



# Backgrounder

## **DRIVING ENERGY-EFFICIENT PERFORMANCE, INNOVATION WITH INTEL® CORE™ MICROARCHITECTURE INTEL DEVELOPER FORUM, MARCH 7, 2006**

The need for raw computing performance has evolved into a broader drive for not only high performance but also expanded capabilities and energy efficiency – what Intel calls “energy-efficient performance.” The Intel® Core™ microarchitecture is Intel's new foundation for delivering even greater energy-efficient performance to meet people's expanding demands – whether for smaller devices, longer battery life, or greater power savings.

The Intel Core microarchitecture is a low power, high performance and highly scalable microarchitecture that can be used across desktop, mobile and server platforms. Processors based on this microarchitecture are expected to start shipping in the third quarter of 2006. Intel mobile, desktop and server platforms will also benefit from using Intel's industry-leading 65nm manufacturing process. These products will extend Intel's strong 2006 roadmap, which began with the successful launches of the Intel® Viiv™ technology and Intel®Centrino® Duo mobile technology platforms, the introduction of the Intel® Core™ Duo processor, and Apple's\* milestone launch of Intel-based Mac\* desktop and notebook systems.

### **Defining Energy-Efficient Performance**

Energy-efficient performance is about delivering the most performance and capabilities per watt – the amount of performance and capabilities delivered within an optimal energy-efficient envelope. High degrees of energy-efficiency are required by mobile platforms and handheld devices, which need long battery life without compromising performance or capabilities, and by data centers, which have high-data-throughput needs and are sensitive to real-estate and electric requirements. Technical computing applications, by contrast, demand enormous raw processing performance but have less emphasis on energy requirements.

Energy-efficient performance is measured as a platform's ability to meet or exceed the performance, energy-efficiency and capability requirements for a given market segment. Higher energy-efficient performance is provided by a design that satisfies the thermal envelope, provides

the required capabilities such as manageability, security, and availability, and delivers leading-edge performance for its market segment.

When expressed within the microarchitecture, energy-efficient performance is a combination of energy-per-instruction and capability-per-watt. The Intel Core microarchitecture delivers critical new capabilities (64-bit addressing, virtualization, active management, trusted operation and multi-threading) while extending the energy-efficiency leadership established by Intel's mobile processors and platforms.

Delivering energy-efficient performance requires a holistic effort across all common platform components – processors, chipsets, hard drives, power supplies, graphics cards, memory subsystems, displays, BIOS, software and more. Intel manages these components as a collective system. This creates a platform whose components work together to deliver performance when required and to conserve resources when needed.

Unlike alternative approaches, Intel is unique in the core strengths it brings to this task, including advanced manufacturing and process technologies; architecture and design expertise; intensive research and development programs; innovative platform technologies; and necessary platform ingredients beyond processors, including chipsets and software. In silicon, Intel's advanced 65nm process technology delivers the most energy-efficient-performance CPU transistors when compared with published results of CPU competitors. The Intel Core microarchitecture is expected to enable significant performance and energy-efficiency gains:

- **Desktop:** Intel expects the desktop processor codenamed Conroe to deliver greater than 40 percent improvement in performance and greater than 40 percent reduction in power as compared with today's high-end Intel® Pentium® D processor 950.\*\*
- **Server:** The server processor codenamed Woodcrest is expected to deliver greater than 80 percent improvement in performance and greater than 35 percent reduction in power as compared with today's Dual-Core Intel® Xeon® processor 2.8GHz with 2x2 MB Cache.\*\*
- **Mobile:** For mobile, the processor codenamed Merom builds upon the already significant performance and performance/watt leadership that Intel is delivering with today's Intel Core Duo processor and Intel® Centrino® Duo mobile technology.

These advances are expected to provide better overall performance and energy-efficiency than Intel's competitors in the second half of 2006.

### **The Intel Core Microarchitecture**

The forthcoming Intel Core microarchitecture is a new industry-leading foundation for Intel's multi-core server, desktop and mobile processors. The first Intel Core microarchitecture products built on Intel's advanced 65nm process technology will deliver higher-performing yet more energy-efficient processors that enable more stylish, quieter and smaller PCs; drive servers that can reduce electricity and real-estate associated costs; and provide critical capabilities such as enhanced security, virtualization and manageability for consumers and businesses.

The Intel Core microarchitecture builds on the power-saving philosophy begun with the mobile Intel® Pentium® M processor microarchitecture (formerly codenamed Banias) and greatly

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\*\* Performance based on estimated SPECint\*\_rate\_base2000; actual performance may vary; power reduction based on TDP

expands it, incorporating many new and leading-edge innovations as well as existing Intel® Pentium® 4 processor technologies, such as wide data pathways and streaming instructions.

For home users, the Intel Core microarchitecture will enable higher performing, ultra-quiet, sleek and low-power computer designs, and new advances in more sophisticated, user-friendly entertainment systems for the digital home. For businesses, the benefits can include reduced space and cooling requirements and reduced electrical demand in server data centers, as well as increased responsiveness, productivity and energy-efficiency across client and server platforms. The Intel Core microarchitecture will provide mobile users with responsive computing performance and enable improved battery life in a variety of small form factors.

### Intel Core Microarchitecture Features

The Intel Core microarchitecture includes platform support for a wide array of new memory technologies such as DDR2, increased integrated graphics performance, improved memory bandwidth for multi-core and multi-threading and a larger, multi-core-optimized cache to deliver improved performance. Other technical advances include:

- **Intel® Wide Dynamic Execution:** Delivers more instructions per clock cycle, improving execution and energy-efficiency. Every execution core is wider, allowing each core to complete up to four full instructions simultaneously using an efficient 14-stage pipeline.
- **Intel® Intelligent Power Capability:** Includes features that further reduce power consumption by intelligently powering on individual logic subsystems only when required.
- **Intel® Advanced Smart Cache:** A shared L2 cache to reduce power by minimizing memory traffic and increasing performance by allowing one core to utilize all cache while the other idles.
- **Intel® Smart Memory Access:** Another feature that improves system performance by hiding memory latency and thus optimizing the use of data bandwidth out to the memory subsystem.
- **Intel® Advanced Digital Media Boost:** Now 128-bit SSE, SSE2 and SSE instructions execute within one cycle at a sustained rate. This effectively doubles the execution speed for these instructions, which are used widely in multimedia and graphics applications.

### For more information, please see:

- Energy-Efficient Performance [www.intel.com/technology/eep](http://www.intel.com/technology/eep)
- Intel® Core™ Microarchitecture  
[ftp://download.intel.com/technology/architecture/new\\_architecture\\_06.pdf](ftp://download.intel.com/technology/architecture/new_architecture_06.pdf)
- Intel® Core™ Duo processors [www.intel.com/products/processor/coreduo](http://www.intel.com/products/processor/coreduo)
- Intel® Platforms [www.intel.com/platforms](http://www.intel.com/platforms)
- Intel Multi-Core [www.intel.com/multi-core](http://www.intel.com/multi-core)
- Intel Architectural Innovation [www.intel.com/technology/architecture](http://www.intel.com/technology/architecture)