

THE DIGITAL AGE

We live in a digital age. Computers are part of our everyday lives. Technology surrounds us. We surf the Net. We talk on cell phones. We watch digital cable, or use cable modems. We have satellite dishes attached to our homes, which beam signals into outer space when we want to change a television channel. We pause live TV to stop and answer the door, and then push a button to pick up watching right where we left off. We even go to the movies and watch films with virtual actors. The world as we know it is changing. It's going digital.



figure | 1-1 |

DVD players are one of the most popular consumer electronics products of all time.

Today, you can walk into Blockbuster Video and rent a movie on DVD. **DVD**, or **digital video disc** (sometimes called digital versatile disc), is a storage medium that will hold gigabytes of information on a single disc. It has enough space to include an entire feature-length film with superior picture quality and sound, not to mention lots of extra footage!



figure | 1-2 |

Many movies, both old and new, are now available on DVD.



figure | 1-3 |

The DVD, or digital video disk, will eventually replace VHS videotape technology.

DVDs are the latest in a series of advances in digital video technology. They also mark the dawn of a new era, one in which video will change forever. Like the demise of 8-track tapes and LPs in the audio world, video will also evolve to take advantage of new technologies. Someday DVDs will replace VHS tapes, and someday is coming sooner than you might think.

DIGITAL VIDEO, DV

Digital video technology is hot right now. In addition to the DVD craze, everybody wants to learn how to connect their new digital camcorder to their computer and edit video. But not so long ago, this concept was a revolutionary one. Video and computers used to be two very distinct technologies. When the television and the computer were each created, no one anticipated they would one day merge. But that's in fact what did happen. Slowly each field began to overlap a little more. Now you can surf the Internet on your TV, or use a computerized **DVR**, or **digital video recorder**, to record hours and hours of programming without videotape. Video has evolved into **digital video**, or **DV**. But in order to truly grasp digital video, we must first understand traditional video technology.

So just how is a video image actually recorded? Video cameras use **CCDs**, or **charge-coupled devices**, which are computer chips that convert the optical images into electrical impulses. Traditional video uses an **analog** signal, which is an electrical signal that fluctuates exactly like the original signal it is mimicking. Digital video converts the analog signal into binary form, which is represented by a series of zeros and ones.



figure | 1-4 |

The Matrox RTMac converts analog video into digital video.

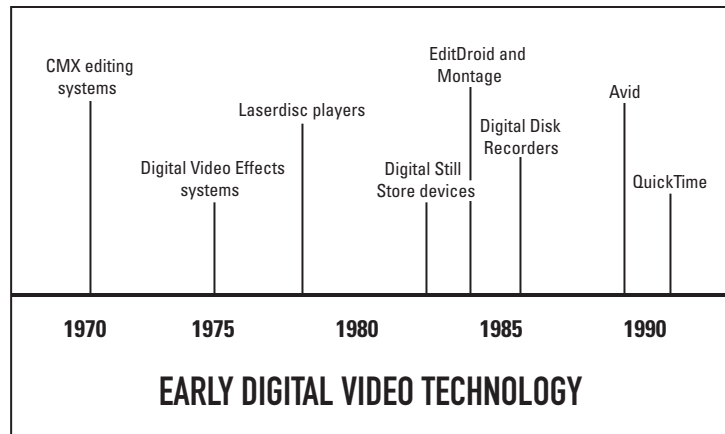
| TIP |

Don't confuse a **video card**, which converts analog video signals into digital video signals, with a **graphics card**, which is used to support the video display of a computer monitor.

HISTORY OF DIGITAL VIDEO

Digital video technology exploded in the 1990s and is now in full swing, but it really began its metamorphosis much earlier. In the 1970s, frames of analog video were converted into digital form and altered for special effects. These **digital video effects systems**, or **DVEs**, were pass-through devices and the frames were not actually stored in memory. In the early 1980s, **digital still store devices** (**DSSs**) were capable of storing and recalling individual video frames. In the mid-1980s, **digital disc recorders** (**DDRs**) were able to both play back and record images at the same time. All of these older technologies contributed to the evolution of digital video.

figure | 1-5 |



NONLINEAR EDITING

Digital video was revolutionized on the Macintosh computer platform with the advent of **QuickTime**, a type of software compression that shrinks the size of digital video files. Avid Technology was the company that pioneered the digital video, or nonlinear editing system, and it still has a strong presence in the digital video industry today. This new style of editing video on the computer was called **nonlinear editing** in the professional arena. When it originated in the consumer realm, it was known as **desktop video**. As computer technology continued to evolve, the gap between nonlinear editing and desktop video began to decrease. The term digital video was coined. Today, professional editing systems have become quite affordable, and many freelancers have entered the digital video market.



figure | 1-6 |

QuickTime is Apple Computer's video compression technology that paved the way for video editing on the computer.

LINEAR EDITING

Traditional video editing is called **linear editing**. In linear editing, the video program is edited consecutively from beginning to end. One or more video decks (the source decks) play the original videotape from the video camera, and a second video deck (the record deck) records the selected shots onto the master, or edited, videotape. Nonlinear editing, on the other hand, is nonconsecutive in nature. The differences between linear editing and nonlinear editing can be clearly illustrated by using the analogy of an audio cassette tape and an audio compact disc, or CD.

An audio cassette tape is linear. To get to the fifth song on an audio cassette tape, you have to fast-forward through songs one through four. An audio CD is nonlinear. Theoretically, it takes the same amount of time to get to the fifth song as it does to the first, the second, the third, or the tenth.

BUZZ WORDS

Are digital video, nonlinear editing, and desktop video the same thing? Yes and no. Like digital video technology, the terminology has also evolved over the years. *Nonlinear editing* originally began as a term that represented a style of editing which is nonconsecutive in nature. Technically, film editing is a form of nonlinear editing. However, with the rise of digital video, the term nonlinear is now often used synonymously with professional quality digital video. *Desktop video* is a term that was popular in the 1990s; it was used to refer to consumer digital video editing on the computer. As the gap between consumer digital video technology (desktop video) and professional video technology (nonlinear editing) began to close, the term desktop video was abandoned in favor of digital video. Today, the term *digital video* encompasses many things. Technically, it is a video signal that has been converted into binary form. Digital video can refer to video cameras and decks that record the video signal digitally. It can also refer to digital nonlinear editing or desktop video. In a broader sense, the term can encompass all digital video technology, including digital video recorders (DVRs), digital video disks (DVDs), digital cable and satellite service, as well as digital video cameras and digital video editing.

RANDOM ACCESS

The founding principle of digital video technology is called **random access** (not to be confused with **RAM, random-access memory**). The principle of random access states that it takes the same amount of time to get to any one point. In linear editing, shot A is followed by shot B, which is followed by shot C, etc. Any changes to the consecutive order of the edited shots are time consuming and difficult to make. However, in nonlinear editing, because of the principle of random access, shots A, B, and C can be rearranged quickly and easily with the click of a mouse.

NOTE

RAM is an integrated circuit memory chip that allows data to be stored, accessed, and retrieved in any order. RAM is a computer chip, while *random access* is a digital video principle.

ADVANTAGES OF DIGITAL VIDEO

Nonlinear editing, or digital video as it is commonly called today, has several distinct advantages over linear editing. Nonlinear editing is faster. Changes are easier to make. Therefore, editors have more creative freedom in arranging their shots. They can easily change the editing order of their shots to see which arrangement they like best.

Another advantage of nonlinear editing is that it does not suffer from generation loss because the video signal is digital. **Generation loss** is the degradation of image quality caused by the duplication of an analog videotape.

If you take a VHS tape and make a copy of it and then make a copy of your copy, the third generation tape has an inferior picture quality when compared to the first generation tape. Conversely, with digital video you can copy a digital video file over and over again, and the last image will be identical to the first one.

Analog videotape is also prone to drop out. **Drop out** occurs when video information is missing on the tape, which in turn, causes a white streak to appear. While digital video still records a digital signal onto tape, the digital format is more durable.

Advantages of Digital Video

- Editing is faster
- Changes are easier to make
- Allows more creative freedom
- Doesn't suffer generation loss
- Less prone to drop out

FIREWIRE (IEEE 1394)

Digital video technology really started to take off when Apple Computer invented **FireWire**, or IEEE 1394, a protocol that allows digital video cameras and computers to transmit digital video signals back and forth. FireWire replaced the need for the traditional video card to digitize video, or convert the analog signal into binary form.

figure | 1-7 |

This FireWire (IEEE 1394) cable can be used to connect a digital video camera to a computer.



Because digital video cameras already record the video signal in digital form, there is no need to translate it from “English” into “Spanish.” The digital signal is then transferred from the digital video camera into the computer via FireWire. All the major electronics manufacturers,

like Sony and Panasonic, adopted FireWire technology. Today, FireWire comes standard with every model of Macintosh computer and is an option on many PCs. A variety of third-party hardware manufacturers also make affordable FireWire expansion cards for PCs.

MAC VERSUS PC

You are probably aware that there are “Mac” people and there are “PC” people. Each computer platform has its own advantages and disadvantages. Business people tend to prefer PCs, and artists tend to prefer Macs. Digital video was pioneered on the Macintosh. Apple invented QuickTime and FireWire, two technologies that have paved the way for digital video. However, PCs caught up quickly, and just about everything you can do on a Mac involving digital video, you can also do on a PC. Also, PCs tend to be more affordable because there are many manufacturers from which to choose. However, having multiple hardware manufacturers also makes it much more difficult to troubleshoot digital video on the PC. Because digital video is still a cutting-edge technology, which pushes even the newest computer to its limit, there will be the need to troubleshoot on any system from time to time. Because there are so many third-party developers for the PC, it is more prone to conflicts. If you are trying to decide whether to buy a Mac or a PC to edit digital video, you need to take these factors into consideration. For example, how technically proficient are you? Will you be able to troubleshoot a more involved system? Do you have more experience on either platform? Do you need to be on the cutting edge of digital video technology? And perhaps most importantly, will this computer be used for other things besides editing digital video? You should thoroughly weigh all the pros and cons before investing a significant amount of time, money, and effort into any system.

THE VIDEO SIGNAL

To edit digital video successfully, it is important to understand the technical aspects of video. The video signal itself is broken down into two parts: chrominance and luminance. **Chrominance** is the color portion of the video signal. Red, green, and blue, or **RGB**, are the three additive primary colors used to construct a video image. All the other colors are created from these three. Print media, on the other hand, uses **CMYK**: cyan, magenta, yellow, and black.

Luminance is the black-and-white portion of the video signal, or its lightness and darkness values. **Hue** refers to the actual shade of the color being displayed, while **saturation** refers to the intensity of the color.

A **component** video signal is a broadcast-quality signal, in which the red, green, blue, and luminance portions are kept separate. An **S-video** signal separates the chrominance and luminance portions. In a **composite** video signal, the chrominance and luminance portions are blended together.