Digital, Cyrix Lawsuits Pressure Intel

Cyrix Seeks Manufacturing Freedom; Digital Motives Unclear

by Rich Belgard and Linley Gwennap

The great powers of the processor world each wields a vast arsenal of patents. Despite mounting evidence that it is difficult, if not impossible, to design a state-of-the-art microprocessor without infringing on some of these patents, these vendors have usually chosen to overlook such minor infringements, since launching a first strike would almost certainly result in mutually assured destruction. In apparent desperation, however, Digital has chosen to violate this implicit peace by filing a lawsuit alleging that Intel's Pentium, Pentium Pro, and Pentium II processors infringe on Digital patents.

Cyrix, seeking to join the ranks of the great powers, announced its own patent-infringement suit against Intel—in a seeming coincidence, on the same day as Digital. Cyrix announced its suit on the day the U.S. Patent Office granted to Cyrix two new patents, which the company believes Intel infringes. The situation is rich with irony: in 1992, Intel filed a patent-infringement suit against Cyrix that festered in court until it was settled in 1994, with Cyrix gaining limited legal protection for its x86 chips.

The key to the outcome of these two suits is the strength of the associated patents. We have examined the ten Digital patents and two Cyrix patents that form the basis of the two lawsuits. While we can find nothing that would guarantee a particular verdict, there are in the Cyrix patents and a few of the Digital patents some specific issues that are certainly arguable. Both cases, however, will probably take years to resolve in court and will be difficult to prove.

Stakes Are Huge, But Huge Victory Unlikely

If either Digital or Cyrix can prove in court that Intel infringes on even one of these patents, Intel could be ordered to stop sales of all infringing products. By the time the suit is completed, however, Pentium is likely to be obsolete, and Intel will have had time to redesign its other parts not to infringe. Intel could also be required to compensate the patent owner with a percentage of its massive profits. Since Intel's profits on its Pentium line total several billion dollars, such a judgment could provide a sizable financial windfall.

The chances of such an occurrence, however, are remote. Digital likes to point to the famous 1991 ruling that forced Kodak to pay $925 million to Polaroid and exit the instant-photography business (and, to rub Intel's nose in it, Digital hired the same lawyer to head its case). Historically, however, patent infringement has been much harder to prove in the microprocessor area; despite extensive efforts, Intel has yet to win such a case in court, typically choosing to settle rather than fight.

Microprocessor designs typically build on fundamental techniques used in previous generations and in earlier mainframe processors, so the advances covered by new patents tend to be rather narrow. These narrow patents can be worked around by choosing a slightly different implementation, assuming the designer is aware of the existing patent. Even if the designer is unaware, simple luck often causes a specific design choice to differ slightly from a patented description, enough to eliminate infringement.

Moreover, the huge number of existing processors makes these patents difficult to enforce. The Patent Office, often understaffed and overburdened, sometimes grants patents that are overly broad. This mistake typically becomes known only when the patent owner attempts to enforce the patent, in which case the defendant is motivated to locate earlier processors or patents, known as "prior art," that cover the same technique. Several key Intel patents are thought to suffer from this problem, which is one reason why Intel has never let them be tested in court.

In the two new cases, Intel is on the defensive and can now take advantage of these issues. The company will first try to show that its designs do not infringe on any of the 12 patents. In situations where this proof is difficult or unclear, Intel will probably attempt to overturn some of the patents by alleging prior art. Of course, Intel's lawyers will also use other legal means to discredit or delay the two lawsuits.

For example, the microprocessor giant will almost certainly file a countersuit alleging Digital has infringed on Intel's patents. Intel has thousands of patents and can certainly find some for which infringement would be arguable. Intel has already filed a suit to force Digital to return confidential data and prototypes of unreleased processors.

In Cyrix's case, a patent-infringement countersuit is probably not an option. As noted, Intel has already sued Cyrix for patent infringement and, after an adverse court ruling, later settled that case, granting Cyrix the right to sell chips of its own design that are fabricated at Intel-licensed foundries (see MPR 2/14/94, p. 8). Cyrix currently uses two licensed foundries, IBM and SGS-Thomson, although the latter has not produced any chips for Cyrix recently.

Cyrix Seeks Protection of Intel Patent License

The number of foundries with Intel patent licenses is small, and as existing license agreements expire, Intel is attempting to renegotiate these pacts to exclude the ability to build x86 chips for companies, such as Cyrix, that do not have their own Intel patent licenses. Whether IBM will be able to retain its right to fabricate x86 chips for Cyrix is uncertain in the long run. Even in the near term, Cyrix would like to expand

its business (and gain negotiating leverage) by working with foundries other than IBM, but popular foundries such as Taiwan's TSMC and Singapore's Chartered Semiconductor do not have Intel licenses.

Thus, the motivation for Cyrix's lawsuit is clear. If the company can prove Intel has violated its patents, Cyrix could demand an Intel patent license in exchange for providing Intel with a license to its own patents. Such a cross-license agreement would put Cyrix on an equal footing with AMD, which has a patent cross-license agreement with Intel as a result of settling another long-running legal dispute (see MPR 1/22/96, p. 5), and allow Cyrix to have its x86 chips manufactured anywhere in the world.

If Cyrix fails to gain an Intel license, it will probably have to defend itself against another Intel patent-infringement suit once it begins using unlicensed foundries. In that case, it would have to prove its designs do not infringe on Intel's patents or seek to overturn the Intel patents. The current suit is intended to avoid this tortuous process.

Digital Launches P.R. Effort

Cyrix filed its lawsuit by presenting the necessary papers at an obscure federal court in Sherman, Texas. Digital, in contrast, launched its lawsuit with what seemed to be its biggest public-relations campaign since the initial Alpha product launch, including a nationwide press conference with CEO Robert Palmer, a letter sent to all major customers, a press kit including videotaped sound bites for the evening news, and full-page ads in several major newspapers.

The simultaneous filing of the two suits was only partly a coincidence. Digital had been preparing its case for months and had planned a slightly later announcement. Cyrix actually filed its case on a Monday (May 12) but didn't send out a press release until Tuesday. By that time, Digital had gotten wind of the Cyrix filing (the two companies share a law firm) and hastily rescheduled its announcement for the same Tuesday. The strategy was most effective: the Digital lawsuit got major play in daily newspapers and television reports, whereas the Cyrix lawsuit, if mentioned at all, was merely a footnote to the larger Digital story.

Digital's motivations for its suit are far murkier than Cyrix's. Palmer repeatedly said, "All we want is for Intel to stop shipping" its flagship products, but that goal is clearly unrealistic. Palmer's financially floundering company would certainly benefit from a large monetary settlement, but such a pot of gold is unlikely and years away at best.

Like Cyrix, Digital could gain an Intel patent license (which it lacks today) in a settlement. Digital could find Intel's patents useful in advancing its Alpha processors and IC process technology. If this were Digital's only goal, however, Intel probably would have been willing to negotiate a cross license. Instead of negotiating, Digital chose to launch a surprise attack.

Perhaps foremost on the mind of Digital's management is Intel's forthcoming Merced processor. Many analysts, including ourselves, expect Merced to match or exceed the performance of Digital's fastest Alpha chips when the radical new processor debuts in 1999. Since Alpha's position in the processor market is based almost entirely on its pre-eminent performance, Merced hangs, like the sword of Damocles, ready to pierce Digital's Alpha strategy.

Thus, the Digital lawsuit may be an attempt to set roadblocks for Merced, whose design is already nearly complete. Forcing Intel to design around Digital's patents could cause Intel to divert additional resources to the project and possibly even delay the schedule slightly. Although none of the patents at suit appears to bear on the type of VLIW design expected of Merced (see MPR 3/10/97, p. 9), Digital may have other, stronger patents in this area that could raise more serious concerns. If not, the patents asserted here are likely to have little effect on Merced's schedule or performance.

A final theory is that Digital's executives are simply frustrated with the lack of progress Alpha has made in the market and are seeking someone to blame (see sidebar, next page). The suit serves as a distraction from a five-year tailspin in corporate revenues, billions of dollars in losses during that period, no year-to-year growth in Alpha system revenues, and no signs that the financial picture has stabilized.

Chilling Digital's PC Business

Perhaps Digital's executives simply feel that they have nothing to lose with this bold attack. But one division likely to suffer is the company's $2-billion PC business, which is based almost exclusively on Intel processors. Digital had hoped the suit would not affect this business, but according to Intel VP Tom Dunlap, "it is unreasonable to think that the relationship can remain the same in light of these unfounded public statements attacking Intel's integrity."

Intel claims its delivery contracts with Digital expire at the end of September; we don't expect Intel to entirely cut off Digital, but subsequent shipments of x86 chips could become somewhat uncertain. Intel has also suspended all contact between its engineers and Digital's and has indicated it will no longer provide advance information and prototypes to Digital. If this freeze continues, Digital's introduction of future x86 PCs and workstations could be delayed by several months, an eternity in this highly competitive market.

Digital recently announced plans to use AMD's K6 processor, becoming the first major PC vendor to do so, and the reason is now apparent. Digital can use AMD processors to fill in gaps in Intel's deliveries. The K6 is no panacea, however, for it doesn't plug into Pentium II systems and isn't suitable for Digital's notebook systems. In addition, most of Digital's PCs are bought by large corporations, which tend to be wary of non-Intel CPUs.

Digital will face other costs from its legal outburst. The company (like Cyrix) will have its executives and engineers tied up giving depositions, responding to subpoenas, and testifying in court. Surely, these efforts would be better spent in improving the company's business and technology.

Viewpoint: Digital's Dreams Die Hard

Many of you have shared the experience of consoling an exasperated small child, frustrated by the world, wailing "It just isn't fair!" Our hearts go out to them because we want them to believe the world is fair, and that good guys do win in the end.

Digital's Robert Palmer and other executives need a big shoulder to cry on. Life isn't fair: the Alpha team has produced extraordinary CPUs, but Alpha hasn't established a strong commercial position, and is unlikely to, in my judgment. The storm and drama over whether AMD's K6 might be 10% faster than Intel's Pentium helps put in perspective the remarkable Digital accomplishment of building microprocessors twice as fast as the competition's.

Digital built its Alpha CPUs in the best of engineering traditions: hardworking, innovative, bright people doing things that common sense said couldn't be done. In the movies, this achievement leads from rags to riches. In the case of Digital and Alpha, this technical superiority can't seem to materially slow the downward slide of a once-great computer company.

I believe Digital is lashing out at Intel with its current patent suit out of frustration that the good guys aren't winning. Emotionally, it must be easier to blame Digital's current situation on an evil empire than on an unfair world. Top executives are people who have dreams and work hard to realize them. When things don't work out, they, like all of us, are tempted to look for someone to blame.

Digital created many of its own problems. It dithered over its operating-system strategy (VMS, OpenVMS, Ultrix, OSF, Unix, or Windows NT?). It had an on-again, off-again commitment to workstations and PCs. The company could have done many things differently, but it didn't, and now it's much too late to go back and improve the decisions.

Many of Digital's past products won just on the strength of their technology. In the early 1970s, Digital's PDP 11/45 minicomputer far exceeded sales expectations because it was so bloody fast, despite meager, at best, software support when it shipped. In the late 1980s, the VAX 11/780's success had little to do with Digital's initial marketing strategy—it was just a very cool, well-engineered system. So why didn't Alpha succeed on the same basis, given its impressive engineering achievements? There are two related reasons: the need for large manufacturing volumes and the ever-increasing importance of software.

Intel has an ideal position because it serves the largest and most profitable microprocessor markets. Both Intel and Digital bear tremendous costs for processor design, IC process development, and fab construction, but Intel can amortize these costs over millions of units, whereas Digital must get by with far smaller volumes. The economics are bad enough if the chips are for high-margin workstations and servers. Competing in the PC space, as Digital intends to do with Alpha, can be deadly.

It's probably Microsoft and not Intel that Digital should be lashing out at. Microsoft's success, more than Intel's, is strangling Alpha. Five years ago, the desktop space had more diversity, with DOS, Mac OS, Windows, and Unix all competing. Now, Windows has won over DOS and Mac OS, and NT over Unix. Microsoft's desktop dominance makes life really hard for a non-x86 processor.

Alpha is now the last non-x86 contender for the Windows NT market. That's either a good sign for Alpha— it has beaten out the other RISC providers—or an indication that MIPS and PowerPC read the tea leaves earlier and cut their losses sooner. Digital believes there is a niche for high-end NT that's big enough to justify ongoing Alpha engineering and manufacturing investment even at PC prices, and that brighter times are just around the corner. I tend to think the writing is on the wall. Let's examine the issues.

The only reason anyone will buy an NT Alpha system is to get a machine faster than a Pentium II system. Given Pentium II's strong integer and MMX performance, Alpha's speed advantage is increasingly limited to floating-point applications. And one big floating-point category—3D—is the province of fast accelerator chips, not the CPU.

The market for NT systems with very fast FP performance is small to begin with and, for Digital, fraught with other difficulties. Despite Digital's clever work with FX!32, running existing x86 software is a riskier proposition on an Alpha/NT system than on a Pentium/NT system. You might just get fired for picking the Alpha system.

It also remains to be seen whether Digital can keep software vendors focused on Alpha. Without a strong complement of native applications, there is little market for Alpha. Apple had a hard time maintaining ISV investment on the Mac despite a much larger market share than Alpha is ever likely to have. Digital can buy ISVs' attention (i.e., pay for ports), but without such financial evangelism, fewer vendors will maintain vibrant Alpha applications.

Finally, corporate IS managers will discourage the acquisition of Alpha systems for the same reasons they discourage the use of Macs—another company to deal with and additional support issues. Apple systems continue to be purchased because key people threaten to quit if they can't use a Mac. I doubt Alpha users will be as vocal.

In the end, I expect Digital, like HP, will smell the roses and leave the silicon to Intel, instead focusing on delivering system benefits to its customers—its strongest suit. But getting there means giving up dreams and realizing how unfair the world can be. They need a shoulder to cry on. *—P.C.*

Peter Christy, the president of MicroDesign Resources, worked at Digital from 1974 to 1984.

Digital's Public Case Holds No Water

In the press conference, Palmer claimed that two events caused Digital to begin investigating Intel's technology. The first was the debut of Pentium Pro in November 1995, when Intel's 200-MHz processor surpassed the integer performance of Digital's 300-MHz 21164, the fastest microprocessor shipping at the time. Palmer claims Intel could not have caught up to Digital's performance without stealing Digital's technology. In fact, Pentium Pro combined a RISC-like internal design, strong compiler technology, and perhaps most important, a next-generation manufacturing process to gain its strong performance, which Digital quickly surpassed with subsequent versions of the 21164.

Second, Palmer said he read an article in *The Wall Street Journal* quoting Intel COO Craig Barrett as saying Intel would have to start doing its own basic CPU research because "now there's nothing left to copy." Anyone familiar with the history of processors knows Barrett was referring to the migration of design techniques from mainframes to microprocessors (see MPR 4/21/97, p. 15, for a detailed description of this phenomenon), not a specific theft of another company's intellectual property. Yet Palmer chose to interpret it that way, at least in public.

On the basis of this quote, Palmer attempted to convince analysts that Intel had willfully stolen Digital's patented ideas and reproduced them in the Pentium and Pentium Pro chips, and that only because of Digital's intellectual property had these products achieved their high performance and associated success in the market. The first claim is totally unfathomable, as Intel has been very careful regarding other companies' intellectual property. Why would Intel knowingly place a multibillion-dollar revenue stream in precisely the jeopardy that the Digital lawsuit represents?

The second claim is even more preposterous. The market success of Pentium and its successors has little to do with their performance but instead is based on the stranglehold Intel's 386 and 486 established in the PC market. The performance of those parts could have been affected only slightly by the Digital patents, even if Intel had infringed on them; the issues covered in the patents might at best improve overall processor performance by only a few percent. More likely, workarounds exist that would have supplied equivalent performance.

Regardless of this posturing, Digital may still have a case. Willful intent, which the lawsuit claims, causes triple damages in a patent lawsuit, but even accidental infringement would be enough for Digital to win its case and have Intel over a barrel.

Similarity Could Come From Common Research

Digital's patents—U.S. Patent numbers 4,755,936, 4,847,804, 5,091,845, 5,125,083, 5,148,536, 5,179,673, 5,197,132, 5,394,529, 5,430,888, and 5,568,624—are concerned with microarchitectural details of Digital's Alpha and VAX implementations and a few other projects that were canceled. None of the patents is fundamental; Intel can probably work around these patents to produce a noninfringing chip in a matter of months, with little or no reduction in overall performance. Since most of the patents are related to microarchitecture rather than software-visible issues, users of the revised processors would not notice any difference in the chips—the impact would amount to a stepping change.

Five of the Digital patents—'536, '845, '804, '936, and '888—are cache and cache-related. Two, '529 and '673, are on branch prediction. The '083 patent deals with a write-back queue, the '624 patent deals with MMX-like technology, and the '132 patent deals with renamed register retirement. These patents are not toys—they are serious patents, some of which are over 50 pages in length. They are also not so-called submarine patents—patents whose claims were written after the fact to cover Intel's technology. Whether Intel's chips actually infringe these patents, however, will hinge on minor design details impossible for an outsider to know. Equally difficult to tell is whether a jury or a judge will find infringement, whether or not it is actually there.

Some of the similarities between Intel's and Digital's processors may come not from technology theft but rather from common research. Both companies supported early research in out-of-order execution and branch prediction done at U.C. Berkeley and more recently at the University of Michigan. Both companies, though not simultaneously, also supported cache-design research done at U.C. Berkeley.

Digital's best patents in the suit are those on branch prediction and cache design. Intel has at least 12 of its own patents on branch prediction and more than that on cache design. So if Digital finds similarity between its patents and Intel's products, Intel will probably find similarity between its patents and Digital's products.

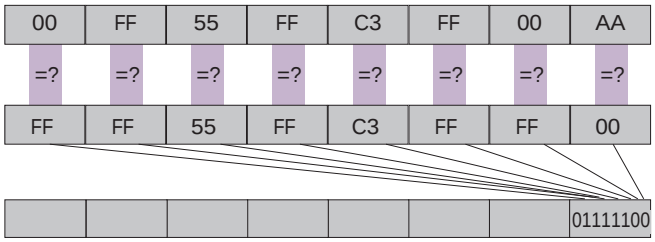
Some Digital Patents Are Far From Mark

Digital's patents are too complex and too long to analyze completely, and at least hundreds of thousands of dollars will go into the analysis by the respective experts. We can look at what appears to be Digital's best opportunity for success and its worst one.

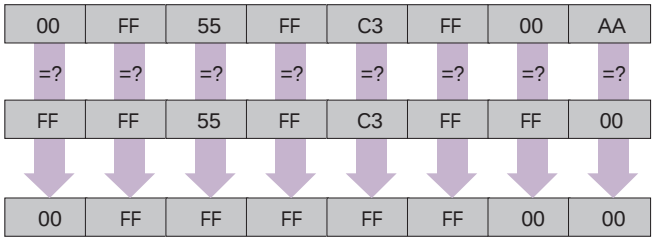
Digital appears least likely to succeed with the '624 patent. This patent appears intended to apply to Intel's MMX technology. Clearly, Intel does not literally infringe this patent—at best, Digital will have to show two levels of "equivalence" of the Intel MMX technology to its claims.

The patent has 19 claims, some of them on hardware, and some of them on a method of operation. Generally, the patent claims comparing two registers, on a byte-by-byte basis, and putting the result in a third register. Intel's MMX instruction set (see MPR 3/5/96, p. 1) contains a similar instruction, PCMPEQB, which Digital will presumably claim infringes its '624 patent.

At the general level, Intel might appear to infringe this patent. But the claims of the patent are much more specific than the general description above. Each claim of the '624



(a) Digital '624 Patent



(b) Intel PCMPEQB

Figure 1. (a) Digital's '624 patent describes a parallel comparison operation. (b) Intel's PCMPEQB instruction has a similar function but encodes the result in bytes, not bits.

patent describes comparing *N* bytes and producing a result with *N* bits, each containing the result of one comparison, as Figure 1(a) shows. Intel's instruction, however, compares *N* bytes with a result of *N* bytes; the results of the comparisons are encoded as bytes, not bits, as Figure 1(b) shows. To demonstrate infringement, Digital must prove these two operations are equivalent.

In addition, the '624 patent consistently uses three-operand instructions (R1 ⊕ R2 → R3), whereas all Intel MMX instructions have only two operands (R1 ⊕ R2 → R1). Again, Digital must show these two forms to be equivalent. The P6's conversion of x86 instructions into three-operand micro-ops (see MPR 2/16/95, p. 9) will help Digital's argument. But relying on two different equivalence arguments in an attempt to show infringement is dangerous. Digital must also be careful not to interpret the claims so broadly as to cover any older patents, including Intel's own multimedia patents, or older implementations, otherwise Digital will invalidate its own patent.

Digital Cache Patent Appears Most Similar

We believe Digital's best opportunity to demonstrate infringement is with 4,847,804. This early patent is clearly not an Alpha patent, as it was originally filed in 1985. The patent covers a cache-memory unit for a multiprocessor system. It appears to cover a specific implementation of a "snoopy cache." Intel's processors, intended for use in multiprocessor systems, also implement a snoopy cache.

The literature is full of such research, and there are dozens of early papers on snoopy caches—much of the research was done at the University of Wisconsin and the University of Illinois. In fact, an identical University of Illinois presentation on cache management was privately given to both Intel and Digital in 1984–85.

The claims of the '804 patent are of the "means plus function" type, which have been interpreted by courts lately to restrict the interpretation of the claims to "the means disclosed and its equivalent." This means Digital will have to show that Intel implements its snoopy cache using the same hardware that Digital shows in its patent or using hardware that is substantially the same.

The '804 patent covers a cache memory that has a status register for keeping the current state of the lines in the cache using four states: invalid, valid, modified, and shared. Like many modern microprocessors, Intel's processors implement the MESI protocol: they contain information on a per-line basis, describing whether the line is modified, exclusive (i.e., valid), shared, or invalid—essentially the same as the Digital patent except for the name of one state.

The '804 patent further requires two different signals to be put on the bus in response to different memory accesses. The first signal is an output from a processor that is about to write to memory. In response, another processor asserts the second signal if the requested data is in its cache.

Pentium supports an inquire cycle in which an INV (invalidate) signal is sent to other processors on the bus. The purpose of an inquire cycle is to check whether the address being presented is in the caches of the other processors. The INV signal tells the other processors that the subsequent data cycle will be a write cycle. If the address put out on the bus during an inquire cycle is in another processor's cache, the other processor asserts the HIT# signal on the bus.

Thus, there appears to be substantial similarity between the Digital patent and the Pentium design. But there are other elements of the claims that are more restrictive and, with so much information on snoopy caches in the public domain, including Intel's own patents, it is impossible to tell if this patent will actually hold up in court.

Cyrix Patents Cover x86 Issues

The Cyrix patents are much closer to the Intel products, as one might expect, since Cyrix's processors are designed to be compatible with Intel's x86 designs. The two Cyrix patents at suit are 5,630,143 and 5,630,149. The '143 patent is directed at microprocessor power management, whereas '149 covers register renaming.

The claims of the '143 patent describe an external signal that disables the clocking of the microprocessor's internal pipeline at the end of an instruction, after which the processor indicates that its clock has been stopped.

Intel appears not to literally infringe this patent. Cyrix is likely to claim that the Intel processors infringe this patent through the equivalence of either the combination of the STPCLK# pin and stop-grant bus cycle or the SMI# pin and the SMIACT# pin. Intel uses the STPCLK# pin to stop portions of the internal pipeline, but there is no single indication that

STPCLK# has been recognized. The indication, instead, is through a stop-grant bus cycle—a combination of address and control pins on the processor.

The SMI# pin is used to externally assert the system-management interrupt, which often (but not always) results in stopping the clock and suspending processing. The corresponding SMIACT# pin indicates that the SMI# has been recognized. Good luck to the jury in sorting this out.

Register Renaming Bears On P6 Design

The Cyrix '149 patent is directed at register renaming, a technique used by most superscalar microprocessors today. (See MPR 8/22/94, p. 9, for an overview of register renaming.) Pentium clearly does not infringe on this patent, as it does not perform any register renaming. Whether or not Intel's P6 infringes is questionable.

The '149 patent is extremely well claimed, but the patent specification falls short in its description of register renaming, which amounts to about 30 lines of text. This specification clearly does not anticipate the out-of-order execution model of Intel's P6; instead, it describes an in-order or marginally out-of-order superscalar core, i.e., Cyrix's M1 processor (see MPR 10/25/93, p. 1).

The patent discloses a renaming circuit that eliminates write-after-write hazards in renaming x86 registers. The x86 architecture is peculiar in that the general-purpose registers can be addressed in different ways. For example, the EAX register can also be referenced as AX, AH, or AL if only certain bytes of the register value are needed.

A superscalar x86 processor should be able to issue

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XOR   AL, AL
MOV   AX, 0xFFFF
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in the same cycle, since the execution of the MOV does not depend on the XOR completing—in fact, the MOV overwrites the result of the XOR. But since the destination registers are both portions of the EAX register, some renaming schemes may rename the AL register and AX register to the same physical register and determine that there is a dependency between the two instructions.

The '149 patent claims a solution to this problem. But more important, Cyrix seems to claim a renaming circuit that can prevent "false dependencies" in renaming registers of the x86 instruction set. Claim 9 describes a method of renaming registers that mitigates stalls due to false dependencies. A false dependency occurs when it appears that a previous pending instruction writes to a register that is also written by the current instruction, but in reality only a nonintersecting portion of the register is written by each instruction.

As another example, in the two instructions

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XOR   AL, AL
MOV   AH, 0xFF
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there is no dependency at all. The AH and AL registers are unrelated except that both are portions of the same register: AX. Therefore, the two instructions should be able to execute simultaneously. Claim 9 appears to cover a method by which the renaming circuitry selectively renames registers to accommodate this situation—a very powerful claim.

In contrast, Pentium Pro's handling of partial-register accesses is notoriously weak (see MPR 7/31/95, p. 1), a shortcoming not repaired in the more recent Pentium II. Instead of trying to issue such instructions simultaneously, the P6 processors wait for the first instruction to fully complete before issuing the second. Cyrix will be hard pressed to find infringement on this claim, but perhaps the more general claim will stick.

Intel Likely to Eventually Settle Suits

This analysis of the patents finds no smoking guns, but the similarities between some of the patents and Intel's designs will be the crux of the two court cases. To escape, Intel must either demonstrate that the similarities are not close enough to constitute infringement or overturn the patents themselves, typically by demonstrating prior art. Intel will also attempt to exhaust the resources and motivation of its smaller competitors by extending these suits and, in Digital's case, launching additional suits.

Neither Cyrix nor Digital needs to prove its case in court; given the potential cost to Intel of an unfavorable judgment, the company is likely to settle both cases before a final verdict is rendered. No matter what technical arguments are made, the verdict of a nontechnical jury can never be certain, and Intel's opponents may be able to gain sympathy from the jury by painting Intel as an evil monopolist.

Depending on the strength of its opponents' cases, Intel may be forced to offer patent cross-license agreements to settle; if either case proves serious enough, a monetary payment may be required as well. In the interim, all parties will probably conduct business as usual, with the exception of some shabby treatment of Digital's PC unit by Intel.

Don't expect a settlement soon: the Intel/AMD lawsuits, for example, took eight years to settle. Dragging out these cases is in Intel's best interest, for several reasons. In addition to trying to exhaust the opposition, Intel can assess the strength of its case and perhaps even see how the jury is receiving the testimony. Of course, these delays also put off any final acquiescence. In particular, Intel may be able to dissuade Cyrix from using unlicensed foundries before its case is resolved.

Another probable outcome is an increased emphasis among all CPU vendors on patent cross-license agreements. While several major microprocessor makers have such arrangements, many others do not. Processor design is simply too complicated and moving too fast not to have such agreements. With hundreds of new microprocessor patents granted each year and thousands of design decisions being made, the chances of overlap are too great. Instead of setting up artificial barriers to progress, microprocessor vendors should compete in the marketplace, not the courtroom. M

For more information on the patents involved in these suits, access the Web at www.MDRonline.com/mpr/patents.