

How things Work

Thursday, February 11, 2010

Working of Xbox 360

How Xbox 360 Works

Microsoft's first video game console, the Xbox, has sold more than 20 million units worldwide since its introduction in 2001. Despite the Xbox's impressive power, the list of big-name video game titles to support it and the success of the Xbox's online component, Xbox LIVE, Sony's PlayStation 2 still outsold it.

As the game industry moved into the next generation of video game technology, Microsoft was determined to dethrone Sony's PlayStation. Enter the Xbox 360.



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Xbox 360.

Microsoft rebuilt the Xbox from the ground up. From the name to the look to hardware and features, the Xbox 360 is a radically different and more powerful machine than its predecessor. Far more than a video game console, the Xbox 360 is a total media center that allows users to play, network, rip, stream and download all types of media, including high-definition movies, music, digital pictures and game content.

In this article, we will learn about the hardware and features that make the Xbox 360 a leap forward into the next generation of gaming consoles.

The Xbox 360, like all video game consoles, is just a computer with hardware and software dedicated to the function of running video game software. The original Xbox was essentially a Windows PC with a modified Pentium III processor, some relatively powerful graphics and audio hardware and a modified version of the Microsoft operating system Windows 2000, all packaged in that distinctive black box. The Xbox 360 is also a specially packaged computer, but once you look inside, you realize that this console has quite a bit under the hood:

- Custom IBM Power PC-based CPU with three 3.2 GHz cores
- Custom ATI graphics processor with 10 MB embedded DRAM
- 512 MB 700 MHz GDDR3 RAM
- Detachable and upgradeable hard drive -- all models except the Core system
- 12x dual-layer DVD-ROM
- Support for up to four wireless game controllers
- Three USB 2.0 ports
- Two memory unit slots

As you can see, Microsoft intends the Xbox 360 to be a serious game machine. The company is also serious about reaching more audiences with the Xbox 360. On the next , we'll look at variations of the Xbox 360 that are marketed to different kinds of gamers.

Xbox 360 Consoles

Microsoft released two versions of the Xbox 360 in November 2005: the **Xbox 360 Premium Package** and **Xbox 360 Core System**. Since then, the lineup has undergone some changes. The Premium Package is now known simply as the Xbox 360 console. A new Elite system hit store shelves in April 2007. Microsoft announced another new system, the Xbox 360 Arcade, in October 2007.



The Xbox 360 debuted at the

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The Core System is "plug and play" -- in addition to the console, it includes a wired controller and an AV cable. The Xbox 360 comes with a wireless controller, an HD AV cable, an Ethernet connectivity cable, a headset and a removable 20-GB hard drive. Initially, it also included a DVD remote, but this is no longer available as part of the package.

The Xbox 360 Elite is similar to the main Xbox 360, with a black case, matching wireless controller and headset. It also includes a larger 120-GB hard drive and an HDMI cable.

To combat Nintendo's surprise powerhouse, the Wii, Microsoft announced the Xbox 360 Arcade in October 2007. Aimed at casual gamers, the console will come with between three and five Xbox LIVE Arcade games and will probably include "Pac-Man," "Uno" and "Luxor 2." Microsoft has also prepared subtle variations of the console for marketing tie-ins. To commemorate the release of "The Simpsons Movie," Microsoft created a run of 100 limited-edition Simpsons Xbox 360s, which were given away in promotions. Fans of Bungie's "Halo" game series can purchase the "Halo 3" limited edition Xbox 360, which comes in "Spartan green and gold" and features a matching controller.

On the next page we will see what makes the Xbox 360 tick -- the central processing unit, or CPU.

Xbox Sales

Because of delays in manufacturing, there were not enough Xbox 360s to meet the demand of the 2005 holiday season. As a result, Xbox 360s were selling for as much as \$2,000 on Web sites like eBay, and initial sales figures were poor. However, Microsoft still got a jump on its competitors, as the PlayStation 3 and the Nintendo Wii did not release until 2006. According to industry analyst the NPD Group, as of August 2007, the Xbox 360 sold 6.3 million Xbox 360s in the United States, to 4 million of Nintendo's Wii and 1.75 million Sony Playstation 3s.

CPU: The Heart of the 360

As with any computer, the CPU is the heart of the Xbox 360. Microsoft has outfitted the 360 with a 165-million transistor, multi-core processor running three 3.2-GHz PowerPC cores.

Each core on the chip functions as a separate processor. 

Recently,

hardware manufacturers have started combining several 

cores, or processors, onto one chip. This is a **multi-core processor**. Multi-core processors offer a combination of tremendous computing capabilities and efficient power consumption.

They split

heavy work loads over multiple powerful processors rather than giving all the work to one super-powerful processor.



The Xbox 360 on display at the 2005 E3 Expo.

The other interesting thing to note about the Xbox 360 CPU is that each core is capable of processing two threads simultaneously. Think of a thread as a set of instructions for a program's job. The core processes these instructions and does the heavy lifting to get the job done. A conventional processor can run a single execution thread. Because the Xbox 360 cores can each handle two threads at a time, the 360 CPU is the equivalent of having six conventional processors in one machine.

What this means when you are playing video games is that the Xbox 360 can dedicate one core entirely to producing sound, while another may run the game's collision and physics engine. The system may allocate an entire processor just to rendering hi-def graphics. It's really up to the game developers how the system's considerable resources are used. With a multi-core processor, the system is powerful enough to pull off the computational demands needed for an amazing gaming experience without even breaking a sweat.

360 Degrees

According to J. Allard, Microsoft Corporate Vice President and chief XNA architect, in an interview with Gamespot, "If we were building another console in the 3D era, we'd just call it Xbox 2 ... So, we eliminated Xbox 2 from the list. So, the name that we came up with was Xbox 360, because we are putting the gamer at the center of the experience."

The graphics processor unit, or GPU, is responsible for the heavy-lifting for the console's beautiful, high-resolution images.

The GPU

Another powerful asset in the Xbox 360 is the Graphics Processor Unit (GPU). The Xbox 360 boasts the new, custom-built 500-MHz ATI Graphics Processor card with 10 MB of embedded DRAM. While the 500-MHz graphics processor is powerful, and 10 MB of DRAM provides ample memory for the GPU to do its job, the most innovative thing about this card is that it is built on **unified shader architecture**.

Shaders are computer programs that determine the final look of what you see on the screen when you're looking at computer animation. Shaders take rendered 3-D objects built on polygons (the building blocks of 3-D animation) and make them look more realistic. There are two types of shaders: pixel shaders and vertex shaders.

Pixel shaders alter the lighting, color, and surface of each pixel. This in turn affects the

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overall color, texture and shape of 3-D objects built from these pixels. Pixel shaders help "smooth out" 3-D objects, giving them a more organic texture.



The Xbox 360 with a custom, wood-grain faceplate.

Vertex shaders work by manipulating an object's position in 3-D space. "Vertex" refers to the intersection of two coordinates in space. The machine maps the position of an animated object in 3-D space by giving it a value. These values are the x, y and z coordinates. By manipulating these variables, a vertex shader creates realistic animation and special effects such as "morphing."

In real-time graphics, like the kind you see in video games, shaders work with the graphics processor. The shaders make billions of computations every second to perform their specific tasks. These computations are performed in steps through a series of computational components. Think of an assembly line. In the world of hardware, these assembly lines are called **pipelines**.

Traditionally, pixel shaders and vertex shaders have dedicated pipelines because each one has very specific and differing needs. As we learned before, the new ATI graphics card in the Xbox 360 has unified shader architecture. What that means is that now, both shader types share the same pipelines. ATI figured out a way at the hardware level to address the needs of both types of shaders using the same pipeline.

The apparent advantage of sharing pipelines is to add more assembly lines, making computation that much faster. ATI claims that this unified shader architecture allows for 48 billion shader operations per second. The Xbox 360 is the first device to use this type of architecture.

On the next , we'll learn about how the Xbox 360 fits in with your home entertainment system.

Jacks, Tracks and Other 360 Features

Input/Output The Xbox 360 supports up to four wireless controllers at once. It also has three USB 2.0 jacks, two in the front and one in the back that can be used to plug in wired controllers for play or wireless controllers when they need to be charged. The USB jacks can also be used to connect devices like digital cameras, MP3 players and computer keyboards to the 360 (but the keyboard can only be used for text entry, not game play).

Online The Xbox 360 has an Ethernet port to hook up to a broadband connection, as well as a slot for a WiFi card. The 360 is WiFi-ready "out of the box" and the bundle includes a connectivity Ethernet cable.

TV Connections The Xbox 360 comes standard with both composite and component video connections to hook up to a TV. There are also optional connections for S-Video and VGA, and the console supports some SCART-type adapters used in Europe. The Xbox 360 Core System includes a standard-definition AV cable, while the other Xbox 360 bundles come with an AV HD cable and a media remote.

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