Today’s News
Intel Technology: Delivering on the Promise

Mission Critical

Tick-Tock

Expandable Server

Nehalem

Larrabee
Intel: The Architecture for Life

Internet

Milli Watts

IA Compatible and Scalable

Peta FLOPs

Milli Watts

IA Compatible and Scalable

Peta FLOPs

Netbook

Smartphone

MID

Embedded

Mobile PC

Desktop PC

Workstation

Server

HPC

Mission Critical
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

<table>
<thead>
<tr>
<th>Rank</th>
<th>Sponsor</th>
<th>SPECPower_ssj2008 result</th>
<th>Platform</th>
<th>Processors</th>
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<td>778</td>
<td>DL180 G5</td>
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First industry standard Energy Efficiency benchmark


SPECPower_ssj2008 results measured as ssj_ops/watt

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Product Cadence for Sustained Leadership

2007-08

TICK

Penryn
Processors
45nm

TOCK

Nehalem
Processors
45nm

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

Ex: 4 Core

Ex: 8 Core

Sample Range of Product Options

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 2\textsuperscript{nd} 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

Simultaneous Multi-threading Enhances Performance and Energy Efficiency
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

Sandy Bridge Processors
32 nm

TICK

TOCK

Continuing the Pace of Innovation
Intel® Advanced Vector Extension (AVX)
256-bit vector extension to SSE for FP intensive applications

**KEY FEATURES**

- **Wider Vectors**
  - Increased from 128 bit to 256 bit

- **Enhanced Data Rearrangement**
  - Use the new 256 bit primitives to broadcast, mask loads and do data permutes

- **Three Operand, Non Destructive Syntax**
  - Designed for efficiency and future extensibility

**BENEFITS**

- **Up to 2x peak FLOPs output**

- **Organize, access and pull only necessary data more quickly and efficiently**

- **Fewer register copies, better register use, more opportunities for parallel loads and compute operations, smaller code size**
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

Computational Modeling

High Definition Audio, Video
Visual Computing: What Does it Take?

Intel Leadership

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

Photorealistic 3D Rendering
Interactive User Interface
High Definition Audio, Video
Computational Modeling
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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Q & A
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