Intel Architecture
Press Briefing

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intel®
Today’s News
Intel Technology: Delivering on the Promise

Mission Critical

Tick-Tock

Expandable Server

Nehalem

Larrabee
Intel: The Architecture for Life

Internet

HPC
Mission Critical

Peta FLOPs

Milli Watts
IA Compatible and Scalable

Netbook
Smartphone
MID
Embedded
Mobile PC
Desktop PC
Workstation
Server

Intel: The Architecture for Life
Tukwila: Delivering Performance to World’s Most Powerful Computers

- Quad-core with 30 MB cache
- 2 billion transistors
- Multi-Threading Technology
- Intel QuickPath interconnect
- Dual Integrated Memory Controllers
- Estimate >2x* performance
- Mainframe-class RAS

“With Intel’s upcoming quad-core Tukwila processor, Windows Server solutions running on Itanium-based systems will provide an even more scalable, reliable, agile and dynamic datacenter foundation for our customers.”

—Bill Laing, GM Windows Server & Solutions Division, Microsoft

* Compared to Dual-core Itanium® Processor 9100 series
Product Cadence for Sustained Leadership

2007-08

Penryn Processors 45nm

TICK  TOCK

Delivering Products on Schedule and Moore’s Law
Expandable and Scalable: Quad-Core Intel® Xeon® processor 7300

- Caneland platform built for virtualization and consolidation
- Energy Efficient performance: Leading in benchmarks
- Scalable
- Enterprise proven reliability and investment protection
- Great customer acceptance

Industry’s Virtualization Platform of Choice
Expandable and Scalable: Gets Better with Dunnington

- 6 core Processor
- 1.9 billion transistors
- 45nm Hi-K technology
- 16 MB L3 cache
- Latest Intel virtualization capabilities
- Socket compatible with Caneland platform
- Available 2H’08
# Energy Efficiency: Top SPECpower* Results


SPECPower_ssj2008 results measured as ssj_ops/watt

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<table>
<thead>
<tr>
<th>Rank</th>
<th>Sponsor</th>
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<th>Platform</th>
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<td>1</td>
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<td>778</td>
<td>DL180 G5</td>
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<td>Dell</td>
<td>719</td>
<td>PE 2950 III</td>
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<td>712</td>
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<td>Intel</td>
<td>468</td>
<td>SM 6025B</td>
<td>2x Intel Xeon® L5335</td>
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</table>
Product Cadence for Sustained Leadership

2007-08

Penryn
Processors
45nm

Nehalem
Processors
45nm

TICK

TOCK

Driving Products to Deliver on Moore’s Law
Nehalem Micro-architecture: Dynamically Scalable and Innovative New Design

- Scalable from 2 to 8 cores
- Micro-architecture enhancements (4-way wide)
- 2-way simultaneous multi-threading
- Integrated memory controller
- QuickPath interconnect
- Shared and Inclusive Level-3 cache
- Dynamic power management
- SSE 4.2
- Production: Q4’08
Nehalem Design Scalable Via Modularity

Nehalem Building
Block Library

IA Core

iGraphics

QPI

Cache

IMC

Sample Range of Product Options

Ex: 4 Core

Ex: 8 Core

Block combinations are for illustration only and do not represent actual product plans. Block sizes are not indicative of die size contributions.
Nehalem: Core uArch Enhancements

Foundation: Intel® Core™ Microarchitecture

Significant Performance and Efficiency Enhancements

- Increased parallelism
  - 33% more micro-ops in flight possible
- Enhanced algorithms
  - Faster “unaligned” cache accesses
  - Faster synchronization primitives
- Further branch prediction enhancements
  - New 2nd level branch predictor
  - Renamed Return Stack Buffer

Builds upon Industry Leading 4 Instruction issue Intel® Core micro-architecture
Simultaneous Multi-Threading (SMT)

- Each core able to execute two software threads simultaneously
- Extremely power efficient
- Enhanced with larger caches and more memory bandwidth

Benefits

- Highly threaded workloads (e.g., multi-media apps, databases, search engines)
- Multi-Tasking scenarios
Enhanced Cache Subsystem

- **New 3-level Cache Hierarchy**
  - L1 cache same as Intel Core™ uArch
    - 32 KB Instruction/32 KB Data
  - New 256 KB/core, low latency L2 cache
  - New Large 8MB fully-shared L3 cache
    - Inclusive Cache Policy - minimize snoop traffic
- **New 2-level TLB hierarchy**
  - Adds 2nd level 512 entry Translation Look-aside Buffer

Superior multi-level shared cache extends Intel® Smart Cache technology
Nehalem/Tylersburg Platforms
(High End Desktop and Server/Workstation)

- **Intel® QuickPath Interconnect**
  - New point to point interconnect
  - 2 links per CPU socket
  - Up to 25.6 Gb/sec total bandwidth/link

- **Integrated DDR3 Memory Controller**
  - 3 channels per processor
  - Massive amounts of Bandwidth
  - Significant Memory Latency Reduction

**Huge Latency Decrease and Bandwidth Increase over Prior Generation**
Nehalem High End Desktop/Server IMC

- 3 channels per socket
- Up to 3 DIMMs/channel
- DDR3-800, 1066, 1333
  - Future scalability
- Supports RDIMM and UDIMM
- Very low latency
- Very high bandwidth
- Built-In RAS Features

Leadership Memory Bandwidth

*Source: Intel internal measurement
Product Cadence for Sustained Leadership

2009-10

Westmere Processors
32 nm

TICK

Sandy Bridge Processors
32 nm

TOCK

Continuing the Pace of Innovation
**Intel® Advanced Vector Extension (AVX)**

256-bit vector extension to SSE for FP intensive applications

### KEY FEATURES

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Wider Vectors</td>
<td>Increased from 128 bit to 256 bit</td>
</tr>
<tr>
<td>Enhanced Data Rearrangement</td>
<td>Use the new 256 bit primitives to broadcast, mask loads and do data permutes</td>
</tr>
<tr>
<td>Three Operand, Non Destructive Syntax</td>
<td>Designed for efficiency and future extensibility</td>
</tr>
</tbody>
</table>

### BENEFITS

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 2x peak FLOPs output</td>
<td></td>
</tr>
<tr>
<td>Organize, access and pull only necessary data</td>
<td>more quickly and efficiently</td>
</tr>
<tr>
<td>Fewer register copies, better register use, more opportunities for parallel loads and compute operations, smaller code size</td>
<td></td>
</tr>
</tbody>
</table>
Visual Computing: Graphics Re-defined

**Mainstream Graphics**
- Triangle / Rasterization
- Rigid pipeline architecture
- Tools constrained by architecture
- Inefficient for non Graphics computing

**Visual Computing**
- New life-like Rendering e.g. Global illumination
- Programmable, ubiquitous architecture
- High definition audio and video processing
- Combines with model based computing (e.g. Physics)
Visual Computing

Acquiring, Analyzing, Modeling and Synthesizing Visual Workloads

Photorealistic 3D Rendering
Interactive User Interface
High Definition Audio, Video
Computational Modeling
Visual Computing: What Does it Take?

Intel Leadership

- Platforms: Client, Workstation, Server
- CPU, Graphics, Media Architecture
- Process and Technology Leadership
- Software, Tools & Developer Support
Larrabee: Visual Computing Architecture

- Many IA cores
  - Scalable to TeraFLOPS

- New cache architecture

- New vector instruction set
  - Vector memory operations
  - Conditionals
  - Integer and FP arithmetic

- New vector processing unit / wide SIMD
Intel Software: Unleashes Developer Freedom

Industry Leading Intel® Software Tools
Addresses development and performance tuning needs

Visual Computing Tools & Resources
Extending Intel® Software for Larrabee Architecture
Supports industry standard APIs (DirectX* & OpenGL*)

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