# Digital Video Computing and Microsoft(R) Video for Windows(tm)

## Backgrounder

The Open, Scalable, Consistent Way
To Implement Digital Video Computing

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**Summary**
In today's world, success demands an ability to gather, assess and present information and ideas. Easy-to-use graphical operating systems and powerful productivity tools that allow personal computer users to manipulate text and graphics have begun to fill this need. The addition of video into the digital world further enables businesses and individuals to get the right information at the right time in a form that they can effectively use. Video has the ability to convey more information, more accurately than text, graphics or still pictures alone. It is also a more engaging and exciting way to communicate. Video in a digital format is even more powerful because it can be easily captured, edited and played back on today's computer systems and integrated into a wide variety of applications. The technology to bring digital video to mainstream computing is here today. The Microsoft(R) Video for Windows(tm) architecture extends the Windows(tm) operating system and enables businesses and individuals to play back video clips and incorporate digital video in a wide variety of today's shrink-wrapped applications. In addition, Microsoft Video for Windows allows users to capture and edit video sequences. This backgrounder will examine:

* Video as a means of communication

* The advantages and power of digital video

* The market for digital video

* Microsoft Video for Windows as a solution for bringing digital video to the mainstream

* Digital video and Microsoft's vision of multimedia computing

**Making Communication More Effective with Digital Video**

A 1992 study by Market Vision found that 43 percent of corporate executives surveyed found their business meetings boring, and 40 percent acknowledged that they'd fallen asleep during business presentations. The same study found that the most effective presentation aid was video. Video is an effective communication medium because it combines both moving pictures and sound. If a picture is worth a thousand words, then a few minutes of video is worth more than a thousand pictures. According to a 1991 study by Inteco Corp., video presentations can cut a meeting's time by 40 percent -- and boost audience retention of information by up to 38 percent.

These findings have broad implications for business communications. They suggest that video can be a useful tool for a range of business uses, including:

* **Business communications.** Multimedia slide shows, electronic product brochures, video product demonstrations, video e-mail, video reports and memos and other tools can be used in sales and marketing applications, staff presentations, corporate communications and advertising. Some of these applications leverage casual video, the type of video that's captured "on the fly" during customer research, staff meetings and tours of manufacturing areas. With Video for Windows, this casual video can now be easily included in reports, presentations and other communications. For example, clips of focus group sessions can be integrated into market research reports, giving greater credibility and urgency to user comments. Professional or produced video can also be incorporated into business communications, including formally produced product demonstrations and customer testimonials for a product brochure.

* **Education and interactive training.** Employee orientations, human resources updates, electronic employee newsletters and safety training courses can all benefit from interactive, user-directed video. Some of these examples might include formal video, the type of video that's carefully and professionally produced. A video message from the chairman, for example, might be embedded in employee newsletters or orientation sessions. Sophisticated animation might be included in employee health and safety materials to explain complex issues or procedures.

* **Technical documentation.** For those users who have suffered through hundreds of pages of user manuals, interactive manuals including video will be a tremendous improvement. Such manuals -- an extension of the context-sensitive help already available in the Windows operating system and other software products -- could be used in service and repair applications. For example, an airplane mechanic could view a video clip contained in an online version on the plane's technical documentation to see and hear how to repair a certain part of the plane.

* **Information delivery.** Authors, animators and other creators can use video as another medium to deliver their ideas and information. Video has long served this use, but as it becomes easier to use and more accessible to more authors, it will become an increasingly popular tool. Also, digital video can be easily mixed with text, graphics and other data types to suit the needs and interests of authors and audiences. Already, college "courseware" takes the place of traditional textbooks in come classes; these interactive software textbooks, which include video, are created by professors, not by software engineers. Reference works, such as travel guides and directories, are obvious candidates for video versions. But fiction books can also get the interactive video treatment. The result will mix the traditional novel with the interactive video game.

**Making Digital Video Computing Possible and Practical**

Text, numerals and graphics have long been available to users to manipulate because of their conversion to digital data. Digital data now extends to other forms of information, including audio and video.

Audio is no longer limited to capture and preservation as a series of tones and pitches in analog form. Photorealistic, moving images are no longer limited to capture and preservation as a complex series of shapes and colors in analog form. Each can be converted into digital data, which opens up new opportunities to manipulate them.

More than one million PCs are now equipped with sound boards, and the installed base is growing rapidly, proving the market success of digital audio technology. By converting audio information into bits and bytes, computers make it far easier to capture, edit, manipulate, store and play audio information back. The same technology is now being applied to video.

Digital video computing gives users a host of advantages over analog video, the video of television, VCRs and camcorders. For example, with digital video:

* searching is facilitated by fast, random access

* copies can be easily reproduced with no loss of image clarity

* interactivity is optimized

* images can be easily and fully manipulated

* rapid transmission is possible across local and wide area networks

Taken together, these advantages add up to video that is far easier to edit, use and update than ever before. Ease of use also translates into far lower cost, which will make it accessible by mainstream users.

The potential for digital video, with broad acceptance as a productivity tool, is huge. The total market for digital video could grow to $50 billion toward the end of the decade, with the PC-based segment of this market accounting for about $20 billion, according to the investment banking firm Morgan Stanley.

Microsoft sees digital video being used differently by two sets of users within the PC segment. A broad set of users only require capabilities sufficient to play back video sequences and to manipulate them in basic ways (e.g., paste a pre-produced video sequence into a presentation, spreadsheet or word processing document). A second set of users wants powerful capabilities to create video sequences for use in all of the application areas mentioned above. A digital video solution must therefore be scalable to meet the needs of all users and support the range of platforms on which users work, from 386SX and 486 machines to personal RISC-based workstations.

**Technology Requirements for Digital Video**

Full color, full motion video contains a tremendous amount of information; each second of video can require 27MB of data. So, one of the key enablers of the digital revolution is increasingly powerful microprocessors that can handle a large amount of information.

Those microprocessors, both as CPUs and coprocessors, are available and popularly priced and advancements in processor technology are reaching users at an accelerated pace. High-end, 486-based chips that are four to five times faster than 286 chips, which represented the high-end of the market just five years ago, are gaining increasing market share. Even more powerful x86-based chips will come on the market in the near future and powerful reduced instruction set computing (RISC) chips are already here. Originally intended for engineering and scientific applications, RISC chips are also showing up in "personal workstations" and peripherals (e.g., color printers) for general business use.

Hardware covers just one set of requirements for digital video, another is software. Compression techniques that make video file sizes manageable must be available. To overcome the problems caused by the massive size of video files, vendors and industry groups have devised various methods that compress data. These methods delete redundant information from images, store them in short-hand form, and then expand them for display and use. But these methods -- called codecs for compressor/decompressor -- vary in how, and how much, data they compress and in their suitability for various applications. Software-only methods, for example, make it easy to distribute video content. Full frame methods are appropriate for video editing.

**Microsoft's Vision for Digital Video Computing and Multimedia**

Digital video computing is a key component of Microsoft's larger vision of multimedia computing, which includes video, audio, animation, graphics, text and other digital data types. Microsoft's goal is to extend personal computing with multimedia to increase the productivity of business and organizational users, and enhance the flow of useful information among PC users.

Multimedia computing brings the right information to users in a form that they can use more

effectively. It enables users to access, create and manipulate the types of information they want -- whether it be text, graphics or video -- in ways that are more intuitive and useful. Combined with robust browsing systems, multimedia brings the right information to users at the right time and allows them to interact with more useful -- not just more -- information.

**Microsoft Supports Digital Video Computing Today**

Microsoft makes this new vision of personal computing a reality today for millions of PC users. Key elements in this strategy are the Microsoft Windows operating system and Video for Windows.

Windows supports multimedia and digital video computing through a range of system elements, including:

* The object linking & embedding (OLE) technology that lets users insert multimedia elements, including digital video, into more than 150 business productivity software programs is already in widespread use, including Microsoft Word, Microsoft Excel and applications from third-party vendors.

* The Media Command Interface (MCI) allows all Windows-compatible application software to control a variety of multimedia devices, including CD-ROM drives, audio and animation players. The Digital Video-MCI (DV-MCI) command set, designed by Intel and Microsoft, supports digital video computing.

* Audio Video Interleaved (AVI) is the file format for digital video under Windows. The file format itself is designed to be cross-platform compatible, allowing content on Windows-based systems to play on other operating systems as well. Files that have the .avi extension are AVI files and the audio and video information contained in them can be accessed, manipulated and preserved by the full range of Windows-compatible hardware and application software.

To more fully support digital video computing, Microsoft has defined two new interfaces, the video capture interface and the installable codec interface. These interfaces provide hooks to enable third party products, such as capture boards and compression/decompression algorithms to work seamlessly in the Windows environment.

**Video for Windows: A Closer Look at How it Works**

Video for Windows is Microsoft's solution for bringing digital video computing to the mainstream. The software is based on the AVI file format. Video files are conceptually similar to traditional movies. They contain frames of image data that are displayed sequentially and played concurrently with a soundtrack. In a video file, audio and video data are stored together. The term "interleaved" refers to the way video and audio data are alternately stored in a video file.

Video for Windows is a practical solution for bringing digital video to businesses and other

enterprises:

* Digital video clips can easily be incorporated into existing applications, because the Video for Windows architecture supports OLE and is based on the Windows operating system familiar to millions of users. With OLE, users can include video clips into more than 150 existing OLE-compatible software applications, including presentation graphics packages, word processors, databases and spreadsheets.

* Video sequences always appear their best because in the Video for Windows architecture a video sequence automatically takes advantage of all the capabilities of the system it is played on, including: color depth; the richness and range of colors available; perceived smoothness; the number of frames per second the computer can display; and, if special hardware is available, image size. These tradeoffs are called scalability. For example, users at an advertising agency benefit from scalability because a production manager, whose primary interest is content, can view the small image of a digital video clip on a low-end system, while an art director, whose primary interest is image quality, can view the same video clip on a high-end system that provides greater image quality.

* It's easy for third-party developers and end users to work with the Video for Windows architecture because it is an extension of Windows. The Video for Windows architecture uses the same programming model as Windows and supports industry standard file formats and interfaces.

* Any Windows-based user with a 386 PC or higher can play back digital video because the basic playback components are built into Windows. Users that want to edit digital video only need to purchase the Video for Windows product, for a suggested retail price (SRP) of $199. Users who want to record and create digital video sequences, will need the Video for Windows product and a hardware capture board, which are available starting at an SRP of $350.

**Video for Windows and Other Digital Video Software Alternatives**

For corporate users considering digital video technology, there are currently two choices, Microsoft Video for Windows and Apple(R) QuickTime(R). Video for Windows offers several advantages not available from QuickTime.

Video for Windows is an extension of the Microsoft Windows operating system. It will play on all Windows-based products, from consumer electronics to desktop computers and personal workstations to high-end servers. As an extension of the Windows operating system, it also supports OLE, and is therefore automatically compatible with more than 150 OLE-aware applications. In contrast, QuickTime video is only supported by those applications specifically rewritten by their developers to include QuickTime APIs.

Another advantage is scalability. Video for Windows offers a compression solution -- Intel(R)

Indeo codec -- that supports scalable playback across both software-only and hardware-assisted systems. Video for Windows will automatically adjust to the capability of the machine it is being played on. It scales seamlessly from low-end computers running modular windows to high-end 486 and RISC-based machines running Windows NT.

Another advantage is flexibility for developers and end users. Video for Windows supports a broader range of scalable compression schemes, including hardware and software, as well as software-only compression. For users, this support means greater choice in adopting compression technology that meets their particular application and platform needs.

The two approaches have the same software only playback quality level of up to 320x240 pixel resolution at up to 24 fps playback.

**Windows: Digital Video and Multimedia**

The Windows family of products -- Modular Windows(tm), Windows 3.1, Windows for Workgroups(tm) and Windows NT(tm) -- support platforms ranging from consumer electronics, palmtops, pen computers and personal digital assistants, up through notebooks and standalone PCs to Intel workstations, RISC workstations and entire network-based systems.

Video should be available for all these platforms -- and with Windows, it is. With Windows, users do not have to worry about which flavor of video-compatible PC they must use to play a particular video sequence. Because all Windows-based products support OLE, MCI, AVI and the other architectural elements of video and multimedia, users can create and playback digital video sequences on any of these platforms, and use them interchangeably.

Scalability offers special advantages in the workgroup environment. Highly cost-effective solutions for enhancing communications with digital video can be developed that can include low-cost playback capabilities at every seat with relatively more expensive hardware-assisted capture stations being centralized for groups of workers. This enables users to adopt Video for Windows for use in e-mail, database and other network-wide applications.

**Additional Microsoft Support for Multimedia**

An open, scalable operating system is just one of the keys to the successful adoption of multimedia by mainstream users. In addition to Video for Windows, Microsoft offers two tools that make it easier to create and use sound and video in productive ways:

* The Microsoft Windows Sound System -- an audio board and software application. The Windows Sound System takes advantage of the audio capabilities of Windows 3.1. Designed for business users, it offers capabilities that can boost business users' productivity and help them to communicate more effectively with co-workers, including the ability to import sound clips into all OLE-aware applications. The Windows Sound System also lets users create audio that's synchronized with digital video in complete sound-and-motion sequences. It can be used to input audio tracks in AVI files.

* The Visual Basic(tm) programming system with Professional Toolkit for Visual Basic -- Microsoft's highly successful Windows programming system includes tools and controls that let programmers access Windows features including multimedia, pen computing and OLE. This allows developers to quickly create powerful Windows-based applications ranging from pen-based laptop communications to specialized business productivity programs and data intensive, multimedia titles. Visual Basic can be used to include digital video in all of these types of applications.

Video for Windows and the Windows Sound System are both compatible with the industry standard MPC specification for multimedia computing, and work in all MPC-compatible systems. That's because the Windows operating system, for which they were created, is the central software component of the MPC standard.

**Evolution of Video Computing**

Digital video is already a highly effective tool for business communication. Nevertheless, this technology will make major strides in the months and years ahead.

Software-only solutions represent a great entry point into digital video. These solutions offer an inexpensive opportunity to incorporate digital video in all types of communications. There is a trade off as software-only video generally plays back at lower resolutions, frame rates and color ranges. Software-only playback may be of lower quality than television or even home camcorder video, but for those who need resolution at TV quality, hardware-assisted video -- which permits higher resolutions, frame rates and color ranges -- is available. Hardware-assisted video, like Intel Indeo technology, makes full-motion, full-screen video sequences possible. It scales seamlessly from software-only to hardware-assisted solutions. This higher quality comes at a higher cost.

Digital video computing technology will not stop there. Powerful processors are already present as CPUs on the motherboards of many PCs and processors will become increasingly powerful and inexpensive as new x86 chips and RISC chips are brought to the business market. These chips -- used instead of add-in coprocessors -- will eventually provide "native CPU support" for digital video, offering the needed hardware-assist with little or no additional processor cost.

Digital video will be added to PCs in the same way as many other functions. For example, graphics processing -- once limited to coprocessor boards -- now exists on many motherboards in the form of graphics chips. Some vendors have begun to replace add-in audio boards with motherboard support. Video will follow this course, too.

**Conclusion**

Digital video computing will change markedly in the years ahead, but with Microsoft Windows and Video for Windows-based software, the technology and products based on it are a reality today. They can be used in real-world applications today, including business communications, education, interactive training, technical documentation and information delivery.

With Video for Windows, Microsoft is taking a leadership role to help ensure that digital video becomes an accepted and successful reality in the computing marketplace. Microsoft is accomplishing this goal by ensuring that an extensible Windows architecture will support a scalable range of video options today -- and tomorrow.

Founded in 1975, Microsoft (NASDAQ "MSFT") is the worldwide leader in software for personal computers. The company offers a wide range of products and services for business and personal use, each designed with the mission of making it easier and more enjoyable for people to take advantage of the full power of personal computing every day.

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