

# Where's Willamette?

## *In a Sea of New Processors, Intel's Next Generation Is Not to Be Found*



Intel has always been a company of engineers, run by engineers. Even the CEOs have PhDs. Intel's dominance of the x86 processor market is due in no small part to the company's continued technical superiority over its competitors. Every time the competition showed signs of catching up, Intel introduced better technology. The 486. Pentium. The P6. MMX. The beat goes on.

Intel's pace of innovation has slowed lately, and at just the wrong time, because AMD has started to innovate on its own. AMD's first innovation, 3DNow, beat Intel's Katmai New Instructions (KNI) to market by nine months. AMD's next effort, the K7, appears at least a year ahead of Intel's seventh-generation processor, code-named Willamette. How did AMD beat Intel to the punch?

With KNI, Intel's problem was finding the right launch vehicle. In 1997, the company introduced the original MMX extensions in both Pentium/MMX and Pentium II. The company chose not to include in MMX any SIMD floating-point instructions—which accelerate 3D games and a few other applications—presumably to reduce die-size and schedule pressures on these initial processors.

In 1998, however, Intel did not introduce any new CPU cores, instead raising performance by converting these 1997 designs to the new 0.25-micron process. But the 0.25-micron versions (Tillamook and Deschutes) added no features to their predecessors. Intel chose to wait until Katmai (Pentium III), due in March, to introduce 3D acceleration in the form of KNI. AMD, however, put 3DNow into the K6-2, which began shipping last June.

Intel hopes KNI will be worth the wait. Although the vendor has yet to disclose the full details of KNI and its implementation in Katmai, the new instructions (see [MPR 10/5/98, p. 1](#)) appear superior to 3DNow. In the long run, AMD's initial nine-month lead will have little effect, other than to embarrass Intel's engineers. The impact of 3DNow is also lessened by the fact that 3D applications appeal to only a fraction of PC buyers.

That Katmai has little to offer other than KNI is more surprising. Pentium/MMX doubled the size of the on-chip cache and made other minor changes from Pentium, resulting in a modest but perceptible performance boost on most applications. In contrast, Katmai's application performance is identical to Pentium II's at the same clock speed, unless KNI can be used, according to sources. Thus, despite the wait for Katmai, the chip offers little to business users or

consumers not interested in 3D or video. Intel has missed an opportunity to increase the value of its products for the majority of its customers.

Instead of Katmai, Intel should be introducing Willamette. In theory, that processor could have debuted as a large die in the mature 0.25-micron process, then moved to the 0.18-micron process by the end of this year, reducing cost and boosting performance. Such a bold move would have given Intel a clear performance lead and reduced the buzz around AMD's K7.

When Pentium Pro (the P6) was launched in 1995, just two years after Pentium, then-CEO Andy Grove implied that Intel's next-generation processor would also appear on a two-year cycle, i.e., in 1997. This plan assumed that Intel's California team, which had developed Pentium, would produce the next CPU. That team was redirected onto the Merced project, however.

That change left Intel's Oregon team to start the next-generation effort after completing the P6. Developing a new x86 processor, particularly one that carried forward some P6 concepts, should have taken three to four years from the completion of the P6, as did previous Intel designs. That schedule would have resulted in Willamette shipments about ... now. But that processor hasn't even taped out, and Intel does not expect shipments until late in 2000.

It appears there were some false starts that delayed the beginning of what is now known as Willamette. The Oregon team has also been distracted by everything from supporting the proliferation of P6-based designs (Klamath, Deschutes, Mendocino, Dixon, and Katmai) to cross-checking the Merced design. Even Intel, with its legions of CPU designers, can't do everything all at once.

If this proliferation of processors for specific market segments has in fact delayed Willamette, Intel made a poor choice. A next-generation core can be deployed across the board, helping all product lines. Perhaps Intel felt that its position must be protected inch by inch, one market segment at a time. With the K7, however, AMD has the opportunity to turn the tables and provide better processors than Intel's.

It remains to be seen whether AMD will seize this opportunity or, as it has in the past, let it slip away. As the putative technology leader, however, Intel should never have gotten into a position where it must rely on its competitor to fall flat. ■