Windows Vista:

The First PC Operating System that Requires a GPU to Get the Best Experience

by

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Introduction

Windows Vista, Microsoft's new operating system (OS), is the biggest change in PC computing in over a decade and a half. The new Windows Vista operating system offers a beautiful new user interface (UI), better security, improved data organization, and near-instantaneous and intelligent search.

One of the most striking features of Windows Vista is the all new 3D desktop and the new user interface called Aero. Finally, the PC is going to take advantage of all graphics processing unit (GPU) power in a global way.

When run on a modern graphics board fully compliant with the DirectX 9, Shader Model 2 API, Microsoft's Windows Vista Aero interface displays almost none of the artifacts that create eye strain and fatigue. As a result, Aero has the potential to increase our overall productivity.

We will look into the ramifications of this new UI in this white paper and how users can get the most from this new operating system.

However, Windows Vista and the Aero interface will also make new demands on system resources in an unprecedented way. Previously, only applications such as advanced 3D games and high end visualization applications pushed display subsystems to the extent that Aero pushes its host computers.

***If you're planning on getting a new computer, you'd better make sure it has a good GPU in it if you want to future proof it for Windows Vista* – Jon Peddie**

Windows Vista Aero

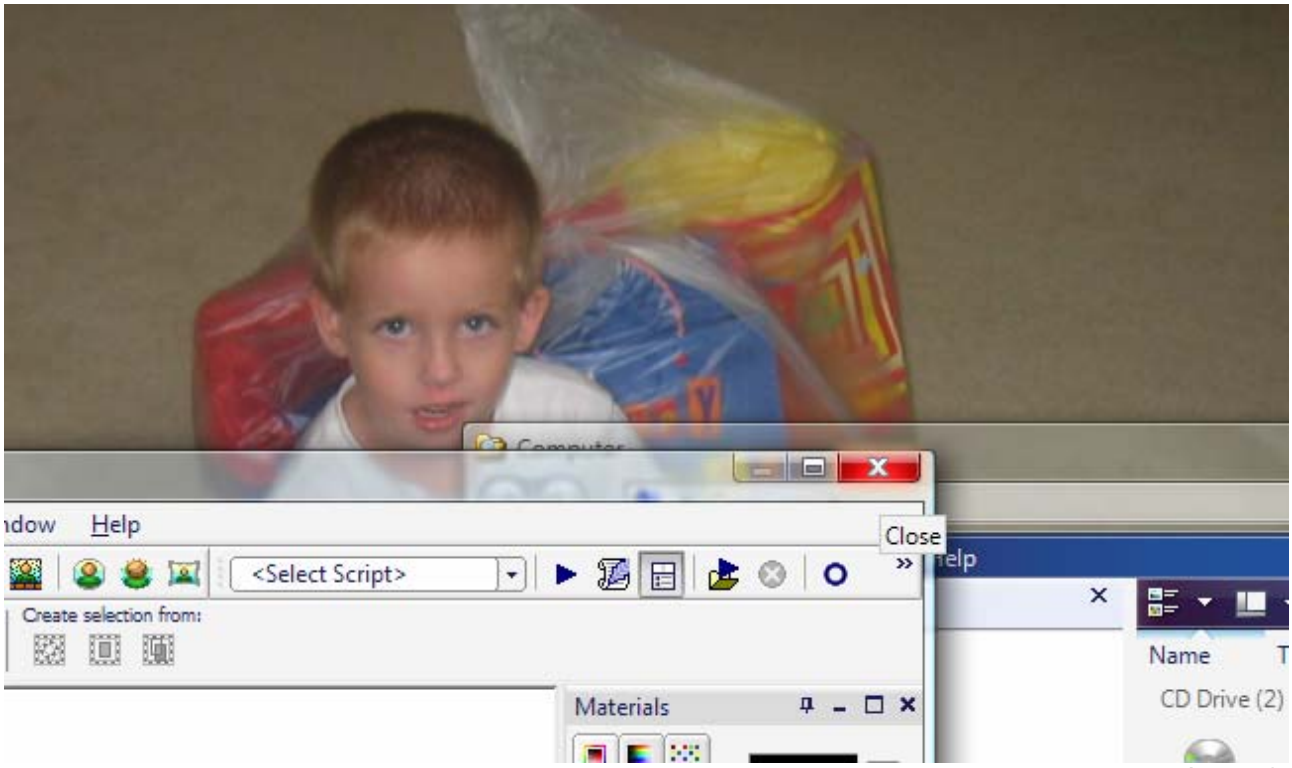
Windows Vista is Microsoft's first Windows operating system capable of gracefully scaling to a computer's hardware capabilities. All computers that meet the extensive hardware requirements will see the Windows Vista user experience, which provides the benefits of the refined interface features. But, computers with a full-featured GPU will be able to display the Aero interface, and be able to fully reap the benefits that Windows Vista delivers to consumers.

A new user interface

Windows Vista Aero provides spectacular visual effects such as glass-like interface elements that you can see through and dialog boxes that expand growing from small to large as if they were approaching the viewer.

Source: Microsoft

Figure 1: The signature "Glass" minimize, maximize, and close translucent window buttons



Source: Microsoft

Figure 2: An Aero interface

Windows Aero is an environment with an additional level of visual sophistication, one that is even more responsive and manageable, providing a further level of clarity and confidence to Windows Vista users. The Microsoft engineers and designers have spent years on the Windows Vista UI design project to bring the features of Aero to the mainstream. Aero, according to Kam VedBrat the lead program manager on the Aero team, stands for Authentic, Energetic, Reflective, and Open, so it is an acronym and not a just a cute name.

The Windows Vista theme has a handful of smaller user interface updates: redesigned Start menu layout, new explorer window layout, live icons, and updated wizard and dialog UI. Microsoft's user value proposition for Aero really breaks down into three pieces:

- Improved visual quality
- Better productivity when multitasking or when using high DPI displays
- An aesthetic design that is more streamlined, efficient, and professional

Graphics is the key – you need some power

Visual quality improvements come from eliminating tearing and painting glitches that Microsoft had in previous versions. Windows are rendered to surfaces instead of just the front buffer, and then they are assembled into a single scene on the front buffer by the desktop composition system – this is a key element and major differentiation of Windows Vista.

This means Windows Vista can present the entire desktop in a single pass at a rate synchronized to the v-sync of the display and eliminate tearing when moving a window around the screen. In the past, tearing resulted from Windows frame refreshes happening out of phase with the v-sync. When this happens viewers see half of each screen which looks like a tear.

To run the Windows Vista Aero experience, computers must have a powerful GPU with a new graphics driver that supports WDDM.

Additionally, because Windows Vista has essentially a "copy" of the last output of every window, it can use that copy as a texture for "filler" in situations where a window becomes unresponsive. So rather than seeing one window "erase" the window behind it (if the window in the back became unresponsive for some reason), you'd see the correct output of the window.

This also means Windows Vista doesn't have to page in the window behind it to do the work of painting the newly uncovered area, so you effectively have less context switching on the CPU and less paging which will result in some small performance wins as well. However, all this requires memory, specifically graphics memory.

To get the full Windows Vista experience, the graphics board needs a lot of memory (64 MB minimum for 10x7 displays, 128 MB minimum for 12x10 displays) and must support the complete DirectX 9 Shader Model 2 API.

Typically only graphics boards introduced since 2004 can meet these requirements, although some earlier high-end boards produced in 2002, can run Aero quite well.

The first thing you'll probably notice in Windows Vista Aero, is that the window buttons (minimize, maximize, and close) glow when the cursor hovers over them. According to Microsoft, Aero with glass elements provide the "full-fidelity Windows Vista experience." It is far more graphics intensive than the Aero experience without the shaders running.

DirectX 10 proceed with caution

Source: NVIDIA

Figure 3: A modern Windows Vista Aero capable graphics add-in card

DirectX's primary usage over the years has been to connect high-powered 3D intensive games with equally high-powered 3D graphics accelerator boards. Those boards, commonly referred to as AICs have a powerful graphics processor unit (GPU) and high-speed private memory called the

frame buffer. (Some of the AICs have frame buffers as large as 512 MB.) The presence of a GPU frees the CPU to do the tasks each processor is best suited for.

Pretty shady stuff

The GPUs are amazingly complex and effective multiprocessors with as many as 24 floating point processors in them, and able to execute 12 to 16 complex instructions over 500 million times a second. Some of those instructions are involved with creating the cinematic effects found in modern games like shadows, reflections, and skin tone. And those operations are called "shader" operations, so the floating point processors in a GPU are commonly called "shaders," and DirectX makes them available to the applications that need them – the application can "call" for the shader operations.

In Aero, shader calls render the translucent glass effects. If the GPU doesn't support shader model 2.0 or better it won't qualify. However, some companies present their products as being DirectX compatible and when there is a call for a shader operation, they pass it off to the CPU. This results in delays and interruptions and produces a slow jerky result on the screen. At the moment, it is a case of *buyer beware*. However, Microsoft is establishing a logo program, which will require AIC manufacturers to meet certain requirements in order to be able to list and label their products as Windows Vista Aero capable.

What's the difference?

In Windows XP, each application redraws the screen individually. If a part of the screen needs updating, whichever application is doing the updating simply draws over the top of it and sends the newly drawn image to the CPU for output. Windows has no memory of what was previously on screen before it was redrawn.

Aero uses the 3D hardware to do layer redraws on top of each other, off-screen (this is how 3D applications like game use off-screen render targets known as front or back buffers.) It's known as alpha plane composition and it's very demanding on processor facilities, as well as memory.

The use of the 3D hardware makes it possible to achieve composition effects that would be extremely slow otherwise. Translucency, for example, is the blending of redraw layers in the GPU so that the windows behind one another show through. Using this technique, windows can be faded in an out by changing their transparency level.

GPUs perform these types of scene composition operations, primarily for games, and are very fast and efficient at doing so.

Windows Vista Aero is the difference

It wasn't until the development of Windows Vista Aero that anything other than games and some high end graphics arts and CAD programs had universally tapped the horsepower in today's modern GPUs.

"The bottom line here," said Dean Lester, Microsoft's general manager for graphics and gaming, "is that Windows Vista is the start of a new era where the incredible graphics power inherent in Windows PCs will be harnessed to improve the user experience for every customer - DirectX is not just for gamers any more."

Better productivity

For a lot of customers, high-DPI displays are difficult to use because the pixels are so tiny that people have difficulty reading and clicking on things that are so small. Because Windows Vista uses desktop composition, it can actually use the hardware accelerated bitmap scaling to increase the size of things (e.g., icons, task bars, fonts, etc.) in a way that applications are unaware of.

Finally – Windows Vista has the aesthetic changes, which were motivated by the design project mentioned earlier (UI design project). This includes use of transparency so Windows Vista Aero can have larger (easier to grab/click/resize) window borders without making them feel "big and heavy" as they would if Windows Vista was forced to make them opaque. Windows Vista also has the animations, etc. which smooth out the experience, and really give it a more fluid feel for customers, when using the product.

No more jaggies

With the Windows Vista Aero compositor technology, the edges of characters and objects can be made smoother. This is done by filling in the pixels near the edges with slightly lighter or darker pixels to trick the eye into seeing a smooth edge. It's called antialiasing, or AA, and Aero, through the DirectX API takes advantage of the graphics board's abilities to perform such operations.

Windows Vista Aero uses the GPUs antialiasing within applications developed on Windows Presentation Foundation. However, the elimination of jaggies around icons and text doesn't come from using the GPU's AA. For icons, Windows Vista Aero generates the icons with an alpha channel and then blends it into the image through explorer to give it the smooth look. For text, Aero uses Microsoft's ClearType technology which is sometimes hardware accelerated using DirectX 9 pixel shader operations depending on where it is used (the window frames, and WPF applications do ClearType through pixel shaders, while older content, like win32 applications authored for Windows XP use the Windows XP ClearType path which is all software).

Weird angles

Windows and documents in Windows Vista Aero can be manipulated as 3D objects and tiled, moved or rendered in different ways from those we have now. Specifically they can be seen on an angle or tilted rather than just flat. However, in order to get the correct perspective, and be able to read the text as it angles away from the viewer requires some special pixel processing, and for those situations Aero uses the shaders and a technique called mip-mapping (which is the application of successively smaller copies of the image) to make features like Flip3D look better.

And more

In addition to the UI features discussed above, Windows Vista will reach into all aspects of the modern computer.

Every application

Hundreds of thousands of software developers have been enabled by Windows Vista OS tools and code foundations to easily create applications driven by the same high-performance GPU engine on modern AICs as Windows Vista. Therefore the Windows Vista Aero GPU experience extends possibly to every application being invented or updated all over the world for Windows Vista. The DPI sensitivity is but one example. All applications will have to be DPI aware now, and the all application will make use of the smooth ClearType fonts in Windows Vista.

The real thing that will drive the desire and adoption for newer and better graphics AICs will be the emergence of non-traditional applications that make use of the GPU to deliver newer and better customer experiences than were possible with straight software rendering.

HD

Probably one of the most often talked about new features in new computers will be HD (H.264, Blu-ray, HD-DVD.) There will be claims and counter claims about this, and Microsoft has said that Windows Vista will support HD-DVD natively, but not exclude Blu-ray. The demands on the GPU for HD will be enormous and no lightweight GPU will be able to handle it. So once again, people who are interested in HD need to include a powerful GPU in their systems to be ready for these new capabilities.

In short

Making things look nicer on the screen may not seem so important until you realize that many of us look at our computer's screen for six or perhaps as much as 16 hours a day every day. Anything that can be done to improve the efficiency (get more information on to the fixed and limited space), make it easier to read, and simultaneously more comfortable aids not only our productivity, but also reduces fatigue.

When we humans look at something, our eyes scan about and are particularly drawn to sharp edges and contrasted objects. Our eye then tries to focus those edges and objects, but relative to the scene. Jaggy lines, distorted perspective, and dramatically abrupt contrast changes fatigue the eyes and are the major reason many people complain about eye strain after working at the computer for a while. This is especially evident for people who have to read a great deal of text.

The Windows Vista Aero interface, when run on a modern GPU can eliminate most if not all of the display artifacts that create eye strain and fatigue and thereby increase our overall productivity.

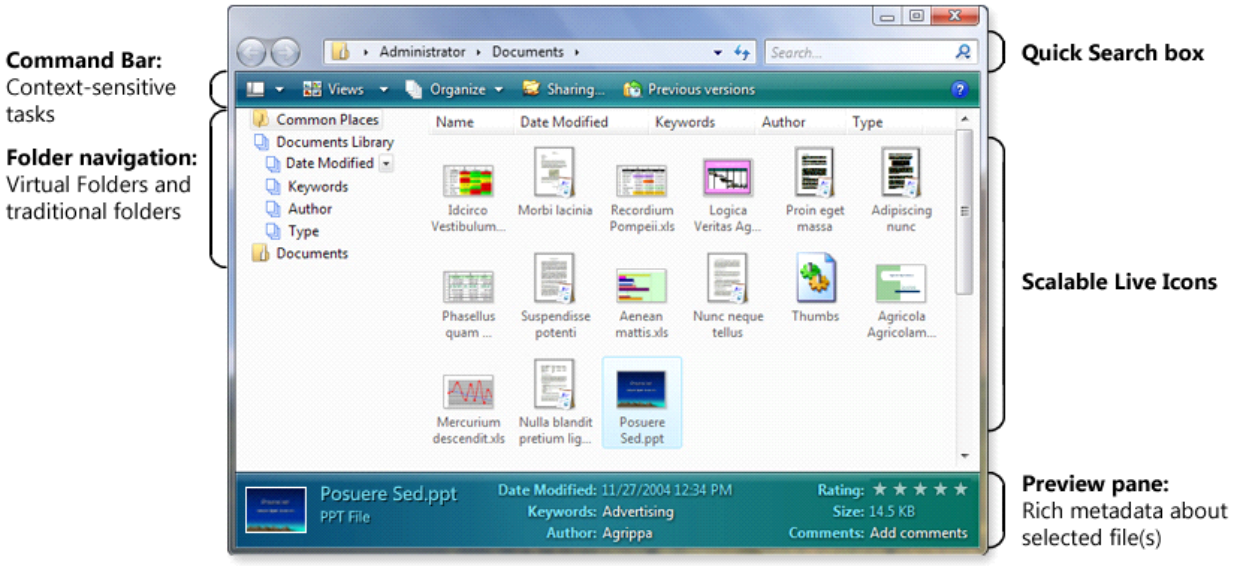
Windows Vista Aero with a modern powerful GPU doesn't just look better, it is better for you.

Looking at Windows Vista

To appreciate the new user interface of Microsoft's new operating system (OS), we offer this quick tour through Windows Vista.

At the core of Windows Vista is a viewer, which is currently being called Windows Vista Aero, and it's designed to make finding things and using things on the desktop easier, faster, and according to Microsoft, more enjoyable. Many of these features are only available to Windows Vista systems that have a GPU capable of running the full Aero experience and a premium version of the Windows Vista OS installed.

The Windows Vista Aero UI is more streamlined than XP's, but not so much so that things don't look or behave familiarly.



Source: Microsoft

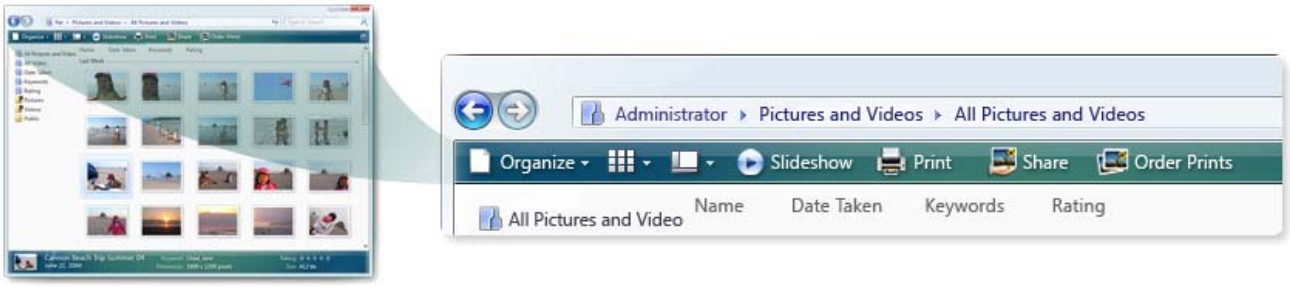
Figure 4: The opening screen of Windows Vista Aero

The new Explorers are easy-to-use tools for working with files consistently across Windows Vista. Explorers give users more information and control and simplify working with files. The experience is easy and consistent, whether browsing photos or documents or even using the new Control Panel.

The navigation pane contains the new Virtual Folders found in Windows Vista as well as traditional folders that have been created on the computer. Command Bars display only the tasks that are most appropriate for the files being displayed.

Icons galore

With new Live Icons (scalable thumbnails) used throughout Windows Vista, users can see the first page of documents, the actual image of a photo or the album art for individual songs in their music collection, this should be a useful aid in finding what they are looking for.



Source: Microsoft

Figure 5: Thumbnails are available for almost everything

Resting the mouse pointer over a taskbar item displays a live thumbnail of the window, showing the content of that window. The live thumbnail is displayed whether the window is minimized or not, and whether the content of the window is a document, photo or even a running video or process.

Windows Flip and Windows Flip 3D

Two new features to manage windows are in Windows Vista: Flip and Flip 3D. Flip allows users to flip through open windows (by using Alt+Tab), providing a live thumbnail of each window, rather than just a generic icon and file name. Live thumbnails make it easier to quickly identify the window wanted, particularly when multiple windows of the same kind are open.

Source: Microsoft

Figure 6: Flipping through Windows Vista windows

With Flip 3D, users can use the scroll wheel on their mouse to flip through open windows in a stack, and quickly locate and select the one they want to work with. This feature is even handier when used with the new Flip 3D key that manufacturers are adding to many keyboards.

Source: Microsoft

Figure 7: 3D view of windows Flip

Windows Vista itself detects, diagnoses, and helps users with common problems. But when incidents requiring support occur, Windows Vista provides centralized support tools and resources.

Don't touch me there

There's also a centralized Parental Controls panel in Windows Vista that provides a single location where parents can set the controls they deem appropriate for each of their children. Parents can designate certain times when their children are allowed to be on the computer, decide which applications their children are allowed to use, and restrict Web sites either by specific URL or the type of content included or restrict specific game titles. Parents can limit their children's play to games that are rated at or below a certain age level, or block any games with certain types of content they do not want their children to see or hear.

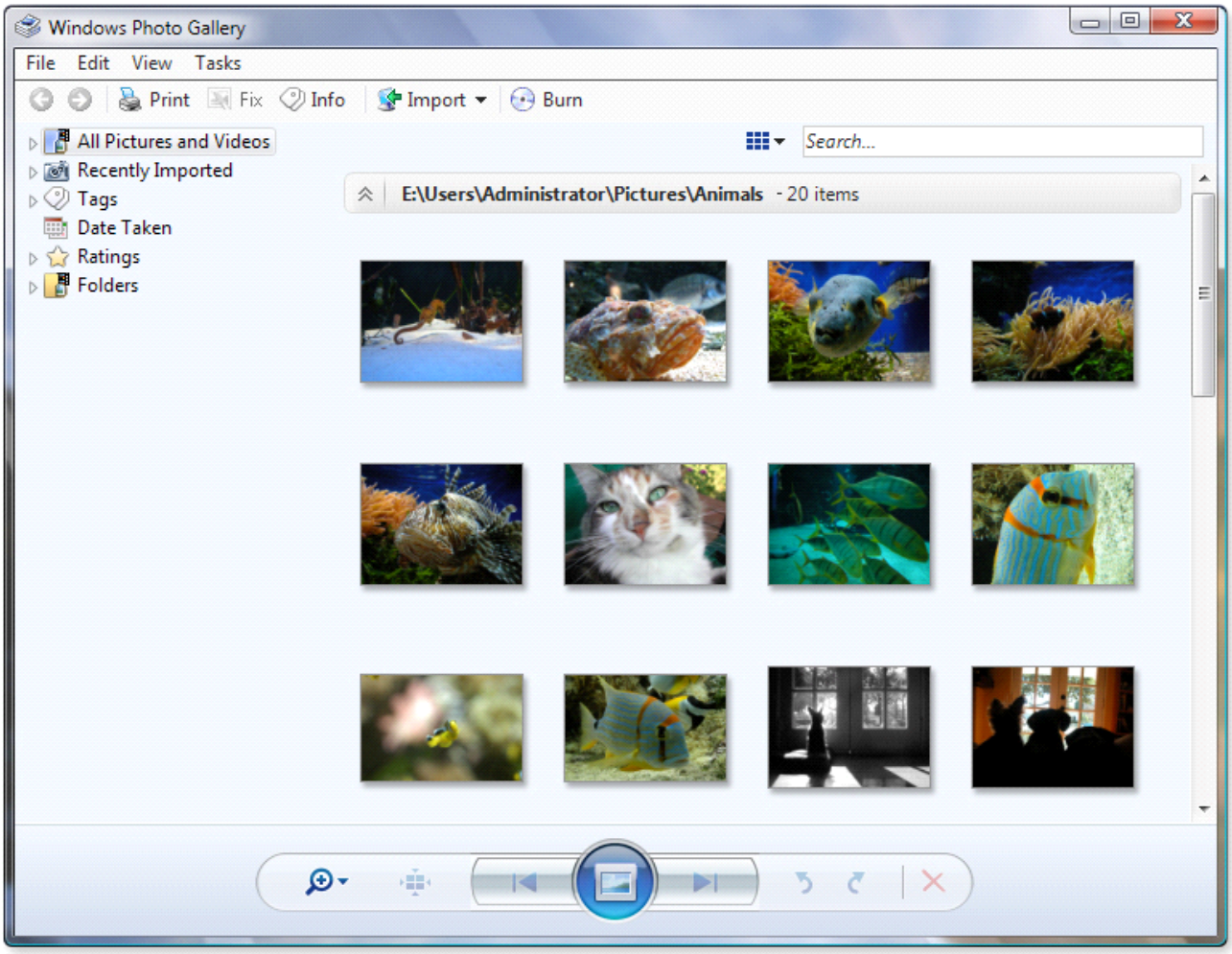
And, Windows Vista gives parents a detailed activity report that shows exactly what their children have been doing on the computer, including the games played, Web sites visited and applications used.

Who moved my mail?

Windows Mail includes a built-in Quick Search box that lets you search all of your e-mail almost instantaneously without leaving Windows Mail. Quick Search is not just confined to e-mail; this feature is available throughout Windows Vista. And there's a junk jail filter to help reduce the hassle of junk e-mail.

Photo Gallery

The Photo Gallery in Windows Vista provides a lot of tools for managing digital photos and videos. You can organize, find and view photos and videos, as well as edit, print and share them from within Windows Photo Gallery.



Source: Microsoft

Figure 8: The Windows Vista photo gallery

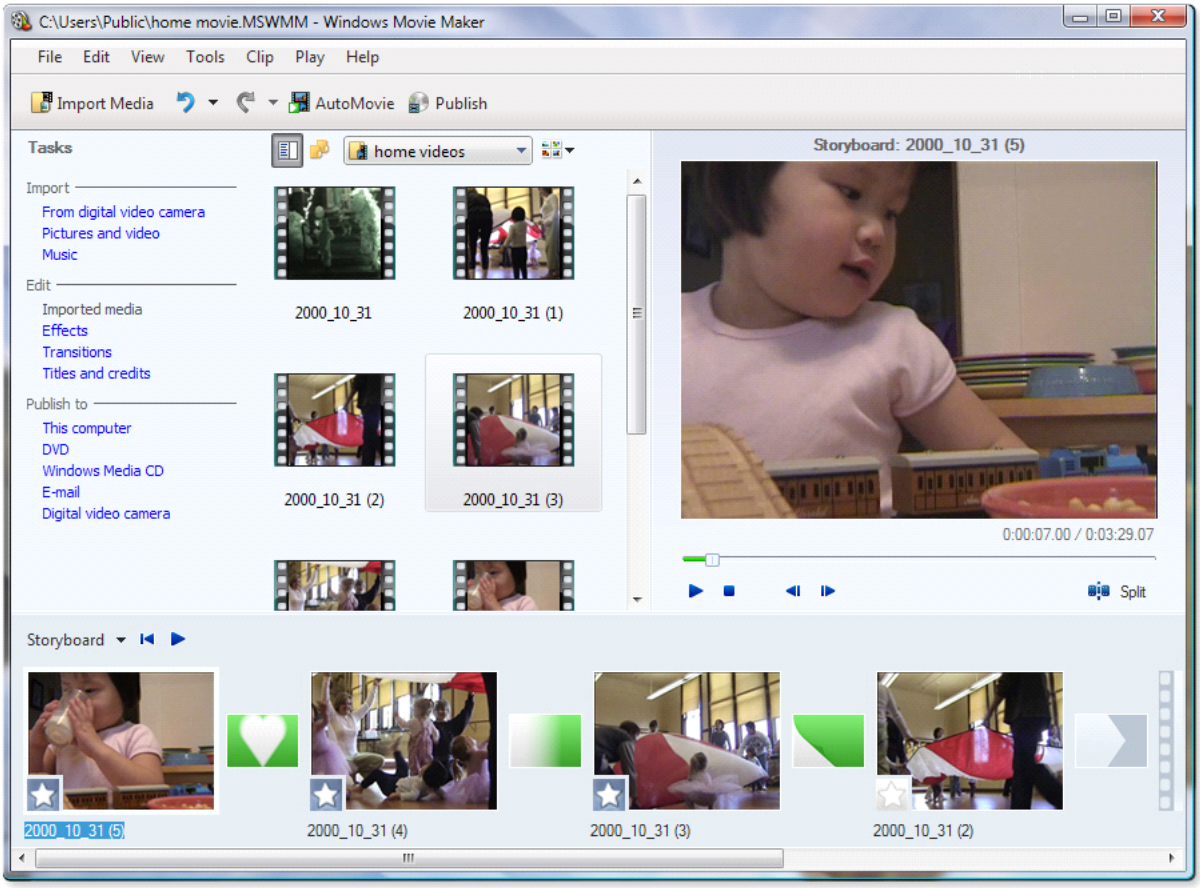
Meet me in the Library

The Media Library in Windows Media Player has been updated to maximize the management and playback of digital entertainment. Customizable album art and stacking views of the users' music collection coupled with improved artist, track and CD information help keep a music collection up to date.

To help users easily find what they want within their Media Library, Microsoft has added Word Wheel Search functionality. The Word Wheel dialog appears when you click a Word Wheel button on a search screen. The Word Wheel dialog then shows indexed information that you can search for. Best of all, users can access their Windows Media Player library from their Xbox 360 video.

Wanna make a movie?

With the new Windows Vista version of Windows Movie Maker, users can import, edit and organize their digital home videos. There are new tools to help manage and edit home videos including new effects, transitions and improved graphics performance. Then you can transfer the movie(s) to DVD. The transitions and effects in a movie are also assisted by the presence of a GPU.



Source: Microsoft

Figure 9: Movie Maker screen in Windows Vista

Media Center built in

Windows XP Media Center is now built into Windows Vista.

Source: Microsoft

Figure 10: Windows XP Media Center in Windows Vista

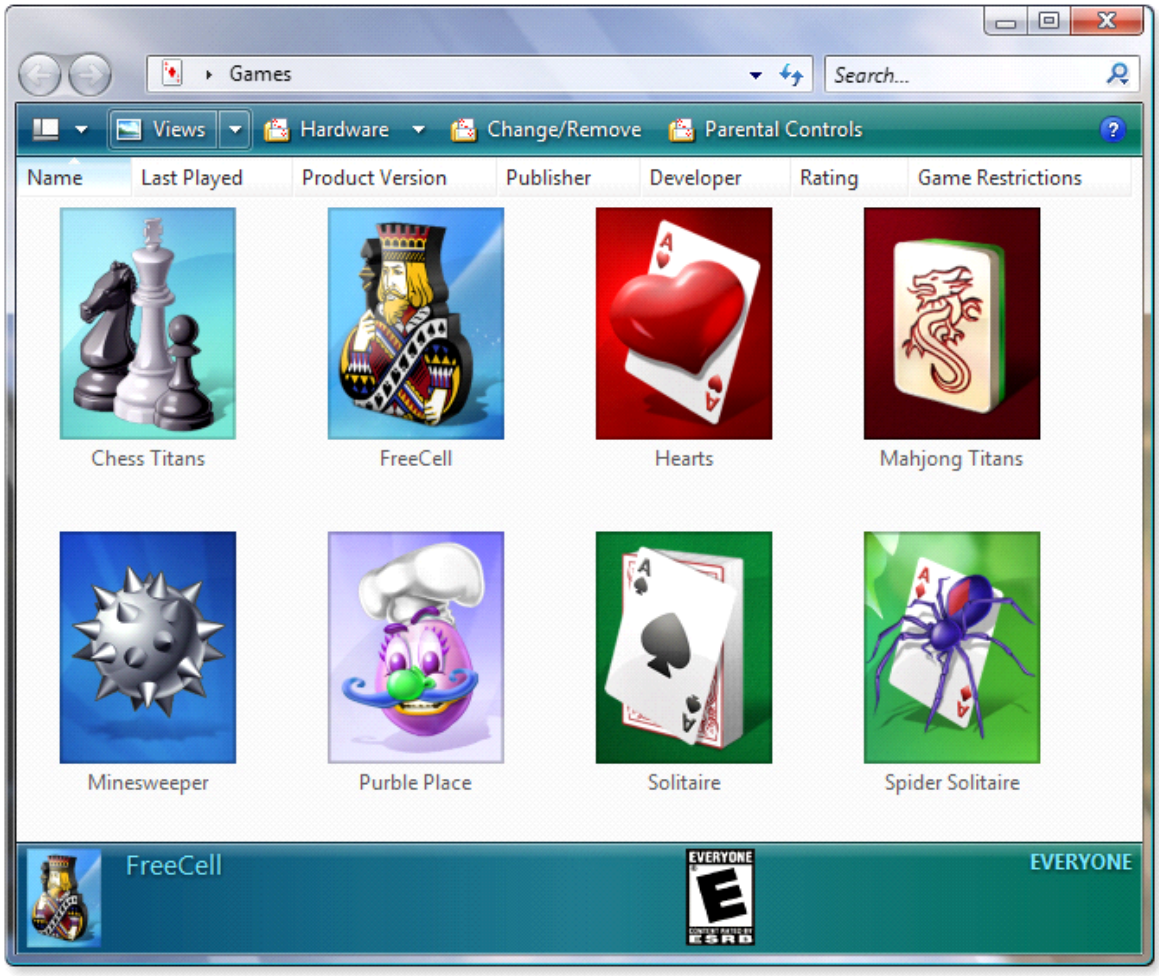
Enhancements for Windows Vista include expanded support for digital and high-definition cable TV, an improved menu system, new options for multi-room access to entertainment through Media Center Extenders, and new partner content offerings, services and applications.

Games too

Windows Vista includes some enhancements to improve PC gaming and make it easier to access, play and manage games.

The Game Folder, listed in the Start menu, offers a convenient list of all the games currently stored on the PC. Thumbnail graphics for each game provide easy access to the games the user might want to play, and also display detailed information such as the game publisher and developer, which version of the game is owned, the game release date, genre, and rating, and even when you last played the game.

Another new feature with Windows Vista is support for the Universal Controller, which allows gamers to use the same controller with both their PC and their Xbox 360 system. It is also likely that Microsoft will also offer wireless capability too (since it was such a big hit on the Xbox 360.)



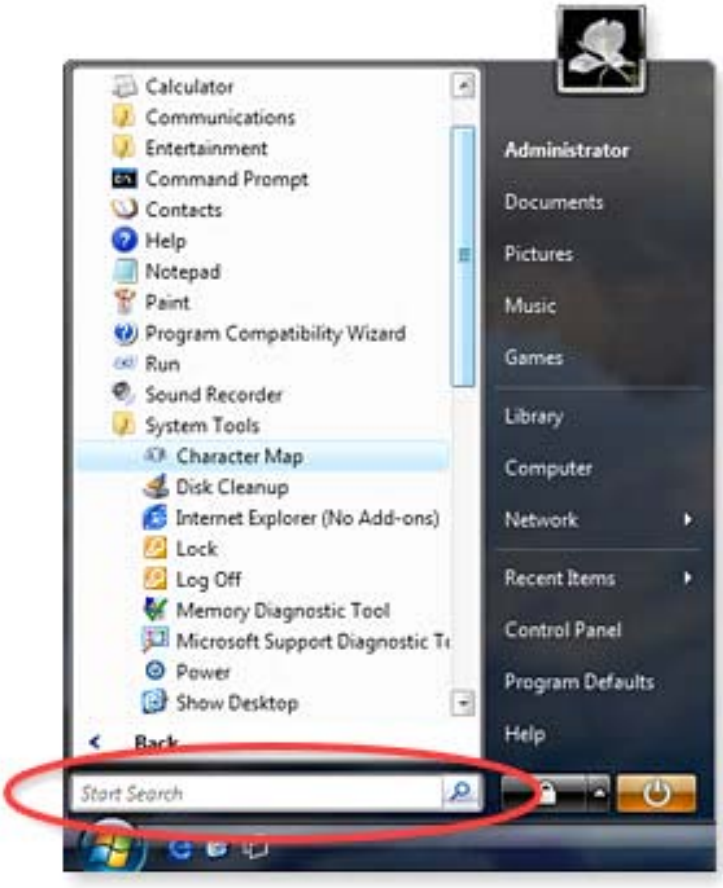
Source: Microsoft

Figure 11: The new Windows Vista game screen

Desktop Search

With Windows Vista, Microsoft says users will no longer have to remember where they store every file. Instead, to find a file, they only need to remember something about it, such as a word contained within a document, the artist of a song or the date a picture was taken.

Users can type a word, a phrase, a property or any part of a file name in a Quick Search box to instantly find the file that they want.



Source: Microsoft

Figure 12: New Windows Vista search screen

Windows Vista introduces Search Folders, a new tool that makes it easy to find and organize files. A Search Folder is simply a search that is saved. Opening a Search Folder instantly runs that saved search, displaying up-to-date results immediately.

SideShow

Laptop users know that it is sometimes impractical to open their laptop and start it up just to check a message or find an address or phone number.

Windows Vista SideShow enables the manufacturers of future laptop models to include a secondary or auxiliary display in their designs. This display can be used to easily view the critical information, whether the laptop is on, off, or in sleep mode.

Source Microsoft

Figure 13: Dual-display laptops

The convenience provided by these auxiliary displays will save time and battery life by allowing quick viewing of meeting schedules, phone numbers, addresses and recent e-mail messages without having to start up the laptop.

Windows Sidebar and Gadgets

As users rely on their computers to access more information, perform more tasks and interact with more software applications, they increasingly face information overload. It's not uncommon to open a Web browser just to check the weather, open an application to view a calendar and open a calculator program to simply add numbers.

In Windows XP you could get widgets for those functions from companies like Stardock with their DesktopX (www.desktopx.net), and of course Apple has had such things on the Mac for years.

In Windows Vista they will be built in, and are shown on the right side of the screen in the next photo.

Source: Microsoft

Figure 14: The Windows Vista built in gadgets and widgets

Windows Sidebar is a pane on the side of the Windows Vista desktop that organizes gadgets and makes them easily available. Microsoft adds that Windows Sidebar is the perfect complement to widescreen monitors. Users can customize the Sidebar to suit their preferred interactions

Zzzzzzz, say good night, Windows Vista

Sleep works in a different way on Windows Vista-based desktops than it does on Windows Vista-based laptops. When a Windows Vista-based desktop is turned off, all the documents, applications, and data that are currently in use are saved in two places. First, they are saved to RAM, where they are quickly accessible (in Windows XP this was called Standby). Simultaneously, the information is saved to the computer's hard disk (in Windows XP this was called Hibernate). In Sleep, Windows Vista simultaneously saves the current user information to both memory and to the hard disk.

In Sleep, Windows Vista uses the data saved to memory to allow faster restarts after extended periods of non-use.

The Sleep state uses the data saved to the hard disk to protect it in case of power loss. When a user resumes using the desktop after a power failure, Windows Vista will quickly restart from Sleep using the data saved to disk, with all of the data and applications intact.

On laptop PCs, Sleep state can be entered by pressing the Power button or simply closing the laptop lid. Data is saved to memory, allowing a faster resume. As battery power winds down, Windows Vista quickly transitions the data to disk, to help keep the data safe. Windows Vista delivers faster and more reliable resume performance than in previous versions of Windows.

Who can use Windows Vista?

In Microsoft's opinion, everyone should be able to run one version of Windows Vista or another (see next section for the various levels of Windows Vista).

In 2005, 63% of the 203 million computers shipped (desktop, notebook, and servers) were equipped with last generation integrated graphics controllers, just the opposite ratio from 2003; the turning point came in Q3'04 when integrated graphics hit parity with discrete graphics chips (GPUs) that are used on AICs.

JPR estimates there are close to a billion PCs in use today most of which are equipped with antiquated integrated graphics, or old fashioned AICs (without shaders).

Over 600 million PCs shipped in the last 3 years, and are still in service. These are the ones that are most logical to upgrade with the new Windows Vista operating system.

However, because of the low graphics performance of integrated graphics solutions found in most of the PCs, they will not be able to take advantage of the richness and benefits of the new Windows Vista Aero GUI and the graphics-based operating system would be unusable on most of them.

The simple solution of course is to add a modern graphics AIC, and we believe the add-in card suppliers are counting on that and predicts we will see big promotional campaigns to educate the users of this low cost solution for tapping into the power of Windows Vista Aero.

JPR found that there was $2.7 billion worth of add-in cards (AICs) sold in just Q4 of 2005, and almost $10 billion for the entire year. Windows Vista could, if the consumers get the message, raise that market value significantly in 2007 when it ships in full volume.

The levels of Windows Vista

In February 2006, Microsoft announced the product lineup of its Windows Vista operating system. The Windows Vista product lineup consists of six versions—two for businesses, three for consumers, and one for emerging markets—Windows Vista Business, Windows Vista Enterprise, Windows Vista Home Basic, Windows Vista Home Premium, Windows Vista Ultimate and Windows Vista Starter.

The number of offerings is the same as the number of offerings available for Windows XP just before the release of Windows Vista. And the lineup is designed to make Windows Vista applicable to a broad range of customers, tailored to meet specific needs of various segments of customers — home PC users, small and medium-sized businesses and the largest enterprises — and is aimed at bringing 64-bit, Media Center and Tablet PC functionality into the mainstream.

“We live in a digital world that is filled with more information, more things to do and more ways to communicate with others than ever,” said Mike Sievert, corporate vice president of Windows Product Management and Marketing at Microsoft. “The PC needs to give people the clarity and confidence to handle this ‘world of more’ so they can focus on what’s most important to them. With our Windows Vista product line, we’ve streamlined and tailored our product lineup to provide what our customers want for today’s computing needs.”

Windows Vista for Businesses of All Sizes

Business customers can choose from two versions that to meet their needs, based on the size and scale of their organizations:

Windows Vista Business

Windows Vista Business is for organizations of all sizes. For small businesses, Microsoft says Windows Vista Business will help keep PCs running smoothly and more securely so they are less reliant on dedicated IT support. For larger organizations, it will provide new infrastructure improvements that will save IT staff time. Some of the specific features of Windows Vista Business are:

- A new user interface, named Windows Vista Aero, will, according to Microsoft, deliver the most productive, highest-performing desktop experience possible. Windows Vista Aero will, when equipped with a powerful GPU, provide a professional-looking, transparent glass design, with subtle effects such as dynamic reflections and smooth animations, along with Windows Flip and Flip 3D desktop navigation features.
- In addition to these navigation improvements, Windows Vista Business makes it easier to manage huge volumes of business documents by integrating search throughout the operating system and providing new ways to organize files.
- Windows Tablet PC technology provides built-in handwriting recognition and enables interaction with the PC with a digital pen or fingertip instead of a keyboard.

Windows Vista Enterprise

To address the needs of large global organizations and those with highly complex IT infrastructures, Windows Vista Enterprise provides all the features in Windows Vista Business plus higher levels of data protection using hardware-based encryption technology. It will also include tools to improve application compatibility and will enable organizations to standardize on a single worldwide deployment image with the inclusion of all Windows user-interface languages. Windows Vista Enterprise will be available only to customers who have PCs covered by Microsoft Software Assurance or a Microsoft Enterprise Agreement. These are some of the specific Windows Vista Enterprise features:

- Windows BitLocker Drive Encryption helps prevent sensitive data and intellectual property from falling into the wrong hands if a computer is lost or stolen.
- Virtual PC Express is one of several built-in tools that improve application compatibility with previous versions of Microsoft operating systems. Virtual PC Express enables a legacy application to run unchanged on a legacy Windows operating system in a virtual environment on top of Windows Vista Enterprise.
- Subsystem for UNIX-based Applications enables users to run UNIX applications unchanged on a Windows Vista Enterprise-based PC.

The new user interface Windows Vista Aero is also available in this edition of Windows Vista, for those enterprise systems equipped with the proper GPUs.

Windows Vista for the Home PC User

Consumers can choose from three versions that promise to deliver new experiences for the home PC user:

Windows Vista Home Basic

Windows Vista Home Basic is expected to be the choice for homes with basic computing needs. For consumers who want to simply use the PC to browse the Internet, correspond with friends and family through e-mail, or perform basic document creation and editing tasks, Microsoft says Windows Vista Home Basic will deliver a safer, more reliable and more productive computing environment than previous systems. It will provide new tools and technologies for making the PC more secure and enjoyable, including features such as a new Search Explorer, Sidebar and Parental Controls. Consumers, Windows Vista Aero will not be enabled in this version

Windows Vista Home Premium

Windows Vista Home Premium will help consumers use mobile or desktop PC functionality more effectively while enabling the enjoyment of new, digital entertainment experiences. Windows Vista Home Premium will contribute to every aspect of digital entertainment experiences, including photos, video, TV, movies, music and games. Windows Vista Home Premium includes everything in Windows Vista Home Basic, along with additional features and enhancements such as the following:

- The new Windows Vista Aero user interface.

- Integrated search throughout the operating system, helping customers easily organize and quickly find large collections of documents, pictures, movies, videos and music.
- Windows Media Center capabilities turn the PC into an all-in-one home entertainment center. Consumers can use Media Center to record and watch TV shows (even high-definition TV) and access new kinds of online entertainment content. It also provides the ability to connect Windows Vista Home Premium to Xbox 360, extending the Media Center experience to multiple rooms in the home.
- Windows Tablet PC technology, which enables interaction with the PC with a digital pen or fingertip instead of a keyboard.
- Integrated DVD burning and authoring allows users to seamlessly burn personal videos photos and files to video or data DVDs, and easily create professional-looking DVDs from home movies that can be shared with family and friends.

Windows Vista Ultimate

Windows Vista Ultimate is the edition of Windows Vista that has it all. It is the first operating system that brings together all the entertainment features, mobility features, and business-oriented features available in Windows Vista.

All new versions are available for either 32-bit or 64-bit systems, depending on the needs of the customer. Windows Vista Home Basic, Home Premium, Ultimate, and Business will be available as a full-packaged product at retail and on new PCs. Windows Vista Enterprise will be offered only to business customers participating in Microsoft's Software Assurance program.

Microsoft also will offer Windows Vista Starter in emerging markets. Windows Vista Starter is for families and entry-level PC users in these markets to experience the world of social and educational benefits that personal computer technology and the Internet makes possible. A 32-bit operating system designed specifically for lower-cost computers, Windows Vista Starter enables popular beginner PC activities and provides an easy-to-use and more affordable entry point to the Windows Vista family of products.

Hardware requirements

Microsoft has released some preliminary specifications for Windows Vista Hardware requirements for those wishing to upgrade to Windows Vista and have the full Aero experience. Some of the more important requirements include:

- Motherboard: ACPI-compatible firmware is required
- Memory: At least 512 MB of system memory
- Graphics Card: A DirectX 9 compatible GPU that is capable of supporting WDDM
- Hard Drive Space: At least 1.5 GB for installation files, possibly more, depending on the version of Windows Vista

The requirements are higher if you want to run the full Windows Vista Aero experience.

Further, any Windows Vista-ready system has to offer protected high-definition digital content, such as next-generation HD DVD movies. According to some reports, HD movies are intentionally blurred unless they are viewed on a High-Bandwidth Digital Content Protection (HDCP)-compatible monitor. A Microsoft official allegedly confirmed this, saying: "Current computer monitors will work with high-value content, although the resolution of displayed images might be lower than what you might get with a protected monitor link."

The Windows Vista graphics requirements are defined in relation to the different desktop experiences.

Aero is the full Windows Vista desktop experience. Built on the new Desktop Compositing Engine, it adds support for 3D graphics, translucency, animation and other visual effects.
The average Windows Vista configuration will likely include:

- Graphics card with a mainstream or high-end GPU.
- 64 MB of graphics memory is recommended for 1024x768 displays and 128 MB is recommended for 1200x1000 displays. The requirements are even higher for systems that support multiple monitors or higher resolutions.
- At least 32 bits per pixel.
- 3D hardware acceleration with capabilities equal to DirectX 9 Shader Model 2.
- A memory bandwidth of 1.8 GB/s, and as much 8 GB/s can be supported.
- A graphics card that uses AGP 8X or PCI Express 16X 8-lane bus.
- Windows Vista Display Driver Model (WVDDM) Drivers.
- A modern CPU.
- A minimum of 512 MB of system memory. All integrated graphics solutions will need 1 GB of main system memory.

However, since, most dedicated GPUs now are DirectX 9 capable, most everyone should be able to enjoy the basic features of Windows Vista.

Conclusion

Windows Vista will be the biggest change in PC computing since the introduction of Windows 3.1 in 1992. The steady improvement in PC performance driven by Moore’s law reflected in faster CPUs, amazingly powerful GPUs, large capacity fast, yet affordable memory and hard disks make a modern PC look better than a super computer of just a decade ago, and yet sells for about the same price or less as PC did a decade ago.

Windows Vista brings all these developments together and exploits them to the user’s benefit. It has been a long standing lament about all the unused computing horse power we have. Now Windows Vista taps into that horsepower and makes great use of it.

We think Windows Vista will change the landscape for PC computing, inviting new applications, and making operating easier for all.