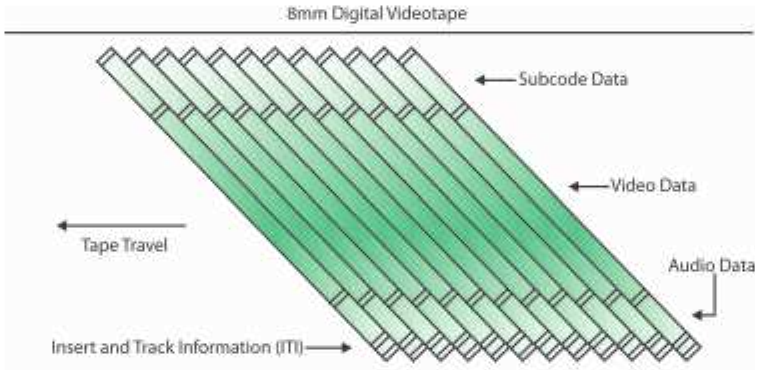
Digital Video

In digital systems, the output of the CCD is digitized by the camera into a sequence of single frames, and the video and audio data are compressed before being written to a tape (see Figure below) or digitally stored to disc or flash memory in one of several proprietary and competing formats.



In 1995, Apple's FireWire technology was standardized as IEEE 1394, and Sony quickly adopted it for much of its digital camera line under the name i.Link. FireWire and i.Link (and USB 2) cable connections allow a completely digital process, from the camera's CCD to the hard disk of a computer; and camcorders store the video and sound data on an onboard digital tape, writable mini-DVD, mini–hard disk, or flash memory.

HDTV

High Definition Television (HDTV) initiative of the Federal Communications Commission in the 1980s changed first to the Advanced Television (ATV) initiative and then finished as the Digital Television (DTV) initiative by the time the FCC announced the change in 1996. This standard, which was slightly modified from both the Digital Television Standard (ATSC Doc. A/53) and the Digital Audio Compression Standard (ATSC Doc. A/52), moved U.S. television from an analog to a digital standard. It also provided TV stations with sufficient bandwidth to present four or five Standard Television signals or one HDTV signal.

HDTV provides high resolution in a **16:9** aspect ratio. This aspect ratio allows the viewing of Cinemascope and Panavision movies. There was contention between the broadcast and computer industries about whether to use interlacing or progressive-scan technologies. The broadcast industry promulgated an ultra-high-resolution, 1920 · 1080 interlaced format (1080i) to become the cornerstone of the new generation of high-end entertainment centers, but the computer industry wanted a 1280 · 720 progressive-scan system (720p) for HDTV. While the 1920 · 1080 format provides more pixels than the 1280 · 720 standard, the refresh rates are quite different. The higher resolution interlaced format delivers only half the picture every 1/60 of a second, and because of the interlacing, on highly detailed images there is a great deal of screen flicker at 30 Hz.

Displays

Colored phosphors on a **cathode ray tube (CRT)** screen glow red, green, or blue when they are energized by an electron beam. Because the intensity of the beam varies as it moves across the screen, some colors glow brighter than others. Finely tuned magnets around the picture tube aim the electrons precisely onto the phosphor screen, while the intensity of the beam is varied according to the video signal. This is why you needed to keep speakers (which have strong magnets in them) away from a CRT screen. A strong external magnetic field can skew the electron beam to one area of the screen and sometimes caused a permanent blotch that cannot be fixed by **degaussing**—an electronic process that readjusts the magnets that guide the electrons. If a computer displays a still image or words onto a CRT for a long time without changing, the phosphors will permanently change, and the image or words can become visible, even when the CRT is powered down. Screen savers were invented to prevent this from happening. Flat screen displays are all-digital, using either **liquid crystal display (LCD)** or **plasma** technologies, and have supplanted CRTs for computer use.

Interlacing and Progressive Scan

The process of building a single frame from two fields is called interlacing, a technique that helps to prevent flicker on CRT screens. Computer monitors use a different **progressive-scan** technology, and draw the lines of an entire frame in a single pass, without interlacing them and without flicker. In television, the electron beam actually makes two passes on the screen as it draws a single video frame, first laying down all the odd-numbered lines, then all the even-numbered lines, as they are interlaced. On a computer monitor, lines are painted one-pixel thick and are not interlaced. Singlepixel lines displayed on a computer monitor look fine; on a television, these thin lines flicker brightly because they only appear in every other field. To prevent this flicker on CRTs, make sure your lines are greater than two pixels thick and that you avoid typefaces that are very thin or have elaborate serifs. If capturing images from a video signal, you can filter them through a de-interlacing filter provided by image-editing applications such as Photoshop and Fireworks. With typefaces, interlacing flicker can often be avoided by anti-aliasing the type to slightly blur the edges of the characters. Most computers today provide video outputs to CRT, LCD, or plasma monitors at greater than 1024 × 768 resolution. The VGA's once ubiquitous 640 × 480 screen resolution is again becoming common for handheld and mobile device displays.

It is common practice in the television industry to broadcast an image larger than will fit on a standard TV screen so that the "edge" of the image seen by a viewer is always bounded by the TV's physical frame, or bezel. This is called **overscan**. In contrast, computer monitors display a smaller image on the monitor's picture tube (**underscan**), leaving a black border inside the bezel. Consequently, when a digitized video image is displayed on a CRT, there is a border around the image; and, when a computer screen is converted to video, the outer edges of the image will not fit on a TV screen. Only about 360 of the 480 lines of the computer screen will be visible