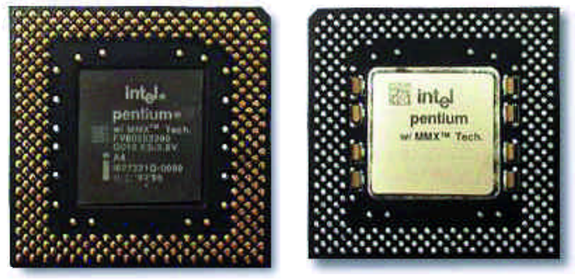
Still waters…

… run deep: Intel has been quietly working away on processor developments, some with curiously watery codenames. Roger Gann anticipates a deluge of new products to come.

A river runs through it — Intel's future processor strategy, that is. For some time now, Intel has codenamed its future processor development projects after local rivers. The watery names have replaced the traditional Pnn scheme that Intel used for a decade.

Last year wasn't particularly busy for Intel. Even though it sold Pentiums by the shipload and hoovered up the cash, its new product release schedule was quite relaxed. After the introduction of the 150 and 166MHz Pentiums in January '96, the only new products were the 200MHz Pentium (July) and the 150MHz Mobile Pentium.

This year promises to be hectic. The launch of the Pentium with MMX Technology will be swiftly followed by OverDrive versions and a special version for notebooks, and we'll see the launch of an MMX-enabled version of the Pentium Pro. So this month I'll take a break from the toil of upgrading and instead gaze into my crystal ball at Intel's road map of future processor products.



The new MMX Pentiums are pin-compatible with their predecessors, but to gain maximum benefit you will need MMX-enabled software

Klamath

The Pentium now has the benefit of MMX technology, but what about the Pentium Pro? You won't have long to wait: Klamath is a cost-reduced version of the Pentium Pro intended to bring Pro performance to mainstream PCs this year. Although still based on the P6 core used in the Pentium Pro, Klamath will add the MMX multimedia extensions already seen in the new Pentiums. Klamath will initially run at 233MHz and later at 266MHz. These new, faster clock speeds are made possible by Intel's new 0.28-micron CMOS process. This will be slightly faster than the 0.35-micron BiCMOS version of the Pentium Pro, allowing Klamath to outperform it but at a lower cost. The new processor will come with a large, 512Kb, L2 cache.

Klamath's most visible difference will be its packaging: it won't resemble existing Pentium and Pentium Pro chips. The new processor will be housed in a new package, the Single Edge Connector (SEC) cartridge, a plug-in design that will require a complete motherboard redesign and which will function in much the same way as a CPU daughtercard. The SEC cartridge will probably ship in a metal case that provides for thermal transfer as well as electro-magnetic shielding.

Although the Pentium Pro was the most powerful processor Intel makes, it added little to its profits: Intel shipped fewer than three million Pentium Pros during 1996, compared with more than 60 million Pentiums. For Klamath to sell in the vast quantities that Intel would like, it must be cheaper to fabricate than the existing Pentium Pro.

The Pro broke new ground by coupling the microprocessor chip with a secondary or Level 2-cache chip in a single package. This solution, although providing good performance, was expensive and consumed too much of Intel's manufacturing capacity. The SEC design allows Intel to employ cheap, off-the-shelf, conventional SRAM chips (normally used for external caches) for its "internal" L2 cache; a move that offers considerable cost savings. The downside of the SEC is that its new packaging means there'll be no Pentium Pro MMX OverDrive upgrade. If you want Klamath, you'll need a new motherboard, too.

Initially, the SEC daughtercard will be designed to direct I/O traffic. Later on, Intel is expected to incorporate microcontrollers, DSP technologies and even some analogue devices into the card, making the prospect of full-screen, full-motion MPEG-2 or DVD-playback a distinct possibility.

It's now looking like Klamath will ship towards the end of Q2 this year, later than originally expected. So, it's more than likely that AMD will beat Intel to the draw by launching its rival K6 processor early in April. A minor fly in the ointment in the impending launch of Klamath is that its new motherboards will use the old 440FX PCI chipset which lacks support for advanced features such as SDRAM, Intel's Advanced Graphics Port (AGP) and 33Mb/sec EIDE transfer rates. An enhanced chipset, likely to be called the 440LX, won't be available until the second half of this year.

Two types of user will derive the most benefit from Klamath. First in line are the users of 32-bit operating systems such as Windows NT 4.0. These business users will see a big performance boost from the chip. Secondly, home users will just love Klamath as it will be great for 3D gaming. The Pentium Pro's floating-point unit is much faster than the Pentium's and thus most 3D programs will be dramatically faster.

Klamath will be a desktop-only processor: there will be no notebook version of the MMX-enhanced P6 processor, simply because it runs too hot. It's likely that Intel will skip a beat and jump to a notebook version of its next-generation processor, code-named Deschutes. So, although Pentium MMX notebook processors will be introduced and enhanced this year, there will be no Intel Pentium Pro-class notebook processor until 1998.

Deschutes

The Klamath architecture will support up to two processors and will be aimed at the workstation and entry-level server markets. The existing Pentium Pro supports Symmetric Multi-Processing (SMP) to the tune of four processors, maximum. This limitation will be overcome by Deschutes, a version of Klamath specifically designed for network servers. Intel is rumoured to be developing an eight-processor motherboard using the Deschutes architecture. And, some reports claim that the new architecture will feature a new bus interface that will allow manufacturers to build systems with up to 32 processors.

The processor itself will be a refinement on Klamath and will probably be a shrink of the Klamath design using the forthcoming 0.25-micron process. The die size of Deschutes will shrink markedly as a result: from 690 mils (0.69ins) for Klamath, which will use 0.35-micron technology, to 400 mils (0.4ins) for Deschutes; enough to allow high-volume, low-cost production.

Similar to the Klamath design, Deschutes will offer a CPU based on the Pentium Pro core but with separate components, such as a larger Level 2 cache and a modular CPU-to-cache bus on an SEC daughterboard. CPU speeds will range from 266MHz, 300MHz and 333MHz for Deschutes.

Some sources have predicted that Intel may also be moving to develop a 75MHz bus to run the Deschutes. Although that would require a new motherboard and related components, they noted that the faster bus might also be necessary. In common with Klamath, Deschutes will be configurable, capable of handling multiple cache memory types such as static RAM or multibank DRAM, the Advanced Graphics Port controller or a communications director for managing high-speed communications. Deschutes might appear towards the end of the year but 1998 is a far more likely timeframe.

In order to realise the full impact of Deschutes, you'll need a network operating system that can handle lots of processors. The current release of Windows NT Server will scale to eight processors but will need to support even more than this in future to take full advantage of Deschutes.

Katmai

Okay, so Katmai isn't a river, it's a volcano. But allow me a little artistic licence here!

Katmai will most likely surface late in 1998 or early '99, about six months after Deschutes. It will essentially be a Klamath MkII, with revamped and enhanced MMX technology, dubbed MMX 2 in the US. This version of MMX technology will significantly improve 3D graphics performance, making it an absolute must-have for serious gamesters. It concentrates on boosting 3D graphics performance — something not specifically addressed by the first version of MMX.

To recap, MMX cleverly re-uses the CPU's floating-point registers for its own highly optimised multimedia tasks. Obviously, programs can't use both FP and MMX instructions within the same routines as both share the same register set. This is rarely a problem, since most programs don't use FP at all. Those that do, typically use these calculations to generate data, while MMX is typically used in separate routines that display data.

For 3D graphics, Intel recommends that geometry calculations remain in floating point while MMX is used to accelerate 3D rendering routines. Each time the processor swaps the FP registers between FP and MMX, a time-consuming "context-switch" is required. Hence Intel's admission that 3D rendering doesn't benefit dramatically from MMX, although applications that take advantage of Microsoft's Direct3D programming interface will see some improvements. MMX2 will have additional instructions and a larger cache compared with the first release of MMX.

Merced

Also referred to as P7, Merced will be the first CPU to be released which supports IA-64, the new 64-bit architecture jointly developed by Intel and Hewlett-Packard under the codename Tahoe. Merced, which appears to have slipped into 1999, is likely to serve primarily the workstation and server markets, while Willamette, a cut-down version of Merced, will drive high-end personal computers.

It is early days, however, and very few hard facts are known about this processor. Intel has been tight-lipped about this particular project. It seems that the processor will comprehensively address many of the limitations of its 32-bit forebears. The chip is a joint Intel/HP venture and will not only support x86 binaries but also HP's PA-RISC binaries for its UNIX workstations.

Presumably, x86 support will be provided by way of emulation, in much the same way that PowerPC Macs can run 68K code. The key in both cases is sheer speed; the PowerPC was so fast anyway that the speed penalty imposed by emulation was unnoticeable. The same will probably be true of Merced.

Tillamook

Conspicuous by its absence from the MMX launch was the 200MHz version of the Pentium MMX for notebooks. Don't worry, though: Intel is planning something special for later in the year.

Codenamed Tillamook, this CPU will be among the first to be built on an Intel-developed pop-out module for notebooks, called MMO. It will include a processor, Level 2 cache, a voltage regulator, a clock and a PCI chipset called the 430TX. Instead of plugging a new processor onto the motherboard, users will plug the MMO processor module into the MMO socket.

So, for the first time, notebook users will have a CPU upgrade path. Fabricated using the new 0.25 micron process, the new CPU will not only be smaller than the Pentium MMX on which it is based but it will draw significantly less juice; down from 2.45v to 1.8v. A 233MHz version will follow.

And just for the record, Tillamook is a town, not a river. So there.

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