■ THE EDITORIAL VIEW

Intel Converting From Chips to Modules

Desktop, Notebook Modules Will Change Vendor's Business Model

Intel recently rolled out its first Mobile Modules, small PC boards that contain a Pentium processor, cache, and system logic *(see* 110202.PDF*)*. The company also says it will sell future Pentium II (P6) processors on a daughtercard that contains the level-two cache. Taken to-gether, these two announcements indicate that, within two years, at least 70–80% of Intel's processors will be sold on modules, not as standalone chips. This transition will affect Intel, its customers, and its suppliers as well as PC buyers.

Contrary to some conspiracy theories, Intel isn't making this change so it can corner the world SRAM market or lock out its competitors. Some or all of these results may occur, but only as side effects to Intel's goal of increasing sales of its processors, particularly at the higher price points where Intel makes the most profit.

As processor performance increases, the PC designer's task becomes more difficult. Faster processors need faster buses to satisfy their burgeoning appetite for data, and Intel realized the number of vendors prepared for the 133-MHz Pentium II cache bus was small, potentially limiting adoption of this next-generation processor.

Rather than limit the performance of the Pentium II by constraining its cache speed to 66 MHz, Intel designed a daughtercard to contain the entire high-speed cache interface, so PC makers won't have to deal with it. Over time, Intel can push the cache speed to 200 MHz or higher without impacting motherboard designs. The daughtercard lets Intel optimize the CPU/cache subsystem while encouraging a wide variety of PC makers to make Pentium II systems.

The notebook module attacks a similar problem but goes a bit further. Because notebook systems are constrained on board space, component height, power consumption, and thermal issues, redesigning a portable system for any new processor is difficult and time consuming. This difficulty has prevented notebook makers from quickly adopting new processors, particularly during generational shifts. Instead, these notebook makers rely on older CPUs than do their desktop brethren.

Intel wants notebook makers to move to its newest processors more quickly. Intel's Mobile Modules should accelerate the adoption of new processor technology, in this case, Pentium II. If a PC maker designs a system for the P55C Mobile Module, it can upgrade to Pentium II in the future simply by plugging in a new module. End users get faster notebooks, and Intel makes more money. Problem solved.

Every solution, of course, creates a new set of problems. Within a couple of years, Intel will be cranking out more than 70 million small PC boards annually. The company has been adding factories to increase its PCB fabrication capacity, and more investment in this area will be required to support such a huge volume of boards.

As every one of these boards will contain at least 256K of cache, Intel will quickly become the world's largest consumer of SRAMs. The company will probably purchase parts from a handful of vendors, using its enormous leverage to pound SRAM prices down to the bare minimum. Although lower prices will benefit PC buyers, SRAM vendors, already bleeding from last year's crash in memory prices, may be hounded out of the market. At least one large SRAM vendor is already considering abandoning this profitless activity.

As Intel absorbs functions onto its processors/modules, it eliminates opportunities for system vendors to differentiate their products. For instance, Intel brought the FPU onto the processor in the 486; by the Pentium generation, this feature was no longer optional. With the P6, cacheless systems are no longer an option. In fact, the 256K cache is likely to disappear over time; as cache sizes grow, Intel will focus on one or two sizes, dropping smaller ones. PC makers must seek differentiation in other aspects of the system, such as main memory and graphics.

End users are likely to benefit from Intel's module plans. Notebook users in particular will get access to the latest CPU technology more quickly than in the past. The modules allow continued intense competition among PC makers, keeping margins and prices to a minimum. Conversely, system makers will see little opportunity to gain profit.

Finally, Intel's modules raise the bar for other x86 processor vendors. If most of the notebook market moves to the new modules, Intel's competitors must engineer compatible modules or target other system makers. Similarly, these competitors must either supply P6-compatible daughtercards or promote an alternative socket for desktop systems.

AMD and Cyrix hope the Pentium socket will continue to be widely used for at least the next two years, giving them a standard pinout for their devices. Intel's efforts to move the market to modules will limit the opportunities for these Pentium-pinout devices. The success of Intel's modules will redefine the concept of compatibility, forcing its competitors to adapt or face limited opportunities. Ⓜ

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