1333 registered ECC), 1x146GB 15K RPM SAS HDD, SUSE Linux Enterprise Server 11 (2.6.27.19-5-smp). Source: Submitted to www.spec.org for publication as of March 15 2010. Geomean Score of 12 workloads: 355

42% gain on VMMark* over previous generation supported by the following:

- Baseline Configuration and Score: Cisco result referenced as published at 25.06 at 17 tiles. For more information see www.vmware.com/files/pdf/vmmark/VMmark-Cisco-2010-01-12-B200M1.pdf
- New Configuration and Score on Benchmark: - Cisco UCS B250 M2 platform with two Intel® Xeon® processor X5680 (3.33 GHz, 12MB L3, 6.4 GT/s, 6-core, 130W TDP), Turbo Enabled, HT Enabled, 192GB memory (48x4GB DDR3 1333), EMC CLARiiON CX4-240 storage system with 25x73GB SSD, 20 x 450GB 15K RPM, 5 x 300GB 15K RPM, VMware vSphere 4,0 U1 Source: www.cisco.com. Score of 35.83@26 tiles. For more information see: www.cisco.com/en/US/prod/ps10265/at_work_promo.html#~industry_benchmarks.



Performance Summary Backup

World Record Benchmarks (continued)

31% gain on Multi-Node server SPECpower*_ssj2008 over previous generation supported by the following:

- Baseline Configuration and Score: 2316 ssj_ops/watt
- http://www.spec.org/power_ssj2008/results/res2009q4/power_ssj2008-20090908-00195.html
- New Configuration and Score: IBM dx360 M3 system with the Intel® Xeon® Processor X5670 (2.93GHz with 256KB L2 cache per core and 12MB L3 cache per processor—2 chips/12 cores/6 cores per chip), 12GB of memory, one 50GB solid state drive, and IBM J9 Java 6 (using a 1500MB heap), and Microsoft® Windows® Server 2008 R2 Datacenter Edition2. Source: IBM testing as of Mar 2010. SPECpower_ssj2008 score: 3038 overall ssj_ops/watt. Submitted and in review at www.spec.org

25% boost on SPECweb2005 over previous generation supported by the following:

- Baseline Configuration and Score: SPECweb2005 Score 83198
- <http://www.spec.org/osg/web2005/results/res2009q4/web2005-20091202-00144.html>
- Fujitsu PRIMERGY TX300 S6 system with two Intel® Xeon® processors X5680 (3.33 GHz, 12MB L3, 6.4 GT/s, Hex-core, 130W TDP), Turbo Enabled, HT Enabled, NUMA Enabled, 96 GB (12x8GB DDR3-1333 DR registered ECC), 8 x Seagate 73GB 15K RPM 3.5" SAS HDD (internal) plus 48 x Seagate 146GB 15K RPM 3.5" SAS HDD (storage subsystem), Red Hat Enterprise Linux 5.3 (2.6.18-128.el5 x86_64), Accoria Networks Rock Web Server v1.4.8 (x86_64). Source: Fujitsu Performance Lab testing as of Mar 2010. SPECweb2005 score: 104422 (SPECweb2005_Banking = 162000, SPECweb2005_Ecommerce = 177000, SPECweb2005_Support = 88000)
- <http://docs.ts.fujitsu.com/dl.aspx?id=2ce10d43-bc0a-4479-bd2b-a67387d57959>

25% gain on SPECfp_rate_base2006 over previous generation supported by the following:

- Baseline Configuration and Score: Score 197, Referenced as published at <http://www.spec.org/cpu2006/results/res2009q2/cpu2006-20090511-07354.html>
- New Configuration and Score: Dell PowerEdge R710 system with two Intel® Xeon® processor X5680 (3.33 GHz, 12MB L3, 6.4 GT/s, six-core, 130W TDP), Maximum Performance Power Management mode, Data Reuse Disabled, C1E Enabled, Turbo Enabled, HT Enabled, 48 GB (12x4GB DDR3-1333 registered ECC), 1x146GB 15K RPM SAS HDD, SUSE Linux Enterprise Server 11 (2.6.27.19-5-sm). Source: Submitted to www.spec.org for publication as of March 15 2010. Geomean Score of 17 workloads: 248.

30% gain on SPECjAppServer2004 over previous generation supported by the following:

- Baseline Configuration and Score: 3975.13 JOPS@Standard <http://www.spec.org/osg/jAppServer2004/results/res2009q1/jAppServer2004-20090310-00128.html>
- New Configuration and Score: Cisco UCS C250 M2 platform with two Intel® Xeon® processor X5680 (3.33 GHz, 12MB L3, 6.4 GT/s, 6-core, 130W TDP), Turbo Enabled, HT Enabled, H/W Prefetcher Disabled, Adj. Cache Line Prefetch Disabled, DCU Prefetcher Disabled, DCU IP Prefetcher Disabled. 96 GB (24x4GB DDR3-1333 registered ECC), 2x73GB 15K RPM SAS HDD, Oracle Enterprise Linux 5 Update 3 x86_64, Oracle WebLogic Server Standard Edition Release 10.3.3, Oracle JRockit(R) 6.0 JDK (R28.0.0-587) (Linux x86 64bit). EMC CLARiiON CX4-240 storage system with 60 x 450GB 15K RPM. Source: Result submitted to www.spec.org as of Feb 24, 2010. 5,185.45 SPECjAppServer2004 JOPS@Standard

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Performance Summary Backup

Technical Computing Benchmarks

- **STREAM:** Baseline Configuration and Score on **Stream-MP** Benchmark: - Intel pre-production system with two Intel® Xeon® processor X5570 (2.93 GHz, 12MB L3, 6.4 GT/s, Quad-core, 130W TDP), C3 Disabled, C6 Enabled, Turbo Disabled, HT Disabled, NUMA Enabled, 24 GB (6x4GB DDR3-1333 DR registered ECC), 1x150GB 10K RPM SATA HDD, Red Hat EL5-U4 kernel 2.6.18-164.el5 experimental.8). Source: Intel internal testing TR1012. Score of workloads: **36588.0 MB/s**
- New Configuration and Score on Stream-MP Benchmark: - Intel pre-production system with two Intel® Xeon® processor X5680 (3.33 GHz, 12MB L3, 6.4 GT/s, Hex-core, 130W TDP), C3 Disabled, C6 Enabled, Turbo Disabled, HT Disabled, NUMA Enabled, 24 GB (6x4GB DDR3-1333 DR registered ECC), 1x150GB 10K RPM SATA HDD, Red Hat EL5-U4 kernel 2.6.18-164.el5 experimental.8). Source: Intel internal testing as of Feb 2010. Score of workloads: **MB/s**.
- **CAE:** Baseline Configuration and Score on **CAE Vertical:** 2-socket server with Intel® Xeon® processor X5570 (2.93 GHz, 8MB LLC, 6.4 GT/S QPI, 95W TDP), Turbo Enabled, HT Enabled or Disabled for best performance on each application, 24 GB memory (6x4GB DDR3-1333 registered ECC), 4x150GB 10K RPM SATA HDD RAID0 for scratch, Red Hat* EL 5.4 64-bit OS (2.6.18-164-el5). Source: Intel internal testing as of January 2010. Geometric mean score for nine applications
- New Configuration and Score on CAE Vertical: Intel pre-production 2-socket server with Intel® Xeon® processor X5680 (3.33 GHz, 12MB LLC, 6.4 GT/S QPI, 130W TDP), Turbo Enabled, HT Enabled or Disabled for best performance on each application, 24 GB memory (6x4GB DDR3-1333 registered ECC), 4x150GB 10K RPM SATA HDD RAID0 for scratch, Red Hat 5.4 64-bit OS (2.6.18-164-el5). Source: Intel internal testing as of January 2010. Geometric mean score for nine applications
- **SPECfp_rate:** Baseline Configuration and Score on **Floating Point (SPECfp_rate_base2006)** Benchmark: - ASUSTek* Z8PE-D18 server motherboard using 2x Intel Xeon processor X5570 (8M Cache, 2.93 GHz, 6.4 GT/s Intel® QPI), 72 GB (28x 4 GB PC3-10600R CL=9), SUSE* Linux Enterprise Server 10 (x86_64) SP2, Intel® C++ Compiler Professional for LINUX version 11.0 (build 20090131). Published: May-2009 Source: <http://www.spec.org/cpu2006/results/res2009q2/cpu2006-20090511-07354.html>
- New Configuration and Score on Floating Point (SPECfp_rate_base2006) Benchmark: - Supermicro* pre-production system with two Intel® Xeon® processor X5670 (3.33 GHz, 12MB L3, 6.4 GT/s, Quad-core, 130W TDP), BIOS rev 01/06/2010 ,C3 Disabled, C6 Enabled, Turbo Enabled, HT Enabled, NUMA Enabled, 48 GB (12x4GB DDR3-1333 DR registered ECC), 1x150GB 10K RPM SATA HDD, SLES 11 kernel: 2.6.27.19-5-default x86_64. Source: Intel internal testing as of Feb 2010. Score of workloads: **247.0**
- **LIFE SCIENCES:** Baseline Configuration and Score on **Life Sciences Vertical:** 2-socket server with Intel® Xeon® processor X5570 (2.93 GHz, 8MB LLC, 6.4 GT/S QPI, 95W TDP), Turbo Enabled, HT Enabled or Disabled for best performance on each application, 24 GB memory (6x4GB DDR3-1333 registered ECC), 4x150GB 10K RPM SATA HDD RAID0 for scratch, Red Hat* EL 5.4 64-bit OS (2.6.18-164-el5). Source: Intel internal testing as of January 2010. Geometric mean score for ten applications
- New Configuration and Score on Life Sciences Vertical: Intel pre-production 2-socket server with Intel® Xeon® processor X5680 (3.33 GHz, 12MB LLC, 6.4 GT/S QPI, 130W TDP), Turbo Enabled, HT Enabled or Disabled for best performance on each application, 24 GB memory (6x4GB DDR3-1333 registered ECC), 4x150GB 10K RPM SATA HDD RAID0 for scratch, Red Hat 5.4 64-bit OS (2.6.18-164-el5). Source: Intel internal testing as of January 2010. Geometric mean score for ten applications
- **LINPACK:** Baseline Configuration and Score on **Linpack** Benchmark: - Supermicro* pre-production system with two Intel® Xeon® processor X5570 (2.93 GHz, 8MB L3, 6.4 GT/s, Quad-core, 95W TDP), BIOS rev 02/23/2009, C3 Disabled, C6 Enabled, Turbo Enabled, HT Disabled, NUMA Enabled, 24 GB (6x4GB DDR3-1333 DR registered ECC), 1x150GB 10K RPM SATA HDD, Red Hat EL5-U3 kernel 2.6.18-128.el5 for x86_64). Source: Intel internal testing TR1011A. Score of workloads: **91 GFlops**.
- New Configuration and Score on Linpack Benchmark: - Supermicro* pre-production system with two Intel® Xeon® processor X5680 (3.33 GHz, 12MB L3, 6.4 GT/s, Hex-core, 130W TDP), BIOS rev 01/06/2010, C3 Disabled, C6 Enabled, Turbo Enabled, HT Disabled, NUMA Enabled, 24 GB (6x4GB DDR3-1333 DR registered ECC), 1x150GB 10K RPM SATA HDD, Red Hat EL5-U4 kernel 2.6.18-164.el5 experimental.8). Source: Intel internal testing as of Feb 2010. Score of workloads: **146 GFlops**.
- **BLACKSCHOLES*:** Baseline Configuration and Score on Benchmark: - Intel pre-production system with two Intel® Xeon® processor X5570 (2.93 GHz, 8 MB last level cache, 6.4 GT/sec QPI), 24GB memory (6x4GB DDR3-1333), 4 x 150GB 10K RPM SATA RAID0 for scratch, Red Hat* EL 5 Update 4 64-bit OS. Source: Intel internal testing as of February 2010. SunGard v3.0 source code compiled with Intel v11.0 compiler. Elapsed time to run benchmark: 18.74 seconds.
- New Configuration and Score on Benchmark: - Intel pre-production system with two Intel® Xeon® processor X5680 (3.33 GHz, 12 MB last level cache, 6.4 GT/sec QPI), 24GB memory (6x4GB DDR3-1333), 4 x 150GB 10K RPM SATA RAID0 for scratch, Red Hat* EL 5 Update 4 64-bit OS. Source: Intel internal testing as of February 2010. SunGard v3.0 source code compiled with Intel v11.0 compiler. Elapsed time to run benchmark: 11.51 seconds.



5 Month Single Core Refresh ROI Claim

- 5 month ROI claim estimated based on comparison between 2S Single Core Intel® Xeon® 3.80 with 2M L2 Cache and 2S Intel® Xeon® X5680 based servers. Calculation includes analysis based on performance, power, cooling, electricity rates, operating system annual license costs and estimated server costs. This assumes 8kW racks, \$0.10 per kWh, cooling costs are 2x the server power consumption costs, operating system license cost of \$900/year per server, per server cost of \$7200 based on estimated list prices and estimated server utilization rates. All dollar figures are approximate. Performance and power comparisons are based on measured server side java benchmark results (Intel Corporation Feb 2010). Platform power was measured during the steady state window of the benchmark run and at idle. Performance gain compared to baseline was 15x.
 - Baseline platform: Intel server platform with two 64-bit Intel Xeon Processor 3.80GHz with 2M L2 Cache, 800 FSB, 8x1GB DDR2-400 memory, 1 hard drive, 1 power supply, Microsoft* Windows* Server 2003 Ent. SP1, Oracle* JRockit* build P27.4.0-windows-x86_64 run with 2 JVM instances
 - New platform: Intel server platform with two Intel® Xeon® Processor X5680 (12M Cache, 3.33 GHz, 6.40 GT/s Intel® QPI), 24 GB memory (6x4GB DDR3-1333), 1 SATA 10krpm 150GB hard drive, 1 800w power supply, Microsoft Windows Server 2008 64 bit SP2, Oracle* JRockit* build P28.0.0-29 run with 4 JVM instances
- 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 Performance Benchmark Limitations.



Single Core Energy Efficient Refresh Calculation Details

	2005	2010	Delta / Notes
Product	Intel® Xeon® 3.8GHz with 2M cache	Intel® Xeon® X5680 (3.33GHz)	
Performance per Server	1	Up to 15x increase	Intel internal measurements on a server side java benchmark as of Feb 2010
Server Power Idle / Active Power	228W idle / 382W active	117W idle / 383W active	Server idle for 16 hours per day and active for 8 hours per day
# Servers needed	315	21	~ 15:1 server consolidation
# Racks needed	15 racks	1 rack	15:1 Rack Consolidation
Annual Server kWh	772,904	37,938	Up to 95% lower energy costs
Total Annual Energy Costs	\$154,581	\$7,588	\$146,993 electricity cost reduction per year. Assumes \$0.10/kWhr and 2x cooling factor
Operating System Licensing Costs	\$283,500	\$18,900	\$264,600 less per year Assumes a RHEL 1yr license at \$900 Source www.dell.com as of 12/16/08
Estimated Annual Cost Savings of \$411,593			
Cost of new HW	n/a	\$151,200	Assume \$7,200 per server
Estimated Payback Period of 5 months			



15 Month Dual Core Refresh ROI Claim

- 15 month ROI claim estimated based on comparison between 2S Dual Core Intel® Xeon® 5160 (3.0GHz) and 2S Intel® Xeon® X5680 based servers. Calculation includes analysis based on performance, power, cooling, electricity rates, operating system annual license costs and estimated server costs. This assumes 8kW racks, \$0.10 per kWh, cooling costs are 2x the server power consumption costs, operating system license cost of \$900/year per server, per server cost of \$7200 based on estimated list prices and estimated server utilization rates. All dollar figures are approximate. Performance and power comparisons are based on measured server side java benchmark results (Intel Corporation Feb 2010). Platform power was measured during the steady state window of the benchmark run and at idle. Performance gain compared to baseline was 5x.
 - Baseline platform: Intel server platform with two Dual-core Intel® Xeon® Processor 5160, 3.33GHz, 1333MHz FSB, 8x2GB FBDMIMM DDR2-667 memory, 1 hard drive, 1 power supply, Microsoft* Windows* Server 2003 Ent. SP1, Oracle* JRockit* build P27.4.0-windows-x86_64 run with 2 JVM instances
 - New platform: Intel server platform with two Intel® Xeon® Processor X5680 (12M Cache, 3.33 GHz, 6.40 GT/s Intel® QPI), 24 GB memory (6x4GB DDR3-1333), 1 SATA 10krpm 150GB hard drive, 1 800w power supply, Microsoft Windows Server 2008 64 bit SP2, Oracle* JRockit* build P28.0.0-29 run with 4 JVM instances
- 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 Performance Benchmark Limitations.

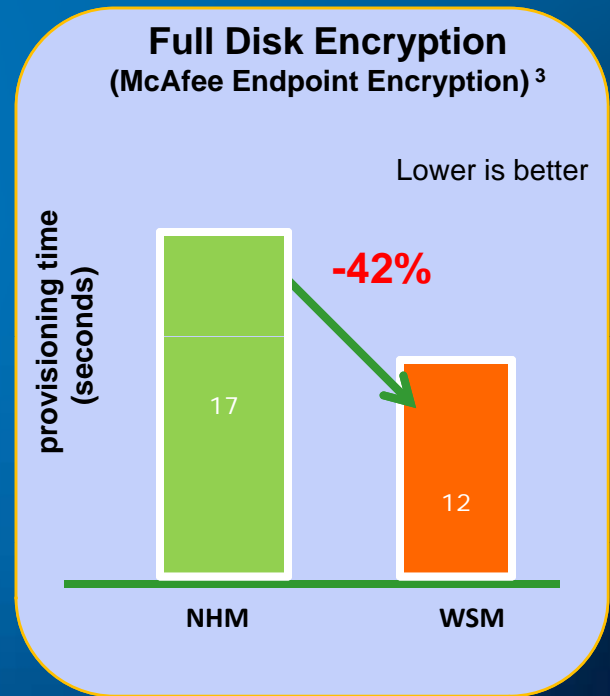
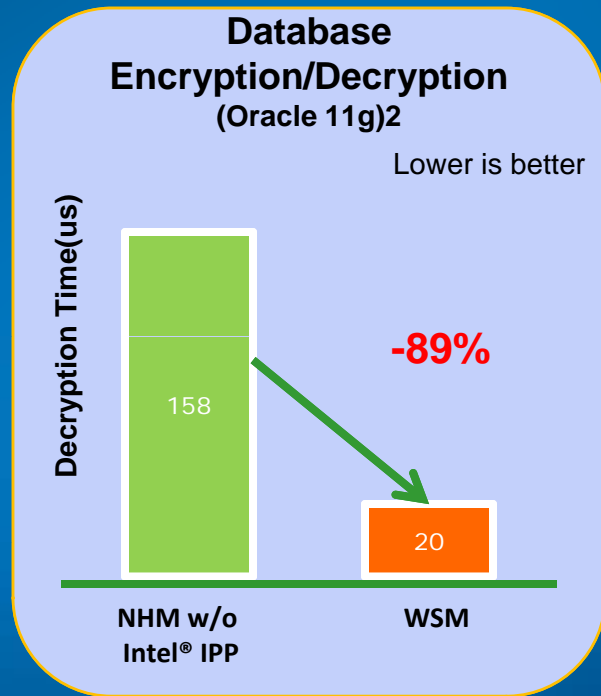
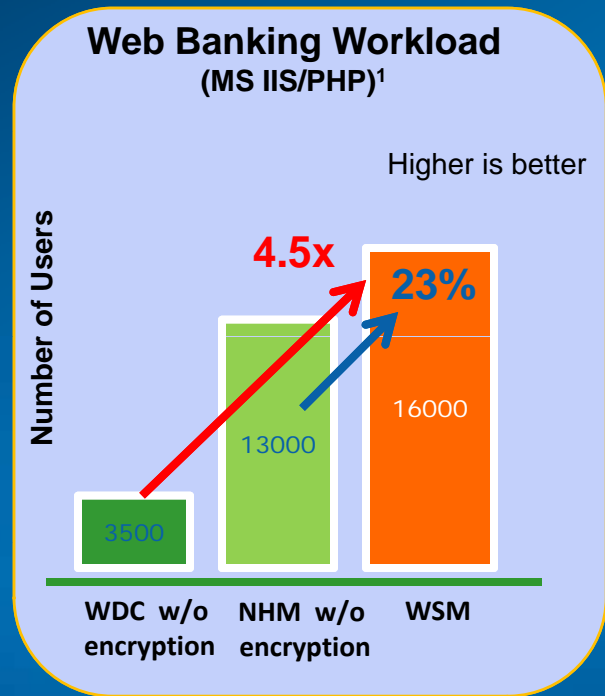


Dual Core Energy Efficient Refresh Calculation Details

	2005	2010	Delta / Notes
Product	Intel Xeon 5100 series (3.00GHz)	Intel® Xeon® X5680 (3.33GHz)	
Performance per Server	1	Up to 5x increase	Intel internal measurements on a server side java benchmark as of Feb 2010
Server Power Idle / Active Power	252W idle / 354W active	117W idle / 383W active	Server idle for 16 hours per day and active for 8 hours per day
# Servers needed	105	21	5:1 server consolidation
# Racks needed	5 racks	1 rack	5:1 Rack Consolidation
Annual kWhr	281,883	37,938	Estimated 85% lower energy costs
Annual Energy Costs	\$56,376	\$7,588	\$45,169 electricity cost reduction per year. Assumes \$0.10/kWhr and 2x cooling factor
OS Licensing Costs	\$94,500	\$18,900	\$75,600 less per year Assumes a RHEL 1yr license at \$900 Source www.dell.com as of 12/16/08
Estimated Annual Cost Savings of \$120,769			
Cost of new HW	n/a	\$151,200	Assume \$7,200 per server
Estimated Payback Period of 15 months			



Intel® Xeon® 5600 Encryption Performance



1 System configuration: Windows 2008 R2 x64 Ent. Server. PHP banking sessions /users measured with Intel® Xeon® X5680 (3.33 GHz) vs Intel Xeon® 5160 (3.00 GHz) and Intel Xeon® X5570 (2.93 GHz), 24 SSD RAID 0 arrays, TLS_RSA_with_AES_128_CBC_SHA cipher suite.

2 System configuration: Oracle 11g with TDE, time takes to decrypt a 5.1 million row encrypted table with AES-256 CBC mode on WSM 3.33 GHz optimized with Intel® Performance Primitives crypto library (IPP) vs NHM 2.8 GHz without IPP. Timing measured is per 4K of data.

3 System configuration: McAfee Endpoint Encryption for PCs (EEPC) 6.0 package with McAfee ePolicy Orchestrator (ePO) 4.5 encrypting a 32GB X25E SSD with WSM 3.33 GHz vs. NHM 2.93 GHz. 24GB of memory.

