



World's 1st 45 nm, High-K Processor Launch

Nov 12, 2007

Today's Activities

3 p.m.- 4 p.m. Analyst Briefing - Salon III

- Bill Holt, SVP & GM Technology & Manufacturing Group
- Steve Smith, VP & Director of Operations Digital Enterprise Group
- Q&A

4 p.m.- 6 p.m. Launch Event - Terrace Courtyard Tent

- Paul Otellini, President & Chief Executive Officer
- Sean Maloney, EVP & GM Sales and Marketing Group
- Bill Holt, SVP & GM Technology & Manufacturing Group
- Dadi Perlmutter, SVP & GM Mobility Group
- Demos



Risk Factors

- Today's presentation contains forward-looking statements. All statements made that are not historical facts are subject to a number of risks and uncertainties, and actual results may differ materially. Please refer to our most recent Earnings Release and our most recent Form 10-Q or 10-K filing available on our website for more information on the risk factors that could cause actual results to differ.



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Intel 45 nm Silicon Technology

Bill Holt

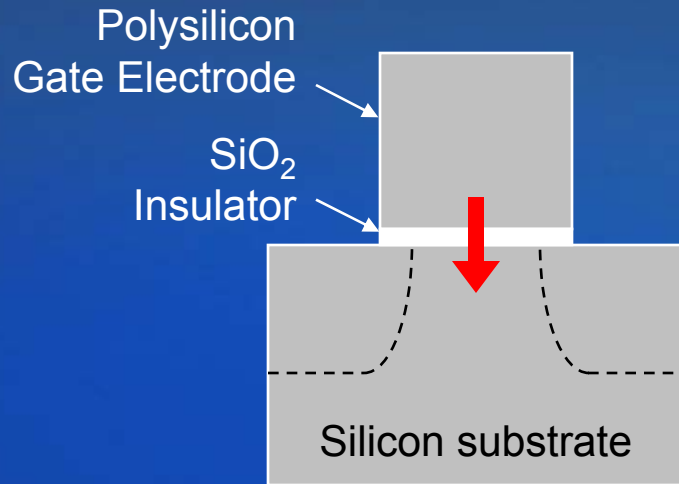
Senior Vice President,

General Mgr., Intel Technology & Manufacturing Group



Transistor Scaling Challenges

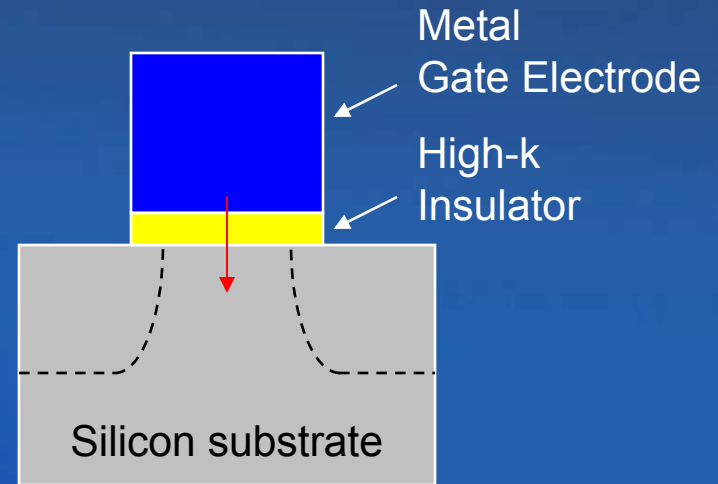
Standard Transistor



Transistor scaling limited by SiO₂ gate insulator

Further SiO₂ scaling results in excessive gate leakage

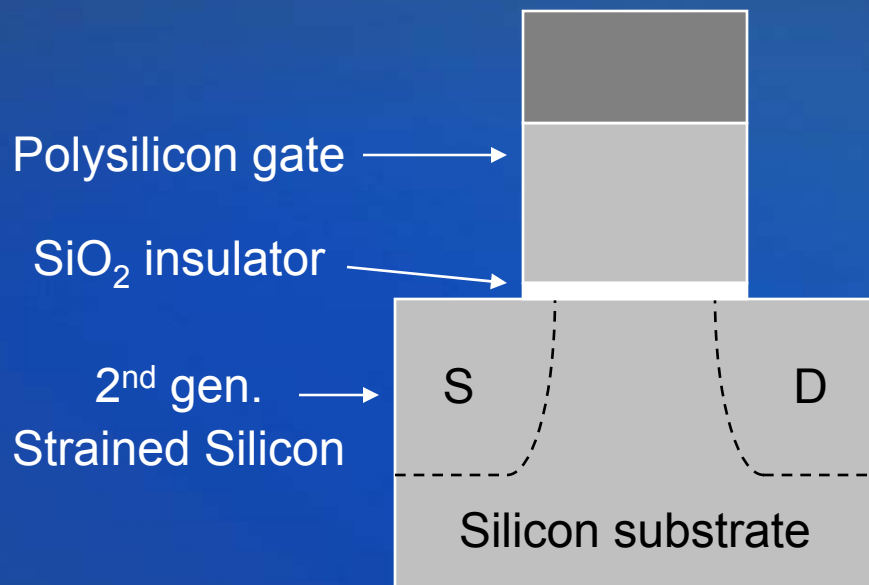
High-k + Metal Gate



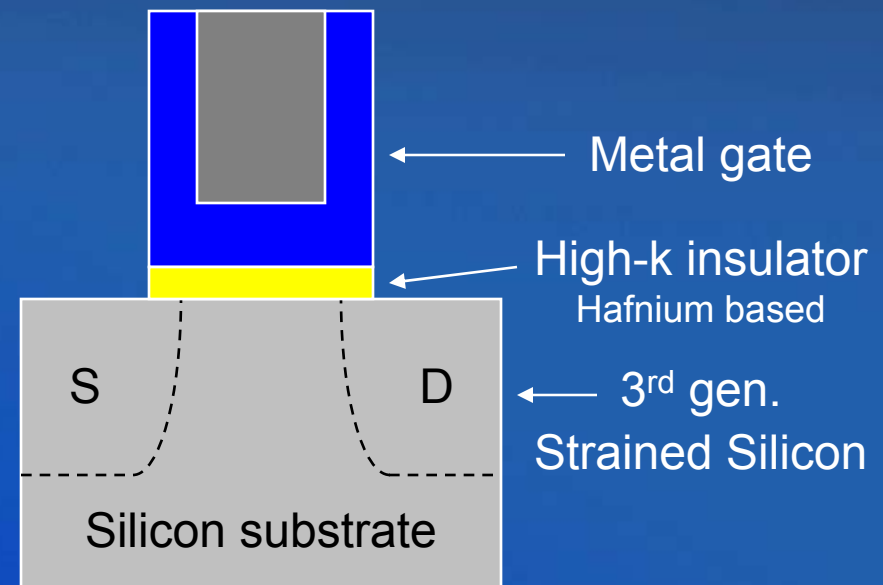
High-k + metal gate reduces gate insulator leakage and improves performance

Fundamental Change to Transistors

65 nm Transistor



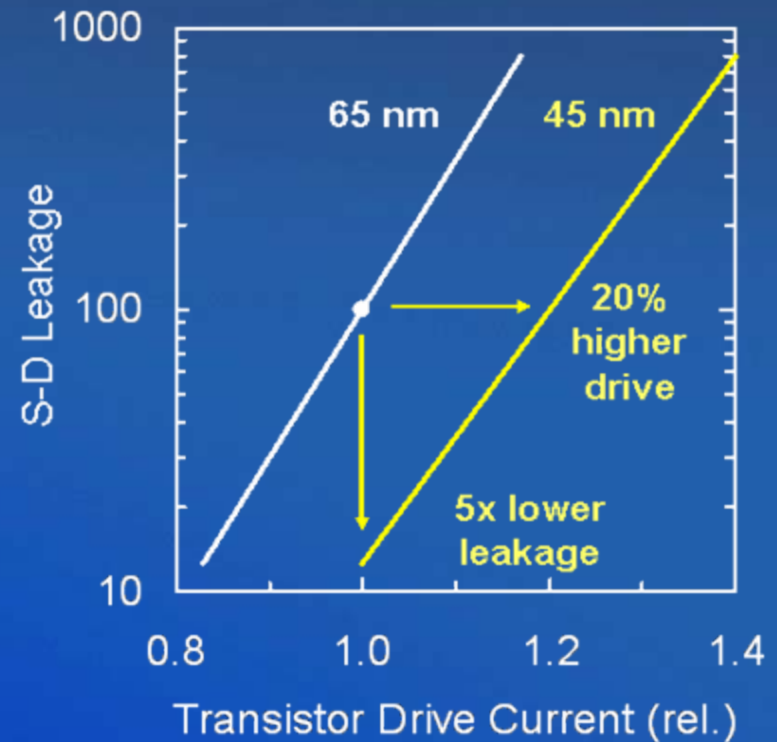
45 nm HK+MG Transistor



Delivering Real Perf/Watt Improvement

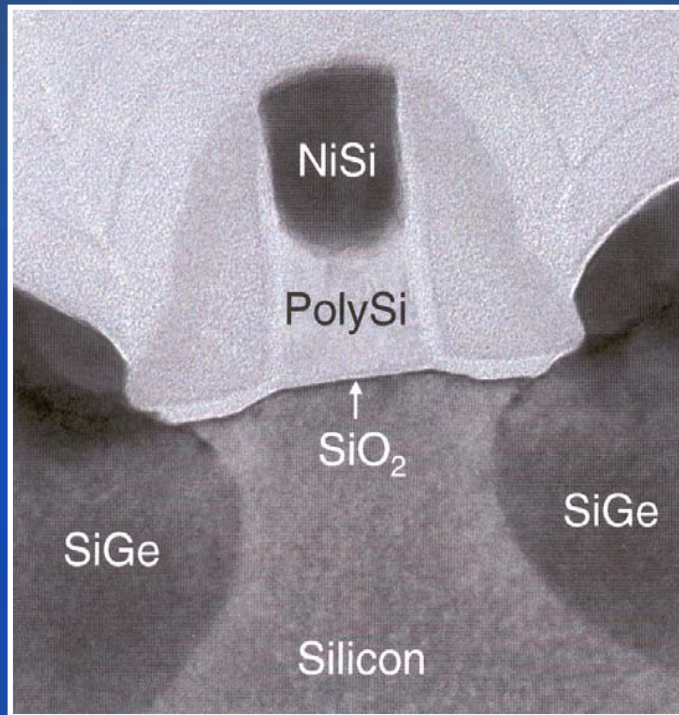
45 nm High-k + Metal Gate Performance / Watt Benefits

- >10x lower gate insulator leakage
- >30% lower switching power
- >20% higher drive current, or
- >5x lower source-drain leakage

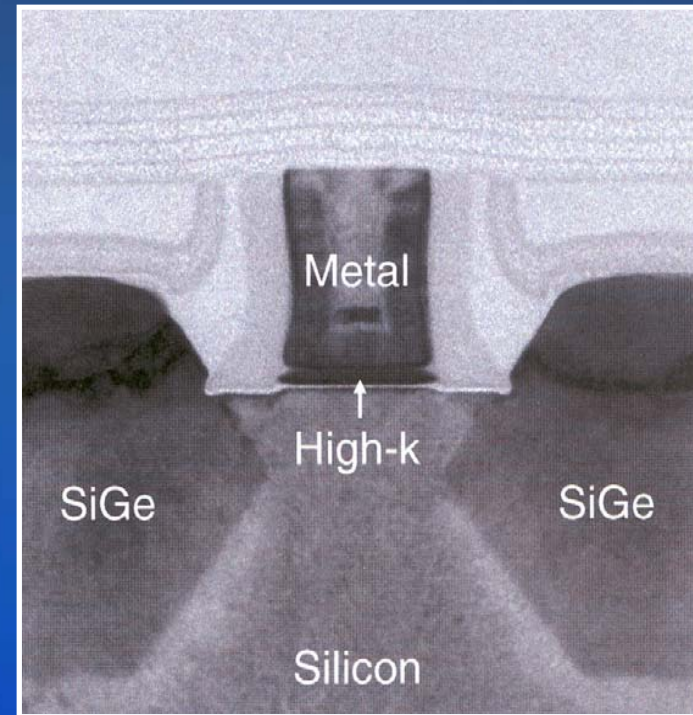


High-k + Metal Gate Transistors

65 nm Transistor



45 nm HK + MG

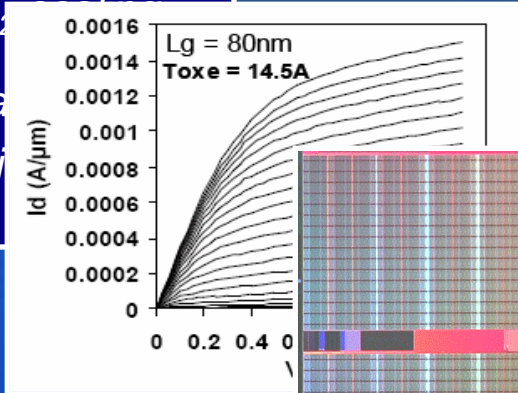


Hafnium-based high-k + metal gate transistors are the biggest advancement in transistor technology since the late 1960s

The Road to 45 nm HK + MG

Intel foresees
end of SiO₂ scaling

High-k transistors
research in progress



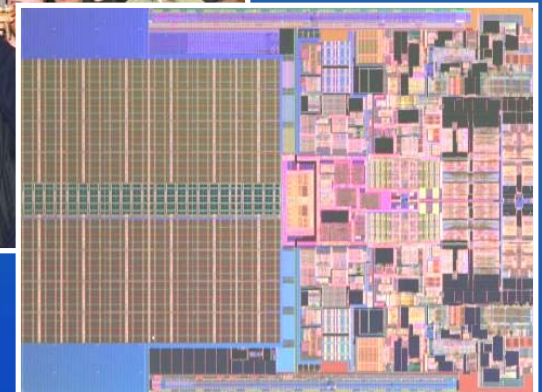
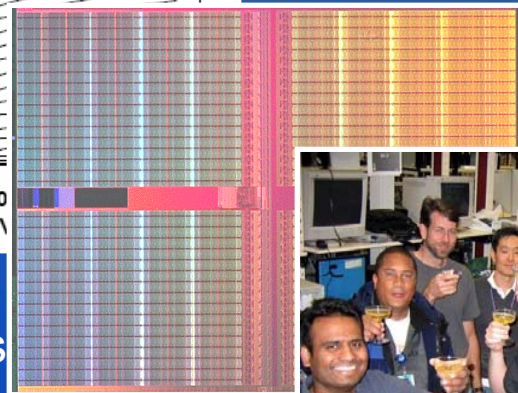
Mid-1990s
Research Starts

Nov. 2003
HK+MG Transistors

Jan. 2006
153 Mb SRAM

Jan. 2007
Penryn 1st Silicon

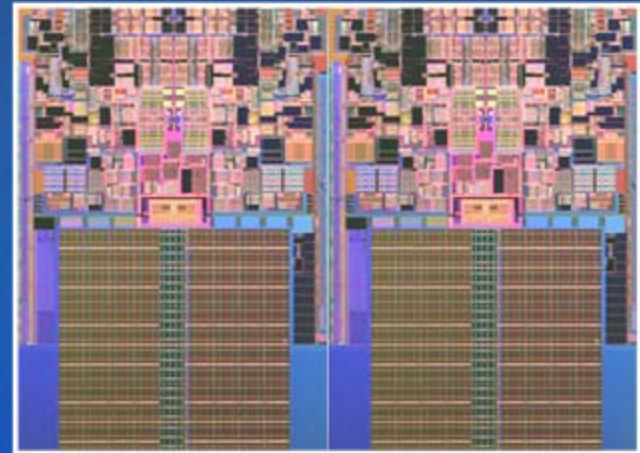
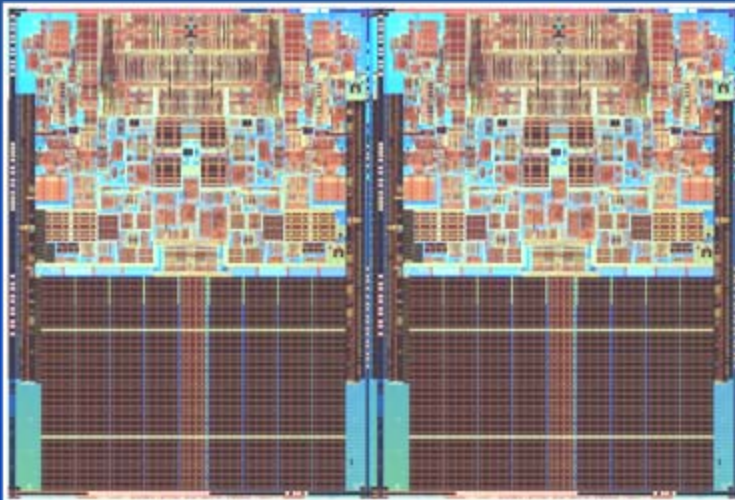
Nov. 2007
Penryn Launch



An Optimized Application of Moore's Law

Intel® Xeon® 5300 Processor
(Clovertown)
65 nm

Intel® Xeon® 5400 Processor
(Harpertown)
45 nm Hi-k



143 mm²*

143 mm²*

107 mm²*

107 mm²*

582M Transistors
8 MB Cache

1.9x
transistors/mm²

820M Transistors
12 MB Cache



*source: Intel

On-Time 2 Year Cycles

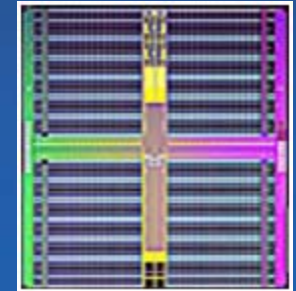
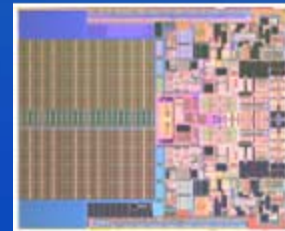
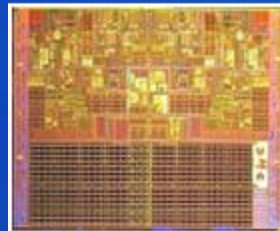
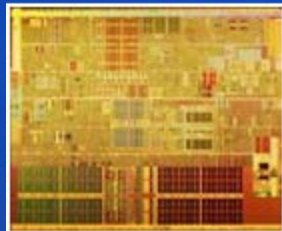
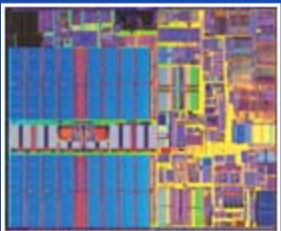
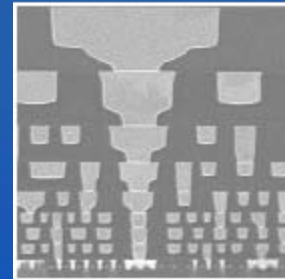
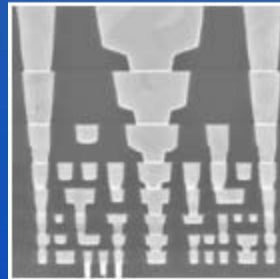
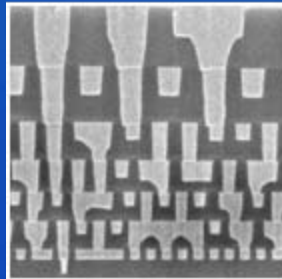
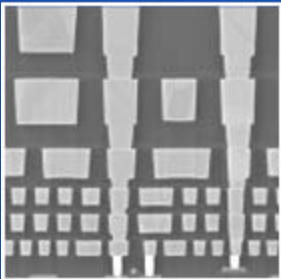
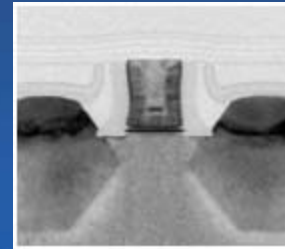
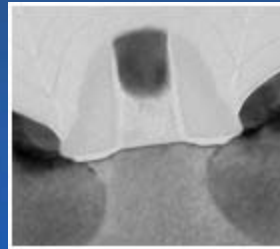
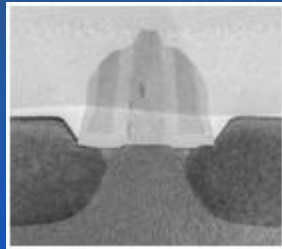
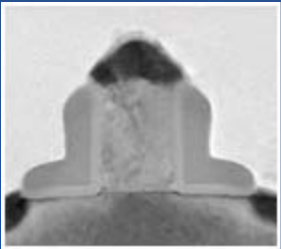
130 nm
2001

90 nm
2003

65 nm
2005

45 nm
2007

32 nm
2009*



291 Mbit
SRAM

2nd gen.
HK+MG

Sep. 2007

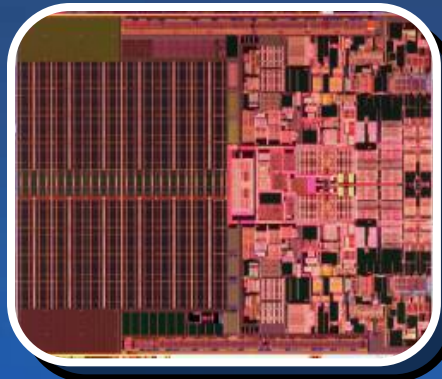


*Forecast

In-House Co-Optimization



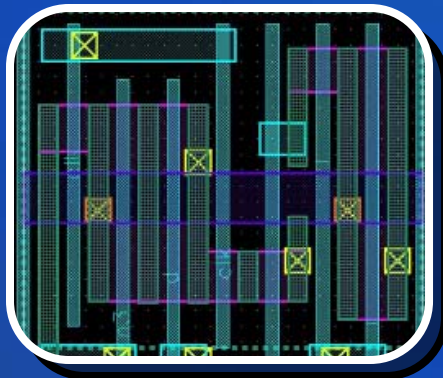
Process



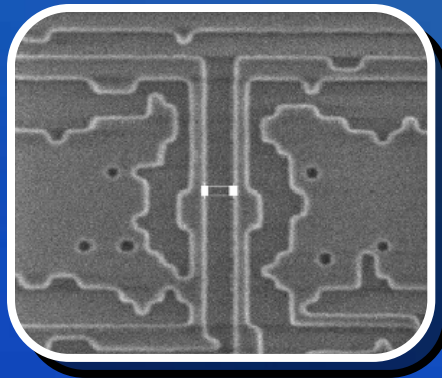
Product



Leading-edge Capacity



Design Tools



Masks

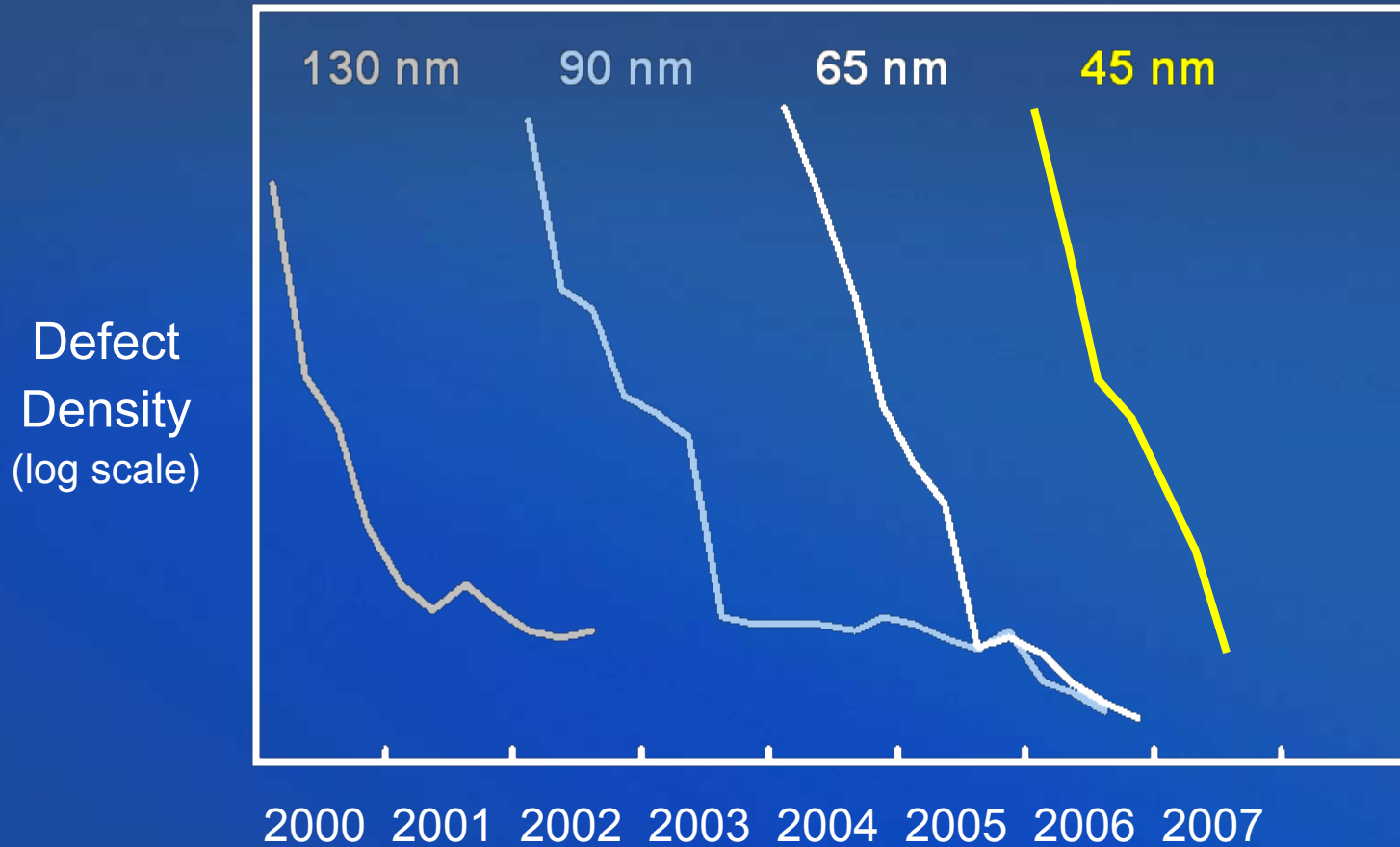


Packaging

Design-For-Manufacturing enables rapid yield learning



Rapid Defect Reduction for High Chip Yield



45 nm Manufacturing Fabs



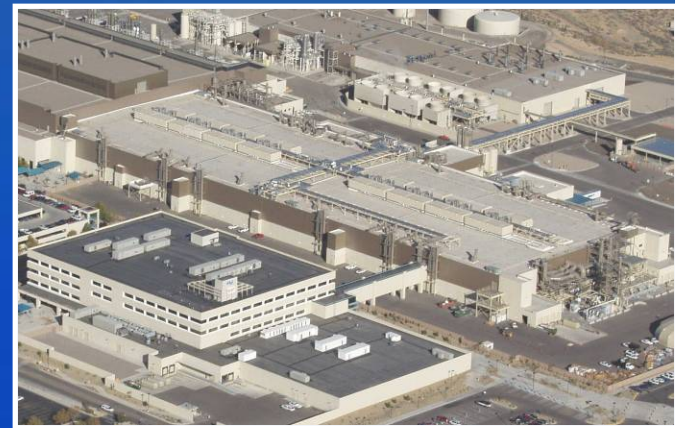
D1D Oregon - Now



Fab 32 Arizona - Now



Fab 28 Israel – 2008*

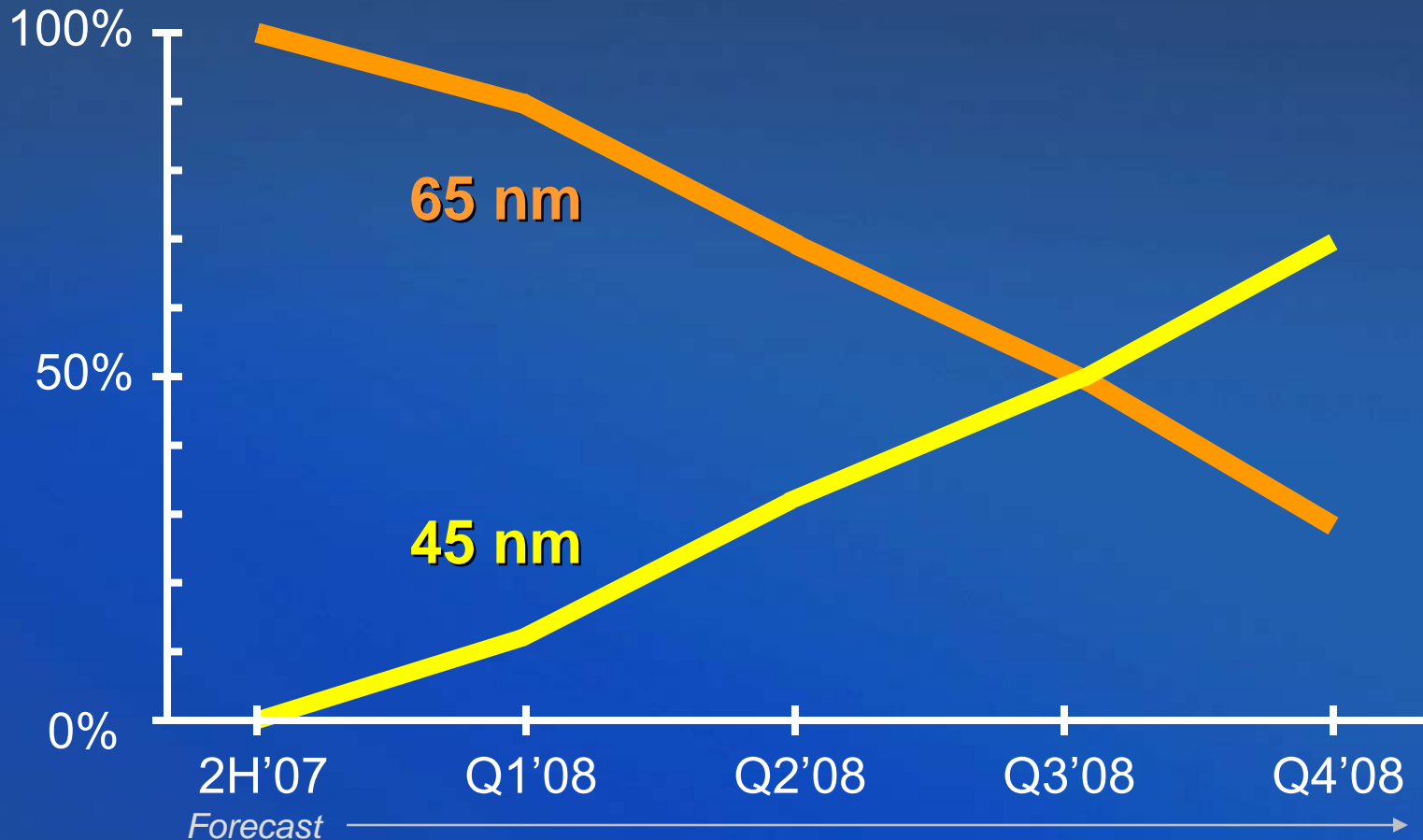


Fab 11X New Mexico – 2008*



*Forecast

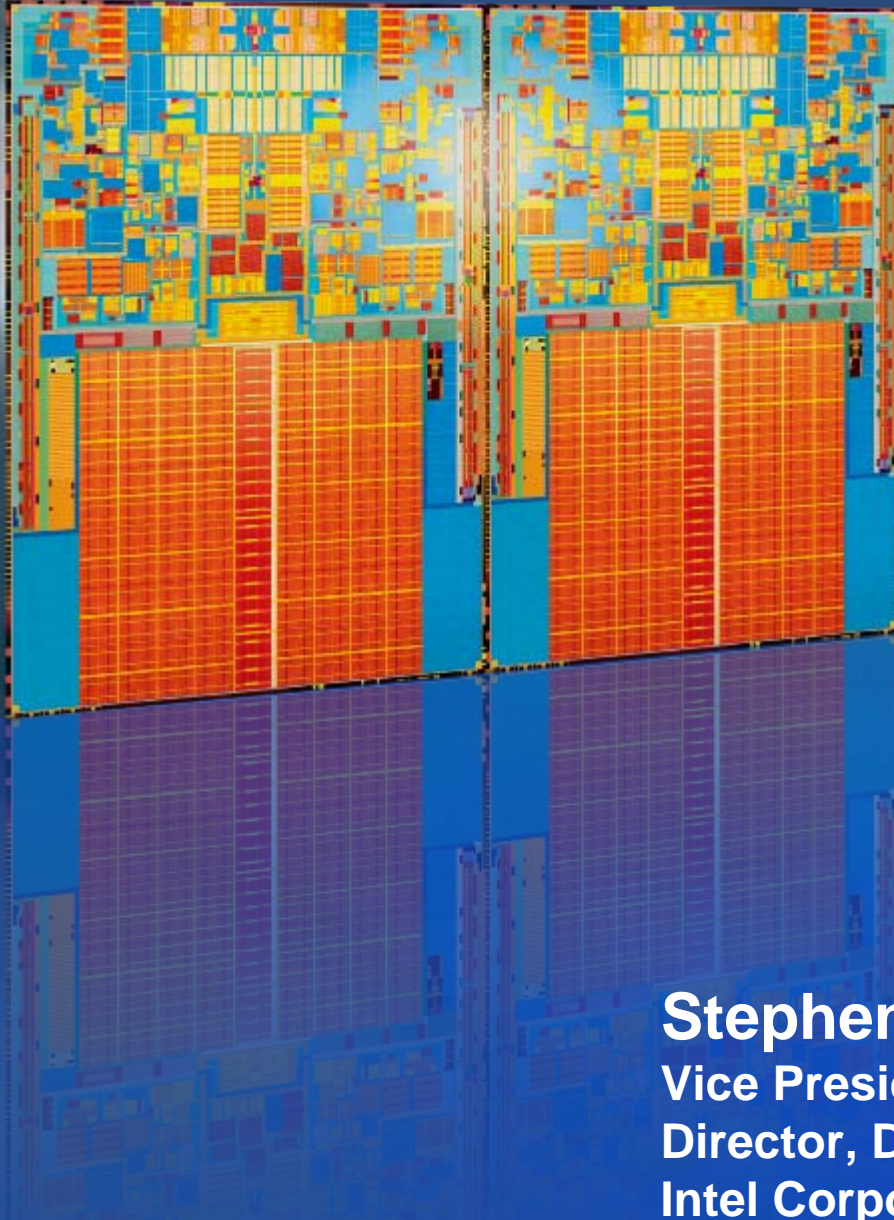
CPU Shipment Crossover



Intel 45 nm CPU shipments expected to crossover 65 nm in Q3'08



Source: Intel Internal



Intel's 45 nm High-K Processors

Stephen L. Smith

Vice President

Director, Digital Enterprise Group Operations

Intel Corporation

Key Messages

45nm next
Generation
Intel® Core™
microarchitecture
(Penryn)

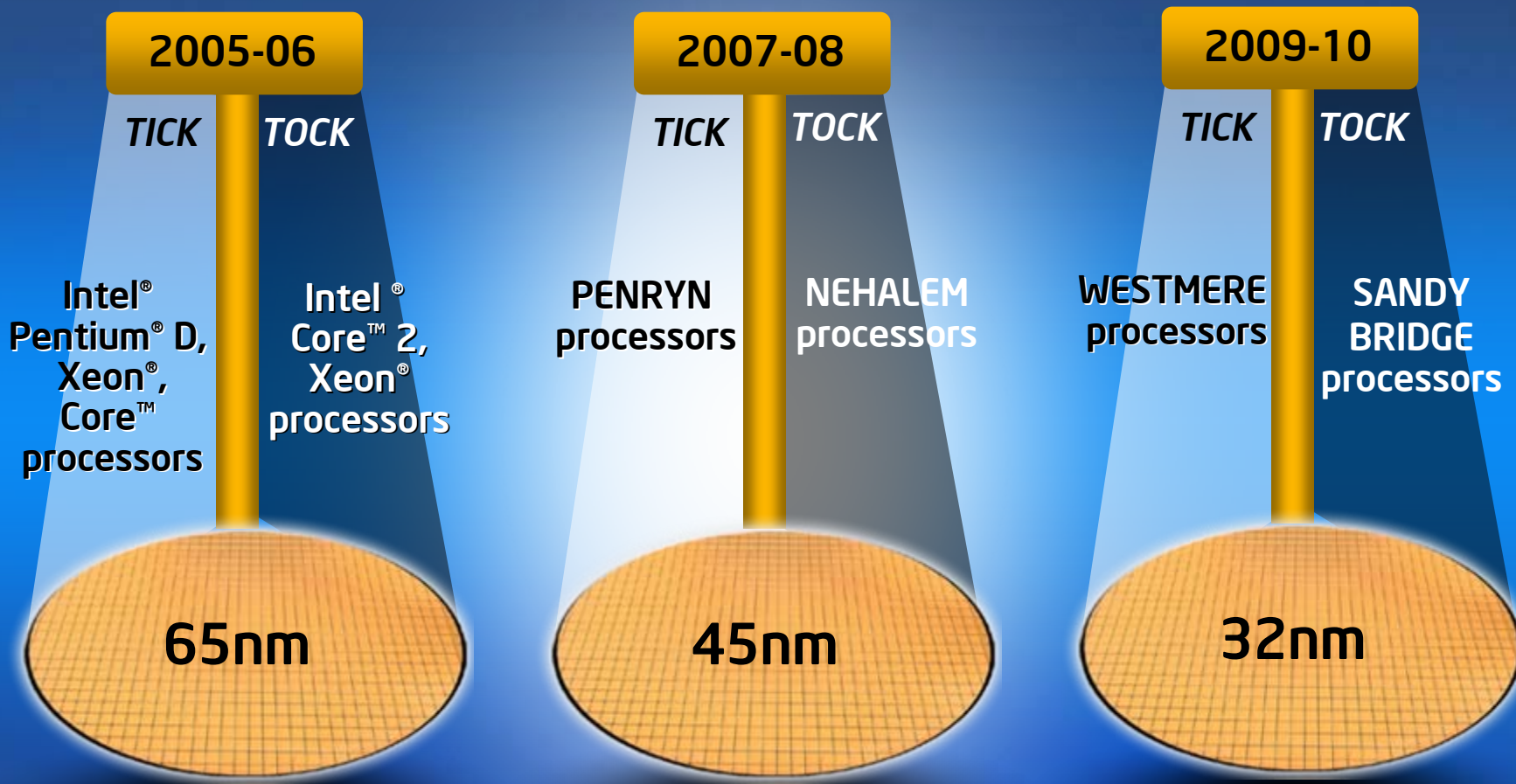
TICK

- Execution to the Tick-Tock model continues
- Intel 45nm next generation Intel® Core™ microarchitecture extends lead
- Delivering new segment-optimized platforms



All product information and dates are preliminary and subject to change without notice

Intel's Tick Tock Development Model



New 45nm High-k Processors

Intel's 2nd Generation quad-core processor

technology rich

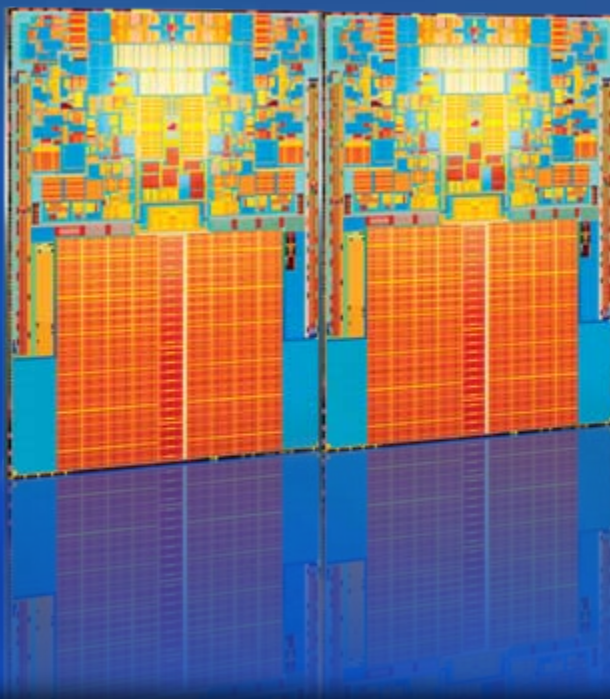
compelling IT benefits

Enhanced
Intel Core
Microarchitecture

Larger Caches

New Intel® SSE4
Instructions

45nm High-k &
Metal Gates
Technology



Greater
Performance at
Given Frequency
and Higher
Frequencies

Greater Energy
Efficiency

The Next "Tick" Delivering Higher Performance
& Energy Efficiency



Enhanced Intel® Core™ Microarchitecture

Intel® Core™
Microarchitecture

Enhanced
Intel Core Microarchitecture

Intel® Wide
Dynamic Execution

Fast Radix-16 Divider
Enhanced Memory Virtualization

Intel® Advance
Smart Cache

50% Larger on die Cache
24 Way Associativity

Intel® Smart
Memory Access

Improved Store & Forwarding
Higher Bus Speeds

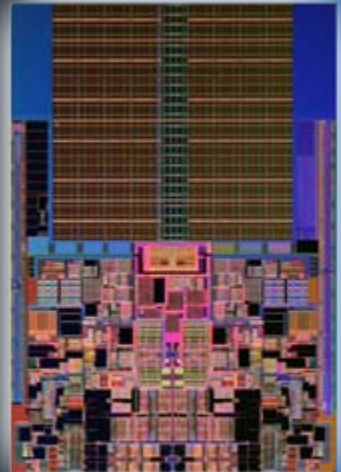
Intel® Adv Digital
Media Boost

Intel® HD
Boost

Intel® SSE4 Instructions
Super Shuffle Engine

Intel® Intelligent
Power Capability

Deep Power Down Technology*
Enhanced Intel Dynamic Acceleration*



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.

*Mobile only features

Intel® Penryn Family



Server

Quad-Core Intel Xeon® 5400 processors
▪ Available: Nov 12, '07

Dual-Core Intel Xeon® 5200 processors (DP)
▪ Available: Dec '07

UP Intel Xeon® processors
▪ Available: Q1'08

Dunnington (MP)
▪ Available: 2H'08



Desktop

Intel® Core™ 2 Extreme processor QX9650
▪ Available: Nov 12, '07

Intel Core 2 Quad processor
▪ Available 1Q '08

Intel Core 2 Duo processor
▪ Available: 1Q'08



Mobile

Intel Core 2 Extreme processor
▪ Available: 1Q'08

Intel Core 2 Duo processor
▪ Available: 1Q'08



45 nm Products Ship in All Segments by '08



Introducing Intel® Core™2 Extreme QX9650 Quad-Core Processor

Intel's 2nd Generation Quad-Core Processor on 45nm Technology

“Fastest high-end desktop chip on the market...”

- CNET Reviews, 10/07

“Simply the fastest processor for gaming, media encoding and just about anything else you could do on your PC.

- PC Perspective, 10/07



“... benefits a startlingly broad range of applications, from games to office apps and scientific computing.”

- Techreport, 10/07

“... simply the fastest desktop CPU on the market today.”

- Extremetech, 10/07

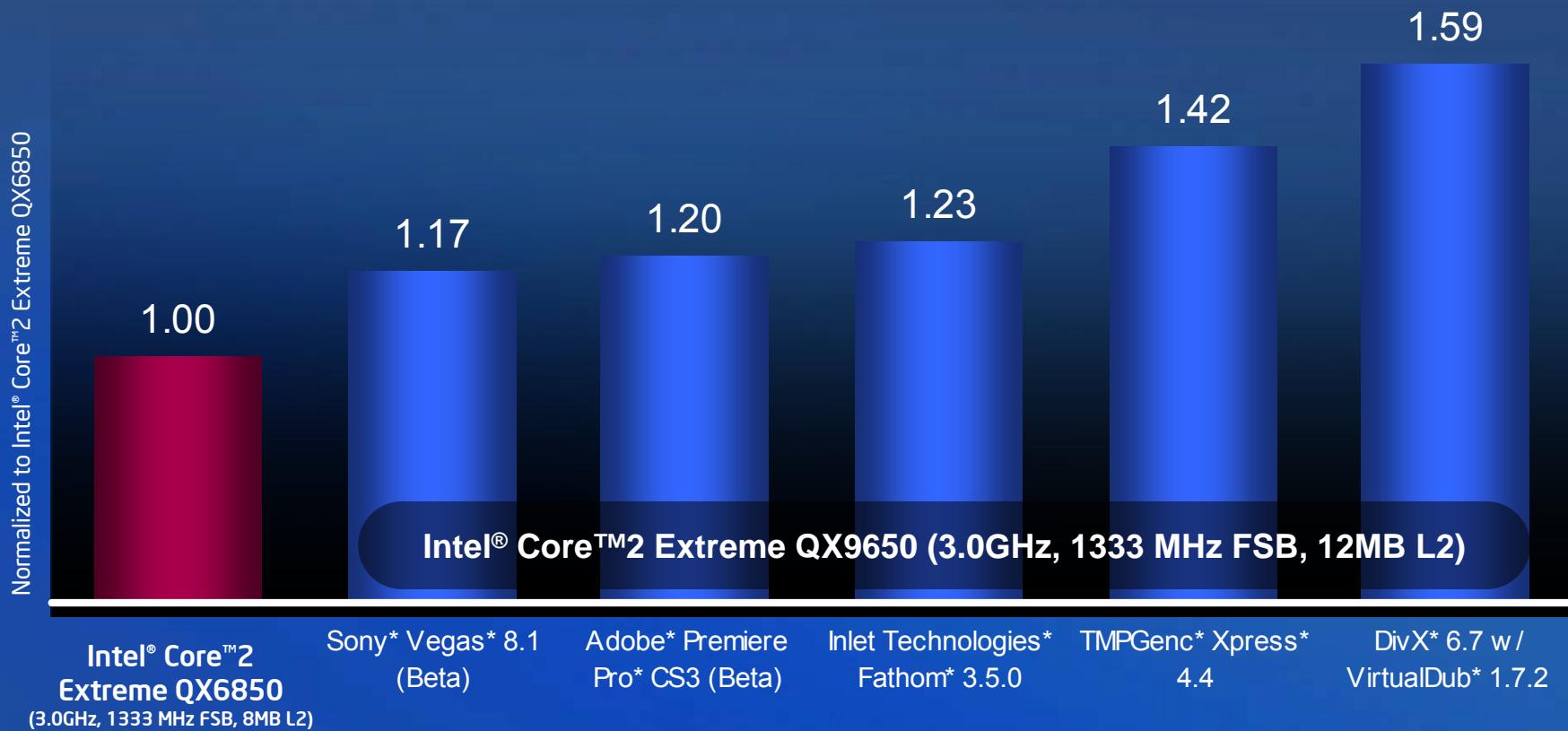
“Less noise, more efficiency, more speed, and more overclocking potential.”

- Tom's Hardware, 10/07

The World's Highest Performing Desktop Processor



3.0GHz Quad-Core Performance Video Encoders¹ Featuring Intel® HD Boost



Intel® HD Boost On The New Intel® Core™2 Extreme QX9650 Processor Turbo Charges Video Encoding & Editing

¹SSE4.1 Support in DivX 6.7 is experimental. Adobe* Premiere Pro* CS3 performance data from a Beta/pre-release of the software. Data is subject to change.

Source: Intel. **Configuration:** Intel® Core™2 Extreme QX6850 (8MB L2, 3.0 GHz, 1333MHz FSB) and Intel Core™2 Extreme Processor QX9650 (12MB L2, 3.0 GHz, 1333MHz FSB) on Asus* P5E3 X38 Deluxe board, Intel Chipset INF 8.4.0.1016, Asus* E6800GTX w/ Nvidia* 8800GT graphics card, 2x1GB Dual Channel Corsair* DDR3-1333 9-9-9 -24, Seagate* 320GB Barracuda* NC9 Serial ATA 7200 RPM, Windows* Vista* Ultimate 32bit. *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/>*

45nm Hi-k Intel® Core™ 2 Extreme Processor



ALIENWARE



Broad System Availability in 2007

Intel® Xeon® Server Product Family

Investment Protection

Scalable
Enterprise

4p - 32p



Intel® Xeon® 7300
(Intel 7300 chipset)
Dunnington 2H '08

Mainstream
Enterprise

2p



Intel® Xeon® 5400
(Intel 5000 chipset)
Efficient Performance

New Targeted Platforms

Medium
Business

2p



Intel® Xeon® 5400
(Intel 5100 chipset)

Cost & Power Optimized

Small
Business

1p



Intel® Xeon® 3200
(Intel 3200 chipset)

Economical 1-way

HPC

2p

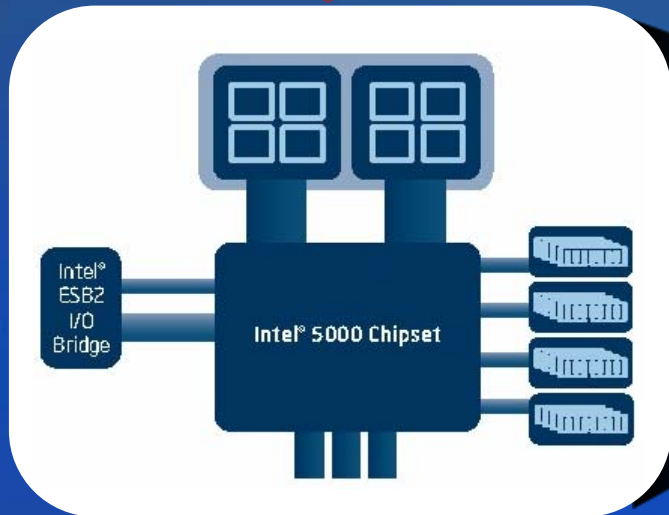


Intel® Xeon® 5400
(Intel 5400 chipset)

Bandwidth Optimized

More Performance in the Stable Platform

Platform of Choice
Since Mid'06 adding
45nm processors



Common 2P Server Infrastructure

Dual-Core
Xeon 5000

Dual-Core
Xeon 5100

Quad-Core
Xeon 5300

NEW 45nm
Quad-Core
Dual-Core

Socket compatible, software compatible, stable power envelope

More Performance in a Stable Platform

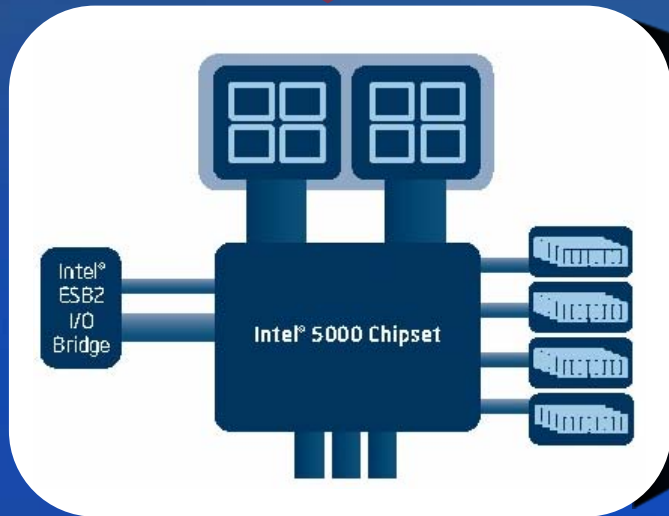


Data source: Published/Measured results as of Oct 2, 2007. See backup for details

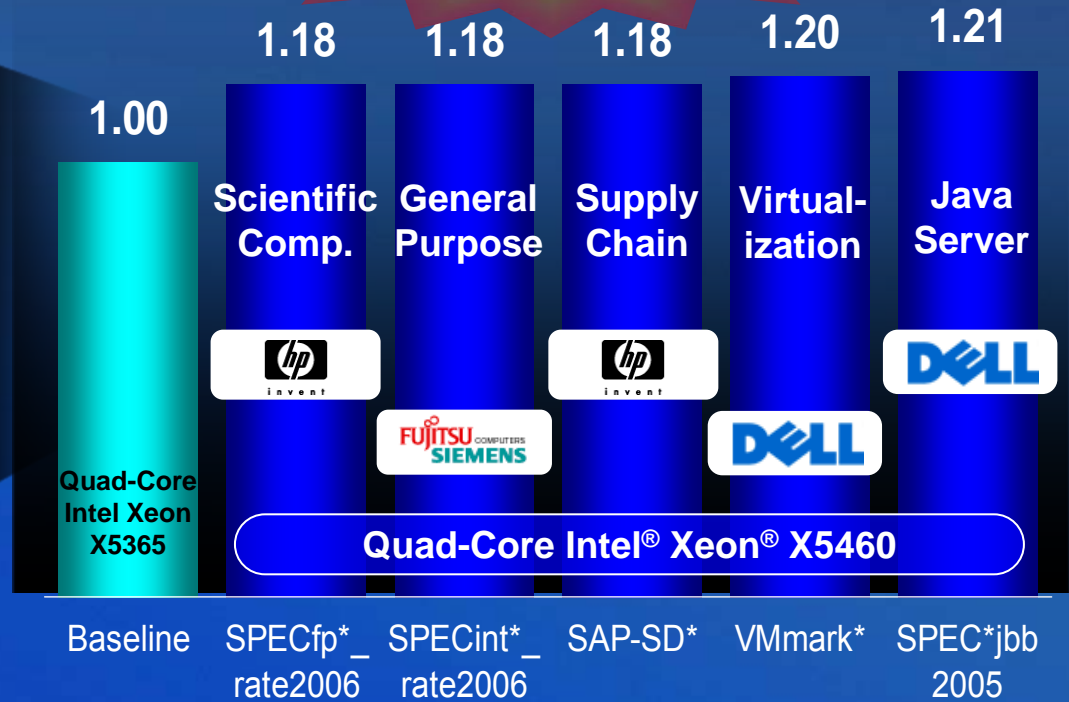
Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance. Buyers should consult 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 Copyright © 2007, Intel Corporation. * Other names and brands may be claimed as the property of others.

More Performance in the Stable Platform

Platform of Choice
Since Mid'06 adding
45nm processors



Up to 21% Higher
Performance



More Performance in
a Stable Platform



Data source: Published/Measured results as of Oct 2, 2007. See backup for details

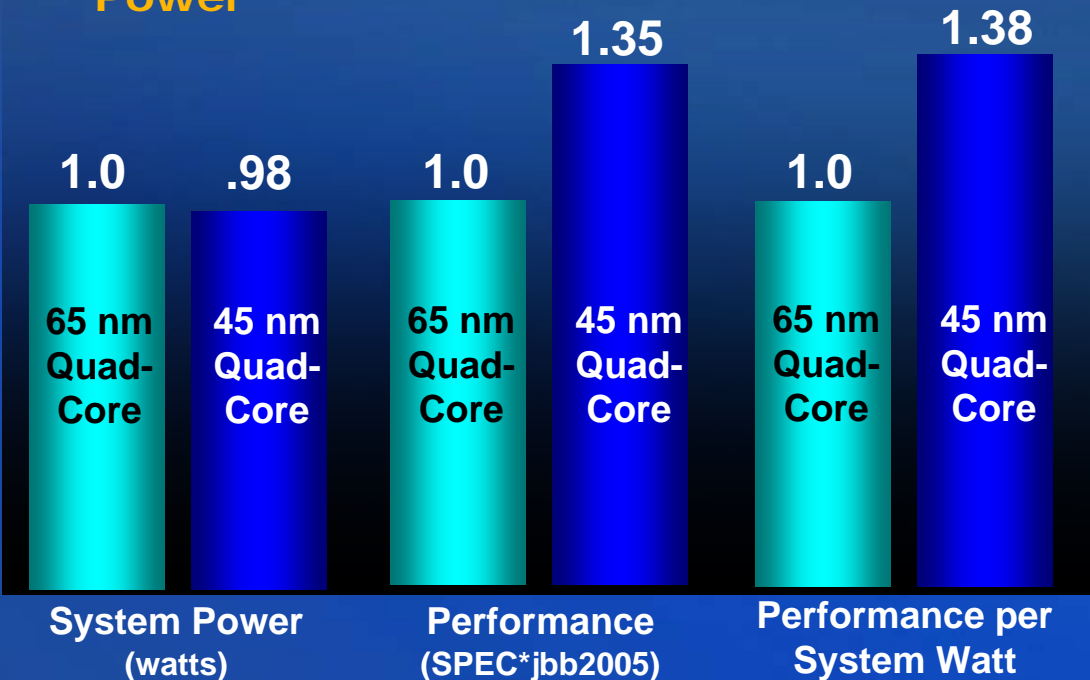
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Energy Efficient Performance



Up to 38% Higher Performance/Watt

Stable System Power + Higher Performance = Higher Perf/Watt



 Intel Xeon E5345 (2.33GHz/1333/80W)
 Intel Xeon E5450 (3.00GHz/1333/80W)

Leverages 45nm High-k & Metal Gate Low Leakage Technology

Up to 2/3 Reduction in Idle Power

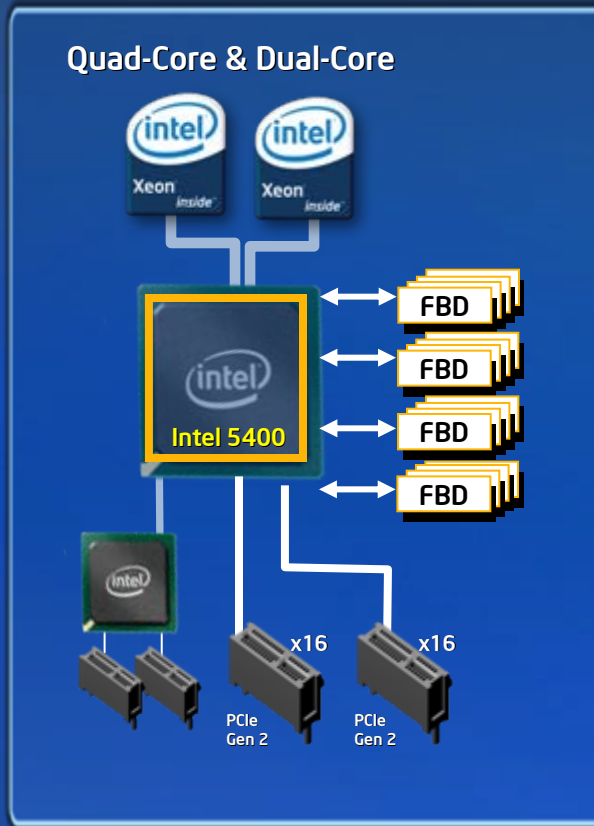
Choice of Processor Power Levels, including 50W Quad-Core¹

¹ - 50W Quad-Core available in Q1'08, all dates and features are subject to change without notice

Data source: Published/Measured results as of Oct 2, 2007. See backup for details. 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 Copyright © 2007, Intel Corporation. * Other names and brands may be claimed as the property of others.



New High Performance Computing Platform



- Quad-core Intel® Xeon® 5400 processor or
- Dual-core Intel® Xeon® 5200 processor
- Intel 5400 Chipset
 - 20% Faster FSB (1600MHz)
 - PCIe Gen 2 (2x bandwidth)
 - Larger Memory Support (up to 128GB)
 - 40 Lanes of Configurable PCIe (gen 1 & 2)

Optimized for

- Bandwidth Intensive Applications
- High Performance Clusters
- Multi-tasking User Environments

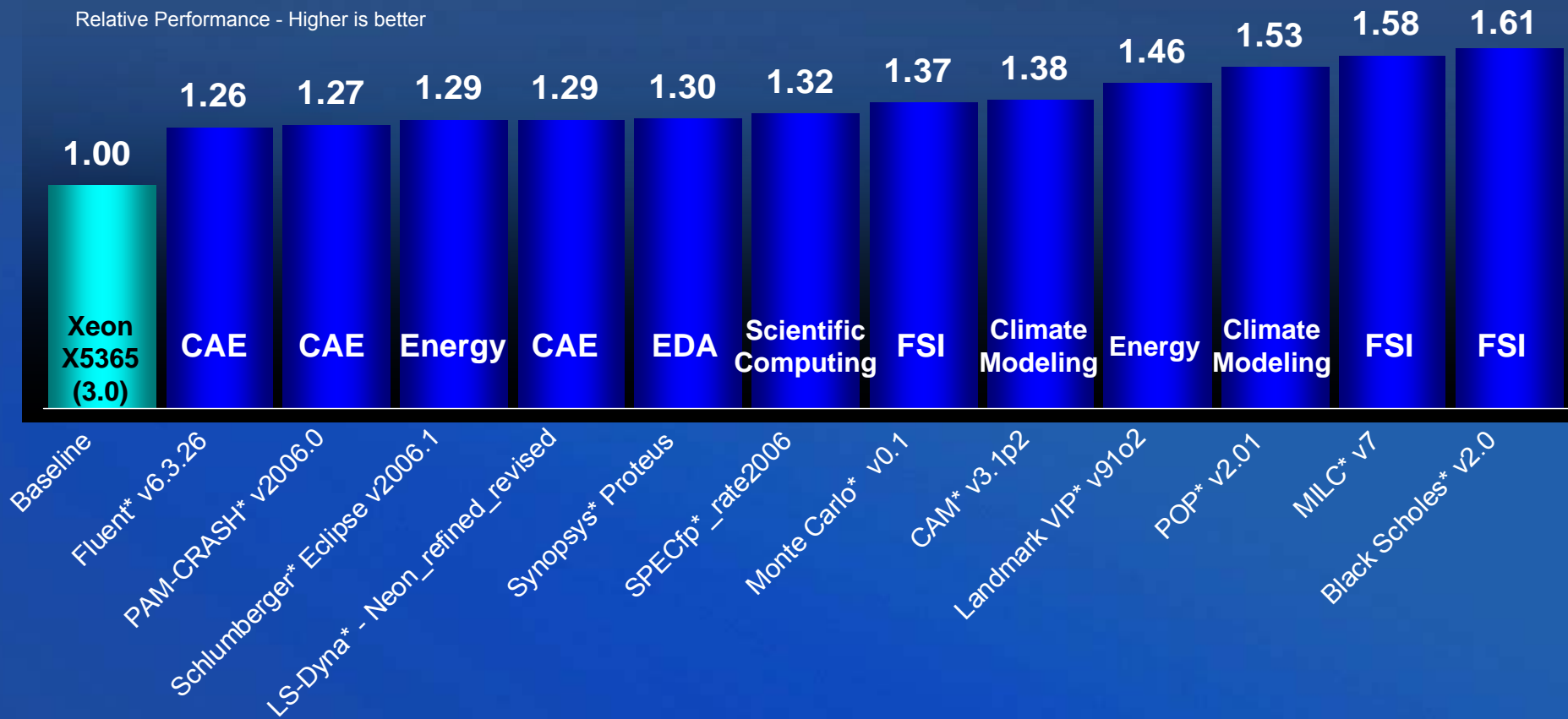


High Performance, Energy Efficient, Advanced Technology

Added Bandwidth Translates into HPC Performance

Xeon E5472 vs Xeon X5365 on HPC benchmarks

Relative Performance - Higher is better



Delivering Leadership Performance on HPC Applications



Data source: Published/Measured results as of Oct 2, 2007. See backup for details

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Putting it All Together

	Circa 2004	Intel Xeon® 5400
M bops (Java)	5.1	5.1
Racks	6	1
Servers	126	17
sq ft	240	40
kW	48	6

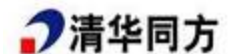
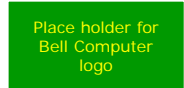
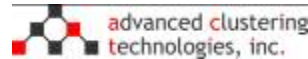


Bottom Line: Intel Xeon® 5400 is a compelling HPC platform

- 83% reduction in floor space (40 sq ft vs. 240 sq ft)
- 87% reduction in annual energy costs (6kW vs. 48kW)
- \$53k annual energy savings (\$8.3k vs. \$61.4k @ \$0.10 kWh)



45 nm Hi-K Quad-Core Intel® Xeon® Processor



Broad System Availability in 2007

Summary

45 nm Hi-k
+ Metal-gate Transistor



Industry Leading
Process Technology

New Eco-friendly Penryn
Family



Energy Efficient Products
Lead-free now,
Halogen free in '08

16 New Processors
Enhanced Server Platforms



Investment Protection
Meet Diverse Needs

Penryn Family Extends Intel's Leadership



Today's Demonstrations

- **OEM Desktop Systems with the Intel® Core™ 2 Extreme processor QX9650**

- Falcon NW Mach V
- Gateway FX540
- HP Blackbird 002



- **HPC Server System**

- Intel® 5400 Chipset and Quad-core Intel® Xeon® processor X5472 (3.00GHz / 12MB cache / 1600 FSB)



Q & A

Risk Factors

- This presentation contains forward-looking statements that involve a number of risks and uncertainties. These statements do not reflect the potential impact of any mergers, acquisitions, divestitures, investments or other similar transactions that may be completed in the future. The information presented is accurate only as of today's date and will not be updated. In addition to any factors discussed in the presentation, the important factors that could cause actual results to differ materially include the following: Intel operates in intensely competitive industries that are characterized by a high percentage of costs that are fixed or difficult to reduce in the short term, significant pricing pressures, and product demand that is highly variable and difficult to forecast. Additionally, Intel is in the process of transitioning to its next generation of products on 45 nm process technology, and there could be execution issues associated with these changes, including product defects and errata along with lower than anticipated manufacturing yields. Revenue and the gross margin percentage are affected by the timing of new Intel product introductions and the demand for and market acceptance of Intel's products; actions taken by Intel's competitors, including product offerings and introductions, marketing programs and pricing pressures and Intel's response to such actions; Intel's ability to respond quickly to technological developments and to incorporate new features into its products; and the availability of sufficient components from suppliers to meet demand. Factors that could cause demand to be different from Intel's expectations include customer acceptance of Intel's and competitors' products; changes in customer order patterns, including order cancellations; changes in the level of inventory at customers; and changes in business and economic conditions, including conditions in the credit market that could affect consumer confidence and result in lower than expected demand for our products. The gross margin percentage could vary significantly from expectations based on changes in revenue levels; product mix and pricing; capacity utilization; variations in inventory valuation, including variations related to the timing of qualifying products for sale; excess or obsolete inventory; manufacturing yields; changes in unit costs; impairments of long-lived assets, including manufacturing, assembly/test and intangible assets; and the timing and execution of the manufacturing ramp and associated costs, including start-up costs. Expenses, particularly certain marketing and compensation expenses, vary depending on the level of demand for Intel's products, the level of revenue and profits, and impairments of long-lived assets. Intel is in the midst of a structure and efficiency program that is resulting in several actions that could have an impact on expected expense levels and gross margin. The tax rate expectation is based on current tax law and current expected income. The tax rate may be affected by the closing of acquisitions or divestitures; the jurisdictions in which profits are determined to be earned and taxed; changes in the estimates of credits, benefits and deductions; the resolution of issues arising from tax audits with various tax authorities, including payment of interest and penalties; and the ability to realize deferred tax assets. Gains or losses from equity securities and interest and other could vary from expectations depending on fixed income and equity market volatility; gains or losses realized on the sale or exchange of securities; gains or losses from equity method investments; impairment charges related to marketable, non-marketable and other investments; interest rates; cash balances; and changes in fair value of derivative instruments. Intel's results could be affected by the amount, type, and valuation of share-based awards granted as well as the amount of awards cancelled due to employee turnover and the timing of award exercises by employees. Intel's results could be impacted by adverse economic, social, political and physical/infrastructure conditions in the countries in which Intel, its customers or its suppliers operate, including military conflict and other security risks, natural disasters, infrastructure disruptions, health concerns and fluctuations in currency exchange rates. Intel's results could be affected by adverse effects associated with product defects and errata (deviations from published specifications), and by litigation or regulatory matters involving intellectual property, stockholder, consumer, antitrust and other issues, such as the litigation and regulatory matters described in Intel's SEC reports. A detailed discussion of these and other factors that could affect Intel's results is included in Intel's SEC filings, including the report on Form 10-Q for the quarter ended September 29, 2007.



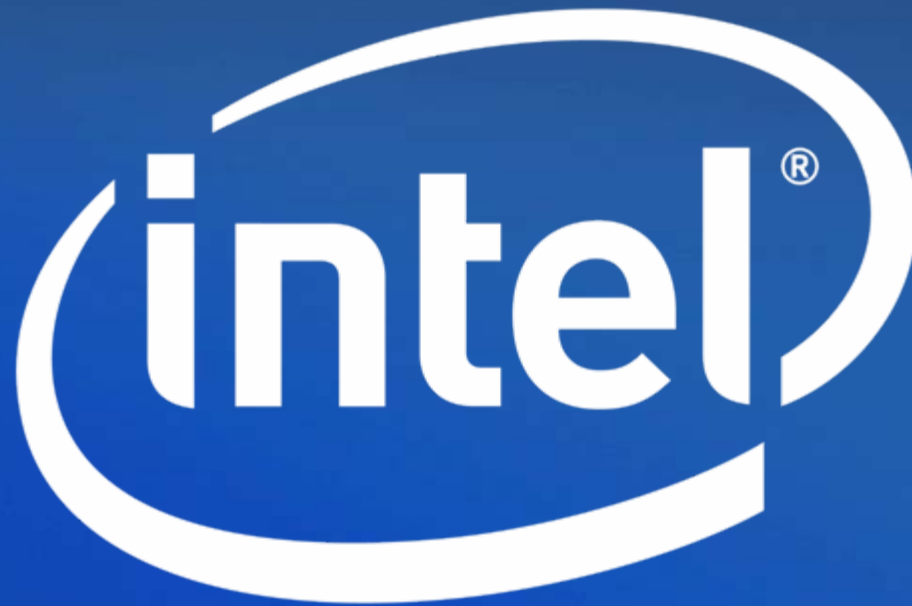
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More Performance in the Stable Platform – Config Details

SPECint*_rate2006

- **Quad-Core Intel® Xeon® processor X5365 based platform details:** Supermicro* Motherboard X7DB3 server platform with two Quad-Core Intel Xeon processor X5365 3.0GHz, 2x4MB L2 Cache, 1333MHz FSB, 32GB Memory (8x4GB DDR2 5300, CL-5-5-5, ECC), 64-Bit Suse Linux Enterprise Server 10 SP1, Intel C++ Compiler for Linux32 and Linux64 version 10.1 Build 20070725. Referenced as published at 117 (SPECint*_rate2006) and 98 (SPECint*_rate_base2006). For more information see <http://www.spec.org/cpu2006/results/res2007q4/cpu2006-20070921-02123.html>
- **Quad-Core Intel® Xeon® processor X5460 based platform details:** Fujitsu Siemens PRIMERGY RX300 S4 server platform with two Quad-Core Intel Xeon processor X5460 3.16GHz, 12MB L2 Cache, 1333MHz FSB, 16GB Memory (8x2GB DDR2 PC2-5300F, 2 rank, CAS 5-5-5, with ECC), SUSE LINUX Enterprise Server 10 SP1 x86_64 Kernel 2.6.16.43-0.12-smp, Intel C++ Compiler for Linux32 and Linux64 Version 10.1 Build 20070725. Measured at 138 (SPECint*_rate2006) and 113 (SPECint*_rate_base2006)

SPECfp*_rate2006

- **Quad-Core Intel® Xeon® processor X5365 based platform details:** Supermicro X7DB8+ platform with two Intel Xeon processors X5365 3.00 GHz, 8 cores, 2x4MB L2 cache, 16GB memory (8x2GB Samsung* DDR2 5300F, 2 rank, CL5-5-5, ECC), 64-Bit SUSE LINUX Enterprise Server 10 SP1 Kernel linux-cbmg 2.6.16.43-0.5-smp for x86_64, Intel C++ and Fortran Compiler for Linux32 and Linux64 Version 10.1 Build 20070725. Published in September 2007. Referenced as published at 63.1 (SPECfp*_rate_base2006) and 66.9 (SPECfp*_rate2006). For more information see <http://www.spec.org/cpu2006/results/res2007q3/cpu2006-20070821-01885.html>
- **Quad-Core Intel® Xeon® processor X5460 based platform details:** HP ProLiant DL360 G5 server platform with two Quad-Core Intel Xeon processor X5460 3.16GHz, 12MB L2 Cache, 1333MHz FSB, 16GB Memory (8x2GB DDR2-667 FBDIMM), 64-Bit SUSE LINUX Enterprise Server 10 SP1 Kernel linux-cbmg 2.6.16.43-0.5-smp for x86_64, Intel C++ and Fortran Compiler for Linux32 and Linux64 Version 10.1 Build 20070725. Submitted to www.spec.org for review. Referenced as published at 70.3 (SPECfp*_rate_base2006) and 78.5 (SPECfp*_rate2006).

TPC-C

- **Quad-Core Intel® Xeon® processor X5365 based platform details:** HP ProLiant ML370 G5 platform with Quad-Core Intel Xeon processor X5365 3.0GHz (2 processors / 8 cores / 8 threads), 2x4MB L2 cache, 1333 MHz system bus, 64GB memory, Microsoft SQL Server 2005 x64 Enterprise Edt SP2, Microsoft Windows Server 2003 Enterprise x64 Ent. R2. Referenced as published at 251,300 tpmC and \$1.63/tpmC; availability date September 5, 2007. For more information see http://tpc.org/tpcc/results/tpcc_result_detail.asp?id=107090501
- **Quad-Core Intel® Xeon® processor X5460 based HP ProLiant details:** HP ProLiant ML370 G5 platform with Quad-Core Intel Xeon processor X5460 3.16GHz (2 processors / 8 cores / 8 threads), 2x6MB L2 cache, 1333 MHz system bus, 64GB memory, Oracle Database 10G, Red Hat Enterprise Linux (RHEL 5). Referenced as published at 273,666 tpmC and \$1.38/tpmC; Availability date November 12, 2007

SPECjbb2005

- **Quad-Core Intel® Xeon® processor X5365 based platform details:** HP ProLiant DL380 G5 server platform with two Quad-Core Intel Xeon processor X5365 3.0GHz, 2x4 MB L2 Cache, 1333MHz FSB, 32GB Memory (8x4GB PC2-5300F), BEA JRockit(R) 6 P27.4.0-10 (build P27.4.0-10-90053-1.6.0_02-20071009-1827-windows-x86_64), Microsoft Windows Server 2003 Enterprise x64 Edition SP1. Referenced as published at 250,918 bops and 62,730 bops/JVM. For more information see <http://www.spec.org/jbb2005/results/res2007q4/jbb2005-20071023-00391.html>
- **Quad-Core Intel® Xeon® processor X5460 based platform details:** Dell PowerEdge 2950 server platform with two Quad-Core Intel Xeon processor X5460 3.16GHz, 12MB L2 Cache, 1333MHz FSB, 16GB Memory (8x2GB DDR2-667 FBDIMM), BEA JRockit(R) 6.0 P27.4.0 (build P27.4.0-10-90053-1.6.0_02-20071009-1827-windows-x86_64), Microsoft Windows Server 2003 Enterprise x64 Edition SP1. Measured at 303,130 SPECjbb2005 bops and 75783 SPECjbb2005 bops/JVM.

VMmark

- **Quad-Core Intel® Xeon® processor X5365 based platform details:** Dell PowerEdge 2950 server platform with 2x Quad-Core Intel® Xeon® processor X5365 3.0GHz, 2x4MB L2 Cache, 1333MHz FSB, 32GB Memory, Microsoft Windows Server 2003 SP2, VMware ESX Server V3.0.1. Measured at 7.03@5 tiles. For more information see http://www.vmware.com/files/pdf/vmmark_dell2.PDF
- **Quad-Core Intel® Xeon® processor X5460 based platform details:** Dell PowerEdge 2950 server platform with 2x Quad-Core Intel® Xeon® processor X5460 3.16GHz, 2x6MB L2 Cache, 1333MHz FSB, 32GB Memory (8x4GB 667MHz FBDIMM), Microsoft Windows Server 2003 SP2, VMware ESX Server V3.5. Measured at 8.47@6 tiles.

SAP-SD

- **Quad-Core Intel® Xeon® processor X5365 based platform details:** HP ProLiant DL380 G5 platform with two Quad-Core Intel Xeon processors X5365 3.0GHz, 2x4MB L2 cache, 32GB memory, Microsoft Windows Server 2003 Enterprise Edition, Microsoft SQL Server 2005, SAP ECC Release 6.0 (2005). Referenced as published at 2,080 users. Certification number [2007057](#) (PDF 45KB).
- **Quad-Core Intel® Xeon® processor X5460 based platform details:** HP ProLiant BL460C server platform with two Quad-Core Intel Xeon processors X5460 3.16GHz, 12MB L2 cache, 1333MHz FSB, 32GB memory, Microsoft Windows Server 2003 Enterprise Edition, Microsoft SQL Server 2005, SAP ECC Release 6.0 (2005). Measured at 2,449 users.



Energy Efficient Performance - Config details

- **Configuration Details:** 38% improvement in Perf/Watt based on performance comparison of results on SPECjbb2005 benchmark. Intel internal measurement as of November 11, 2007. System power was measured during the steady-state window of the performance run. Performance per system watt is calculated by taking the performance score from the benchmark and dividing it by the average system power usage (AC power from the wall).
- **Quad-Core Intel® Xeon® Processor E5345 based platform details:** Intel® preproduction server platform with two Quad-Core Intel® Xeon® Processor E5345, 2.33 GHz, 2x4MB L2 Cache, 1333MHz system bus, 16GB memory (8x2GB DDR2-667), Microsoft Windows* 2003 Enterprise Edition. BEA JRockit build P27.4.0-3-86647-1.6.0_02-20070801-1931-windows-x86_64. Run with four JVM instances.
- **Quad-Core Intel® Xeon® Processor E5450 based platform details:** Intel® preproduction server platform with two Quad-Core Intel® Xeon® Processor E5450, 3.00 GHz, 2x6MB L2 Cache, 1333MHz system bus, 16GB memory (8x2GB DDR2-667), Microsoft Windows* 2003 Enterprise Edition. BEA JRockit build P27.4.0-3-86647-1.6.0_02-20070801-1931-windows-x86_64. Run with four JVM instances.



Added Bandwidth Translates into HPC Performance – Config details

- **SPECfp_rate2006**
 - **Quad-Core Intel® Xeon® processor X5365 based platform details:** Supermicro X7DB8+ platform with two Intel Xeon processors X5365 3.00 GHz, 8 cores, 2x4MB L2 cache, 16GB memory (8x2GB Samsung® DDR2 5300F, 2 rank, CL5-5-5, ECC), 64-Bit SUSE LINUX Enterprise Server 10 SP1 Kernel linux-cbqm 2.6.16.43-0.5-smp for x86_64, Intel C++ and Fortran Compiler for Linux32 and Linux64 Version 10.1 Build 20070725. Published in September 2007. Referenced as published at 63.1 (SPECfp_rate_base2006) and 66.9 (SPECfp_rate2006). For more information see <http://www.spec.org/cpu2006/results/res2007q3/cpu2006-20070821-01886.html>
 - **Quad-Core Intel® Xeon® processor E5472 based platform details:** Supermicro X7Dw3 server platform with two Quad-Core Intel Xeon processor E5472 3.00GHz, 12MB L2 Cache, 32GB Memory (8x4GB PC2-6400 DDR2-800, CL5, 2 rank, 8 bank), SUSE LINUX 10.1 X86-64 (Linux 2.6.16.13-4-smp), Intel C++/Fortran Compiler 10.1 for Linux Build 20070913 Package ID: l_cc_p_10.1.008, l_fc_p_10.1.008. Measured at 78.4 (SPECfp_rate_base2006) and 88.1 (SPECfp_rate2006). Submitted to www.spec.org as of Nov 12, 2007
- **HPC Application Benchmarks (All other data shown) platform details:**
 - **Configuration Details:** All comparisons based on results measured/published/submitted/approved as of November 11, 2007. Same platform configuration for all the workloads
 - **Quad-Core Intel® Xeon® Processor X5365 based platform details:** Supermicro® X7DB8+ server platform with two Quad-Core Intel Xeon processor X5365 3.00GHz, 2x4MB L2 Cache, 1333MHZ FSB, 16GB Memory (8x2GB FBD 667MHz), 64-bit Red Hat® Enterprise Linux 4 Update 4.
 - **Quad-Core Intel® Xeon® Processor E5472 based platform details:** Supermicro® X7DWA-N server platform with two Quad-Core Intel Xeon processor E5472 3.00GHz, 2x6MB L2 Cache, 1600MHZ FSB, 16GB Memory (8x2GB FBD 800MHz), 64-bit Red Hat® Enterprise Linux 4 Update 4.
- **ISV Application Workload details**
 - **Fluent® v6.3.26 - FLUENT** is a powerful computational fluid dynamics (CFD) software package from ANSYS, Inc. It offers a comprehensive range of physical models that can be applied to simulation-based product development in a broad range of industries and applications. The benchmark suite of 15 real-world cases covers a representative set of CFD analysis types and simulation model sizes. Dual core results are based on 4-process parallel FLUENT; quad core results are based on 8-process parallel FLUENT. See <http://www.fluent.com/software/fluent> for details.
 - **PAM-CRASH® v2006.0 - Crash & Occupant Safety/Manufacturing segment.** World's most widely used crash simulation software. Highly scalable and one of the most memory bandwidth application in HPC eco-system. Version used is 2006.0, 64-bit Intel optimized binary, using Intel MPI 3.0. Standard frontal crash test from USNCAP consortium. Model Chrysler NEON with 300K and 1M elements. Audi frontal crash test with 1M element model.
 - **Schlumberger Eclipse v2006.1 - Schlumberger Eclipse®** is commercial simulator that is used to predict the flow of petroleum fluid and gas compositions in oil and gas reservoirs. The benchmarks use Eclipse® Parallel to simulate black oil workloads up to 1 million cells. (E100 100K, ONEM1)
 - **LS-Dyna - Neon_refined_revised - LS-DYNA** is a commercial engineering application used in finite element analysis such as a car collision. The workloads used in these comparisons is called neon_refined_revised and is publicly available from www.topcrunch.org. The metric for the benchmark is elapsed time in seconds (lower is better).
 - **Synopsys Proteus - Synopsys Proteus OPC** is a distributed application used in semiconductor design. We tested throughput by running one input dataset, dataset A, processed by multiple OPC application instances (one job per processing core on each server)
 - **Monte Carlo® v0.1 - Financial Modeling workload.** Monte Carlo methods are a widely used class of computational algorithms for simulating the behavior of various physical and mathematical systems, and for other computations.
 - **CAM® v3.1p2 - CAM - (Community Atmosphere Model)** from NCAR - the latest in a series of global atmosphere models for the weather and climate research communities. CAM also serves as the atmospheric component of the Community Climate System Model (CCSM). (<http://www.cesm.ucar.edu/models/atm-cam>). Workload name - 2x25
 - **Landmark VIP® v91o2 - Landmark VIP®** is a commercial reservoir simulator used to predict the flow of petroleum fluid and gas compositions in oil and gas reservoirs. The benchmarks measure the time to simulate black oil and compositional workloads for models up to 1 million cells.
 - **POP® v2.01 - POP - (Parallel Ocean Program)** from Los Alamos National Lab (LANL) - an ocean circulation model in which depth is used as the vertical coordinate. The model solves the three-dimensional primitive equations for fluid motions on the sphere. (<http://climate.lanl.gov/Models/POP>). Workload name - X1
 - **MILC® v7 - MILC - from MIMD Lattice Computation Collaboration - large scale numerical simulations to study quantum chromodynamics (QCD)** (<http://www.physics.utah.edu/~detar/milc/>) Parallelized by means of MPI*. Benchmarked version: Version 7. see http://www.physics.utah.edu/~detar/milc/milc_qcd.html
 - **Black Scholes® v2.0 - The Black-Scholes kernel workload** is based on a financial modeling algorithm for the pricing of European-style options. After its publication in 1973 by Fisher Black, Myron Scholes, and Robert Merton, its impact was enormous and rapid. The benchmark consists of a kernel that implements a derivative of the Black and Scholes technique. SunGard developed the code, which uses a continuous-fraction technique that is more accurate than the traditional polynomial approximation technique. The test produces the time, in seconds, the server took to complete the workload; lower completion times are better.

