HP Grabs Performance Lead

Hewlett-Packard has managed to squeeze enough PA-8000 chips out of its fab to put a single expensive system onto its price list with immediate availability. Fulfilling a prediction HP made when the PA-8000 was first revealed *(see* **081501.PDF** *)*, the new HP 9000 K-class system is faster than any other currently shipping product. The HP system is rated at 10.8 SPECint95 and 18.3 SPECfp95 (base), far surpassing Digital's 333-MHz 21164 system *(see* **1002MSB.PDF** *)*, which achieves scores of 8.3 and 12.4. Systems using the forthcoming 400-MHz 21164 should exceed the PA-8000's integer score, but HP's impressive floating-point score appears untouchable for the next few quarters.

The new system runs the PA-8000 at 180 MHz, confirming our speculation about the previously unannounced clock speed of the part. HP would not disclose the price of the new system, but the previous high-end K-class system was priced at about $80,000, so it is unlikely that the new product sells for much less. At this price, volume demand will be low while HP ramps PA-8000 production. Higher-volume workstations will be announced when production increases, probably in a few months.

The PA-8000 is the most advanced microprocessor to reach production, with a 56-entry reorder buffer, eight function units, branch prediction, and register renaming. At 180 MHz, it has a peak floating-point execution rate of 720 MFLOPS. It is also HP's first 64-bit processor. As the new device moves downward into volume workstations, it will erase the performance gap created by the disappointment of the PA-7200, strengthening HP's position.

In particular, the move diminishes Digital. Since its introduction, Alpha's main reason for existence has been its preeminent performance, but Alpha has now lost that performance lead twice in the past few months. Even if Digital quickly regains the integer lead, as appears likely, other vendors are getting closer to Alpha's performance than ever before, causing that architecture to lose some luster in buyers' eyes, particularly those that don't use Windows NT.

Digital Developing Low-Cost 21164

Aiming to move its processors into the high end of the PC market, Digital is developing a low-cost version of its 21164 processor dubbed the 21164PC. The company would not disclose specific details about the new device, which is due to appear in systems by 1H97, but indicated it would be based on the current 21164 core and have similar performance. The company has already announced versions of the 21164 at speeds of up to 400 MHz with SPEC95 (base) ratings of 11.2 integer and 15.2 floating-point.

One barrier keeping Alpha chips out of the PC market, even at the high end, has been price: a 21164, for example, currently lists for well over $1,000. In addition, the chip requires 4M of external cache and an expensive system-logic chip set to achieve its rated performance. Digital claims that the total cost of the 21164PC, external cache, and chip set will be roughly $500, allowing it to be used in systems selling for as little as $2,500. The company plans to reveal later this year how it will achieve this price point without severely diluting performance.

If the 21164PC achieves its goals, it should offer slightly better integer performance than a competitive Klamath (P6) processor at a similar system price. Floating-point performance should be significantly better. Digital also plans to add multimedia extensions to the 21164PC to compete with Klamath's MMX. With FX!32 *(see* **100302.PDF** *)*, a 21164PC system will be able to run the same 32-bit Windows applications as an Intel-based system, although in this mode the Alpha chip loses most, if not all, of its performance advantage. Thus, Digital will still need native Alpha applications for this PC strategy to succeed.

Cyrix PCs Debut

As previewed last issue, Cyrix officially entered the PC systems business by announcing several systems based on its Pentium-class 6x86 processor. The systems can be ordered directly from Cyrix via telephone, fax, or the Web. Although the systems are built by EDS, Cyrix will provide all sales and technical support. On-site support is available through DecisionOne, an independent service provider.

Cyrix provided list prices for complete multimedia configurations including 256K of synchronous cache, 16M of EDO DRAM, a 28.8-kbps fax/modem, 6× CD-ROM, and speakers. The Cyrix 6x86-P133 system (the "+" in the processor name is dropped from the system name), with a 1.6G hard drive, midrange graphics accelerator, and 15" monitor, lists for $2,399. The top-of-the-line P166 system runs $3,349, including a 2.1G disk, Matrox Millennium graphics, and 17" monitor. Cyrix will build systems to order, however, selling a variety of configurations.

Recent test results by MDR Labs confirm that the 6x86 P150+ and P166+ retain their performance advantage over comparable Pentium chips even with 256K of cache, but the 6x86-P120+ is slightly slower than a Pentium-120 when both use 256K caches. For a complete performance report, access the Web at *www.chipanalyst.com*.

These system prices compare well with those of comparably configured Pentium systems, but there is still plenty of room for Cyrix's chip customers to offer systems at lower prices. This arrangement keeps Cyrix from stepping on its OEM's toes while allowing an aggressive branding campaign based on the new systems. The company plans to spend $20 million on advertising this year and has already begun running ads that directly target Dell and Gateway, including one featuring a squashed cow (Gateway's mascot). These two

PC vendors are widely regarded as surrogates for Intel, Cyrix's real target in this campaign.

Cyrix hopes to convince its customers (both OEMs and end users) that it offers premium products at top performance points, eliminating the need to discount its processors relative to Intel's. The PC business is merely a vehicle for this branding campaign. While advertising may improve Cyrix's image in the short term, the company must continue to deliver leading-edge processors to maintain its hoped-for new image.

AMD Advances Elan with SC310

AMD's new version of its Elan microprocessor lowers the cost of its entry-level PC-on-a-chip product to $25. The new Elan 310 is a subset of the existing Elan *(see* **071404.PDF** *)*, now formally known as the Elan 300. Like the 300, the 310 includes a complete set of PC/AT peripheral hardware, including a memory controller, ISA interface, real-time clock, DMA, and timers. The Elan 310 does not include its predecessor's PCMCIA or LCD controllers, shrinking the price by 20%.

AMD has priced the 33-MHz Elan 310 at $28 in 25,000-unit quantities; the 25-MHz version costs $25. Both chips compete with Intel's integrated 386EX device *(see* **071405.PDF** *)* for lucrative DOS-compatible embedded designs. The Intel device and both of AMD's chips share nearly identical static 386 cores, although AMD's core reaches higher frequencies at lower voltages. All three chips have a basic assortment of PC-compatible I/O, but the Elan processors come with a DRAM controller and an ISA interface.

In place of Elan's memory controller, the 386EX has a 386SX-style bus interface. The chip is supported by a pair of ASICs from Radisys; one adds DRAM-control functions while the other provides PCMCIA and LCD controllers similar to those on the Elan 300. The 386EX's processor bus allows it to work with a 387 FPU, an option the Elan chips' memory buses do not support.

AMD is touting Elan's faster clock rates and higher integration to customers who want DOS compatibility but don't want to spend the money or the PCB real estate on support chips. On the other hand, the 386EX chip's conventional address and data buses allow the Intel device to be used with many existing logic designs, and the 386EX's $15–$20 price tag significantly undercuts AMD's.

AGP to Provide New Graphics Connection

At WinHEC, Intel said it is developing a new interface that connects graphics accelerators directly to its system-logic chip sets rather than relying on PCI. Although one of the key objectives of the Intel-led PCI design was to provide enough bandwidth for graphics, Intel is now convinced that advanced video applications, particularly 3D graphics, need more bandwidth than PCI can deliver.

The new connection, dubbed the Accelerated Graphics Port (AGP), is 32 bits wide and operates at up to 66 MHz, with double-clocking (transferring data on both clock edges) an option for the future. Although AGP is based on the PCI protocol, its read bandwidth is four times that of a standard PCI bus, and write bandwidth is twice that of PCI. Much of this increase is due simply to running the clock at twice the 33-MHz speed of the standard PCI bus; this feat is eased by the point-to-point nature of AGP, which supports only a single interface card. Read performance is further improved by pipelining transactions, the most significant protocol improvement over PCI.

Because system-logic chip sets will connect directly to AGP and to DRAM, data can pass rapidly between the graphics accelerator and main memory. This feature allows the graphics chip to store textures in main memory, reducing the need for adding expensive graphics RAM to the frame buffer. Some 3D chips may choose to keep the Z buffer and/or alpha buffer in main memory as well, further reducing cost.

In Intel's view of the world, the host CPU handles geometry calculations while the graphics controller does the setup and rendering *(see* **100103.PDF** *)*. AGP moves the graphics chip closer to the CPU to enable faster communication between the two. Intel expects that its newest processors will efficiently handle these geometry calculations. This model, of course, increases demand for host CPU performance, Intel's ultimate goal.

Although Intel positions AGP as an open initiative similar to PCI and USB, a key difference is that Intel is maintaining control of the AGP specification. Intel is working with ATI, Cirrus, S3, and Microsoft on the AGP definition, but at the end of the day, all decisions are made by Intel. The company says it has taken this route, rather than the traditional open committee approach, to get AGP to market quickly; it plans to publish the 1.0 version of the AGP specification by June. But the specification is open in the sense that, once version 1.0 is complete, any chip-set or graphics vendor may obtain a royalty-free license to AGP by signing a patent-reciprocity agreement (a process used for PCI and USB as well).

Intel intends to implement AGP in its system-logic chip sets by mid-1997. The company expects two or three of its lead partners to have AGP-ready accelerators by that time. Because of the similarity between AGP and PCI, most vendors will probably offer a combined AGP/PCI interface on their graphics chips by 1998. At that time, system designers will choose where to connect these new graphics chips, thus deciding the ultimate fate of AGP.

3DO Licenses Technology to Cirrus

Seeking to expand its business model, 3DO has licensed the 3D graphics technology from its M2 video-game player to Cirrus Logic for inclusion in a 3D accelerator for PCs. Sales of 3DO's original game machine have been slow, and only one vendor has signed up to build M2 systems. The royalties from the Cirrus deal will hopefully give 3DO a long-term revenue stream.

For Cirrus, the partnership will accelerate its efforts to develop a 3D graphics chip, an area where Cirrus has lagged other vendors *(see* **100304.PDF** *)* in rolling out products. According to 3DO, the 64-bit 3D engine in the M2 is capable of processing 500,000 polygons per second (peak). Although several other 3D chips can match this speed for rendering, most require the host CPU to perform polygon setup, greatly reducing the overall graphics throughput. Cirrus claims its M2-based chip will outperform all competitors, although we believe the 3Dfx Voodoo chip set, which also does setup in hardware, will give it a run for its money.

Cirrus did not announce specific products based on the new technology but hopes to deliver them well before the end of this year. The M2 core has already been validated at 3DO but must be adapted to Cirrus's manufacturing processes and combined with standard PC features (PCI interface, 2D graphics, and video) to form a complete single-chip PC accelerator. This new product should revitalize Cirrus's sagging desktop graphics line and position it for the 3D market.

Intel Delivers Docking Chips

The 380 Dock Set is the first shipping chip set to enable hot docking for PCI-based notebooks, allowing these systems to be inserted or removed from the dock while powered on or in sleep mode. The chip set takes advantage of the docking capabilities of Windows 95.

The Dock Set consists of two chips, the 82380PB and 82380AB. The 208-pin PB is a PCI-to-PCI bridge that supports 5-V or 3.3-V PCI and up to four expansion slots in the docking station. It supports power management for mobile docks. The PB connects to a serial EEPROM that stores dock identification and configuration information, speeding dynamic configuration when the notebook is inserted into the dock. The 160-pin AB is a PCI-to-ISA bridge, supporting up to three 5-V ISA slots in the dock. The Dock Set is designed to work with Intel's Mobile Triton chip set *(see* **091301.PDF** *)*.

Cirrus previously announced its Nile PCI-to-PCI chip for hot docking *(see* **0911MSB.PDF** *)*, but delays have prevented that device from shipping, whereas the Intel Dock Set is available immediately. The Intel chip set is priced at $31 in quantities of 1,000.

With this chip set, notebook vendors can target mobile professionals who would like a single system they can use in the office or on the road but are frustrated by current docking options. Hot docking improves ease of use with plug-and-play simplicity, and the PCI bridge provides a high-bandwidth path between the notebook and local graphics and network cards. Intel expects its Dock Set to enable docks selling for $200 to $600. We project docking chips from Intel and others will increase sales of PCI-based notebooks and particularly docking stations over the next year. M