The Fourth Wave of PCs

By 1995, PCs Will Have Shed Their 1981-Era Baggage

Personal computers are entering an exciting new phase—their fourth wave. This wave of systems, which is just starting to emerge, will arrive in full force in 1995. It is the battle among these systems that will determine which architectures get a place on the desktop.

The first wave was populated by machines such as the Apple II, CP/M systems from companies like Northstar, and the Commodore PET. While these systems were wonderful at the time, they were too limited to become widespread.

The second wave began with the IBM PC, and was joined by the hordes of DOS-based systems from literally hundreds of vendors. This wave made "PC" a household word and spawned the Intel/Microsoft dynasty.

The third wave marked the emergence of systems with graphical user interfaces: Apple's Macintosh and PCs running Windows. We are now at the tail end of this wave, which is characterized by systems that have been stretched far beyond their natural lives. Apple's Macintosh has held up remarkably well, but it is now clearly aging and in need of both hardware and software revision. Windows PCs, while obviously enormously popular, carry forward a bus structure, system-logic design, display standard, and underlying DOS operating system that originated with second-wave systems and have been stretched again and again for third-wave machines.

The first signs of the fourth wave are now upon us. These systems are designed to exploit the current state of processor and I/O technology, so they can properly handle a full-featured graphical user interface and run more sophisticated applications. Fourth-wave systems hope to deliver human-centric computing, using natural input/output methods such as speech and video.

Competitors in this fourth wave of personal computers include Apple's PowerPC Macs; Windows NT systems using Pentium, MIPS, Alpha, PowerPC, or SPARC processors; and Pentium-based systems running Windows 4.0 (Chicago). Because the PC and Mac both have large installed bases, fourth-wave systems must retain compatibility with third-wave systems while dropping as much of the baggage from older systems as possible.

At the heart of all fourth-wave systems will be microprocessors delivering performance starting at 50 SPECint and going much higher. In the x86 world, various versions of Pentium will predominate, with Cyrix's M1 and AMD's K5 hoping to gain a position. In the RISC arena, the key contenders will be the MIPS R4000 family, Digital's 21066, and the PowerPC 603 and 604.

To keep up with these processors, high-performance system designs are essential. Apple has the luxury of controlling both its hardware and its software evolution, which will enable it to move relatively quickly to a RISC processor and to optimize its hardware designs. Other makers of RISC systems, while generally dependent on outside system-software vendors, have the advantage of starting from scratch with their platform definitions.

The antiquated PC architecture could put x86-based PCs at an enormous disadvantage if they continue with a decade-old system design. The ISA bus, VGA graphics, lack of auto-configuration, clumsy interrupt and DMA controllers, and poor support for high-bandwidth peripherals cripple the PC/AT architecture.

Fortunately—or unfortunately, for makers of RISC-based systems—Intel and Microsoft recognized this problem a few years ago, and both companies have made enormous investments to move PCs into the fourth wave. Intel's PCI bus is the most significant hardware technology, and it will lead to the eventual demise of the PC/AT (ISA) bus. Microsoft's Windows 4.0 (Chicago) is the key software advance, eliminating the DOS underpinnings, adding preemptive multitasking and memory protection, and providing a host of ease-of-use features and support for mobile systems.

The evolution of the PC will be gradual; the first sign is the emergence of PCI-based Pentium systems. By 1995, PCs will have shed most of their 1981-era baggage and moved solidly into the fourth wave. In that same time frame, Apple will have moved most of its Macintosh line to PowerPC, IBM's Power Personal Systems division will be pumping out a range of PowerPC systems, and a variety of MIPS- and Alpha-based systems (as well as PowerPC systems) will be running Cairo, the next generation of Windows NT.

While RISC systems are likely to maintain a lead in raw performance and in price/performance, the massive investment in keeping x86-based systems competitive presents a formidable barrier to any large-scale takeover by RISC systems. With increasingly portable software, however, it won't be necessary for a platform to achieve x86-like dominance to be successful. The second half of the decade promises a broad assortment of powerful systems, both x86- and RISC-based, that will change the face of personal computing. ♦