THE EDITORS' VIEW

Pentium vs. the RISCs

Now that Pentium and Windows NT are both imminent, the stage is set for the first real battle between the x86 and RISC architectures. While it is far from assured, there appears to be a significant opportunity for RISC processors to capture part of the high-end PC market.

Some Intel executives would have us believe that this issue is moot because Pentium is, in essence, a RISC in CISC clothing. Their story is that Pentium is really a RISC processor, with just a small amount of logic devoted to handling the complex instructions. Indeed, Intel's marketing materials talk about even the 486 having a "RISC integer unit." While this is a nice idea, it is simply untrue for either the 486 or Pentium.

The fact is that the complexity of the x86 architecture—the variable length instructions, complex instruction formats, multifunction instructions, and so forth—has a pervasive effect on the chip's design. It is accurate to say that the 486 and Pentium processors use many of the same implementation techniques as RISC processors, but there is nothing in either processor that can be called a "RISC integer unit" without distorting the term beyond any usefulness.

Let's put aside the theoretical arguments and look at a specific example. Pentium has roughly the same performance as the R4000, a mid-range RISC processor. But Pentium is going into production more than a year after the R4000, and it has about 2.5 times as many transistors, even though the cache sizes are the same. While Intel has not released Pentium pricing, it is a safe bet that it will cost substantially more than an R4000. And while neither vendor will provide specifics on development costs, Intel surely invested much greater sums in Pentium than MIPS did in the R4000.

The x86 architecture's complexity, and its resulting implementation cost, is the driving force behind the belief that RISC processors will find a place in mainstream desktop computers. As long as RISCs remained tied to UNIX, however, they had a handicap of their own that easily countered any advantages they might have had in the business computing market. Windows NT changes everything by making mainstream PC software available on RISC systems.

Various projections put the size of the Windows NT market between 2 and 8 million units in mid-decade. By this time, the overall PC market should be over 40 million units, so NT will still be a minority player. From a RISC vendor's perspective, however, even a 2-million-unit market is huge. The question is, how much of the NT market can be captured by RISC systems?

To have any reason at all for their existence, RISC-based Windows NT systems must provide higher performance than a Pentium system at a comparable price, or comparable performance at a lower price. The first of these goals will be met by several MIPS and Alpha systems this summer. By early '94, we expect to see RISC-based PCs with Pentium-class performance selling at 486 system prices, meeting the second goal.

Assuming that these system advantages materialize, the question becomes one of software. Windows NT will initially support MIPS and Alpha in addition to the x86. Hewlett-Packard is rumored to be very interested in a Windows NT port for PA-RISC. Motorola is likely to pursue a Windows NT port for its PowerPC, since Motorola would like to have some customers besides Apple, IBM, and a few other workstation makers; Windows NT is the only apparent software path to enable such customers.

By sometime in 1994, we therefore expect Windows NT to be running on four of the five major RISC architectures—all except SPARC. The big question then becomes applications. One of the promises of Windows NT is that recompilation for another architecture will be more painless than ever before. Unlike UNIX implementations, the operating system calls will be identical for all NT versions, eliminating a major source of porting problems. The hope of the RISC vendors is that the ease of recompilation will encourage software developers to support a range of architectures. They expect that software developers will provide a single package with multiple binaries supporting two, three, or more Windows NT platforms. CD-ROM distribution will eliminate any cost premium for doing so.

How many software developers will actually do this remains to be seen, but it is not necessary for all applications to be recompiled; all versions of Windows NT will include emulation software to allow x86 binaries to be executed. DEC is claiming that its Alpha PCs will offer emulation performance comparable to a 33-MHz 486. If it is even half this good, then it will be practical to run most applications under emulation. A user would buy a RISC machine to get maximum performance on the few applications that are truly performance critical, such as 3-D modeling or image manipulation. All other applications, such as word processing and communications, could then be executed in emulation. This is the scenario that could lead to RISC systems capturing the high end of the PC marketplace. ♦