The Empire Strikes Back ... with the X-Box

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Microsoft's fortunes have certainly gone sour recently. The US Federal antitrust case took a turn for the worse when Judge Jackson ruled that Microsoft had used its Windows monopoly to suppress competition in the browser market. Then the Europeans filed a similar suit. Beset with litigation on several fronts, Microsoft's stock prices began to plummet.

In response, US Federal Reserve Chairman Alan Greenspan uttered more "irrational exuberance" warnings like those that helped the NASDAQ, and Microsoft stock, nose-dive in April. Stories of a Microsoft brain drain caused by old hands cashing out only made a bleak picture gloomier.

Battered and besieged, Microsoft struck back.

Figure 1. The X-Box promises near-photo-realistic graphics and lifelike animation.

YOU CAN'T WIN UNLESS YOU PLAY ... GAMES?

For those of us who like games, the dark cloud hovering over Microsoft has a silver lining. First, the company released Windows 2000, its replacement for NT that—finally—lets users play 3D games on their "business" OS. Microsoft is also preparing the release of DirectX 8.0, a game and multimedia API with advanced features for multiplayer networking and audio. The new version will also support graphics instructions for transform and lighting that supposedly rival those found in the industry-standard OpenGL API.

Overshadowing these developments, however, is Microsoft's announcement that it plans to build the X-Box, a game console that purportedly offers unprecedented graphics and processing power. The X-Box is so important to Microsoft's overall business strategy that chairman and chief software architect Bill Gates took the time to announce the system personally at the Game Developers Conference in March. Microsoft's main goal at the conference was to capture the enthusiasm of software developers so that they will begin writing X-Box games.

Having steadily expanded its own line of PC games in the past few years, it was perhaps inevitable that Microsoft would turn its attention to the console market. While a hit PC title can sell several hundred thousand copies, a console hit can sell *millions* of copies.

By stepping into this more lucrative arena, Microsoft will be challenging three established players—multinationals based in Japan that have years of experience in the game console industry. Undaunted, Microsoft intends for its X-Box to go head-to-head with Sega's Dreamcast, Sony's PlayStation2, and Nintendo's forthcoming Dolphin.

According to Gates, the company has done its homework. "Building on our strengths as a software company, X-Box will offer game developers a powerful platform and game enthusiasts an incredible experience. We want X-Box to be the platform of choice for the best and most creative game developers in the world" (http://www.microsoft.com/PressPass/press/2000/Mar00/XBoxPR1.asp).

> Can Microsoft's powerful new gaming machine extend the company's influence into a console market dominated by Sony?

Robbie Bach, senior vice president of Microsoft's Games Division, expanded on Gates' words in a recent interview: "X-box brings Microsoft into the living room and den, where ... there are two or three people playing a game at one time. That is a very vibrant market, and Microsoft wants to become a leader in this market" (http://www.microsoft.com/presspass/features/2000/05-10bachqa.asp). Microsoft indicated the seriousness of this desire in April, when it gave Nvidia a $200 million contractual advance payment against the manufacturer's future supply of its graphics processing units for the X-Box (http://www.nvidia.com/).

CLASH OF THE TITANS

When Microsoft moved into the PC games market, the company's size and resources made it relatively easy to acquire

the talent and titles to quickly capture a healthy market share. The console market will prove a tougher challenge, though, because here Microsoft faces dominant, entrenched competition: Sony. The entertainment giant has already sold more than 70 million of its PlayStation consoles worldwide. The PlayStation2, most powerful of the new-generation consoles already in production, debuted in Japan earlier this year—and sold out immediately. So far, the only limit to Sony's success has been its PlayStation2 production capacity. The console will reach US shelves in October.

Microsoft's strategy for winning this war for the living room appears to hinge on a combination of performance and features.

A tiny supercomputer

The X-Box's designers hope to match other consoles' ease of use and, like the PlayStation2, the X-Box will ship with the ability to play DVDs. So what makes the X-Box so special? Performance. As Table 1 shows, if Microsoft can deliver an X-Box that matches the console's published specs, the machine will debut with a huge advantage over the competition—including graphics performance better than three times that of the PlayStation2.

The X-Box's outrageous compute-performance numbers show that we live in an era of ubiquitous supercomputers. The Japanese government has already assessed the PlayStation2 as powerful enough to require export restrictions. The X-box is poised to join the PlayStation2 in the ranks of $300 supercomputers and will likely force the US Commerce Department to rewrite export regulations.

According to Microsoft, the X-box's 146-Gigaflop performance offers an order-of-magnitude improvement over the PlayStation2. Although Nvidia's engineers admit these are not Linpack floating point numbers—and thus don't register high on that supercomputing benchmark—they are still stunning.

Microsoft claims that the X-Box will push at least 100 million polygons per second, even with all features turned on—including mip maps, bump maps, and full-scene anti-aliasing. The prototype unit shown at the GDC ran an Nvidia NV15 chipset. Although the demos on the NV15 look spectacular, the final design will feature the NV25: an even more powerful chip that's two generations beyond the NV15.

The NV25 will have a quad-pixel pipeline, operate at 300 MHz internally, and have a fill rate of 4.8 Gigapixels per second (http://www.gamespot.com/features/xbox/index.html). According to Nvidia, the NV25 will be capable of several rendering and cinematic effects designed to make 3D scenes appear photorealistic, including 8:1 texture compression, motion blur, and soft shadows and reflections.

The X-Box will be built around a fast CPU: at least a 733 MHz Intel Pentium

Table 1. The X-Box versus the competition. (Adapted from http://www.msxbox.com/faq.shtml and http://www.gamespy.com/potd/image.asp?/E3/xbox/syspecs.gif.)

Component or Feature	Microsoft X-Box	Sega Dreamcast	Sony PlayStation2	Nintendo Dolphin
CPU	733-MHz Intel P3	200-MHz Hitachi SH4	300-MHz Emotion Engine	400-MHz IBM Gecko
Graphics processor	300-MHz Nvidia custom chip	100-MHz NEC PowerVR	150-MHz Sony GS	200-MHz Artx
Memory	64 Mbytes	26 Mbytes	38 Mbytes	?
Memory bandwidth	6.4 Gbytes/sec	800 Mbytes/sec	3.2 Gbytes/sec	3.2 Gbytes/sec
Polygon performance	300 M/sec	15 M/sec	66 M/sec	66 M/sec
Sustained polygon performance	150 M/sec	3 M/sec	20 M/sec	20 M/sec
Compressed textures	8:1	Yes	No	Yes
Full-scene anti-aliasing	Yes	Supersampling	Software	Likely
Maximum resolution	1,920 × 1,080	640 × 480	1,280 × 1,024	?
Storage medium	8-Gbyte hard disk	128-Kbyte visual memory unit	8-Mbyte memory card, HD rumored	Memory card
Media	4× DVD	GD-ROM	2× DVD	DVD
DVD movie playback	Built in	None	Utility required to be on memory card	?
HDTV support	Yes	No	Limited	Limited
Audio channels	256	64	48	64
3D audio support	Yes	Yes	No	Likely
Broadband enabled	Yes	Future upgrade	Future upgrade	Future upgrade
Analog modem	Future upgrade	56Kbps	Future upgrade	Likely
Joystick ports	4	4	2	4
I/O ports	Modified USB	Custom joystick, serial I/O	IEEE1394, USB	Custom
US launch date	Fall 2001	September 1999	October 2000	Spring 2001

Figure 2. The X-Box will offer vibrant colors and enhanced 3D effects, such as transparency and reflections.

III processor with Streaming SIMD (single instruction, multiple data) Extensions, Intel's latest instruction set for enhancing graphics performance.

Online games … and beyond

The X-Box will ship with a hard drive. This apparently controversial design decision threatens to increase the complexity—and thus decrease the reliability—of the traditionally simple, consumer-oriented gaming console. On the positive side, a hard drive lets gamers download games from the Internet via a separate 56 Kbps modem or a broadband connection such as 100 Mbps Ethernet. Gates' comments reveal another use for the drive: "We think there's going to be incredible, persistent, online worlds that are created because of what you can do."

The X-Box will include a 4x DVD drive for playing games and movies. The console's operating system will be a stripped down version of the Windows 2000 kernel that weighs in at less than 500 Kbytes. Moreover, the X-box will have 64 Mbytes of unified memory for both the application and graphics textures.

The X-Box has controller ports for up to four USB gamepads and a fifth USB port for additional peripherals such as a mouse, keyboard, or camera. A custom A/V-out port will support video output to standard TVs, CRT monitors, LCD flat-panel displays, and high-definition TVs, up to a maximum resolution of 1920 x 1080.

Beyond these features, Microsoft plans to include online gaming support through Microsoft Zone, TV viewing functions such as taping television shows to the hard drive, WebTV-based e-mail, and other Internet functions.

INDUSTRY RESPONSE

The waves generated by Microsoft's plunge into the console market have already spread far and wide. To remain competitive, Sega—maker of the first of the new-generation consoles—recently began offering a free Dreamcast with each subscription to its Internet service. Sony is rumored to be considering a similar move.

So far, though, the X-Box has made the biggest splash in the computer graphics sector, where companies are scrambling to stay competitive. ATI Technologies, a graphics chip vendor that targets both the PC and consumer cable set-top markets, last month paid $400 million for ArtX, a small firm chosen by Nintendo to design the graphics chip for its upcoming Dolphin. Meanwhile, graphics board maker 3dfx Interactive paid $186 million for Gigapixel, which almost won the contract for installing graphics chips into Microsoft's X-box game console. Then 3dfx bought Intergraph's Intense 3D graphics division with stock, thereby acquiring the expertise behind the Wildcat video boards that power Sun's new graphics workstations.

Other graphics companies, unable or unwilling to acquire the technology needed to compete—including S3 and NeoMagic—chose to abandon the market altogether.

Can Microsoft deliver what it's promised, and do so on time? Although the X-Box's demos look stunning, and it boasts impressive specs, we should recall that Sony's PlayStation2 offered up almost equally impressive demos and marketing literature this time last year. Has that console, now in production, justified its hype?

Not everyone thinks so. Brad Wardell, a game developer for Stardock who attended the Electronic Entertainment Expo in Los Angeles this year, admitted that "the PlayStation2 was a huge disappointment for me" (http://www.stardock.com/media/articles/e3-2000.html). Overwhelmed by Sony's presentations at last year's show, Wardell said that "it looks to me now that they ran their demo at a far higher resolution than TV resolution and as a result, their racing demo and other demos looked far less pixilated and far crisper than the reality."

Thus, while Microsoft has created some remarkable X-Box demos (http://pc.ign.com/news/16450.html), these alone do not guarantee that the production console will run equally remarkable games. Yet the X-Box must reach shelves performing as advertised and on schedule—because even if the company achieves those goals, Sony's PlayStation2 will still have had a year's head start in the market, while Sega's Dreamcast will have had two.

Microsoft has cause for optimism, however. Given their maturity, most of the X-Box's major components should be relatively easy to produce and integrate. Microsoft has raised the bar by adding a hard drive, however, and must prove that it can include this component while maintaining the low costs and high reliability consumers expect from consoles.

Yet it is the graphics arena that will present Microsoft and partner Nvidia with their toughest challenge. To a great extent, the X-Box's success or failure may hinge on how well their PC graphics expertise translates to the console market. ✸

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