Most Significant Bits

Intel, AMD End Legal Feud

PC users cheered, lawyers wept, and sanity ruled when AMD and Intel announced they had settled all pending legal action between the two companies. After eight years of arbitration and courtroom battles over AMD's rights to Intel's 386 and 486 technology, the companies put together a settlement in just a few months. Federal magistrate Patricia Trumbull, who had been overseeing some of the cases, had strongly urged the companies to settle their disagreements out of court.

The settlement came just days after Intel lost yet another round, this time at the hands of the California Supreme Court. The court reinstated an arbitrator's ruling granting AMD the right to make 386 chips. Intel had argued that this award was outside the arbitrator's rights. A court of appeals accepted Intel's view *(see **0708MSB.PDF**)*, but the latest ruling reverses the appellate court's action, upholding AMD's right to the 386.

That ruling ended a bruising legal year for Intel, which had also lost cases dealing with foundry patent licensing, the '338 "Crawford" patent (twice), and Intel's 287 microcode *(see **090101.PDF**)*. The company's sole victory against AMD came in the ICE module of the 486 microcode case, which forced AMD to pull 486 chips with SMM (system-management mode) off the market.

The settlement grants AMD a royalty-free license to manufacture and sell 386 and 486 processors so long as these chips do not use Intel's ICE microcode. AMD has already redesigned its 486 chips with a noninfringing version of SMM and is in the process of testing this design. AMD will pay Intel $58 million in damages for the ICE infringement, and Intel will pay $18 million to AMD as required by the arbitrator, leaving a net payment of $40 million from AMD. This payment is only slightly greater than AMD's legal fees for 1994.

Both sides agreed to drop all pending legal action, including AMD's antitrust suit against Intel, and will not initiate new lawsuits concerning any activity that took place before 1/6/95. AMD does not receive the right to any Pentium or P6 technology. The settlement does not preclude Intel from lawsuits relating to AMD's forthcoming K5 processor, but that chip's independent design should minimize the possibility of such suits.

AMD and its customers receive a license to the system-level claims of the '338 patent. The two companies continue to negotiate licensing terms for other Intel patents. Under the agreement, AMD can use external foundries for up to 20% of its 486 production, although the vendor can get around this limit by using clean-room microcode at the foundries.

The settlement dispels the cloud of uncertainty that has hung above AMD and its x86 products. The company, particularly its senior management, can now devote more time to planning product strategy rather than sitting in courtrooms. The $40 million in damages works out to just $4 per 486 that AMD expects to ship in 1995. The end result, however, is simply maintenance of the status quo: aggressive competition in the x86 market.

After a string of legal defeats, Intel pragmatically realized that its remaining 386 and 486 cases were unlikely to have much success. We believe that the company was unwilling to face the expense and bad press of an antitrust suit, leading it to negotiate a settlement instead. (The company also settled an antitrust suit from Cyrix.) Intel is unlikely to entirely cease its legal strategy but may be more judicious in the future, picking situations where it has a strong likelihood of victory.

Of course, Intel remains the top microprocessor vendor in the world, and losing a few lawsuits will not change this fact. The company must now focus more on competing in the marketplace instead of the courtroom, and its products will make life difficult enough for the competition, even without the threat of eternal litigation.

Intel Relents on Pentium Bug

Just after our article on the Pentium FPU bug *(see **081702.PDF**)* went to press, Intel announced a full replacement policy for its Pentium chips. The company will issue a new processor, free of charge, to any customer who requests one, and will also reimburse the cost of installing the new chip. Previously, Intel had been issuing replacement processors only after questioning users regarding their need for a new device. Pentium system owners interested in a replacement chip should contact Intel at 800.628.8686 or 916.356.3551.

The new policy lays the Pentium bug to rest and came in time to minimize the impact on Christmas

Bug Stories Sought

Intel's Pentium saga has raised the visibility of bugs in microprocessor designs. Have you lost time due to a processor bug that was known to the vendor but not to you? We'd like to hear your story. Please tell us the nature of the bug, why you didn't have the vendor's errata list (if the bug was on such a list), how much time you lost, and how it was ultimately resolved.

All submissions will be assumed to be for publication unless otherwise specified. We reserve the right to edit for brevity and clarity. We will withhold names on request but cannot accept anonymous submissions. Send to the editor at our editorial office.

purchases. Although criticism of Intel's statistics (much of it, in our opinion, unjustified) contributed to the decision, in the end Intel realized that the issue was image, not statistics, and took steps to preserve the good image that it had spent hundreds of millions of dollars to buy. Ironically, Intel's image was perhaps too good: consumers expected that microprocessors—unlike software or automobiles—would work perfectly every time.

The final question is the ultimate cost to Intel. The company set aside $475 million from its fourth quarter earnings to cover the replacement program and the cost of scrapping its inventory of flawed chips. We estimate that this breaks down to roughly 500,000 scrapped chips and 1.5 million returns, or 30% of the Pentiums in the field. The final cost could be greater if more users demand new chips, but the majority of existing Pentium systems are owned by home users, who are less likely to take the time to fix a problem that they probably won't encounter.

The costs, however, go beyond immediate finances. Intel's management spent nearly two months consumed by this problem. Frustrated PC makers are taking shots for a problem not of their own making. Software vendors must update their code to work around the bug.

Intel hopes that most consumers will remember the "no questions asked" replacement policy and not the initial problem. In the technical community, however, memories of Intel's cover-up and initial mishandling of the bug will linger. The company (and others that copy its lifetime guarantee) may get burned again in the future if customers demand fixes for other, less severe bugs.

PA-RISC, i960 Maintain Shipment Lead

According to Andrew Allison, editor of *Inside the New Computer Industry*, revenue from systems based on POWER and PowerPC processors more than doubled in 1994, to $5.4 billion. This figure puts the architecture in third place in the RISC system market, slightly behind SPARC. Both, however, are well in back of PA-RISC, which leads the pack for the third consecutive year, as the table below shows.

	1994		1993		Annual Growth
	Share	Revenue	Share	Revenue	
1) PA-RISC	33%	$9.6 B	34%	$7.5 B	28%
2) SPARC	20%	$5.8 B	23%	$5.0 B	16%
3) PowerPC*	18%	$5.4 B	11%	$2.4 B	125%
4) MIPS	18%	$5.2 B	20%	$4.5 B	16%
5) Alpha	5%	$1.5 B	2%	$0.5 B	200%
6) Other**	6%	$1.8 B	10%	$2.3 B	-22%
	100%	$29.3 B	100%	$22.2 B	32%
*includes POWER **includes 88K, Transputer, etc.					

Allison finds Alpha system revenues at the back of the pack, less than one-third those of most other lines and one-sixth of PA-RISC revenues. This gap underscores Digital's challenge in making Alpha a viable product line. We expect that, in 1995, Alpha revenues will

surge but will not erase this gap. SPARC and MIPS shipments will be relatively flat, but PowerPC should see another big jump, challenging PA-RISC for the top spot.

Allison also released figures on merchant RISC microprocessor shipments. These figures include embedded applications but bar, for example, PA-RISC as an in-house product. They also neglect Hitachi's SH7000 family, which, due to the Sega win, is currently outshipping all of these RISC processors.

	1994		1993		Annual Growth
	Share	Units	Share	Units	
1) i960	42%	5.20 M	56%	4.60 M	13%
2) PowerPC	15%	1.80 M	4%	0.29 M	521%
3) 29K	12%	1.50 M	11%	0.92 M	63%
4) MIPS	12%	1.50 M	11%	0.87 M	72%
5) ARM	10%	1.20 M	8%	0.62 M	94%
6) SPARC	5%	0.56 M	5%	0.43 M	30%
7) Other*	5%	0.62 M	6%	0.48 M	31%
	100%	12.38 M	100%	8.21 M	51%
*includes Transputer, 88K, i860, Hobbit, merchant Alpha and PA-RISC					

Ignoring the SH7000, the i960 maintained its volume lead with 5.2 million units shipped in 1994, but its growth was far slower than that of the overall market. PowerPC raced into the second spot despite impressive growth in 29000, MIPS, and ARM shipments. With traditional markets such as laser printers saturating, consumer goods is emerging as the new frontier for embedded RISC chips. As the SH7000 shows, one big design win can "make" an architecture. The volume lead is likely to continue changing hands as more consumer products adopt RISC processors.

First Mac Licensees Announced

The first two companies to offer Macintosh clone systems will be Power Computing and Radius (both in San Jose, Calif.). Power is a small startup company, with major funding from Olivetti, whose sole purpose is to produce PowerPC-based systems. Radius, which recently merged with SuperMac, is a leading supplier of monitors and other add-ons for Macintosh systems. Neither company has announced specific product plans or pricing. Power expects to have systems for sale around March, while Radius has committed only to 1H95 shipments.

Radius plans to sell complete systems to end users, bundling a Power Mac (probably 604-based) with high-end video and other Radius products. These systems will target Radius's traditional market of high-end graphics production. Power Computing will start with clones of current 601-based Power Macs, moving to a broader range of systems in 2H95. The company, led by PC mail-order pioneer Stephen Kahng, will sell systems to end users by mail order. It will also sell to OEMs; Olivetti, for example, is likely to resell these systems in Europe.

Kahng expects a significant amount of business to come from motherboard sales as well. This plan implies

that a number of low-tech Macintosh vendors will appear, combining motherboards with peripherals and enclosures using little more than a screwdriver. In this way, Power (and Apple) hopes to duplicate the success of the x86-based PC business model and jump-start the market before CHRP (common hardware reference platform) systems emerge in 1996 *(see 0816MSB.PDF)*.

Apple also announced a low-cost entertainment platform known as Pippin. Because Pippin is a subset of the Power Macintosh, games and other software written for the new system will also run on the Mac. Bandai, Japanese maker of the popular Mighty Morphin Power Ranger toys, is the first Pippin licensee.

In recent years, the Macintosh has suffered from a lack of software compared with the more popular PC platform. With Pippin, Apple hopes to make an end run around the PC by entering the high-volume market for home entertainment. If Pippin is successful, the combined volume of Pippin and Macintosh systems could spur developers to build more Mac-compatible entertainment and educational software. With its newly aggressive licensing stance, Apple is finally attacking its software problems head-on.

New Versions of Windows, Mac OS Slip

Microsoft has announced that Windows 95, the long-awaited upgrade to Windows 3.1, will not ship before this August, two months later than previously expected. As with previous delays, the company attributed this slip to compatibility problems with existing software. In the interim, qualified users can acquire the Beta 3 version of Windows 95 for a nominal fee of $30. (For more information, contact Microsoft at 206.936.BETA.)

This delay would have offered an opportunity for Apple to counterstrike with an upgraded Mac OS, but the company's own next-generation effort has slipped as well. On the same day as Microsoft's announcement, Apple revealed that shipments of Copland, expected to be marketed as Mac OS 8.0, are now planned for 1H96 rather than 2H95. The company says that the delay is due to the inclusion of portability features, previously planned for a later release, that are now required for the new common hardware platform (CHRP).

Microsoft's dominance of the PC operating-system market allows it to be somewhat leisurely in bringing its future technology to market; the company's biggest concern at this point is delivering a high-quality product. Windows 95 threatens Apple's technology leadership by offering features, such as preemptive multitasking and multithreading, that Mac OS does not while approaching the Mac's ease of use. Copland also includes these features and offers an improved user interface, but given

the latest delay, it may not be enough to prevent Mac users from considering Windows 95.

New Embedded PowerPC Chips Due

Two new PowerPC processors, both aimed at embedded applications, are expected to be announced in the next six months. Leading off will be a device for set-top boxes and other high-end embedded designs that will be detailed at ISSCC *(see 0901RES.PDF)* next month. Reportedly called the PowerPC 602, the chip was developed jointly by IBM and Motorola for use by 3DO in future game machines *(see 0812MSB.PDF)*. Its die size is just 50 mm^2, which should allow a fairly low cost, and it operates at speeds up to 66 MHz. Other details will be presented at the conference.

Motorola is working alone on a second chip designed for PDAs. This device incorporates a 25-MHz PowerPC core with a number of integrated peripherals, including serial, audio, and PCMCIA ports. Some of the peripherals are leveraged from the Astro chip used in Motorola's Magic Cap–based Envoy PDA *(see 080404.PDF)*. Although offering lower performance than Motorola's existing PowerPC 505, the new chip will outrun the 68349 CPU used in Envoy.

The PowerPC PDA chip may be used in a variety of devices. Apple has committed to porting its Newton OS to PowerPC, and the use of Astro peripherals would ease the porting of Magic Cap to the new device. IBM is also working on its own PDA operating system. Motorola expects to unveil the chip by midyear.

Separately, Matsushita announced that it will use PowerPC chips. The company's immediate plans include a PowerPC upgrade to its 3DO game machine as well as other consumer products, possibly including set-top boxes and PDAs. The Japanese vendor has a line of SPARC computer systems but did not mention any plans to replace these with PowerPC-based products.

Motorola Buys Digital Fab

Digital will sell its South Queensferry (Scotland) fab to Motorola for an undisclosed sum estimated at several hundred million dollars. The company had been quietly seeking a buyer for months, as limited demand for Alpha chips has left Digital with more manufacturing capacity than it needs. This oversupply will be exacerbated when the company's giant new fab in Hudson (Mass.) comes on line later this year.

Motorola will build Alpha processors at the Scottish fab for up to two years while Digital transitions production to the Hudson plant. Motorola will also honor Digital's agreement to build 486 chips for AMD. The deal gives Digital a much-needed infusion of cash while providing Motorola with capacity to expand production of its popular communications chips. ♦