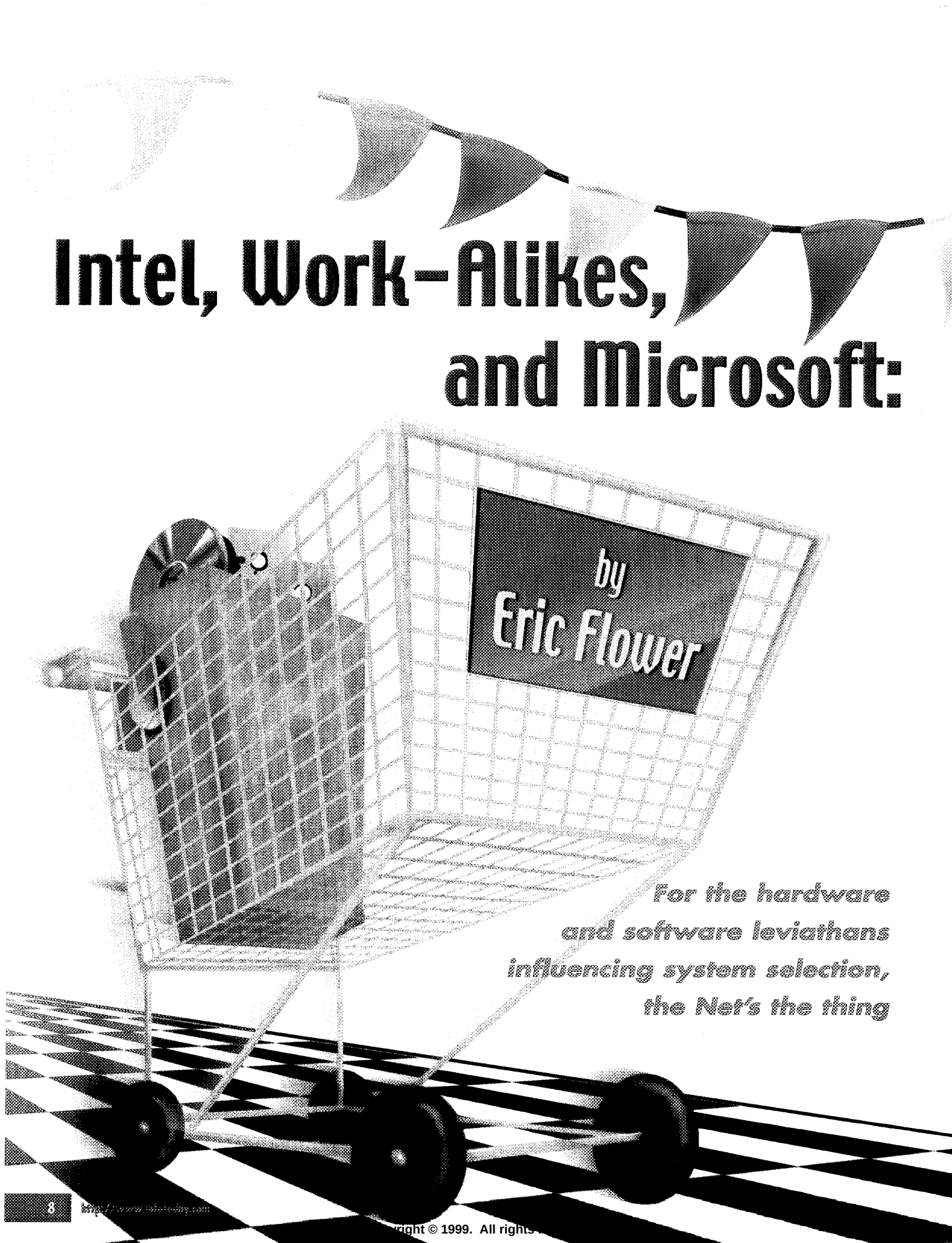
# Intel, Work-Alikes, and Microsoft:




*For the hardware and software leviathans influencing system selection, the Net's the thing*

# Purchasing Systems at the Millennium

Welcome to the seventh annual Intel and Intel work-alike PC systems buyer's guide. There have been substantial changes in corporate direction by both Intel and Microsoft over the past 12 months, and these new visions are the focus of this article.

Longtime readers of this series will be familiar with this quote from James Martin: "The future belongs to organizations skilled in providing solutions for the desktop-computing environment, the database infrastructure and the network infrastructure." (James Martin, *PC Week*, May 14, 1990, p. 74.) The purpose of this article is to focus on the desktop portion of the equation in an increasingly connected environment. The reasons quickly will become evident.

In today's work environment tasks are increasingly network-based—whether you're talking about a LAN, a WAN, or the Internet. Users sit at networked desktop PCs and work with content provided over the Internet. Other workers have workstations where they create multimedia-rich content for Net delivery, and still other employees deliver that Net content with servers. This tidy vision of client PC, workstation, and server is Intel's latest take on how the world of work turns. And those of us sitting at the client PCs live inside of Microsoft Office (or similar suite), copying, embedding, linking, or otherwise manipulating objects of one kind or another. Indeed, as I write, I'm copying objects to and from different documents using two word processors, a presentation package, and an Internet browser. At the millennium, we have graduated from being word processors to being "work processors."

## *Missions, Tasks, Perspectives*

Hardware selection is software driven. Software selection in turn is determined by the tasks at hand, and these tasks are determined by the organization's mission and goals. Those common organizational goals are pursued collaboratively in a networked environment. In this roundabout way, our hardware choices flow from the organization's mission and goals. In the following paragraphs we'll touch on users in the organization, the applications they require, operating systems, the hardware required to run both the operating systems and application software, as well as make some forecasts of both short-term and long-term trends.

Every PC purchase has at least three perspectives. The most obvious of these is the end user's. From his or her vantage point, the new machine should accomplish the tasks at hand. The performance measures are that it be both fast and always available. Another view belongs to the support staff. Above all they want software stability, hardware reliability, and anticipation of future needs. Their performance measures are getting no support calls and never opening the case for a repair or hardware upgrade. Finally there is management's perspective. Their concern always seems to be price. They may use any or all of three measures: purchase cost (surely); total cost of ownership (perhaps); or return on investment (rarely).

Oddly, the most difficult perspective may belong to the support staff because they have to keep in mind where the user fits into the organization's continuum while performing the equipment selection part of their job. It's easy to spec out a purchase based on what users are doing today, and it's not hard to guess what tasks they'll be doing a year from now. But it's difficult to project what users will be doing 18 to 24 months out in a dynamic organization unless management has a clear plan for the organization and that plan has been communicated to—and accepted by—all involved. See Table 1, "PC Purchase Planning Continuum," for a summary of these relationships.

**Table 1**

**PC Purchase Planning Continuum**

| Now | 12 Months Out | 18-24 Months Out |
|---|---|---|
| Current Tasks | Expected Tasks | Projected Tasks |
| Current Applications | Expected Applications | Projected Applications |
| Current Operating System | Expected Operating System | Projected Operating System |
| Individual in the Organization | Expected Relationships of the Individual in the Organization | Projected Relationships of the Individual in the Organization |

## *New Directions for Vendors*

Assuming we all know the paths to follow in pursuit of our organizations' goals, we have to face certain realities. The easiest to recognize is that we must plan with Microsoft and Intel in mind, and, to a lesser extent, other software and hardware vendors. It's useful to know what these corporations are doing today and where they plan to lead us tomorrow.

During the March 1999 announcement of a significant Microsoft corporate reorganization, Bill Gates articulated a new direction for the firm when he said:

> Our original vision of "a computer on every desk and in every home" is still extremely relevant. Looking to the future, our vision is much more expansive. We see a world where people can use any computing device to do whatever they want to do anytime, anywhere. The PC will continue to have a central role in this future, but it will be joined by an incredibly rich variety of digital devices accessing the power of the Internet. We want to give people the power, connectivity, and ability to choose how they want to use computing in their lives.

This comment was excerpted from a Microsoft press release entitled "Gates and Ballmer Outline Blueprint to Reinvent Microsoft," March 29, 1999. More about the reorganization plan and the reasons for it may be read at http://www.microsoft.com/PressPass/press/1999/Mar99/reorgpr.htm.

As noted above, the original Microsoft vision coined in 1975 was, "A computer on every desk and in every home." (And parenthetically, "All running Microsoft operating systems and applications.") On April 7, 1999, at the Windows Hardware Engineering Conference in Los Angeles, Steve Ballmer, president of Microsoft, expanded on Gates' recent remarks when he said: "This industry is not just about a PC on every desk and in every home. The PC is about empowerment ... connecting to the Internet anytime, anywhere, on any device." (And parenthetically, "All running Microsoft operating systems and applications.") For the full report, see "Ballmer Outlines New Initiatives, Win 98 Plans at WinHEC," by John G. Spooner, in the April 7, 1999 edition of PC Week Online, at http://www.zdnet.com/pcweek/stories/news/0,4153,1014307,00.html.

Intel also has been seeking new directions, or more properly, what they like to call new market segments. Its old business model might have been summarized as "A CPU line for every market segment—server, desktop, mobile, consumer." The market segments are now Internet-based with client PCs viewing Internet-delivered content, workstations creating that content, and servers delivering that content. In short, according to Paul Otellini, executive vice president and general manager, Intel Architecture Group, on February 23, 1999, at the Intel Developer Forum, "The Internet is now the single most important growth driver in the computer industry. The Internet is as important to Intel's future as silicon was in our past." See the Intel press release "Intel Sees One Trillion Dollars In Industry E-Commerce Revenues By 2002" at http://www.intel.com/pressroom/archive/releases/cn022399.htm.

This may be old hat to some readers since Sun Microsystems' business model has been "The Network is the Computer" since 1982. See Sun's vision on its Web site at http://www.sun.com/corporateoverview/who/vision.html. What's important here is that for the first time, all of the players involved—the consumer, the software creators, and the hardware manufacturers—are starting to look at the same picture. The visions are converging, and they all are Internet-centric.

## *The Vision at Microsoft*

Microsoft has a new version of its application suite called Office 2000. It will work with Windows 95 or Windows 98, and with NT 4.0 or Windows 2000 (NT 5.0), but Windows 98 or Windows 2000 are required for full functionality. Suggested hardware specifications for PCs running Office 2000 had not been finalized at my deadline for this article, but minimum specifications included 32 MB of RAM and 280 MB of disk space. To learn more see http://www.microsoft.com/insider/office2000/articles/faq2k.htm on the Microsoft Web site.

Windows 9x development will end sooner or later depending on when you ask and whom you talk to, although much will be made about updated consumer versions of Windows 98. Later this year, Microsoft intends to offer Windows 98 Second Edition. It will include a full version of Windows 98, bug fixes, some new features such as Internet connection sharing, Internet Explorer 5.0, and new drivers, and it will cost $89. There also will be a less expensive version for those who have Windows 98 and only want the fixes and new features. It will sell for $19.95. Bug-fix-only service packs will continue to be available as free downloads from the Microsoft site.

Eventually Microsoft plans to unite the consumer and business operating system markets with the core code of NT. In the meantime, Windows 2000, formerly called NT 5.0, will be Microsoft's business operating system of choice, and it has a target release date of October 6, 1999. This release date may not be that important given all the time, effort, and cash being spent on finding and fixing Y2K bugs. Few organizations will want to implement a new operating system with all that entails just before year end. Most of us have other problems we need to concentrate on. Microsoft recommends the following hardware when running Windows 2000: a 300-MHz-plus Pentium or equivalent; 128-K Level 2 cache or equivalent; and 64 MB of RAM. Keep up to date at http://www.microsoft.com/windows/professional.

## *The Nature of Cache, a Key Performance Determinant*

Before continuing with our main themes, a brief digression on CPU cache may be in order because cache is so critical to performance. CPU cache is high-speed memory devoted to retrieval of frequently used instructions and frequently requested data. Level one (L1) cache is found on the CPU itself and runs at the CPU clock speed. Level 2 (L2) cache may or may not be on the CPU, although it is always closely coupled to it. If it is on the CPU, so much the better. Level 3 (L3) cache adds yet a third high-speed storage area. In all cases the closer to the CPU core the better, and the more cache memory the better, although the law of diminishing returns eventually comes into play. The point of cache is simple: It is to have instructions and data available when called for so the CPU can run as efficiently as possible.

## *The New Vision at Intel*

According to Intel's new vision, there are three processors we need to consider when making purchasing decisions for clients working with Net-delivered content: the Celeron, the Pentium II, and the Pentium III. They break down into the following office desktop system market segments:

- Value—Celeron-based systems that sell for less than $1,000 in the marketplace
- Mainstream—Pentium II-based systems selling today for $1,500 (give or take 20 percent), and Pentium III-based systems selling at that price point in the near future
- Performance—Pentium III-based systems where speed is the critical buying factor, costing around $2,000 and more

The Celeron processor is available at 333-, 366-, 400-, 433-, and 466-MHz speeds. It includes 16-K instruction and 16-K data Level 1 caches, 128 K of on-core integrated L2 cache, and MMX media enhancement technology. The Pentium II now runs at 233, 266, 300, 350, 400, and 450 MHz, and has 16-K instruction and 16-K data L1 caches, 512 K of external L2 cache running at half the processor speed, and MMX multimedia enhancement technology. It will be available through the end of 1999, which means it should be at the heart of some very good deals about the time this issue of *Computers in Libraries* appears. The Pentium III runs at 450 and 500 MHz, with 550 MHz available soon. It has 16-K instruction and 16-K data L1 caches and 512 K of L2 cache running at half the processor speed. The Pentium III includes the MMX instruction set as well as 70 new Streaming SIMD (Single Instruction, Multiple Data) Extensions or SSE instructions to enhance imaging, 3-D, streaming audio and video, and speech recognition applications beyond MMX technology. (Note: New software must be written to see these benefits.) In addition, any application using TCP/IP may show up to a 10 percent performance boost. According to Albert Yu, senior vice president and general manager, Intel Microprocessor Group, the Pentium III is the " ... first Intel processor designed specifically to power a new Internet experience." See http://www.intel.com/procs/perf/PentiumIII/brief/summary.htm on the Intel Web site for more on the Pentium III.

Early response to the Pentium III in the office environment was not kind. According to Christopher Yates in "PIII Advances Aren't Enough," *PC Week*, February 28, 1999, at http://www.zdnet.com/products/stories/reviews/0,4161,391810,00.html, "The chip offers only marginal performance improvements over Pentium IIs—no more than 8 percent—when running most business applications." And further along in the article, "The Celeron and Pentium II chips are better aligned with IT's goal of lowering desktop computing costs because they are less expensive and fast enough for running normal business applications." Nevertheless, at least one vendor, Dell, announced plans to discontinue Pentium II-based systems soon after the Pentium III release. Dell will concentrate on Celeron-based PCs in the low end of the market and Pentium III-based PCs at the high end.

Finally, Intel has released its Pentium III Xeon chip. The 500-MHz version is available with 512-K, 1-MB, or 2-MB cache in one-, two-, or four-processor systems. The 550-MHz version with 512-K cache is sold in one- or two-processor configurations. There are plans to add more processors to both models in the future. Early single processor Xeon systems were available for about $4,000. This processor family is so powerful that it can work in a client, workstation, or server capacity, making it Intel's first post-market segment chip and therefore a milestone worth noting. A Xeon-based client would be overkill in nearly all common situations, but there are markets for Pentium III Xeon-based workstations creating multimedia-rich content, and Pentium III Xeon-based servers delivering multimedia-rich content. To learn more about Xeon-based systems, see http://developer.intel.com/design/PentiumIII/xeon/prodbref/index.htm, another Intel site.

## *Plans at AMD and Cyrix*

At the end of 1998 and into 1999, systems based on Advanced Micro Devices or AMD (http://www.amd.com) processors were outselling those based on Intel CPUs in the Value market segment. This occurred because AMD was selling low-priced yet powerful multimedia-capable processors like the AMD K6-2 with 3DNow! Technology for the industry standard System7 motherboard. The K6-2 competes with the Celeron in the Value market. It runs at 300, 333, 350, 366, 380, 400, or 450 MHz and includes 32-K instruction and 32-K data L1 caches. Vendors typically include 512 K of L2 cache in their K6-2 systems. The chip supports MMX instructions as well as an extended AMD instruction set that delivers advanced floating-point performance for 3-D games, education, and business software.

More recently AMD began to offer the AMD K6-III with 3DNow! Technology. It competes with the Pentium II and III in the mainstream and performance markets. It runs at 400 or 450 MHz and also has 32-K instruction and 32-K data Level 1 caches. In addition, it includes 256 K of on-core integrated L2 cache. Finally the chip supports up to 2 MB of optional Level 3 cache with the Super7 motherboard. When paired with the cost-effective Super7 motherboard, the K6-III will be found at the heart of many powerful yet relatively inexpensive systems designed to run business applications. An early review of several K6-III-based systems appearing in the May 1999 issue of *PC World* (Lin-

coln Spector, "AMD's K6-III Shifts Into Overdrive," pp. 46-51) had this to say:

> In our *PC World*-Bench tests, which measure PCs' performance on common desktop applications, the fastest K6-III PCs we tested this month—unlike the first K6-III model we tested last month—performed as well as Pentium IIIs that run at higher clock speeds.... But where speed matters most—multimedia and 3D graphics—the K6-III was a disappointment.... The lowdown: For business use, the K6-III is within striking distance of the fastest machine you can buy, but it lacks power for serious game playing or complex graphic tasks like multimedia editing.

AMD soon will release its next-generation AMD-K7 processor. It will have 128 K of on-chip Level 1 cache and support for 512 K to 8 MB of Level 2 cache while running above 500 MHz.

Cyrix MII processors compete with the Intel Celeron in the Value PC market. They run at 300, 333, and soon, 350 MHz. They offer 64 K of unified instruction and data L1 cache and Socket 7 motherboard compatibility for inexpensive deployment. The Cyrix Media GX pioneered the sub-$500 market. It integrates multimedia and system functions on the processor and supports Universal Serial Bus technology. Cyrix has been showing a wireless device called the WebPAD in its most recent technology demonstration. See the WebPAD animation at http://www.cyrix.com/html/emerging/index.htm on Cyrix's Web site and get a glimpse of tomorrow's environment.

## *Trends to Watch for in Processors and Systems*

In the short term, look for increased CPU clock speeds, larger integrated (on core and thus faster) cache, and increased integration in the low end of the market. Systems based on AMD's K7 chip may be worth waiting for. Properly implemented, the tri-level cache design on the System7 motherboard could produce a system with a superb price/performance ratio. Intel's next Pentium III chip, code-named "Coppermine," is the Pentium III you want. It will run at 600 MHz and up and replace the 512 K of external L2 cache with 256 K of on-core integrated cache. Expect the 70 new instructions featured in the Pentium III to be incorporated into the next generation of Celeron chips. (See the article by CNET News writer Michael Kanellos, "Pentium III OK Now, Gets Better Later," March 1, 1999, http://www.news.com/News/Item/0,4,33032,00.html.)

Going out on a prediction limb, look for vendors to talk up the advantages of multiprocessor systems in the workplace. There's been little of this to date, and given the processing power available, little need, but it's a market and there might be some sales to be made. Most companies have these systems in their product lines, but they just have not marketed them strongly to date.

Longer term, Intel's "Merced" chip will appear in mid to late 2000. This Intel Architecture 64-bit chip signals the end of CPU life as we know it with its Explicitly Parallel Instruction Computing (EPIC) design. Intel promises it will maintain binary compatibility with current Intel instruction sets so all of our software will continue to work. Expect Microsoft to offer a 64-bit version of NT for the chip. Other operating system manufacturers also will produce 64-bit versions for the chip. For more about Merced, see the Intel site http://developer.intel.com/design/ia64/index.htm.

When the Merced chip does appear, look for the Pentium III chip (or its successor) to become the heart of the Intel 32-bit mainstream lineup while the Pentium III Xeon becomes the heart of the 32-bit high-performance lineup in a classic case of market segment processor replacement. This happens whenever a new processor is released. Yesterday's premier chip is reduced to also-ran status and pushed down market.

Finally, Microsoft and Intel are developing a multi-year "Easy PC" initiative to develop consumer-friendly PCs that are easy to use and stable. (Isn't this something we've wanted for years?)

My article in last year's *CIL Buyer's Guide* concluded with a paragraph on the implications of an expanding cheap PC market, and over the past year we have seen staggering growth in the under-$500 segment. An early leader in this arena was eMachines (http://www.e4me.com), which in only 6 months became the fourth-largest PC vendor on the strength of its eTower line. "It's no longer a technology business. You don't need a team of engineers to build a PC today," according to Steven Dukker, CEO of eMachines in the article "PC Makers Get Crunched" by Karl Taro Greenfeld, *Time*, April 5, 1999, pp. 50-51. The market strategy here is to sell hardware at the break-even point or possibly at a loss, but to make up for it in the future with a steady stream of revenue from ISP services or by charging for help calls.

Free PCs create entirely new markets and market strategies because the PC is no longer the most highly valued item in the buying equation. Rather it becomes something else like information you provide a vendor for its database mining ventures, a contract wedding you to an ISP, or the creation and maintenance of some form of brand loyalty. "Free PCs" by Mike Hogan in the April 1999 issue of *PC Computing* (pp. 134-138) has more on the topic. Taking the model one step further, at least one company, Free-pc.com (http://www.free-pc.com), is giving away PCs if your demographics are right, you use the PC at least 10 hours per month, and you are willing to devote a portion of your screen to advertisements. No doubt vendors eventually will give us the PC and then pay us to look at ads, if they haven't begun to do so already.

## *PC 99 System Design Guide*

If you've ever wondered why PCs have the features they do, take a look at the latest version of the "PC System Design Guide." It is authored by Microsoft and Intel with contributions, comments, and data from other chip makers and OEMs for an audience of engineers who build personal computers, expansion cards, and peripheral devices that will be used with Windows. Its purpose is to "... provide guidelines for designing PC systems that will result in an optimal user experience with typical Windows-based applications running under either the Microsoft Windows 98 or Windows NT Workstation operating systems." Its secondary purpose is to allow for product differentiation in the PC market. "The guidelines ... provide a starting feature set that encourages differentiation among hardware manufacturers and among product lines based on the addition of advanced features and innovative implementations." Corporate office systems are designed to run productivity applications in a networked environment.

The design guide also features specifications (both required and recommended)

for consumer PCs, entertainment PCs, mobile PCs, and workstations. The "PC 99 System Design Guide" calls for the following features or minimum performance levels (among others) in the typical office desktop configuration to be delivered in or after the fourth quarter of 1999:

- 300-MHz-plus Pentium or equivalent CPU
- 128-K Level 2 cache
- 64 MB of RAM
- Upgradable BIOS
- Plug-and-Play support
- Universal Serial Bus; no more ISA slots; IEEE 1394 recommended
- Network adapter with support for remote system setup
- CD or DVD (DVD recommended)

For more about the Guide, see "PC 99 System Design Guide: Welcome to PC 99" at http://www.microsoft.com/hwdev/xpapers/pc99 on Microsoft's Web site.

## *Some Popular Suggestions*

There are any number of popular sources of advice on system selection. One of the better ones can be found in *PC Computing*. Each month it publishes an Editor's "A-List" of hardware and software in various categories. Given its diverse audience, *PC Computing* divides the desktop market into the following segments:

- State-of-the-Art Desktop PC
- High Performance PC
- Desktop Workhorse
- Low-Cost Desktop PC
- Small Office/Home Office/Entertainment PC

All of the systems recommended last year by *PC Computing* boasted multimedia playback capabilities, although the multimedia components varied widely in quality and price. For most readers, selections probably came from the High Performance, Desktop Workhorse, or Low-Cost PC categories. A year ago (May 1998) the High Performance PC included a 300-MHz Pentium II, 64 MB of RAM, AGP graphics, a 6.4-GB hard drive, and CD-ROM, and it cost $2,188. The Desktop Workhorse had a 233-MHz Pentium II matched with 32 MB of RAM, AGP graphics, a CD-ROM, and a Zip drive, for $2,099. The Low-Cost Desktop system had a 233-MHz Pentium II with 32 MB of RAM, a 3.2-GB hard drive, and CD-ROM drive for $999.

This year (May 1999) the Editor's "A-List" Picks included the following systems:

- High Performance PC: Dell Dimension XPS R400 based on the Pentium II chip and selling for $2,199. "With DVD, a built-in Zip drive, and tons of storage and RAM, this system's got it all."
- Desktop Workhorse: Gateway's E3200 450 based on the 450-MHz Pentium II. The price is $1,999. On a budget? The editors suggest Gateway's 366-MHz Celeron-based E1200 system, for $999.
- Low-Cost Desktop PC: In this category the *PC Computing* editors recommend the eMachines eTower 300k. It is a complete multimedia system with a 300-MHz K6-2 CPU, 32 MB of RAM, a 2-GB hard drive, a 4-MB AGP graphics card, a sound card, and speakers, for $399. All you need to add is a monitor.

Keep up-to-date with industry trends by reading the "How to Buy" columns in *Computer Shopper*. This outline of systems, subsystems, and peripherals includes general information on CPUs, memory, storage, video, and peripherals of all kinds. Follow that up with specific recommendations from the monthly "A-List" in *PC Computing* or "The Top 100" in *PC World*. However you mix and match components, buyers will find complete systems in four price ranges: low cost (cheap), less than $600; value, less than $1,000; mainstream, approximately $1,500; and performance, more than $2,000.

## *System Recommendations*

Smart buyers will want to keep track of the following items when they start to write specifications for one or a hundred PCs:

- Their organization's purpose
- Their users' tasks now and in the future
- Microsoft application and operating system directions
- Intel and competitors' plans
- "PC 99 System Design Guide"
- Market segments and prices

In light of users' needs, industry leader plans, and future trends, the following recommendations are offered for the typical mainstream office system that's running Windows 95 or 98 and Microsoft Office (or similar suite) now and planning to move to Windows 2000 and Office 2000 in the future:

- Higher speed (350 MHz-plus) Pentium II or III or equivalent AMD K6-III
- 512-K L2 cache (less if L2 cache is on chip)
- 64 MB of RAM for Win95 or Win98; 128 MB of RAM for Windows 2000
- 8- to 12-GB-plus hard drive with less than a 10-ms access speed
- AGP video with 8 MB-plus of RAM
- 17-inch monitor
- Multimedia subsystem including CD-ROM, but DVD preferred
- Network interface card

The budget-minded who are staying with Windows 95 or 98 should look for the fastest Intel Celeron, AMD K6-2, or Cyrix MII-based system they can afford and 64 MB of RAM. Other components ought to approach those listed above. All systems also should include an uninterruptible power supply (UPS) and backup device(s) as well as antivirus and system utilities software, because your data is worth much more than your hardware!

## *The Microsoft Office Application Market Today*

Perhaps the best news to report is that it is now almost impossible to order a badly configured system in the "Microsoft Office Application Market." Just remember never to buy PCs based on the latest and greatest processor for typical office tasks. The good deals are a step or two back from the bleeding edge. Spend the money you save by stepping back on additional RAM. With this in mind, we should have little trouble writing system specifications for our Net-centric "work-processing" colleagues at the millennium.

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