■ **VIEWPOINT**

WebTV Tide Could Slow PC Growth

Intel Is Vulnerable to Information Appliances

by Peter Christy

For more than a decade, the x86-based PC has withstood challenges from Macintoshes, workstations, and other platforms vying to become the dominant computing device. During this period, the PC has thrived with a remarkable growth rate while its competition has suffered. As the maker of most x86 processors, Intel has become the largest semiconductor vendor in the world based on the success of the PC. Now, information appliances are preparing to take on the PC. The success of the PC market, as well as that of Intel, is yet again under attack.

Information appliances are computers designed to perform a single application. To date, video-game consoles are the sole example of an information appliance that saps real volume from PC sales. It's easy to hypothesize why an information appliance is preferable to a PC: it's significantly cheaper, simpler, and easier to use. That argument notwithstanding, so far consumers have chosen to buy a general-purpose PC instead of one or more information appliances.

The most recent challenge to the PC is the dedicated-function World Wide Web browser. Oracle, Sun, and others have introduced network computers for commercial use. Startup WebTV (Palo Alto, Calif.) and others have introduced Web browsers for the home in the form of a TV add-on. Will these information appliances catalyze a significant shift in computer-buying patterns? If so, what would be the impact on the microprocessor industry? If information appliances catch on, will the impact on the PC business be slow, or might it be surprisingly abrupt? Is modern chaos theory applicable?

PC Market Could Have Multiple Stable Forms

A butterfly flaps its wings in Beijing, spawning a tornado in Kansas, or so goes a standard example of what it means for a system (the atmosphere in this case) to be *chaotic* (not governed by linear models). The point is not that the world is wildly unstable, but rather that the specific path history takes is unpredictable. Chaotic systems have many potentially very different stable points, not one. What initiates the transformation from one stable state to another may by itself seem as inconsequential at the time as a butterfly. The transition between states can be surprisingly swift.

Increasingly, evolution in nature is seen as chaotic. If we reset the world to its state 100 million years ago and replay history from that point, it would come out dramatically different in ways we can't predict. Increasingly, chaotic

models are also being applied to today's high-technology businesses (for more details, see the recent summary article by Brian Arthur, "Increasing Returns and the New World of Business," *Harvard Business Review,* July–August 1996). Arthur's standard example is VHS and Beta competing for VCR market share. Objectively, he feels Beta should have won, but small events tipped the momentum in favor of VHS, positive feedback set in, and VHS gained unstoppable market power. Where "positive return" economics apply, the winners get stronger and the weak die.

Microprocessors and PC operating systems are clearly subject to increasing-return, positive-feedback economics: the winners have all the advantages, the losers fade. If nothing changed, it would be like baseball before free agency, when local revenues went to local teams: it was great and stable, if you were a Yankee fan! But nothing is constant in our business. Technological changes introduce new stable states in the economic and industrial infrastructure.

The eventual shift from one stable state to another can be abrupt and can be triggered by something that seems minor at the time. A new technology (for example, DVD, the new high-density CD-ROM format) can come along and quickly relegate VHS to the junk heap without regard for its dominance of the VCR market.

Information Appliances Have Advantages

To date, the computer market has been dominated by general-purpose PCs. Early PCs weren't extremely good at any specific task, with the exception of the new applications enabled by the PC, such as spreadsheets. These PCs made up for their shortcomings by running lots of different applications. Although PC performance has improved dramatically and diverse new applications have been created, in many ways PC hardware and software are still weak: the systems are complex and unstable, the applications are complex and difficult to use, and—despite the dream of plug-and-play—nothing works perfectly with anything else. Still, consumers vote with their money for general-purpose machines.

Intel and Microsoft dominate the industry because of their hold on the PC CPU, operating system, and key applications—the essence of general-purposeness. Positive return, increasing-share economics are clearly at work. The strong have gotten stronger.

How could information appliances upset the existing applecart? To make the point, let's focus on a new entry to the market. The WebTV people and their manufacturing and marketing partners—Sony and Philips—have set out to

demonstrate that there is a market for Web browsing without a PC. With WebTV, the consumer buys an information appliance (also called a WebTV) that connects to the phone for Web access and to a TV for display. Not surprisingly, the strengths of the WebTV are exactly the weaknesses of the PC.

In the WebTV view of the world, rather than getting Netscape or Internet Explorer software to run on your PC or Mac and hiring an Internet service provider (ISP) to provide access to the Web (typically via a 14.4- or 28.8-kbps modem), you buy a WebTV box, plug it into your phone and TV, and surf the Web.

What's the big deal? It could be the sum of these points:

- The WebTV CPU, a 112-MHz IDT R4640, costs a factor of ten less than a midrange Pentium yet delivers adequate performance for the WebTV. Not only is the R4640 much cheaper for the same power, it includes instruction-set additions (e.g., multiply-accumulate) to accelerate digital-signal processing, needed for communications and video processing. Information appliances don't need expensive Intel processors.

- The WebTV box has clever hardware and software (which they call TVLens, with patents pending) that make the picture on a TV look as good as the basic resolution of the TV permits (which is a lot better that what we're used to with video-game TV interfaces, for example). A WebTV doesn't need a big, expensive PC monitor. It doesn't need a monitor at all, if you already have a TV.

- When you turn on the WebTV box, it's ready to surf much more quickly than if you have to boot Windows 95, connect to your ISP, and start Netscape. A WebTV doesn't need a complex operating system. It doesn't need a visible operating system at all.

- As user-friendly as the Netscape browser may be, the WebTV application is still friendlier and can be driven by a device much like a TV remote control. (An infrared-connected keyboard is available as an option, but a remote works as well for basic Web surfing as for channel surfing.) A WebTV doesn't need a user interface that can also run Microsoft Office, just one optimized for this single application.

- WebTV runs a specialized Internet service provider (the core of the WebTV business plan is the monthly service revenues from this service, not licensing fees from the sale of the set-top boxes). Because the service is designed to be integrated with the software in the set-top box, it is much easier to deal with than a typical ISP, PC, and browser. To use this single application, the user doesn't need to know anything at all about the network.

- Software updates of the WebTV application are automatic and much less disruptive than Windows operating system and application updates tend to be. You can't screw up your browser because your kid installed a new version of Doom. The PC pays a necessary penalty for being general purpose, and many different applications and hardware devices must play well in the system. WebTV is one-stop shopping,

a single integrated product that doesn't need any user integration or administration.

- The WebTV application has been designed so details like phone use are much better thought out than in almost all PC applications. The WebTV box includes a high-speed modem (33.6-kbps V.34bis), and only this modem is supported by the application. Because only one application is involved, the use of the modem and phone line is well thought out and engineered (what WebTV calls Lineshare). Incoming call-waiting is supported, as is outgoing use of the phone. Although the modem connection to the WebTV ISP is broken when the phone line is used for other purposes, the logic of the connection is not disrupted. When the phone line is available again, the surfing connection is transparently re-established. WebTV obviates the normal challenge of making a new modem work with communications applications.

- The WebTV box reads ISO-compliant Smart Cards, including credit cards, cash cards, and ATM cards. Potentially, your WebTV account can be authorized by a personal Smart Card and available anywhere you find a WebTV box (for example, in an airport or a hotel room). A WebTV is better equipped for doing commercial transactions than a modern PC.

In short, the WebTV people thought a lot about what someone would want as an information appliance to browse the Web at home (or in a school or hotel room, where a TV and phone can be assumed but a PC can't), and they built a box, software, and a service which delivers that specific function extremely well—and at a much lower hardware cost than a PC. Philips has announced a list price of $329 for its version of the WebTV set-top box (the specifics mentioned here apply to that product).

Success Is Not Assured

The success of WebTV is by no means assured.

- We don't know how many Web surfers don't have convenient access to a PC. Lots of non-PC users think they would like to surf the Web, but when they finally get a chance, will the fascination remain?

- Even $329 is still a lot of money outside Silicon Valley, not to mention the $20/month service fee we expect. Money spent on WebTV will come from some other home budget item: fewer video games, fewer movie rentals, fewer premium TV channels on cable. When the tradeoff has to be made, will surfing make the priority list?

- It's possible that Web surfing will evolve to require functions found in a modern PC but not in the WebTV box (e.g., high-performance 3D graphics). That is certainly Intel's intent in its current drive for applications integrating Internet control with rich media on a PC instead of depending on network delivery of all the content.

These questions notwithstanding, the WebTV effort comes close enough to call the information-appliance question: When do customers want the general-purpose PC, and

when would they prefer an optimized information appliance? At $329 each, you can buy more than one information appliance rather than a single PC. And consumer research has shown that, except for home-computer hobbyists, more and more consumers like the idea of an information appliance that does something well and doesn't require a lot of computer knowledge and administration.

Intel Has the Most to Lose

Intel has the most to lose if consumers decide their 150-MHz Pentium PC can last for a few more years without replacement, instead spending the money saved on information appliances (just as the U.S. auto industry has adjusted as new cars have become more expensive and are kept longer). If fewer hot PCs are sold, or if Intel has to lower its CPU average selling price (ASP) to serve demand for lower-cost computers (a $329 list-price Web browser won't have a $250 Pentium inside), Intel's financial and business model is in for some real revision.

Intel reports the majority of its revenues and a "significant majority" of its profits come from the sales of Pentium processors. At a CPU ASP of $150, a 100-million-unit PC business is a $15-billion CPU business, whereas with a CPU ASP of only $30, even a 200-million-unit information-appliance market represents just $6 billion of CPU revenue. If Intel's high-end CPU business catches a cold, all of Intel gets quite sick (interestingly, not unlike the serious illnesses that IBM and Digital faced with the decline of their proprietary systems markets).

The price and profit premium that Intel gets for the Pentium is fueled by two things: (1) a continuing need for more raw CPU power and (2) the value in being able to run all the legacy software and systems. As the WebTV plan shows, you don't need a P6 to surf the Web, and you don't need Windows and Netscape to do Web browsing. In many ways, a general-purpose system is a liability, not an asset, because the system is much more complex. If there is a big market for information appliances, it won't matter much what CPU or operating system is used.

Web browsing might prove to be a fad, like the pet rock. PCs could well be the Web browser of choice after all. And even if something like WebTV catches on as a Web browser, the impact on the PC market could be slow and gradual. On the other hand, maybe a small startup in Palo Alto flaps its wings and a big semiconductor company's revenues, profits, and stock value hiccup. Perhaps it won't be this butterfly, but sometime, somewhere... ◍

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