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Fact Sheet

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News Flash: Intel Details Upcoming New Processor Generations

Marking the next step in Intel's "tick-tock" product strategy and cadence to deliver a new process technology with an enhanced microarchitecture or entirely new microarchitecture every year, Intel Corporation will begin producing its next-generation Penryn family of processors in the second half of this year. These new processors benefit from enhancements to the Intel® Core™ microarchitecture and also Intel's industry-leading 45nm Hi-k process technology with its hafnium-based high-K + metal gate transistor design, which results in higher performance and more energy-efficient processors.

Intel has more than 15 45nm Hi-k product designs in various stages of development, and will have two 45nm manufacturing fabs in production by the end of the year, with a total of four in production by the second half of 2008 that will deliver tens of millions of these processors. Below are many of the details of the Penryn processor family and a glimpse into some of the key features of Intel's future generation of processors, codenamed Nehalem.

PENRYN FAMILY MICROARCHITECTURE INNOVATIONS

- ***A Range of Products*** – Six Penryn family processors, including dual and quad-core desktop processors and a dual core mobile processor are all under the Intel Core processor brand name as well as new dual and quad-core server processors under the Intel Xeon processor brand name. A processor for higher-end server multiprocessing systems is also under development. As previously noted, Intel already has a total of 15 45nm products scheduled.
- ***Technical Marvel*** -- 45nm next-generation Intel® Core™2 quad-core processors will have 820 million transistors. Thanks to our high-k metal transistor invention, think of 820 million more power efficient light bulbs going on and off at light-speeds. The dual-core version has a die size of 107mm², which is 25 percent smaller than Intel's current 65nm products -- and quarter of the size of the average U.S. postage stamp -- and operate at the same or lower power than Intel's current dual core processors.

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- ***Deep Power Down for Energy Savings, Improved Battery Life*** -- The mobile Penryn processor has a new advanced power management state called Deep Power Down Technology that significantly reduces the power of the processor during idle periods such that internal transistor power leakage is no longer a factor. This helps extend battery life in laptops. This is a major advancement over previous generation industry leading Intel mobile processors.
- ***Intel Dynamic Acceleration Technology Enhanced Performance for Single Threaded Apps*** -- For the mobile Penryn processor, Intel has enhanced the Intel® Dynamic Acceleration Technology available in current Intel Core 2 processors. This feature uses the power headroom freed up when a core is made inactive to boost the performance of another still active core. Imagine a shower with two powerful water shower heads, when one shower head is turned off, the other has increased water pressure (performance).
- ***Speeding Up Video, Photo Imaging, and High Performance Software*** -- Penryn includes Intel® Streaming SIMD Extensions 4 (SSE4) instructions, the largest unique instruction set addition since the original SSE Instruction Set Architecture (ISA). This extends the Intel® 64 instruction set architecture to expand the performance and capabilities of the Intel® Architecture.
- ***Other Technical Features to Improve Performance***
 - ***Microarchitecture Optimizations*** -- Increases the overall performance and energy efficiency of the already leading Intel Core microarchitecture to deliver more instruction executions per clock cycle, which results in more performance and quicker PC responsiveness.
 - ***Enhanced Intel® Virtualization Technology*** -- Penryn speeds up virtual machine transition (entry/exit) times by an average of 25 to 75 percent. This is all done through microarchitecture improvements and requires no virtual machine software changes. Virtualization partitions or compartmentalizes a single computer so that it can run separate operating systems and software, which can better leverage multicore processing power, increase efficiency and cut costs by letting a single machine act as many virtual “mini” computers.
 - ***Higher Frequencies*** -- Penryn family of products will deliver higher overall clock frequencies within existing power and thermal envelopes to further increase performance. Desktop and server products will introduce speeds at greater than 3GHz.
 - ***Fast Division of Numbers*** – Penryn-based processors provide fast divider performance, roughly doubling the divider speed over previous generations for computations used in nearly all applications through the inclusion of a new, faster divide technique called Radix 16. The ability to divide instructions and commands faster increases a computer’s performance.
 - ***Larger Caches*** -- Penryn processors include up to a 50 percent larger L2 cache with a higher degree of associativity to further improve the hit rate and maximize its utilization. Dual-core Penryn processors will feature up to a 6MB L2 cache and quad-core processors up to a 12MB L2 cache. Cache is a memory reservoir where frequently accessed data can be stored for more rapid access. Larger and faster cache sizes speed a computer’s performance and response time.

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- **Unique Super Shuffle Engine** -- By implementing a full-width, single-pass shuffle unit that is 128-bits wide, Penryn processors can perform full-width shuffles in a single cycle. This significantly improves performance for SSE2, SSE3 and SSE4 instructions that have shuffle-like operations such as pack, unpack and wider packed shifts. This feature will increase performance for content creation, imaging, video and high-performance computing.

NEHALEM MICROARCHITECTURE

After Penryn and the 45nm Hi-k silicon technology introduction comes Intel's next-generation microarchitecture (Nehalem) slated for initial production in 2008. By continuing to innovate at this rapid cadence, Intel will deliver enormous performance and energy efficiency gains in years to come, adding more performance features and capabilities for new and improved applications. Here are some new initial disclosures around our Nehalem microarchitecture:

- ***Dynamically scalable for leadership performance on demand with energy efficiency***
 - Dynamically managed cores, threads, cache, interfaces and power
 - Leverages leading 4 instruction issue Intel® Core microarchitecture technology
 - Simultaneous multi-threading (similar to Intel® Hyper-threading technology) returns to enhance performance and energy efficiency
 - Innovative new Intel® SSE4 and ATA instruction set architecture additions
 - Superior multi-level shared cache leverages Intel® Smart Cache technology
 - Leadership system and memory bandwidth
 - Performance enhanced dynamic power management
- ***Design scalable for optimal price/performance/energy efficiency in each market segment***
 - New system architecture for next-generation Intel processors and platforms
 - Scalable performance: 1 to 16+ threads, 1 to 8+ cores, scalable cache sizes
 - Scalable and configurable system interconnects and integrated memory controllers
 - High performance integrated graphics engine for client

-- 30 --

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