OBLIQUE PERSPECTIVE

Strategic Product Rescheduling

What's the Real Reason for Pentium's Late Release?

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News item: During 1992 Intel's monopoly on 386 microprocessors came under attack by software-compatible devices from AMD, Chips & Technologies, Cyrix, Texas Instruments, and IBM. By year end, AMD was shipping more 386s than Intel.

News item: During 1992 the average selling price of 386-compatible microprocessors took a nosedive, forcing Intel to drop its prices on some 486-family products.

News item: During 1992 a variety of technical problems were rumored to have forced Intel to postpone formal introduction of the P5 (Pentium) microprocessor from 2Q92 until 1Q93. Pentium-based PC shipments were delayed until mid 2Q93.

Lower volumes, lower margins, and an inability to ship new parts. With three strikes against it, Intel was clearly in for some tough times in 1992.

Measured Performance

And yet a funny thing happened on the way to fiscal collapse. During 1992 Intel became the world's largest semiconductor supplier, surpassing both NEC and Toshiba. Sales for the year set a new all-time record, up 22% to $5.84 billion. Income rose by 30% to set another all-time record. Not bad for a recession year.

And the trend lines were positive, too. During Q4—the quarter when the eagerly awaited Pentium sales did *not* materialize—company sales *rose* by 30% vs. Q3. So did income—by 127%. "Q4 was a stunning quarter," Intel management said in a memo to the workforce, "one of those unusual times when just about everything was going right." In appreciation, all employees were given a cash bonus of more than three weeks' pay.

Wall Street was pleased. Intel stock closed the year by setting a series of all-time highs. Between Thanksgiving and Valentine's Day, its value rose from $70 to nearly $120 per share, comparable to an annualized interest rate of more than 700%.

And what about the purported beneficiary of Intel's failure in the 386 market? While AMD sales and profits were up, their stock value fell sharply during the first half of '92, and ended up essentially unchanged for the year—50% off its 1984 high. Displeasure over company performance fueled a proxy battle to unseat Jerry Sanders as chairman, and forced concessions by the board of directors.

Scorched Earth in the 386 Wars

So what's going on here? While AMD has indeed captured most of the market for 386s, their victory may have been Pyrrhic. When a price war breaks out, the lowest-cost vendor has the edge. Virtually all of AMD's sales are for the highest-speed 40-MHz parts, a market in which Intel chooses not to compete. Intel 386s have smaller die, are fabbed using an older, cheaper process, and enjoy a six-year head start on the learning curve.

In any case, by the time AMD's production of 386s surpassed Intel's, the product line had already sunken to play a minor role in the Intel arsenal. Higher-priced, higher-margin 486 devices in their various incarnations were already outshipping 386s by a wide and growing margin. Industry wide, shipments of 386s for PCs have been in free-fall since autumn.

Et tu, Pentium?

Which brings us to Pentium. For some time P5 development seemed to be right on schedule. Finally, just when Intel was about to introduce the part—they didn't. The rumors were that manufacturing problems had arisen, that the parts ran excessively hot, or that they couldn't meet their target speed.

When Pentium designers were asked about the introduction delays at a pre-announcement briefing, they explained that higher performance parts inevitably burn more power, pointing to the classical CMOS power formula: Power = Switched-Capacitance × Effective-Switching-Frequency × Switching-Voltage^2. They also made some fuzzy allusions to difficulties in predicting the power demands of the all-new BiCMOS process. These explanations seem just a tad disingenuous. It's hard to believe that some of the world's best chip designers and process engineers would misjudge device geometries or such basic laws of physics.

My old boss taught me that when an organization's actions seem not to match its words, the words should be suspect. While it may be true that Pentium initially encountered speed, power, or yield problems, it's also true that delaying the part's introduction may have been the best thing that could have happened for Intel.

Whatever direct competition there is in the x86 market exists only among 386-family sockets; demand for sole-sourced 486s keeps rising. Intel is essentially production-limited on "second-generation" x86 CPUs: the workhorse 486DX, the low-cost 486SX, the low-power 386SL and 486SL, and the 486DX2 speed demon.

These are all high-volume, high-yield, high-margin parts. Right now, the only way Intel could meet demand for low-margin 386s or low-yield Pentia would be to reallocate wafer starts from higher-margin 486s. In such a business climate, it's dumb to keep building moribund products or to rush a new product to market.

Selling No Chips Before It's Time

It's like the EPROM wars all over. Intel invented EPROMs, and held a virtual monopoly on the business for years. As the competition struggled to build parts at a given density level, Intel's head start let it finish the design of devices at the next higher level.

Rather than introduce the next-generation parts, though, Intel quietly built up inventory, all the while continuing to ship lower-capacity devices according to an "MGA" (maximum gougeable amount) pricing strategy. It was these obscene margins that made the EPROM market so attractive to the competition.

But once a viable alternate source for the smaller chips finally did come on line, it was just a matter of days before Intel introduced the higher-density devices, began flooding distribution channels with new stock, and bombed the price of the older parts into the dirt. The competition would be left holding the bag—no market, no margin, and no way to recoup the development costs of their now-obsolete designs. Sound familiar, AMD?

So, just for fun, suppose the P5 *had* been finished in the first half of 1992, on schedule, at speed, and fully functional. Would Intel have announced it then? I think not. With the sales and profits of existing products at record highs, more likely the Pentium introduction would have been postponed until it was needed.

Is Pentium Late, or Early?

When the 486 was first introduced, its mission was to kill off the multiple-sourced 286 and promote demand for the 386. No doubt Pentium's initial role will be to squash 386 sales and shore up the 486. But from a business perspective, the Pentium introduction may still be premature. In the months ahead, Pentium will be competing not with 386s or RISC-based PCs, but with high-end 486-based designs. Every Pentium device Intel sells is a 486 sale lost forever; every low-yield Pentium wafer started will be a 486 wafer forgone. And the 486 has plenty of life in it yet, with 486DX3s still to come.

But one can only delay a high-profile introduction for so long before one starts to lose credibility. At some point Intel had to ramp up or shut up. As a result, Intel may now find itself in the bizarre position of having been forced to introduce a device for which they would prefer not to incur major sales.

One way to reduce interest in Pentium might be to keep its introduction low-key. The 486 intro party alone reportedly cost over a million dollars. Pentium was introduced at a press briefing in Santa Clara.

Another way might be to restrict information flow. Presentations at last year's Hot Chips conference and Microprocessor Forum alluded to D-cache interleaving, branch caching, and other capabilities with few if any details. Contributing Editor Nick Tredennick suggested at the time that Intel apparently planned to unveil the 3-million-transistor device one transistor at a time.

Even now, a lot of Pentium information is still being withheld. While the "Virtual 8086" operating mode has been revised to boost performance, and virtual memory can now support larger pages, the details are all hidden in the secret Appendix H *(see **070402.PDF**)*. How the parallel instruction decoder works, and whether the I-cache includes predecoded bits may never be revealed.

And it appears Intel may still be trying to discourage high-volume sales. Pentium-based PC vendors were forbidden from introducing their wares until May. The part is being offered only in 60-MHz (!) and 66-MHz versions, and only in a pinout that implements the full 64-bit bus. There is no 50-MHz part, and the ability to run external logic at some fraction of the CPU speed has been omitted or disabled. Intel has postponed at least until next year the 32-bit-bus, clock-multiplied "P24T" variation that plugs into the OverDrive sockets already present in many 486-based PCs.

This is the antithesis of Intel's traditional strategy, which is to design parts in such a way as to reduce system costs, increasing the perceived value of the CPU itself. Building a 66-MHz motherboard is hard, and running 60-MHz devices at 50 MHz or less would seem to squander their power. By contriving to keep Pentium system costs high, Intel is able to keep demand low.

Anticipated Tactics

Intel likes to characterize high-tech marketing as "civilized warfare," with products used as the weapons. And as in real wars, a new offensive system need not be deployed to achieve its desired effect. Remember the excitement over ACE not long ago, when the MIPS R4000 was seen as a viable CPU for future PCs? Where are they now? Just as the threat of a "Star Wars" Defense Initiative may have helped bring about the demise of the USSR, Pentium's ongoing impending release may have helped sidetrack ACE and led to the absorption of MIPS. Pentium may thus have won its first skirmish without shipping a single chip.

Of course the market will continue to change. Someday Cyrix may start selling parts with a 486 pinout; someday AMD may finish its clean-room 486 microcode. Intel's x86 monopoly will then again come under attack. When that happens, I wonder how many days it will be before Intel begins flooding the market with a raft of cost-effective new Pentium solutions.♦

