Commodity Microprocessor Is a Myth

Intel Competitors Indulge in Wishful Thinking, Spin Control

With the sudden emergence of a number of strong competitors in the x86 processor market has come the emergence of the term "commodity microprocessor." The term, typically used by one of Intel's competitors, implies that all microprocessors are really the same, so why should a PC buyer pay Intel's premium prices when others offer the same thing less? While this argument is seductive, it simply doesn't survive critical scrutiny. Microprocessors are not a commodity.

Oil is a commodity. DRAM is a commodity. (Note that true commodities tend to lose their plural form.) Microprocessors, on the other hand, are the most complex devices ever fabricated by humans, as our founder is fond of pointing out. It is ludicrous to believe that two devices, each containing millions of individual components connected in completely different ways, can be functionally identical on a cycle-by-cycle basis for millions of cycles per second.

Compatibility is the first hurdle an x86 processor must clear. All important PC applications must run properly on a true x86 chip, where "important" means any application a customer wants to run. All x86 vendors claim to be fully software compatible with Intel, but there have been persistent reports of a few applications that don't run properly on Cyrix's 6x86, for example. PC buyers may want to take into account the reputation of the microprocessor supplier before assuming the CPU is fully compatible.

Some might ask why Intel's chips don't have to pass the same compatibility hurdle. To a certain extent, they do: the recent Pentium II floating-point bug, for example, highlighted an incompatibility between Pentium II and earlier Intel chips. But nearly all x86 software is developed and tested on Intel processors, so most incompatibilities are resolved before the application is ever shipped. This is yet another advantage of Intel's dominant position.

Once a microprocessor manufacturer manages to match Intel's chips feature for feature, bug for bug, the next issue is performance. The designs of Pentium, the 6x86, IDT's C6, AMD's K6, and Pentium II are all quite different, and each excels to differing degrees on different programs. The non-Intel processors are generally comparable to Intel's on mainstream integer PC applications, as measured by Winstone 97, but they trail the Intel chips in floating-point and MMX performance (see MPR 6/2/97, p. 32). If these various performance metrics were graphed on a radar chart such that Pentium/MMX's defined a perfect circle, the performance of the non-Intel chips would form smaller shapes that touch or cross over the Pentium circle in just one place.

A more complete picture of performance requires analyzing the same set of processors in several system configurations. In a low-end system configuration, such as the one chosen by IDT for benchmarking its C6 processor, the performance of the CPU can be masked by slower peripherals, making it relatively simple to show that two different processors have similar performance. By benchmarking in high-end configurations, other x86 vendors have demonstrated a better likelihood that their chips will continue to perform well even as system configurations improve in the future.

Another factor a PC buyer should consider is a CPU vendor's support for its chips. In 1994, after much anguish and denial, Intel offered to replace millions of Pentium chips when a bug was discovered in those processors (see MPR 1/23/95, p. 4). When the recent Pentium II bug was discovered, Intel quickly said it would stand behind its product, although it turned out that no replacements were necessary. Cyrix offered some customers replacements for faulty 6x86 chips last summer (see MPR 9/16/96, p. 4). AMD has been fortunate enough to avoid such problems, and IDT, of course, has no track record yet.

None of these issues should necessarily dissuade a potential buyer of a non-Intel processor. The chances of being affected by a compatibility problem are very small, and the performance of the processor may well be adequate for the applications and system configuration a buyer intends to use. For a significant price discount, some PC buyers are willing to take their chances. These buyers define a market segment, which we estimate is roughly 20–30% of the overall PC market, that forms the core opportunity for Intel's competitors.

On the other hand, most PC buyers are willing to pay a bit more to get an Intel processor. This is not an irrational desire spurred by "Intel Inside" advertisements. Intel processors are simply the least likely to have compatibility problems or unexpected performance shortfalls, factors that deserve a premium price. The thoughtful PC buyer should keep these issues in mind and not fall into the trap of believing that x86 microprocessors have become an undifferentiated commodity. The combined judgment of these PC buyers ultimately determines the price premium associated with the Intel brand. Ⓜ

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