IA: The Intelligent Architecture Investment

Pat Gelsinger
Senior Vice President and General Manager
Digital Enterprise Group

聚信与共 创赢未来

IDF2009
英特尔信息技术峰会

Today: Intel Architecture

Clients

Servers

Embedded

Visual

IDF2009
英特尔信息技术峰会

intel

Transitioning Nehalem to Mainstream

Revolutionary Microarchitecture

Nehalem Enables Highest Performing DT Microprocessors on the Planet

Nehalem Platform Re-partition

Greater Performance and Lower Power via Higher Integration

32nm Process Technology

Intel's Most Advanced Process Extends Nehalem Through Mainstream

Intel™ Core™ i7 Processor
The Highest Performing Processor On the Planet

- Revolutionary Nehalem microarchitecture
- Superior energy efficient performance
- Intel™ Hyper-Threading technology
  - 8 threads, 4 cores
- Intel™ Turbo Boost technology
- Intel™ Core™ i7 Launched In Nov 2008

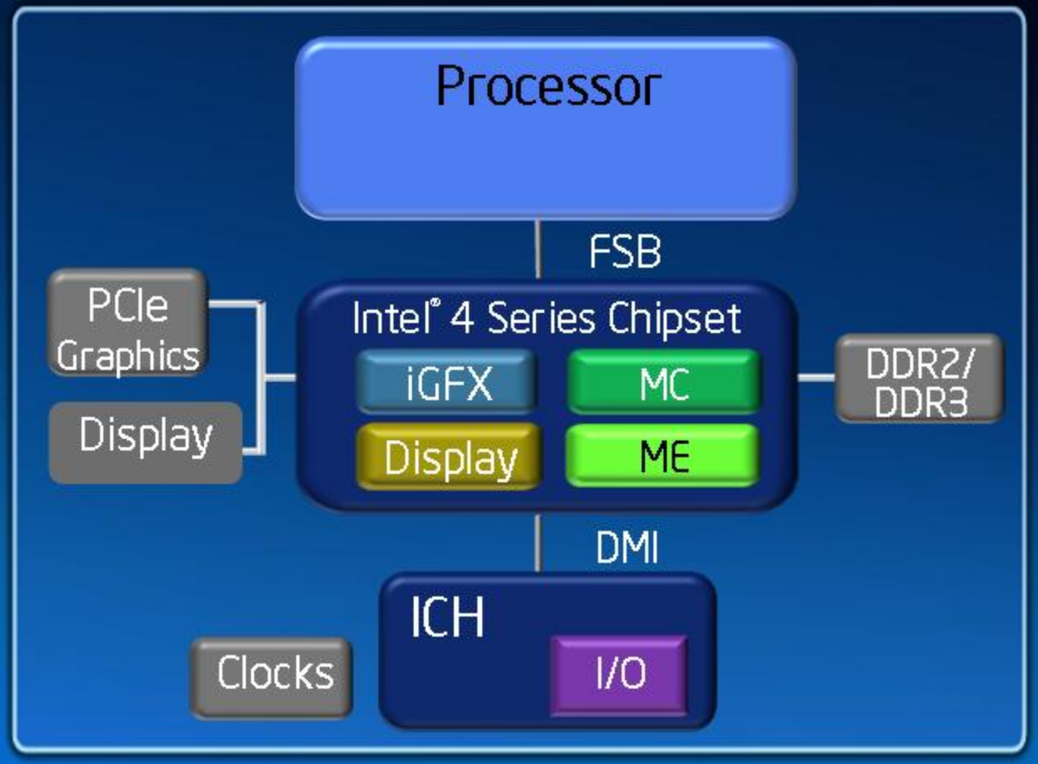
Enabling Nehalem For Every Segment

	2008	2009+
High End Desktop	英特尔 酷睿 i7 英特尔 酷睿 i7 Revolutionary Microarchitecture	4 Cores / 8 Threads Mainstream Desktop — Lynnfield Thin & Light Notebook — Clarksfield Platform Re-partition

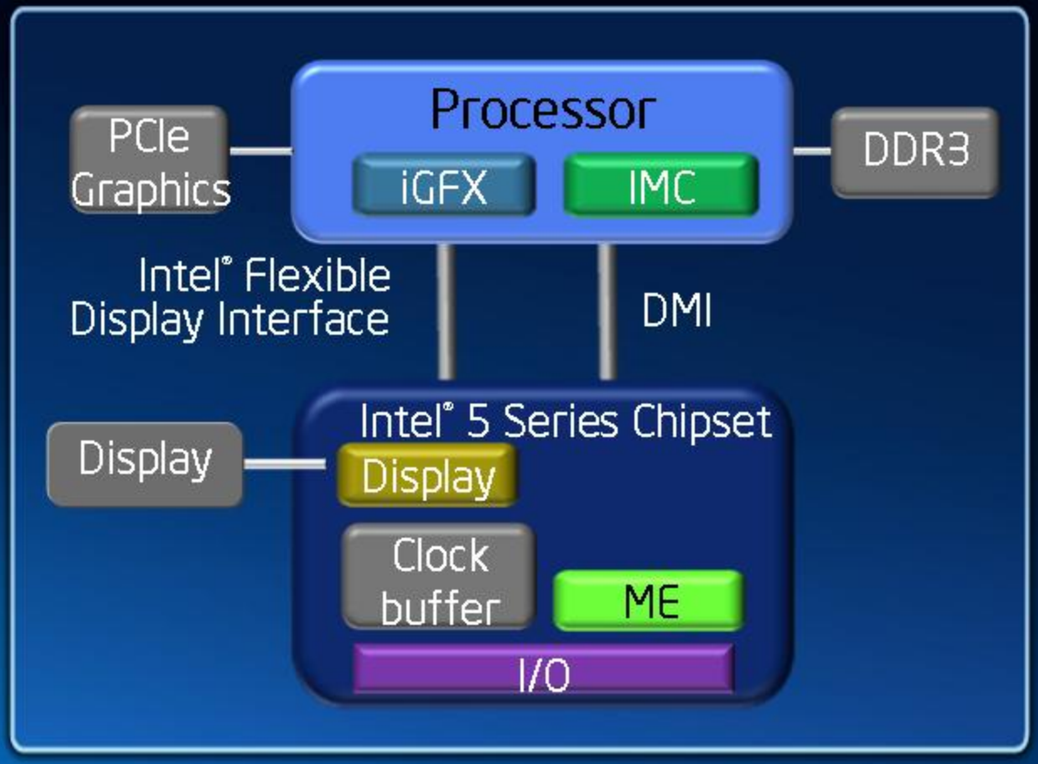
45 nm High-K

Nehalem Platform Re-Partition

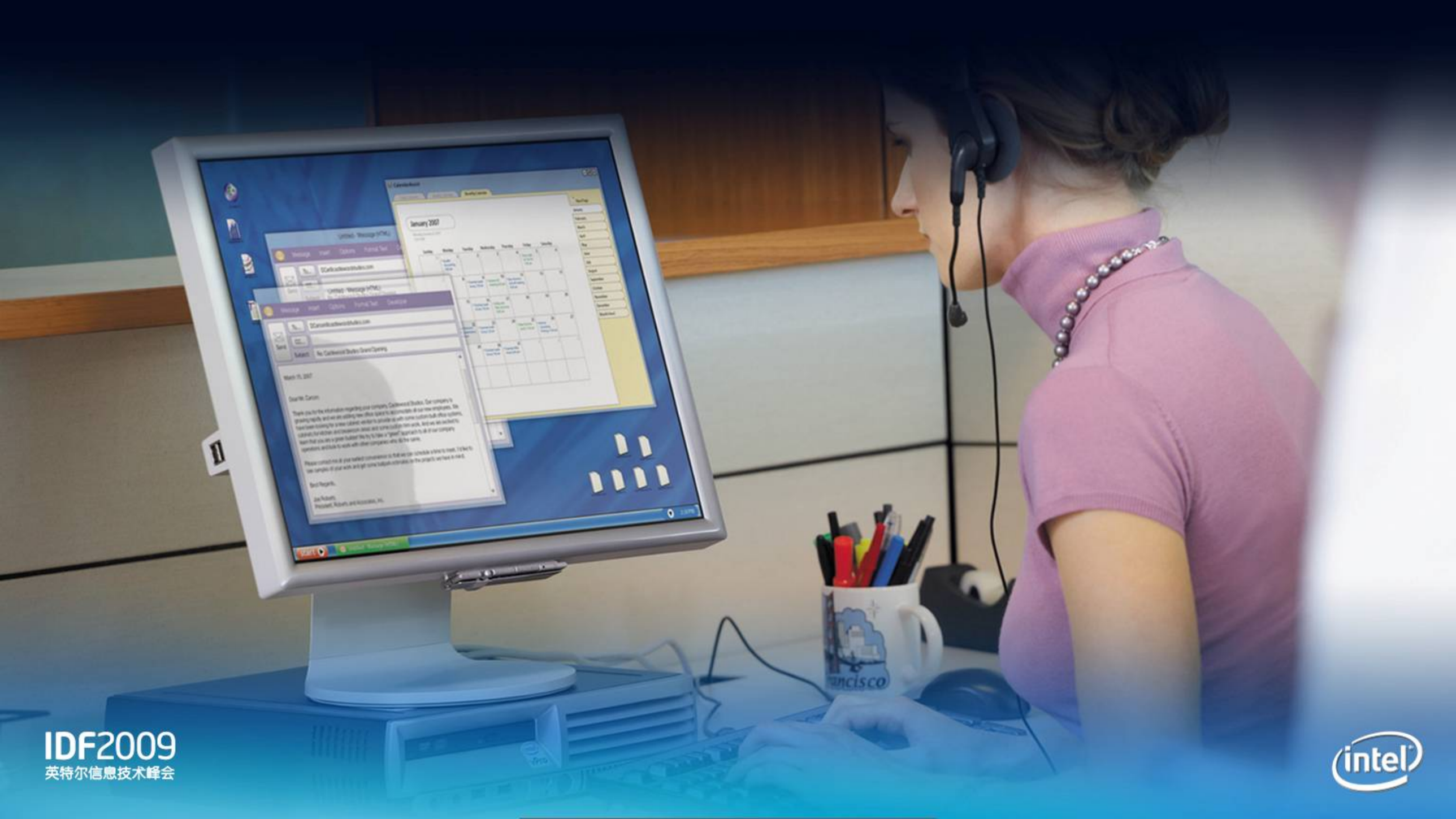
Penryn Based 3-chip Solution



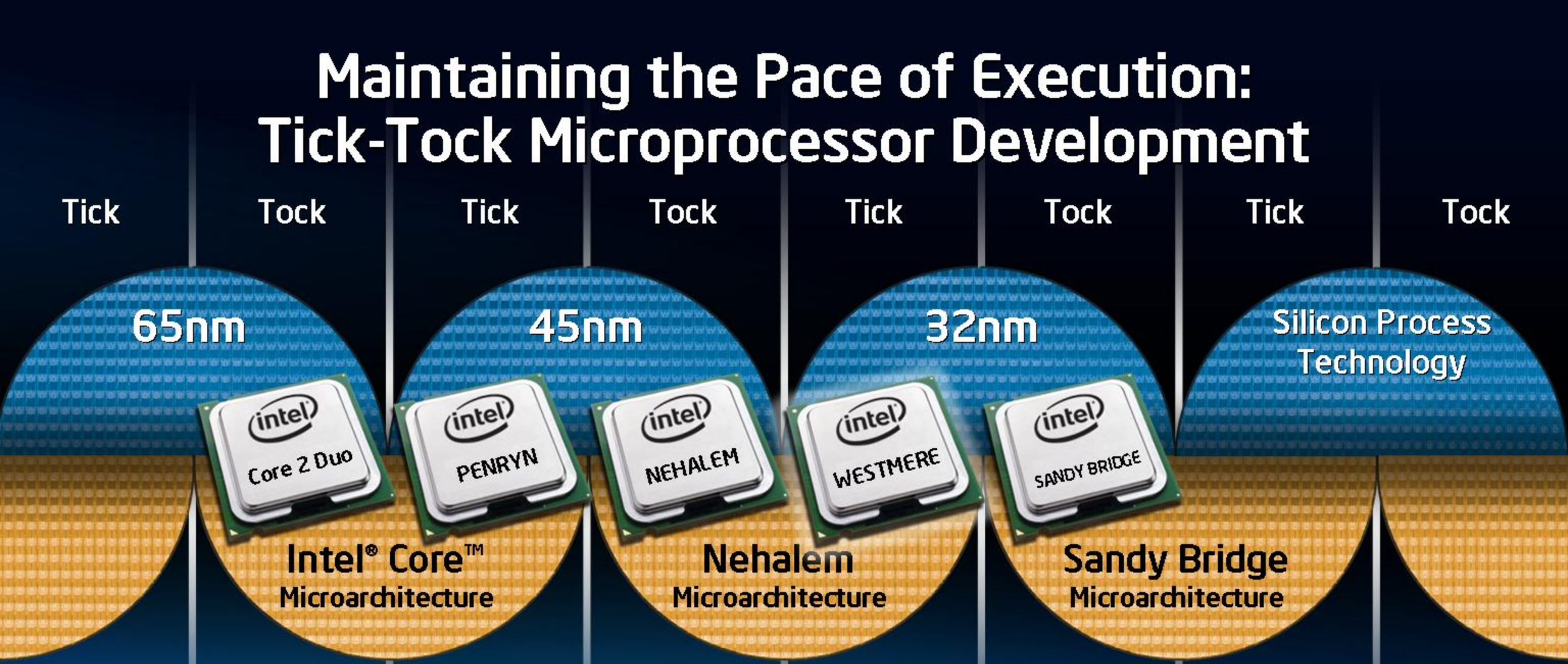
Nehalem Based 2-chip Solution



Greater Performance and Lower Power via Higher Integration


IDF2009
英特尔信息技术峰会
intel

Maintaining the Pace of Execution: Tick-Tock Microprocessor Development



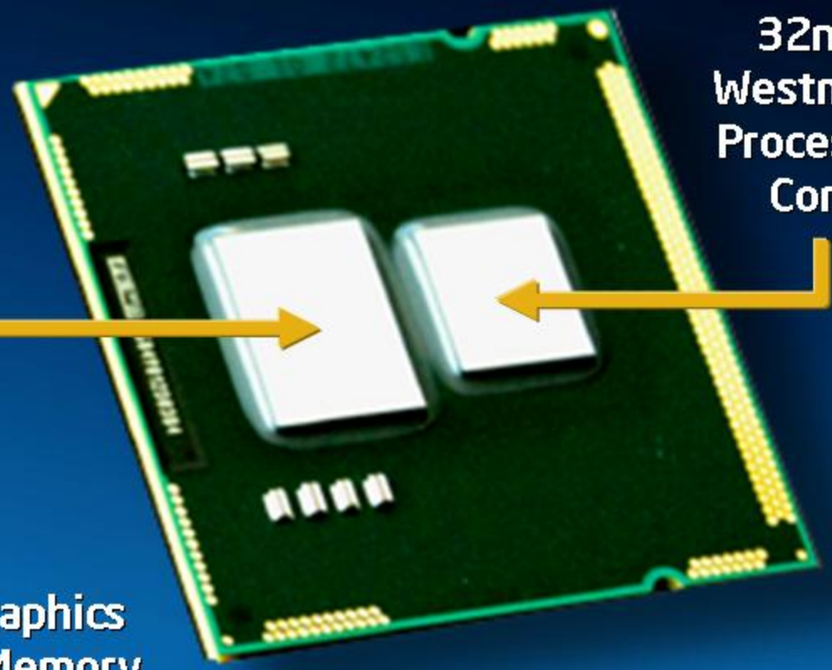
32nm Process Health Enables Acceleration of Westmere Product Ramp

Enabling Nehalem For Every Segment

	2008	2009+	
		4 Cores / 8 Threads	2 Cores / 4 Threads with Integrated Graphics
High End Desktop	Revolutionary Microarchitecture	Mainstream Desktop	Clarkdale
		Thin & Light Notebook	Arrandale
		Platform Re-partition	32nm Process Technology

45 nm High-K → 32nm High-K

First 32nm Westmere Products



Key Features

- Intel™ Turbo Boost Technology
- Intel™ Hyper-Threading Technology
- Intel™ Graphics Media Accelerator
- Integrated Memory Controller with 2 Channel DDR3

Not all features are available on every processor line item

intel

Nehalem vPro™ Corporate Platforms

New Levels of Security and Manageability

Lynnfield
Clarksfield
Clarkdale
Arrandale

Intel™ 5 Series Chipsets

Advanced I/O processing and manageability

Smarter, Energy-efficient Performance

Nehalem micro-architecture

Expanded Manageability

Intel™ Active Management Technology

Enhanced, Proactive Security

Intel™ Anti-Theft Technology

IDF2009
英特尔信息技术峰会

intel

PRC Customers Embracing vPro™

- Shanda Interactive
- Guang Anmen Hospital
- AQSIQ
- MOR
- Panyu's People Hospital
- Shanghai Hongqiao Airport

Intelligent Architecture for Embedded Computing

Arrandale Platform Delivers

Smarter, energy-efficient Performance

Nehalem micro-architecture

Expanded Manageability

Intel™ Active Management Technology

Enhanced, Proactive Security

Intel™ Anti-Theft Technology

Benefits to Retailers

Lower OpEx

70% Power Reduction
Reduced Truck Rolls
More Secure Transactions

Improved Shopping Experience

Richer Visual Compute Experience In Same Footprint

IDF2009
英特尔信息技术峰会

Based on comparison between POS terminals with Intel® Pentium™ D processors and POS terminals with Intel® Core™2 Duo mobile processors. Source: "Advanced CPUs: The Impact on TCO Evaluations of Retail Store IT Investments" by Global Retail Insights (an IDC company).

intel

New Retail Experience

Today: Intel Architecture

Clients

Servers

Embedded

Visual

Intel™ Xeon™ Processor 5500 Series: Transforming Computing

Most Important Server Launch Since Pentium™ Pro

15 Billion Connected Devices

Design and Discovery

Intelligent Platform

World's Most Adaptable Server Platform

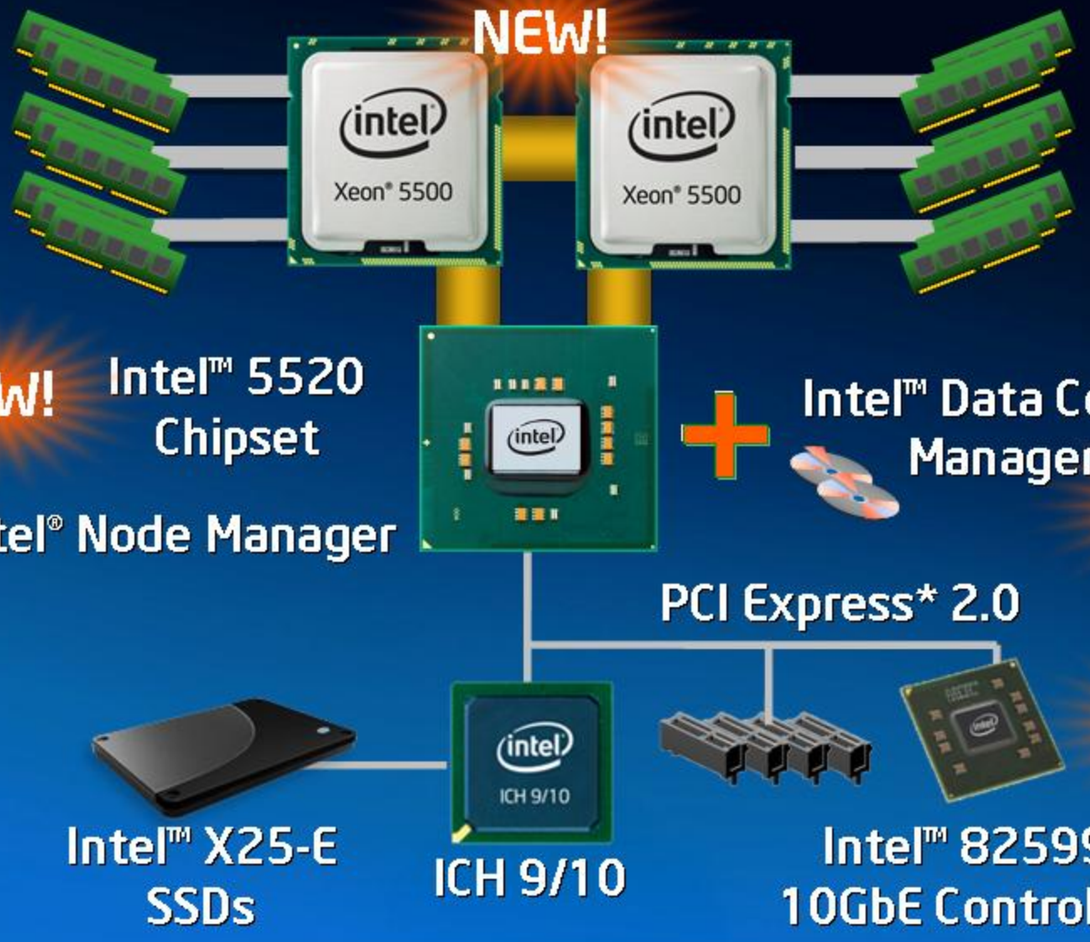
Intelligent Choice

Delivers Higher Performance, Lower TCO

Estimated 8 Month Payback For Single-core Server Refresh

intel

Intel™ Xeon™ 5500 Platform



- New Memory Subsystem
- Intel™ QuickPath Interconnect
- Intel™ Intelligent Power Technology
- New I/O Subsystem

Superior Platform Available Today

Intel® Xeon® 5500 Performance Publications

SPECint*_rate_base2006
240 score (+71%)

SPECpower*_ssj2008
1860 ssj_ops/watt (+64%)
IBM J9* JVM

SPECfp*_rate_base2006
194 score (+125%)

SPECjAppServer*2004
3,975 JOPS (+93%)
Oracle WebLogic* Server

TPC*-C
631,766 tpmC (+130%)
Oracle 11g* database

SAP-SD* 2-Tier
5,100 SD Users (+102%)
SAP* ERP 6.0/IBM DB2*

SPEComp*Lbase2001
234,996 score (+189%)
Intel Compiler 11.0/RHEL 5.3*

TPC*-E
800 tpsE (+152%)
Microsoft SQL Server* 2008

SPECWeb*2005
71,045 score (+140%)
Rock Web* Server

Fluent* 12.0 benchmark
Geo mean of 6 (+127%)
ANSYS Fluent*

SPECjbb*2005
604,417 BOPS (+64%)
IBM J9* JVM

SPECapc* for Maya 6.5
7.70 score (+87%)
Autodesk* Maya

Over 30 New 2S Server and Workstation World Records!

IDF2009
英特尔信息技术峰会

Percentage gains shown are based on comparison to Xeon 5400 series; Performance results based on published/submitted results as of March 30, 2009. 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

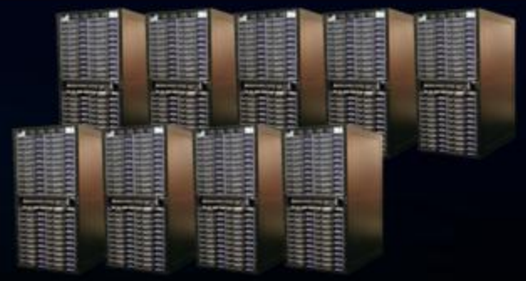
Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance. Buyers should consult 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

Refresh Benefits

2005

184 Intel™ Xeon™ Single Core Servers

Performance Refresh



184 Intel Xeon 5500 Based Servers

Up to **9x** Performance

18% Annual Energy Costs Estimated Reduction

- OR -

Efficiency Refresh

21 Intel Xeon 5500 Based Servers

As Low as **8 Month** Payback

90% Annual Energy Costs Estimated Reduction

IDF2009 英特尔信息技术峰会

Source: Intel estimates as of Nov 2008. 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.

Intel™ Xeon™ 5500 Series: Worldwide Industry Support

IDF2009 英特尔信息技术峰会

Broadest Ecosystem of Server, Storage & Embedded Partners

intel

Other brands and names are the property of their respective owners.

Microsoft®

"We're very excited about the release of the Intel Xeon 5500 processor, built on the new Intel Nehalem Microarchitecture. The complementary features of Windows Server 2008, Hyper-V, and the Intel Xeon 5500 series processors will provide our mutual customers with exceptional performance, energy efficiency, and flexibility, so they can achieve even greater cost savings."

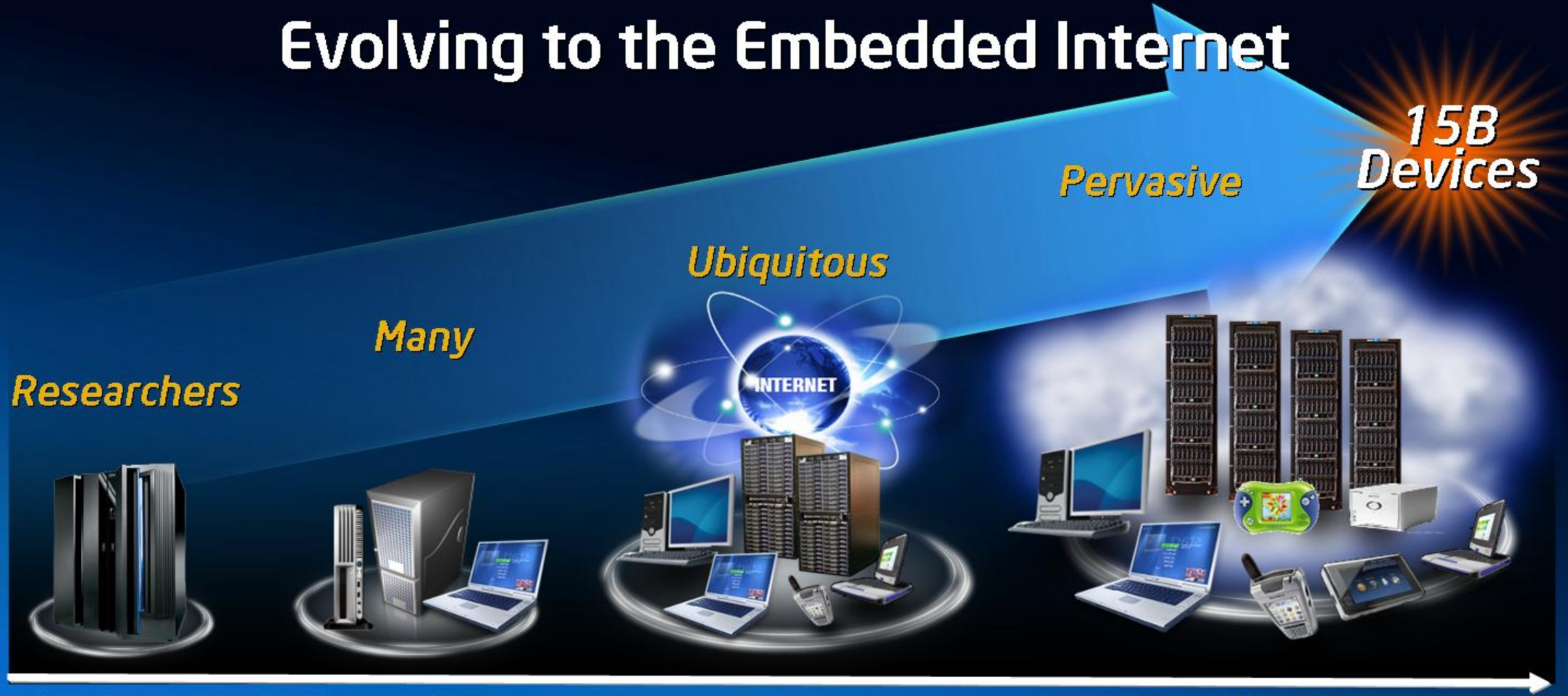
Bill Laing
Corporate Vice President
Windows Server

IDF2009
英特尔信息技术峰会

intel

Other brands and names are the property of their respective owners.

Evolving to the Embedded Internet

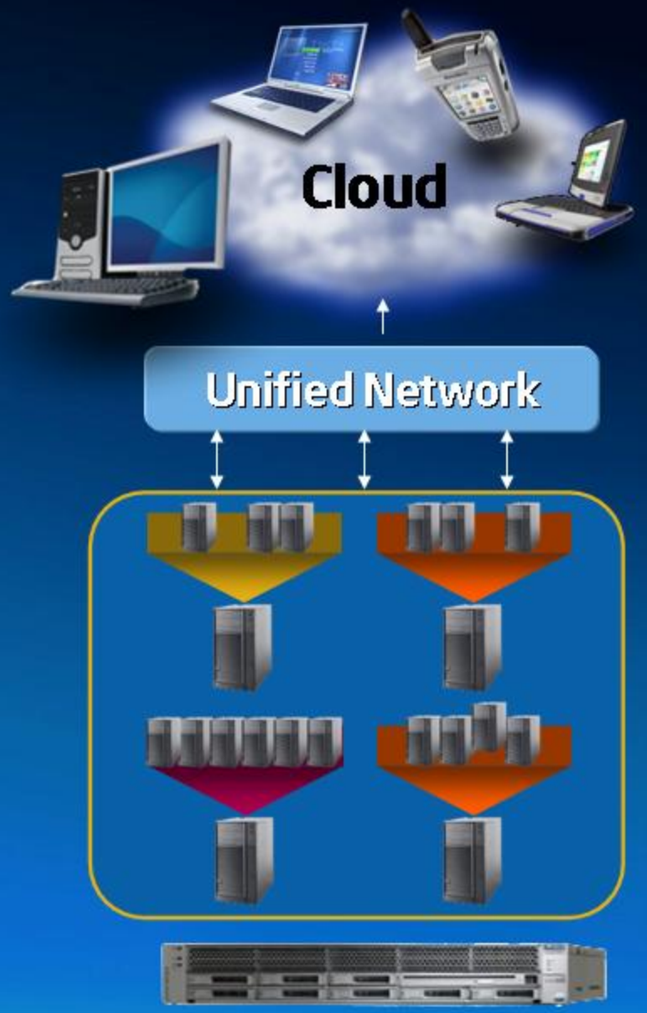


IDF2009 英特尔信息技术峰会

Requires Dynamic, Efficient and Scalable Infrastructure

intel

Cloud Architecture Requirements

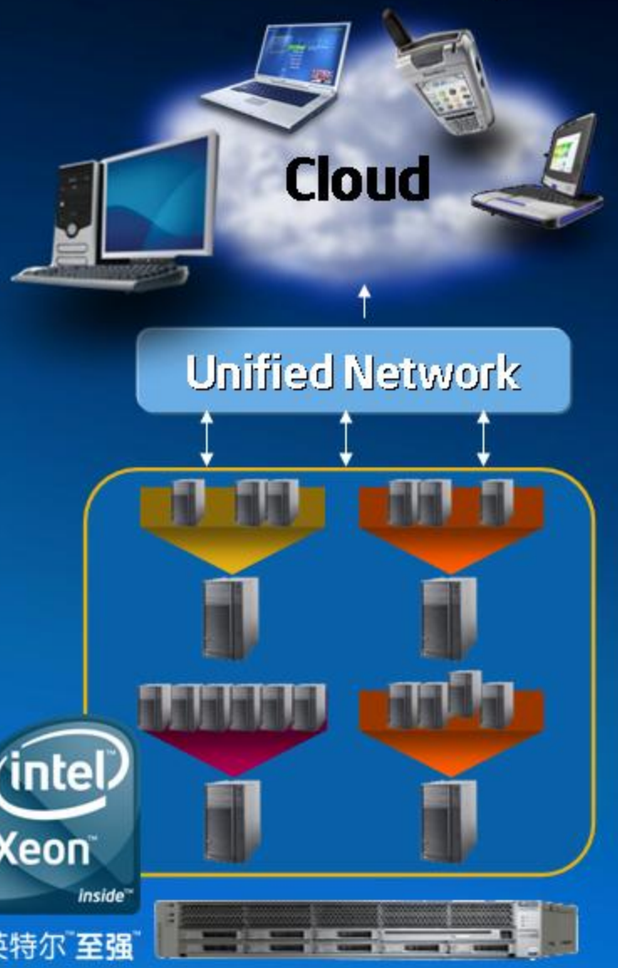


Intelligent Performance

Energy Efficiency

Dynamic Virtualization

Intel™ Xeon™ 5500: Optimized for the Cloud Architecture



Intelligent Performance	Up To 125% Higher Compute Performance*
Energy Efficiency	Automated Power States ~50% Lower Idle Power * Higher Operating Temperature*
Dynamic Virtualization	Up To 2X Virtualization Performance Enhanced I/O Virtualization

IDF2009
英特尔信息技术峰会

* Up to 125% higher compute performance, 50% idle power, and up to 2X virtualization performance are based on comparison to previous generation 5400 series. Lower cooling cost based on Intel internal analysis (January 2009). For detailed calculations, configurations and assumptions refer to the legal information slide in backup.

intel

vmware™

"We are excited about the evolutionary road VMware and Intel are helping to pave for our customers by combining the new Intel Xeon Processor 5500 Series with VMware's forthcoming vSphere generation of products. Together, our products provide a power-efficient, high-performance, platform for the datacenter and the cloud that enables our joint customers to do more with less – providing new levels of efficiency, control and choice for them to run their datacenters effectively."

— Paul Maritz, CEO, VMware

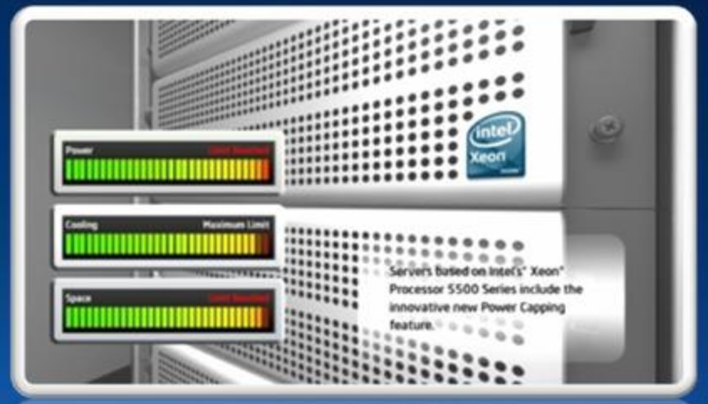
IDF2009
英特尔信息技术峰会

intel

Other brands and names are the property of their respective owners.

Intel Optimization in Action

Technology: Intel™ Dynamic Node Manager



Baidu 百度

Platform: Optimized for Data Center

inspur 浪潮

宝德 PowerLeader

Performance Optimization

淘宝网 Taobao.com 阿里巴巴旗下网站

Image Processing: 3X Improvement

Data Center: Design and Consultation

中国电信 CHINA TELECOM

Other brands and names are the property of their respective owners.

Intel™ Xeon™ 5500 Series: Powering Leading China Internet Portal

"To enable continuous business growth, we have developed the new generation of distributed search architecture based on Intel Xeon 5500 and Intel SSDs. During search application testing, we're excited to see about 100% performance boost and 120% higher performance per watt. Currently, we're deploying hundreds of Intel Xeon 5500-based servers to meet upcoming rapid traffic growth."

— Zhou Lin, Sohu Senior Technical Director

Other brands and names are the property of their respective owners.

Intel™ Xeon™ 5500 Series: Advancing Online ERP / SaaS in China

"It's really amazing for UFIDA Online ERP Service to get 3.37x performance boost and 3.36x performance per watt boost on the new Intel Xeon 5500 EP platform. The amazing results show that the new Xeon 5500 EP is certainly the preferred platform for our online service and high performance will certainly greatly impress our customers."

— Mr. Chen Shuichao , R&D director

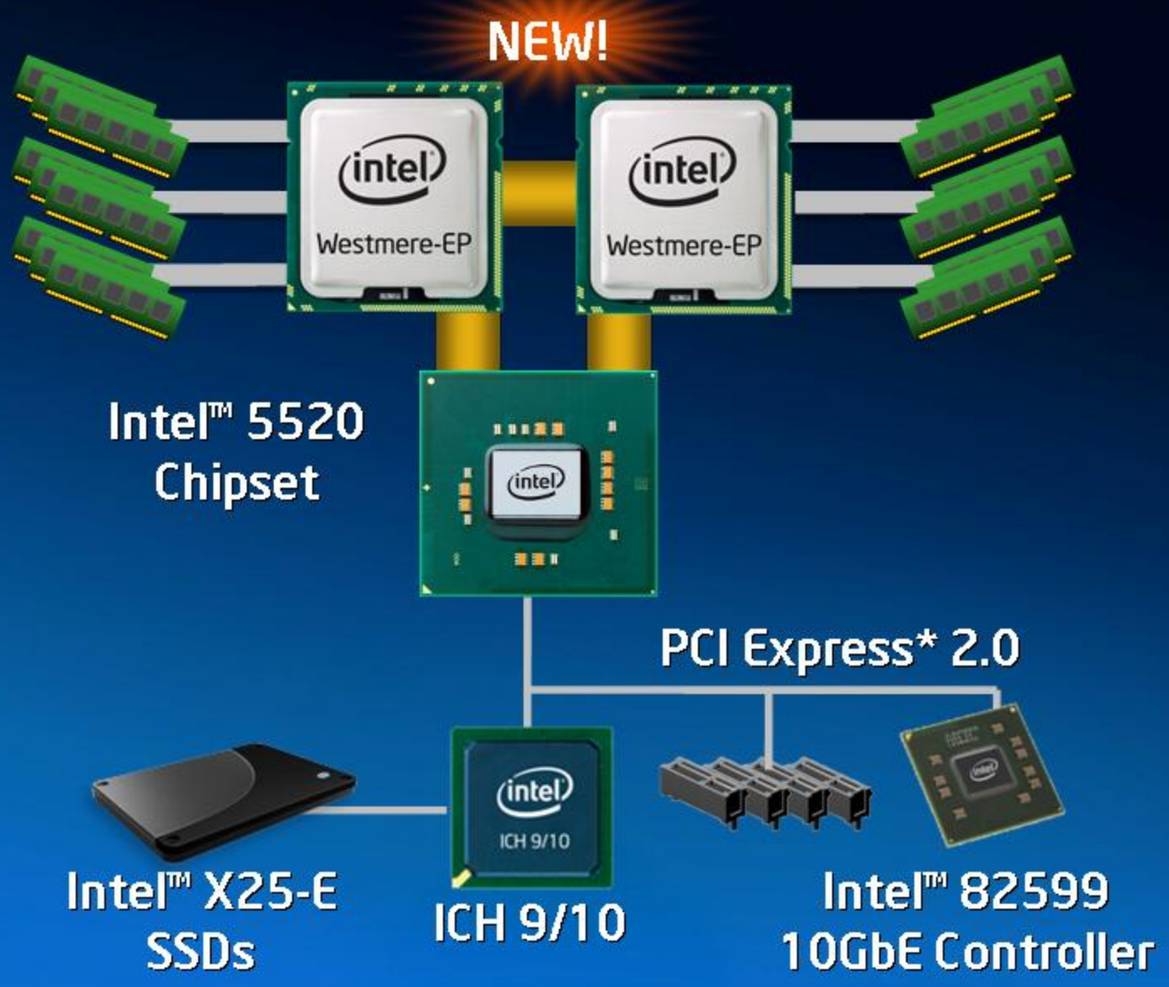
用友在线应用服务 weCoo.com 伟库网 UFIDA

IDF2009
英特尔信息技术峰会

intel

Other brands and names are the property of their respective owners.

Westmere-EP: Next Generation Xeon™ Processor



- 32 nm High-k Process
- Cache Enhancements
- Improved Energy Efficiency
- Up to 6 Cores
- Available 2010

Socket Compatible with Intel™ Xeon™ 5500 Platform

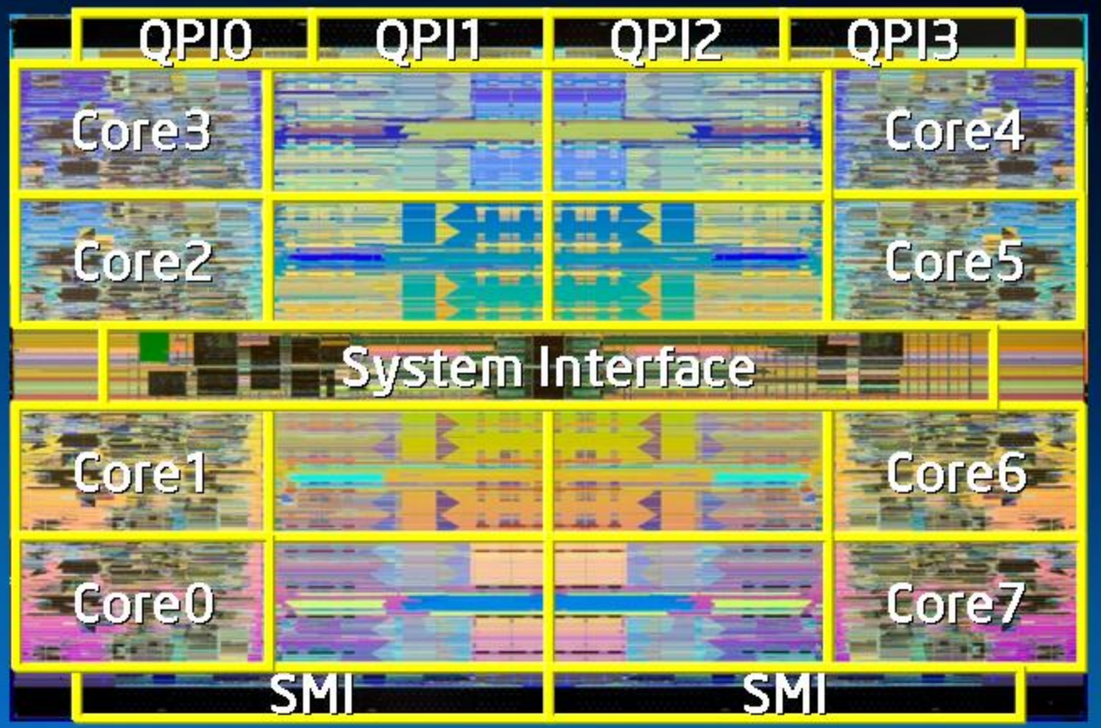
EX Segment Roadmap

Intel Virtualization Technology FlexMigration

32nm Westmere Generation On Track

Designed for Demanding Apps and Large-Scale Consolidation

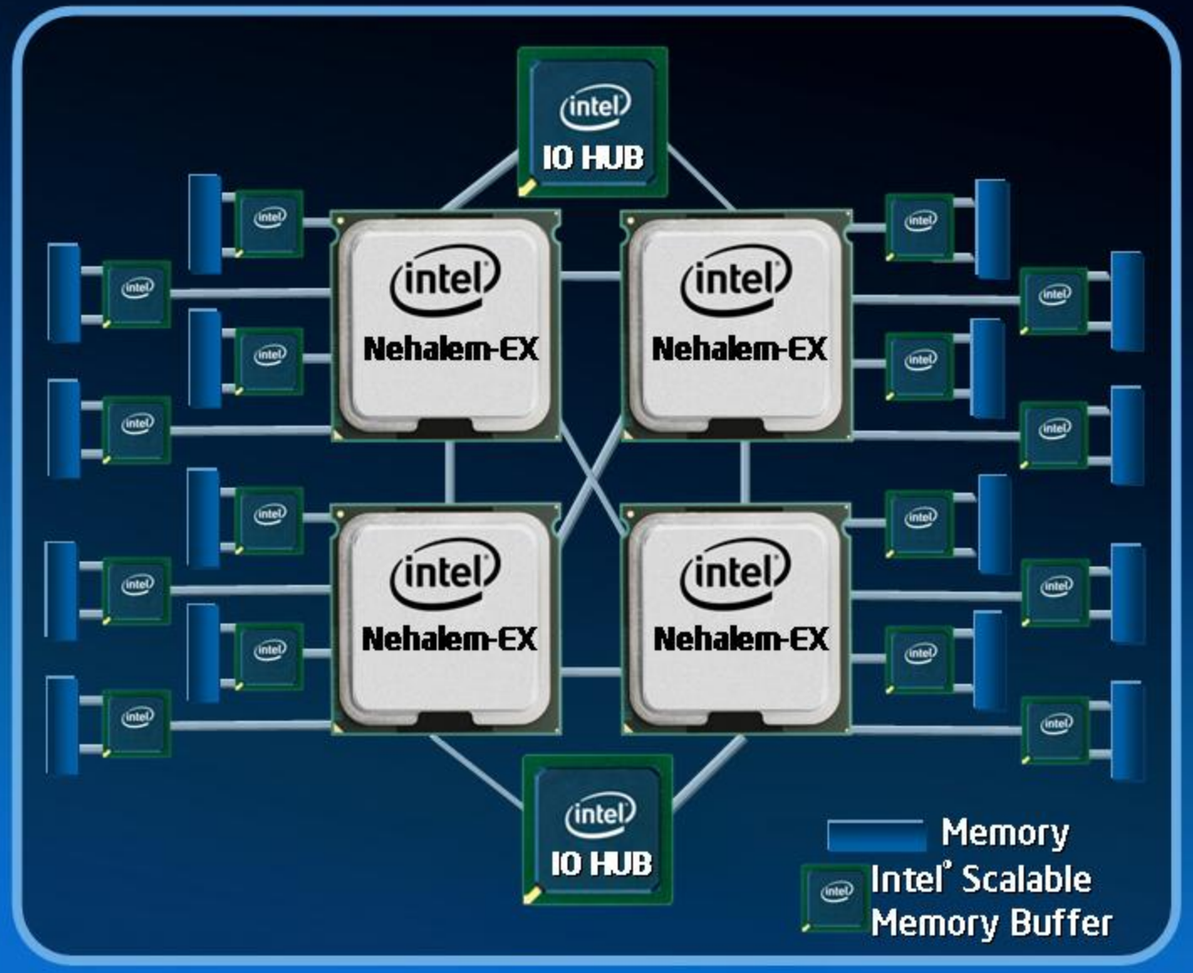
Nehalem-EX



- Up to 8 Cores
- 24MB of Shared Cache
- Intel® Hyper-threading
- Integrated Memory Controllers
- 4 High-bandwidth QPI Links
- 2.3B Transistors

The Next Generation Intelligent Expandable Platform

Nehalem-EX: 4-Socket Platform

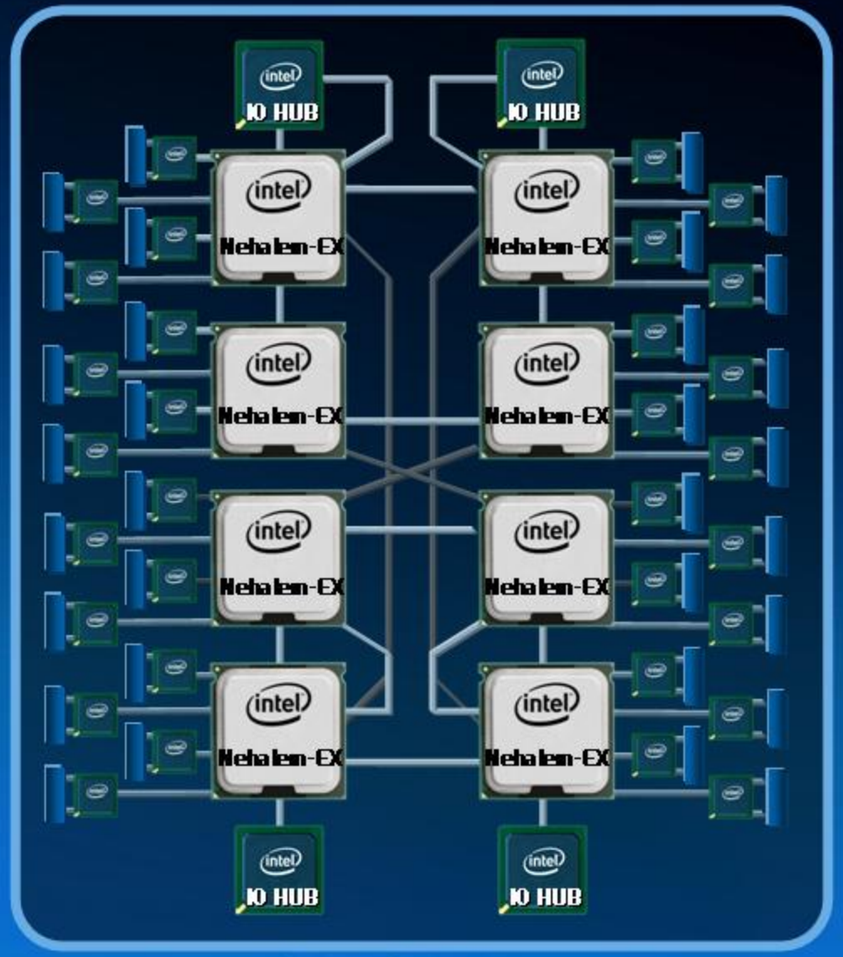


- 8 Cores/64 Threads
- QPI Architecture
- Intel™ Scalable Memory Interconnect with Buffers
- Next Generation I/O with Virtualization Technology

IDF2009
英特尔信息技术峰会

intel

Nehalem-EX: 8S "Glueless" Capability

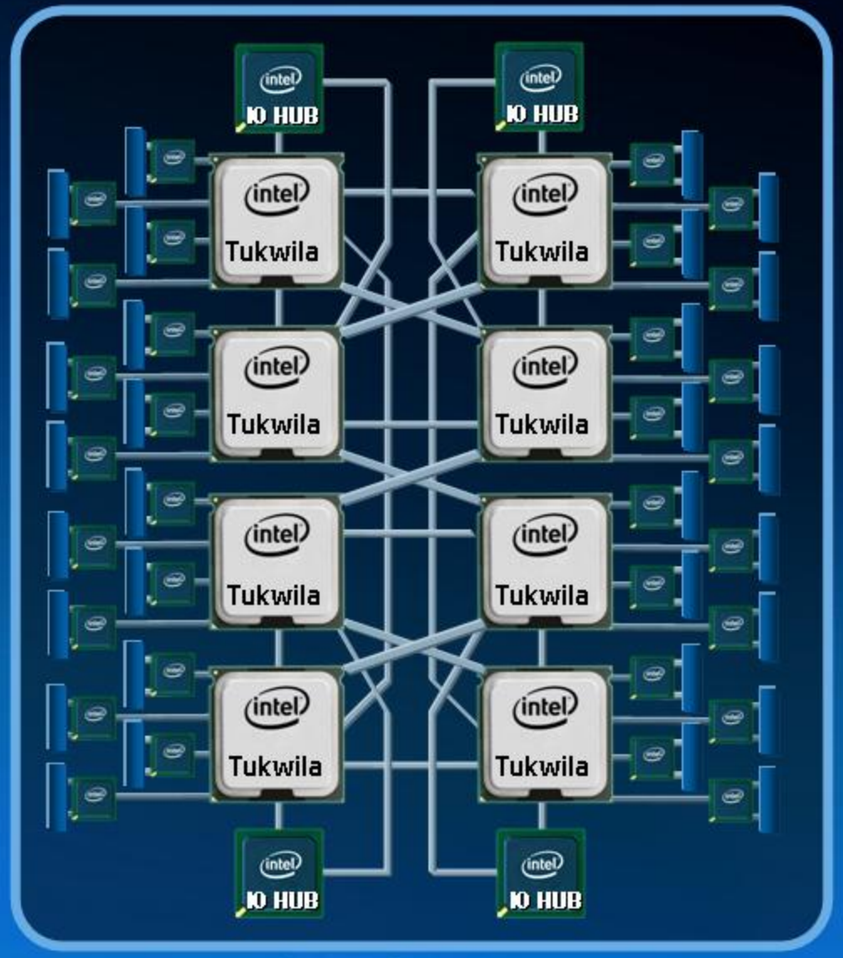


Memory
Intel® Scalable Memory Buffer

- 8 Sockets with 128 threads
- Scalable performance through modularity
- Leadership RAS with MCA recovery

Industry Standard,
High-end Enterprise Leadership

Tukwila: Game Changer for Mission Critical



- High platform longevity
- Highest scalability
- RAS: Mainframe-class RAS + MCA recovery
- 2x Performance vs. previous generation
- Leading-edge virtualization capabilities
- Next generation I/O and manageability

Itanium™ Platform: Impressive Strength and Continued Growth

Making the Right Investment Choice

$3T of Global Stimulus

Broadband

Construction

Transportation

Education

Manufacturing

Energy

intel

Intel's Collaboration: Energy

- 3 year build-out of "Smart Grid"
- Cover 80% of China's mainland and 1 billion people
- Collaboration
  - Joint lab to incorporate HPC, vPro™, and embedded technologies
  - Intel Xeon™ 5500 servers for grid simulation
  - Network Isolation and Power Station Automation

Other brands and names are the property of their respective owners.

Today: Intel Architecture

Clients

Servers

Embedded

Visual

Embedded IA Products Today and Future

Traditional Embedded IA

Server

英特尔™至强™

Desktop

英特尔™ 酷睿™ 2 双核

Mobile

英特尔™迅驰™2

New Low Power IA for Embedded

英特尔™至强™

Launched March 2nd!

Production Q1'010

英特尔™凌动™

Future

IDF2009
英特尔信息技术峰会

Intel™ Atom™ Processor: Global Embedded Opportunity

In-Vehicle Infotainment
Handheld terminal
Rugged tablet
DSS Video Server
Wearable PC
Smart shopping cart
Digital signage
Surgery patient monitoring
Portable Sonogram
Smart soldier wearable computer
Unmanned vehicle system
Music Keyboard
TV Camera
Residential Gateway

英特尔™凌动™

Automated farm equipment
Portable Point of Sale terminal
Mobile video streamer
Fleet navigation & mgmt system
Kiosk
IP-media phone
Sewing machine
Ocean monitoring equipment
Ruggedized handheld
Home Automation
PLC (Programmable Logic Controller)
HMI (Human Machine Interface)
Smart Camera
Weight Scales

~1,000 Embedded Design Engagements in Progress

New Options for Intel™ Atom™ Processor

Processor Options for Embedded

Two packages (13x14 or 22x22 mm)
Industrial or commercial temp

System Controller Options

Two packages (22x22 or 37.5x37.5 mm)
Industrial or commercial temp

Improved Power Efficiency

45nm High-K
Enhanced Intel SpeedStep™

Embedded Segment

IA software compatible
7 year extended life cycle support

Adding 4 New Processors and 2 System Controller Hub Options for Embedded

Intel Atom™ Processor: Embedded Growth in PRC

Industrial

Education

In-Vehicle Infotainment

Digital Security & Surveillance

Intelligent Transportation

Medical

Point of Sale

Digital Signage

EVOC GROUP

华北工控 NORCO

HPC HUIPU SCIENCE

视源电子 Shiyuan Electronics

SEEYCO

博创科技 UP-TECH

CENTERM information 升腾资讯

深圳众博金科技有限公司 SHENZHEN ZBJ TECHNOLOGY

DT Research

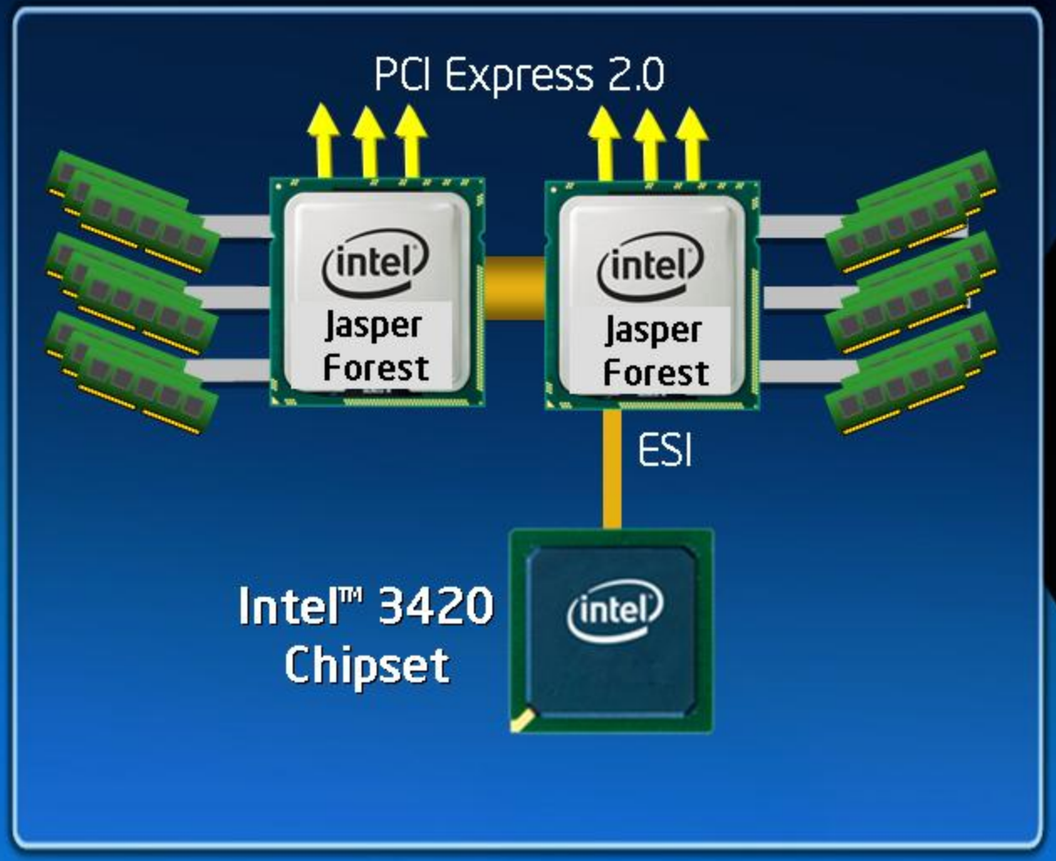
SBS THE INNOVATORS

CYNOVO 矽·鼎·科·技

文安科技 VION-TECH.COM

Other brands and names are the property of their respective owners.

Jasper Forest:
Unparalleled Leadership for Embedded and Storage



Increased Scalability
Quad, Dual, Single Core SKUs
23-85W Options

Integration for Reduced Real Estate
Native PCI Express with Non-transparent Bridging
Native RAID Acceleration

Telecommunications-Grade Reliability
Higher Tcase for NEBs Certification

Today: Intel Architecture

Clients

Servers

Embedded

Visual

Larrabee

- Intel's first many-core architecture
  - Designed for high throughput applications
  - Expect many derivatives overtime
- A highly differentiated architecture
  - Programmable graphics pipeline enables developer innovation and stunning visual effects
  - IA programmability provides great flexibility
  - Fully coherent cache architecture
  - Standard API support (DirectX*, OpenGL*, OpenCL*)

First Discrete Graphics Products In Late 2009 Or 2010

*Other names and brands may be claimed as property by others

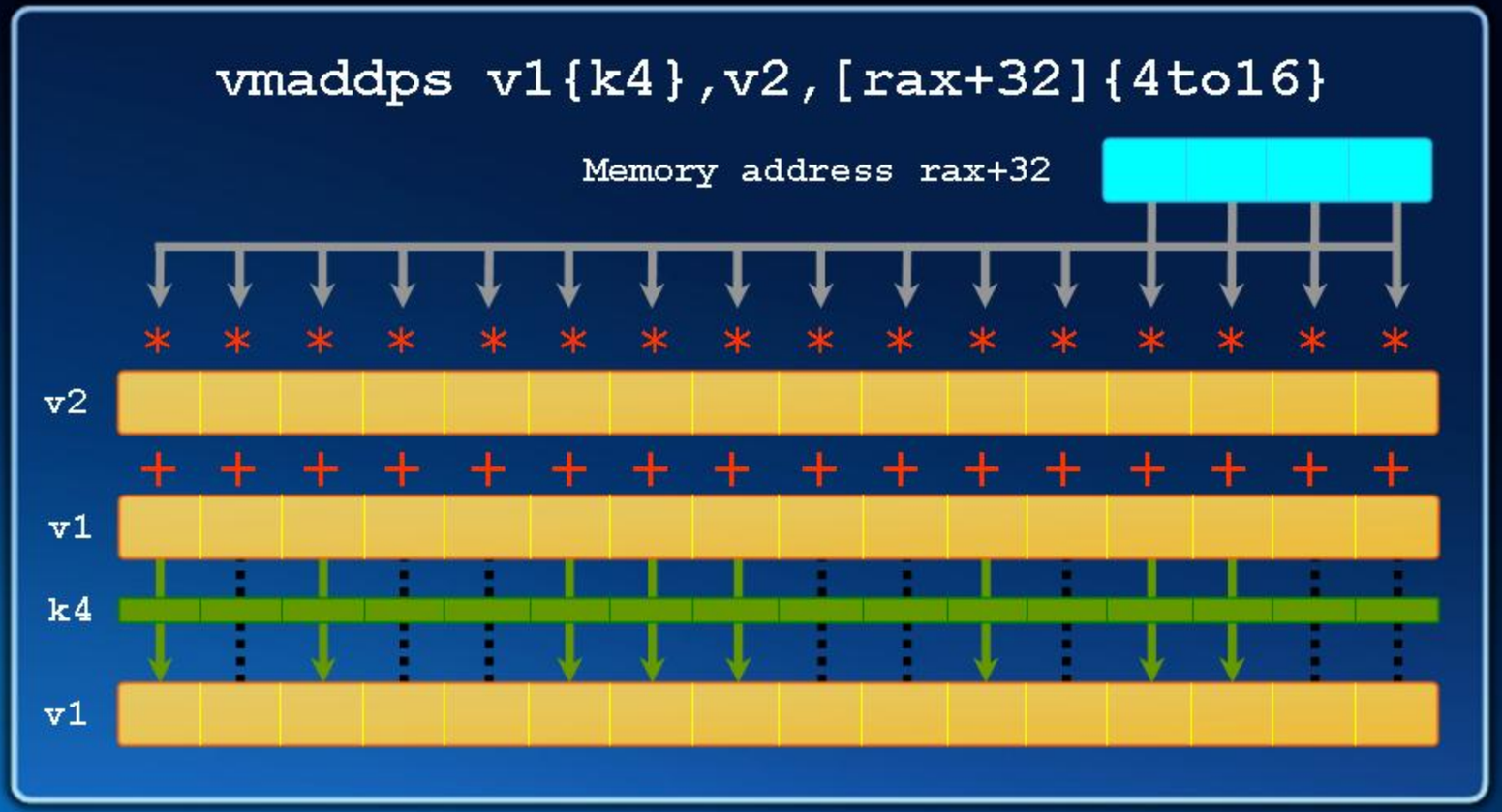
Prototyping on Larrabee

- C++ Larrabee Prototyping Library
  - Released at Game Developer's Conference, 27 Mar '09
- Enables early Larrabee code exploration and prototyping
  - Gives developers deep insight into the architecture and efficiency

Now Available on www.intel.com/software/graphics

C++ Larrabee Prototype Library

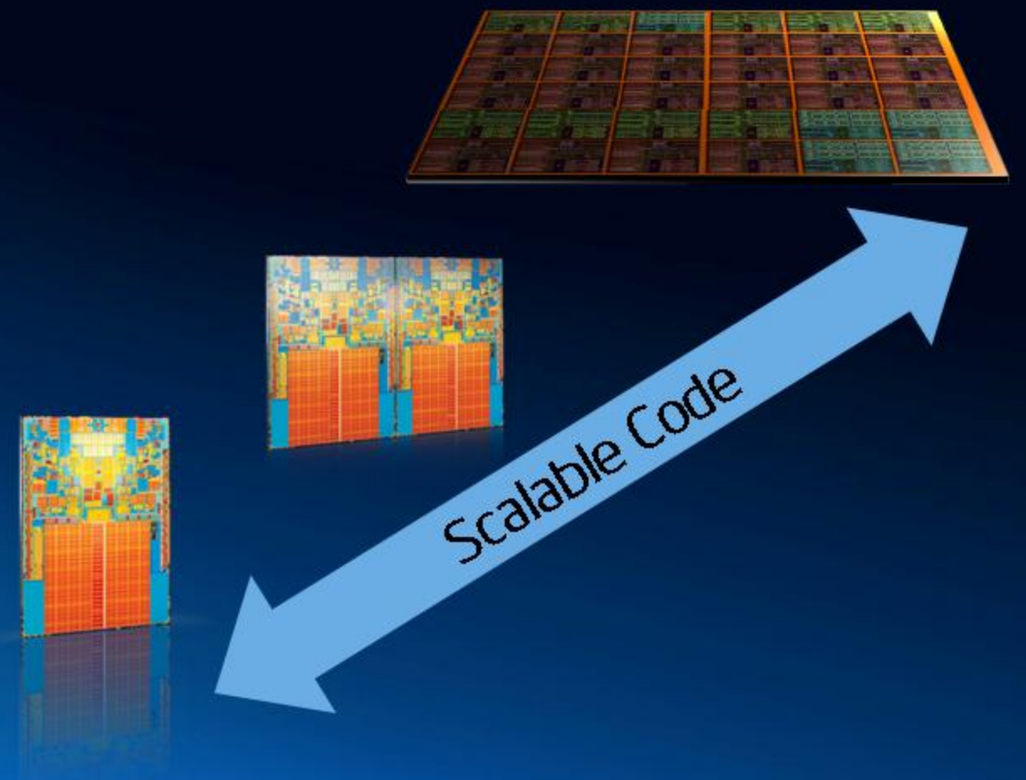
- 100+ Vector instructions
- Ex: 512 bit SIMD
- Load-op
- Format conversion
- Broadcast/swizzle
- Ternary
- Multiply-add
- Predication
- Gather/scatter support



Developed with Software Developers to Deliver the Programmability they Need most

Ct: Superior Data Parallel Programming Solution

- Avoid parallel programming pitfalls
- Develop readable programs
- Scale from dual-core to many-core



Ct: The Right Way to Do Data Parallelism

Announcing: Ct Technology Going Into Intel Tools

Data Parallel Programming for Multi-core and Many-core Processors

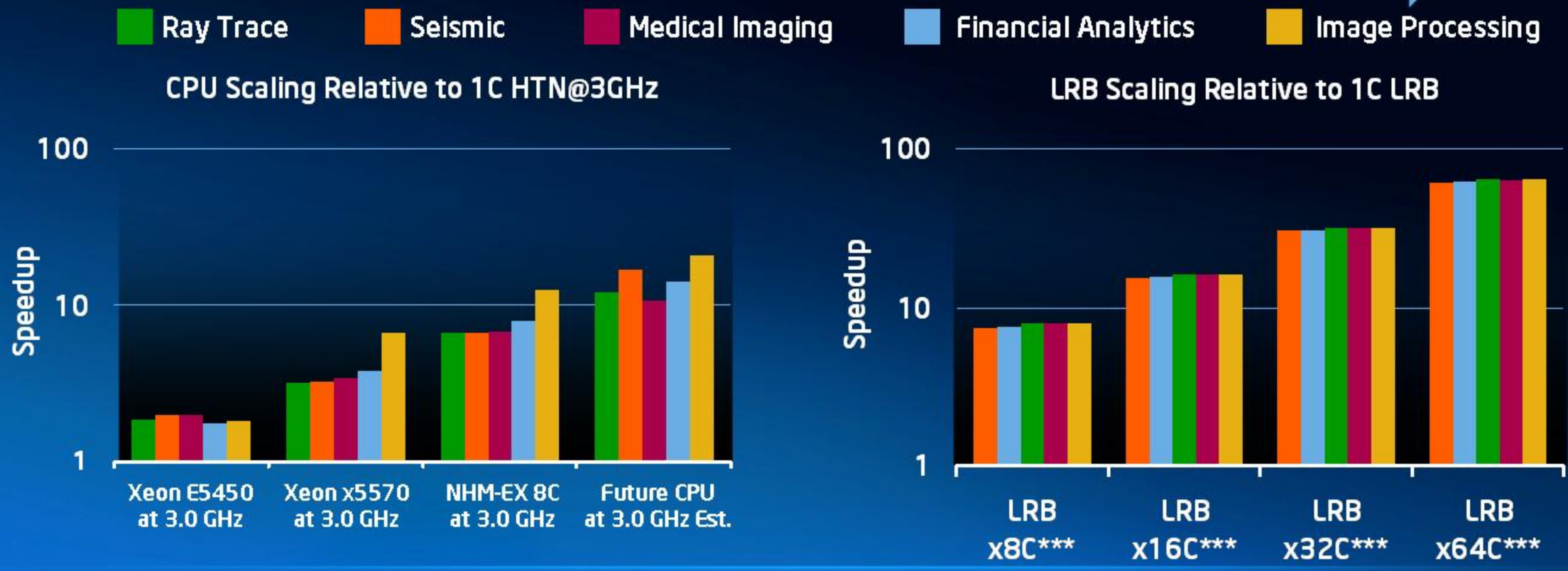
- Productive data parallel programming
  - High level abstraction for ease of use
- Investment protection
  - Performance scaling from dual-core to many-core CPUs
- C++ extended by standard use of templates
  - No changes to standard C++ compilers
- Complements software tools from Intel and others
- Product beta by EOY 2009

Bringing New Capabilities to Data Parallelism

intel

Forward-Scaling Data Parallel Performance

No Recompile Or Processor-specific Coding Required!



www.intel.com/software/data_parallel

IDF2009 英特尔信息技术峰会

* Intel Xeon Processor E5450 at 3.0 GHz with 8 GB RAM Linux distribution Ubuntu 8.10 x86_64 server; ** Intel Xeon Processor X5570 at 2.93 GHz (SMT off, Turbo off) with 16 GB RAM with Linux distribution FC9 x86_64; *** Simulated performance, LRB performance is simulated in native mode; PSI workload is a geomean of Black-Scholes, Binomial Tree and Poisson Solver; Image Processing is a convolution; Medical imaging is a backprojection; Ray Trace is a ray tracer; Seismic is a Kirchhoff time migration. All workloads uses synthetic datasets. Compile time is factored out.

intel

Industry Feedback on Ct Technology

"Intel's Ct technology will help us take full advantage of the power of data parallelism and will help us quickly scale our applications into the future."

— Xia Zhang, Neusoft CTO

"Ct is a breakthrough capability. As the underlying hardware platform evolves, we would like to take advantage of Ct's ability to scale, so we can build high-performance financial algorithms that protect our investment."

— Jeffrey M. Birnbaum, Managing Director, Bank of America

"Ct represents an essential new development for the future of parallel programming and we believe Ct will become one of the cornerstones of CERN's future programming environment."

— Prof. Dr. Volker Lindenstruth,
Chair of Computer Engineering, Univ of Heidelberg.
Head of ALICE High Level Trigger

"We believe Intel's Ct, is an exciting new technology for data-intensive computing environments such as seismic imaging."

— Laurent Clerc, VP Technology Services, CGGVeritas

Register for Ct Newsletter at Intel Software Network

www.intel.com/software/data_parallel

*Other names and brands may be claimed as property by others

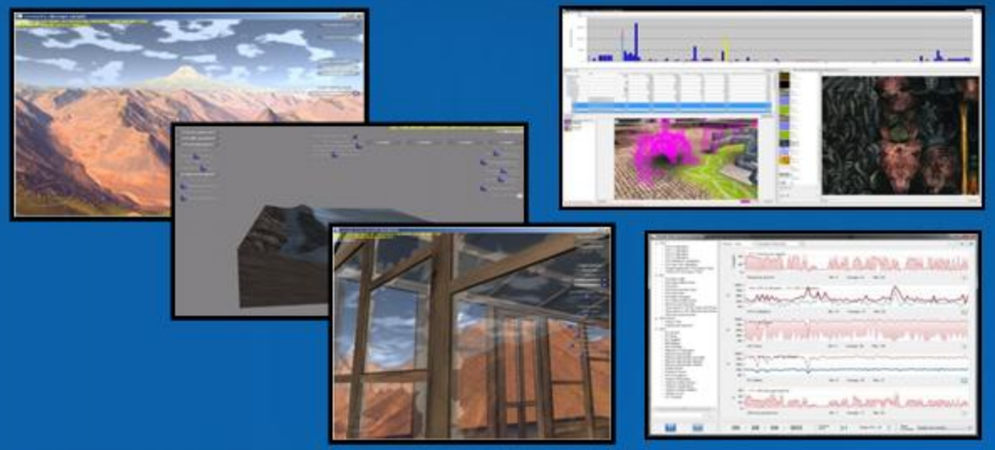
Software Support for Many Core

Proven Intel Tools and Development Model

- C ++ Auto-vectorizing Compiler
- Intrinsics
- Native Threading
- Ct support planned

Intel™ HPC Tools

Intel Parallel Studio



Extending Support for Larrabee

- Compiler, debugger, libraries & samples
- Intel Graphics Performance Analyzers extended to Larrabee (DirectX and Native mode)
- Supports standard APIs: DirectX*, OpenGL*, OpenCL*

*Other names and brands may be claimed as property by others

Summary

Intel Nehalem Microarchitecture Products for Mainstream Computing

32nm Based Products In 2010

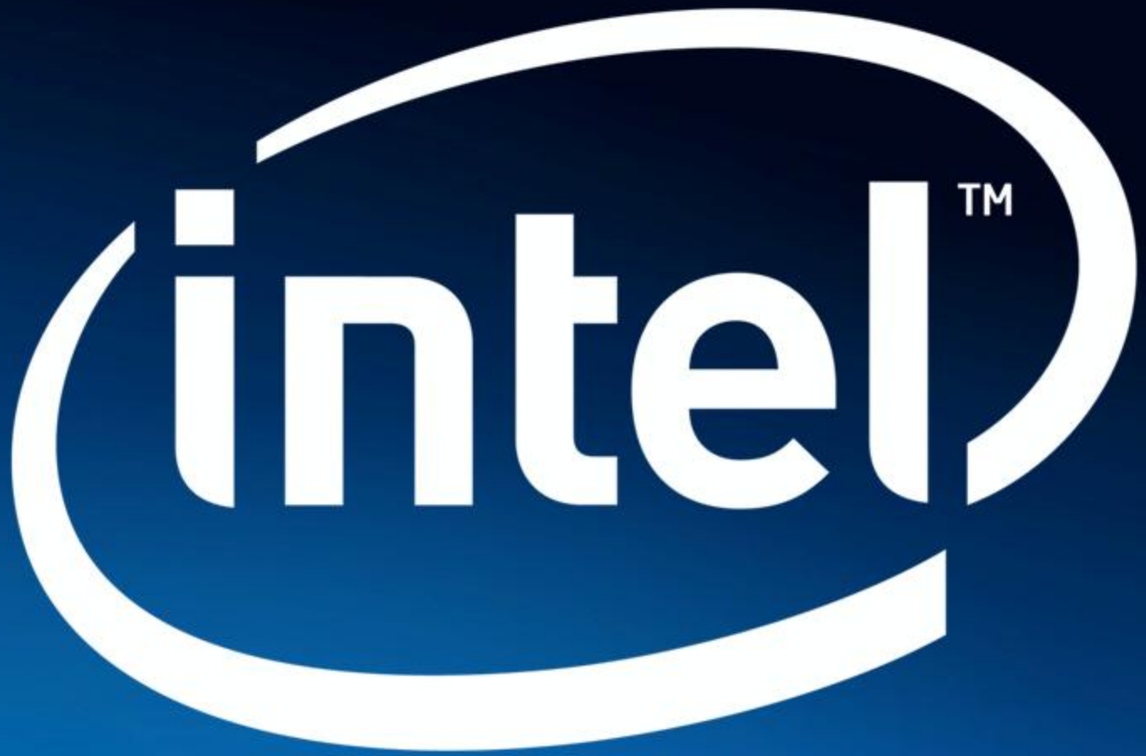
Intel Xeon™ 5500 Transforms Computing and Provides Great ROI

Nehalem-EX Brings New RAS Capabilities and 4S-8S Scalability In 2009

Atom, Jasper Forest and Arrandale Extend the Reach In Embedded Segment

Larrabee on Track and Rich Set of Developer Tools for Scalability

IA: The Intelligent Architecture Investment
Accelerate Design Of Nehalem Micro-architecture Based Products


intel
TM

Legal Disclaimers

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 or call (U.S.) 1-800-628-8686 or 1-916-356-3104.

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.

SPEC, SPECint2006, SPECfp2006, SPECjbb, SPECWeb are trademarks of the Standard Performance Evaluation Corporation. See http://www.spec.org for more information. TPC-C, TPC-H, TPC-E are trademarks of the Transaction Processing Council. See http://www.tpc.org for more information.

Intel® Virtualization Technology requires a computer system with an enabled Intel® processor, BIOS, virtual machine monitor (VMM) and, for some uses, certain platform 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.

Hyper-Threading Technology requires a computer system with a processor supporting HT Technology and an HT Technology-enabled chipset, BIOS and operating system. Performance will vary depending on the specific hardware and software you use. For more information including details on which processors support HT Technology, see here

Intel® Turbo Boost Technology requires a Platform with a processor with Intel Turbo Boost Technology capability. Intel Turbo Boost Technology performance varies depending on hardware, software and overall system configuration. Check with your platform manufacturer on whether your system delivers Intel Turbo Boost Technology. For more information, see http://www.intel.com/technology/turboboost."

Intel processor numbers are not a measure of performance. Processor numbers differentiate features within each processor series, not across different processor sequences. See http://www.intel.com/products/processor_number for details. Intel products are not intended for use in medical, life saving, life sustaining, critical control or safety systems, or in nuclear facility applications. All dates and products specified are for planning purposes only and are subject to change without notice

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

Copyright © 2009 Intel Corporation. All rights reserved. Intel, the Intel logo, Xeon and Intel Core are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries. All dates and products specified are for planning purposes only and are subject to change without notice

Benchmark configuration details

- All comparisons based on published/submitted/approved results as of March 30, 2009
- **SPECint_rate_base2006:**
- Baseline Intel® Xeon® processor X5470 based platform details: Fujitsu Siemens PRIMERGY* RX200 S4 server platform with two Intel Xeon processors X5470 3.33GHz, 12MB L2 cache, 1333MHz FSB, 16GB memory (8x2GB DDR2 PC2-5300F, 2 rank, CAS 5-5-5, with ECC), SUSE Linux Enterprise Server 10 SP2 x86_64 Kernel 2.6.16.60-0.21-smp*, Intel C++ Compiler for Linux32* and Linux64* version 11.0 build 20080730. Referenced as published at 140. For more information see http://www.spec.org/cpu2006/results/res2008q3/cpu2006-20080901-05156.html.
- Intel® Xeon® processor X5570 based platform details: Fujitsu PRIMERGY* TX300 S5 server platform with two Intel Xeon processors X5570 2.93GHz, 8MB L3 cache, 6.4GT/s QPI, 48 GB memory (6x8 GB PC3-10600R, 2 rank, CL9-9-9, ECC), SUSE Linux Enterprise Server 10 SP2 x86_64 Kernel 2.6.16.60-0.21-smp, Intel C++ Compiler for Linux32 and Linux64 version 11.0 build 20010131. Submitted to www.spec.org for review at 240 as of March 30, 2009.
- **SPECfp_rate_base2006**
- Baseline Intel® Xeon® processor X5482 based platform details: Hewlett-Packard ProLiant DL160 G5p server platform* with two Intel Xeon processors X5482 3.20GHz, 12MB L2 cache, 1600MHz FSB, 16GB memory (8x2GB 800MHz CL5 FB-DIMM), 64-Bit SUSE Linux Enterprise Server 10 SP1, Intel C++ Compiler for Linux32 and Linux64 version 10.1 build 20080730. Referenced as published at 86.4. For more information see http://www.spec.org/cpu2006/results/res2008q4/cpu2006-20081013-05587.html.
- Intel® Xeon® processor X5570 based platform details: Fujitsu PRIMERGY* TX200 S5 server platform with two Quad-Core Intel Xeon processors X5570 2.93GHz, 8MB L3 cache, 6.4GT/s QPI, 24 GB memory (6x4 GB PC3-10600R, 2 rank, CL9-9-9, ECC), SUSE Linux Enterprise Server 10 SP2 x86_64 Kernel 2.6.16.60-0.21-smp, Intel C++ Compiler for Linux32 and Linux64 version 11.0 build 20010131. Submitted to www.spec.org for review at 194 as of March 30, 2009.
- Intel® Xeon® processor X5570 based platform details: Cisco B-200 M1 server platform with two Quad-Core Intel Xeon processors X5570 2.93GHz, 8MB L3 cache, 6.4GT/s QPI, 24 GB memory (6x4 GB PC3-10600R, 2 rank, CL9-9-9, ECC), SUSE Linux Enterprise Server 11_RC4 x86_64 2.6.27.15-2-default, Intel C++ Compiler for Linux32 and Linux64 version 11.0 build 20010131. Result measured at 194 as of March 30, 2009.
- **SAP-SD 2-Tier**
- Baseline Intel® Xeon® processor X5470 based platform details: HP ProLiant BL460C server platform* with two Intel Xeon processors X5470 3.33GHz, 12MB L2 cache, 1333MHz FSB, 32GB memory, Microsoft Windows Server 2003 Enterprise Edition, Microsoft SQL Server 2005, SAP ECC Release 6.0 . Referenced as published at 2,518 SD users. Certification number 2008048.
- Intel® Xeon® processor X5570 based platform details: IBM System x3650 M2 Server with two Intel Xeon processors X5570, 2.93GHz 8MB L3 cache, 6.4QPI, 48GB memory, Microsoft Windows Server 2003 Enterprise Edition, DB2 9.5, SAP ECC Release 6.0 (2005). Referenced as published at 5,100 SD users. Certification number 2008079.
- **TPC-C**
- Baseline Intel® Xeon® processor X5460 based platform details: HP ProLiant ML370 G5 platform with Intel Xeon processor X5460 3.16GHz (2 processors / 8 cores / 8 threads), 2x6MB L2 cache, 1333 MHz system bus, 64GB memory, Microsoft SQL Server 2005 x64 Enterprise Edition SP2, Microsoft Windows Server 2003 Enterprise x64 Ent. R2. Referenced as published at 275,149 tpmC and $1.44/tpmC; availability date January 7, 2008. For more information see http://tpc.org/tpcc/results/tpcc_result_detail.asp?id=108010201.
- Intel® Xeon® processor X5570 based platform details: HP ProLiant DL370 G6* platform with two Intel Xeon processors X5570 2.93GHz (2 processors / 8 cores / 16 threads), 8MB L3 cache, 6.4GT/s QPI, 144 GB memory (18x8 GB DDR3). Oracle 11g database* with Oracle Enterprise Linux OS*. Result submitted to www.tpc.org as of March 30, 2009.

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 Copyright © 2009, Intel Corporation. * Other names and brands may be claimed as the property of others.

Benchmark configuration details

- All comparisons based on published/submitted/approved results as of March 30, 2009
- **TPC-E**
- Baseline Intel® Xeon® processor X5460 based platform details: Fujitsu-Siemens PRIMERGY TX300 S4 server platform* with Intel Xeon processor X5460 3.16GHz (2 processors / 8 cores / 8 threads), 2x6MB L2 cache, 1333 MHz system bus, 64GB memory, Microsoft SQL Server 200 x64 Enterprise Edition*, Microsoft Windows Server 2008 Enterprise x64*. Referenced as published at 317.45 tpsE and $523.49/tpsE; availability date August 30, 2008. For more information see http://www.tpc.org/tpce/results/tpce_result_detail.asp?id=12.
- Intel® Xeon® processor X5570 based platform details: Fujitsu-Siemens PRIMERGY RX300 S5 server platform* with two Intel Xeon processors X5570 2.93GHz (2 processors / 8 cores / 16 threads), 8MB L3 cache, 6.4GT/s QPI, 96 GB memory (12x8 GB DDR3-1066), Microsoft SQL Server 2008 x64 Enterprise Edition, Microsoft Windows Server 2008 Enterprise x64. Result submitted to www.tpc.org at 800tpsE and $343.91/tpsE as of March 30, 2009. Availability date April 1, 2009.
- **SPECjbb2005**
- Baseline Intel® Xeon® processor X5470 based platform details: Fujitsu Siemens PRIMERGY RX200 S4 server platform* with two Intel Xeon processors 5470 3.33GHz, 12MB L2 cache, 1333MHz FSB, 16GB memory, Microsoft Windows Server 2008 Enterprise x64 Edition*, Oracle JRockit 6 P28.0.0 (build P28.0.0-8-109238-1.6.0_05-20090130-1408-windows-x86_64) 4 JVM instances. Referenced as published at 368,034 BOPS. For more information see http://www.spec.org/osg/jbb2005/results/res2009q1/jbb2005-20090220-00583.html.
- Intel® Xeon® processor X5570 based platform details: IBM Bladecenter HS22 Server platform* with two Intel Xeon processors X5570 2.93GHz, 8MB L3 cache, 6.4GT/s QPI, 24 GB memory (6x4 GB DDR-1333MHz), Microsoft Windows Server 2008 Enterprise x64 Edition, IBM J9 2.4 JRE 1.6.0 (build pwa6460sr5-20090323_04(SR5)) run with 4 JVM instances. Result measured at 604417 BOPS - March 30, 2009.
- **SPECweb2005**
- Baseline Intel® Xeon® processor X5460 based platform details: HP Proliant DL380 G5 server platform with two Intel Xeon processors X5460 3.16GHz, 12MB L2 cache, 32GB memory (8x4G 667MHz ECC DDR2 FB-DIMM), RedHat Enterprise Linux 5 (2.6.18-53.el5), Rock Web Server v1.4.6 x86_64. Referenced as published at 29591. For more information see http://www.spec.org/web2005/results/res2008q1/web2005-20080225-00104.html.
- Intel® Xeon® processor X5570 based platform details: HP ProLiant DL380 G6 platform* with two Intel Xeon processors X5570 2.93GHz, 8MB L3 cache, 6.4GT/s QPI, 144 GB memory (18x8 GB DDR3), Red Hat Enterprise Linux 5.2 .Rock Web Server v1.4.7 (x86_64). Result submitted to www.spec.org for review at 71,045 as of March 30, 2009.
- **Fluent:**
- Baseline Intel® Xeon® processor X5482 based platform details: Supermicro X7DB8+* server platform with two Intel® Xeon® processors X5482 3.20GHz, 12MB L2 cache, 1600MHz FSB, 16GB memory (8x2GB 800MHz DDR2 FB-DIMM), 64-bit RedHat Enterprise Linux 5.3*. Performance measured using Fluent Version 12.0 Beta. (Version 12.0.13)*. Six individual benchmarks are shown as a measure of single node performance. "Overall" performance is the geometric mean of the six individual benchmarks.
- Intel® Xeon® processor X5570 based platform details: SGI Altix ICE 8200EX* server platform with two Intel Xeon processors X5570 2.93GHz, 8MB L3 cache, QPI 6.4 MT/sec, 24GB memory (12x2GB 1066MHz DDR3), 64-bit Suse Linux Enterprise Server* 10 SP2 with ProPack 6SP2*. Performance measured using Fluent Version 12.0 Beta. (Version 12.0.9) Six individual benchmarks are shown as a measure of single node performance. "Overall" performance is the geometric mean of the six individual benchmarks.

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 Copyright © 2009, Intel Corporation. * Other names and brands may be claimed as the property of others.

Benchmark configuration details

- All comparisons based on published/submitted/approved results as of March 30, 2009
- **SPECompM2001**
- Baseline Intel® Xeon® processor E5472 based platform details: Supermicro X7DB8+ server platform* with two Intel Xeon processors E5472 3.0GHz, 12MB L2 cache, 1600MHz FSB, 32GB memory (8x4GB 800MHz DDR2 FB-DIMM), SUSE LINUX 10.1* (X86-64) (Linux 2.6.16.13-4-smp). Binaries built with Intel Compiler 10.1. Referenced as published at 17187. (SPECompMbase2001). For more information see http://www.spec.org/omp/results/res2007q4/omp2001-20071107-00274.html.
- Intel® Xeon® processor X5570 based platform details: Cisco B-200 M1 server platform* with two Intel Xeon processors X5570 2.93GHz, 8MB L3 cache, 6.4GT/s QPI, 24 GB memory (6x4 GB DDR3-1333MHz), Red Hat EL 5.3, Linux Kernel 2.6.18-128.el5 SMP x86_64, Binaries built with Intel® C/C++ Compiler 11.0 for Linux. Result submitted to www.spec.org for review at 43593 (SPECompMbase2001) as of March 30, 2009.
- **SPECpower_ssj2008**
- Baseline Intel® Xeon® processor L5430 based platform details: Powerleader PR2510D2 server platform* with two Intel Xeon processors L5430 2.33GHz, 12MB L2 cache, 1333MHz FSB, 8GB memory, Oracle JRockit* (build P27.5.0-5_o_CR371811_CR374296-100684-1.6.0_03-20080702-1651-windows-x86_64, compiled mode). Published at 1135 ssj_ops/watt. For more information see: http://www.spec.org/power_ssj2008/results/res2008q4/power_ssj2008-20081007-00086.html.
- Intel® Xeon® processor X5570 based platform details: Verari Systems, Inc. VB1305 server platform* with two Intel Xeon processor X5570, 2.93GHz, 8 GB (4 x 2), Microsoft Windows Server 2008 Enterprise* Service Pack 2 OS. Oracle JVM (build P28.0.0-14-111048-1.6.0_05-20090303-1104-windows-x86_64, (compiled mode) result of 1943 provided by Verari as of 3/30/2009.
- **SPECjAppServer2004**
- Baseline Intel® Xeon® processor X5460 based platform details: HP Proliant BL460c G1 server platform with two Intel Xeon processors X5460 3.16GHz, 12MB L2 cache, 16GB memory (8x2G 667MHz ECC DDR2 FB-DIMM), Oracle Application Server 10G Release 10.1.3.3 - Java Edition, BEA JRockit(R) 6.0 JDK (R27.3.0-106) (Linux x86 32bit), Oracle Database Enterprise Edition Release 11.1.0.6. Referenced as published at 2056. For more information see http://www.spec.org/osg/jAppServer2004/results/res2007q4/jAppServer2004-20071023-00088.html .
- Intel® Xeon® processor X5570 based platform details: Dell PowerEdge R610 server platform* with two Intel Xeon processors X5570 2.93GHz, 8MB L3 cache, 6.4GT/s QPI, 24 GB memory (12x2 GB DDR3), Oracle WebLogic Server Standard Edition Release 10.3, Oracle JRockit(R) 6.0 JDK (R27.6.0-50) (Linux x86 32bit), Oracle Database Enterprise Edition Release 11.1.0.7, Result submitted to www.spec.org for review at 3975 as of March 30, 2009.
- **VMmark:**
- Baseline Intel® Xeon® processor X5470 based platform details: HP Proliant* ML370 G5 server platform with two Intel Xeon processors X5470 3.33GHz, 2x6MB L2 cache, 1333MHz FSB, 48GB memory, VMware ESX V3.5. Update 3 Published at 9.15@7 tiles. For more information see www.vmware.com/files/pdf/vmmark/VMmark-HP-2008-10-09-ML370.pdf.
- Intel® Xeon® processor X5570 based platform details: Dell PowerEdge* R710 Server platform with two Intel Xeon processors X5570 2.93GHz, 8MB L3 cache, 6.4GT/s QPI, 96 GB memory (12x8 GB DDR3-1066MHz), VMware ESX beta build 150817. Submitted to VMware for review at 23.55@16 tiles.

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 Copyright © 2009, Intel Corporation. * Other names and brands may be claimed as the property of others.

Xeon 5500 Refresh Slides (System Configurations)

- 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 to Xeon 5500 Refresh Configuration Details
- Source: Intel internal measurements 2005 – 2008 comparing 2S Xeon 3.8GHz (Irwindale), 8x1GB DIMMs, 1 HDD, 382W power under load to 2S Xeon X5570 (Nehalem 2.93GHz), 6x2GB DIMMs, 1 HDD, 315W power under load.

- Dual Core Xeon 5100 to Xeon 5500 Refresh Configuration Details
- Source: Intel internal measurements 2005 – 2008 comparing 2S Xeon 5160 (Woodcrest 3.0GHz), 8x2GB DIMMs, 1 HDD, 354W power under load to 2S Xeon X5570 (Nehalem 2.93GHz), 6x2GB DIMMs, 1 HDD, 315W power under load.

Single Core Energy Efficient Refresh Calculation Details

	2005	2009	Delta / Notes
Product	Intel® Xeon® 3.8GHz with 2M cache	Intel® Xeon® X5570 (2.93GHz)	
Performance per Server	1	8.7x increase	Intel internal SPECjbb2005* measurements as of Feb 2009
Server Power Idle / Active Power	228W idle / 382W active	174W idle / 312W active	Server idle for 16 hours per day and active for 8 hours per day
# Servers needed	184	21	~ 9:1 server consolidation
# Racks needed	9 racks	1 rack	**9:1 Rack Consolidation**
Annual Server kWhr	451,474	42,515	**90% lower energy costs**
Total Annual Energy Costs	$90,294	$8,502	$81,792 electricity costs per year. Assumes $0.10/kWhr and 2x cooling factor
Operating System Licensing Costs	$165,600	$18,900	$146,700 less per year Assumes a RHEL 1yr license at $900 Source www.dell.com as of 12/16/08
Annual Cost Savings of $228,854			
Cost of new HW	n/a	$147,000	Assume $6,900 per server
Payback Period of 8 months			

Single Core Performance Refresh Calculation Details

	2005	2009	Delta / Notes
Product	Intel Xeon single core (3.8Ghz w/ 2M cache)	Intel Xeon 5500 series (2.93GHz)	
Performance per Server	50,970 bops SPECjbb2005*	447,000 bops SPECjbb2005*	bops = business operations per second
Power Consumption per Server	382W active	315W active	Server active 24hr per day (assuming HPC application)
Data Center Capability = 1 MW			
DC Cooling Factor	1.6 PUE	1.6 PUE	**Same Design** PUE: = Power Usage Effectiveness.
# of Servers	1,637	1,637	**Same Footprint**
Data Center Performance	83,437,890 bops	731,739,000 bops	**Up to 8.8x Performance Increase**
Data Center Power	1,000 KW	825 kW	**Estimated 18% Lower Power** # of Servers * Svr Power * PUE

For 50% Lower Platform Idle Power

Configuration details for 50% lower idle power: Intel internal measurements of 221W at idle with Supermicro 2xE5450 (3.0GHz 80W) processors, 8x2GB 667MHz FBDIMMs, 1x700W PSU, 1x320GB SATA hard drive vs. 111W at idle with Supermicro software development platform with 2xE5540 (2.53GHz Nehalem 80W) processors, 6x2GB DDR3-1066 RDIMMs, 1x800W PSU, 1x150GB 10k SATA hard drive. Both systems were running Windows 2008 with USB suspend select enabled and maximum power savings mode for PCIe link state power management. Measurements as of Feb 2009.

For Virtualization Performance

- Up to 2.10x Virtualization performance compared to Xeon 5400 series claim supported by performance results on VMmark* benchmark. Xeon X5470 data based on published results. Xeon X5570 Intel internal measurement. (Feb 2009)
  - Configuration details: - VMmark benchmark
  - Baseline Quad-Core Intel® Xeon® processor X5470 based platform details: HP Proliant ML370 G5 server platform with two Quad-Core Intel Xeon processors X5470 3.33GHz, 2x6MB L2 cache, 1333MHz FSB, 48GB memory, VMware ESX V3.5. Update 3 Published at 9.15@7 tiles.
  - New platform: Intel preproduction server platform with two Quad-Core Intel® Xeon® processor X5570, 2.93 GHz, 8MB L3 cache, 6.4QPI, 72GB memory (18x4GB DDR3-800), VMware ESX Build 140815. Performance measured at 19.51@ 13 tiles