Topic: 1.1.4 Video

Video is an electronic medium for the recording, copying and broadcasting of moving visual images characteristics of video streams.

Number of frames per second

Frame rate, the number of still pictures per unit of time of video, ranges from six or eight frames per second (frame/s) for old mechanical cameras to 120 or more frames per second for new professional cameras. PAL (Europe, Asia, Australia, etc.) and SECAM (France, Russia, parts of Africa etc.) standards specify 25 frame/s, while NTSC (USA, Canada, Japan, etc.) specifies 29.97 frame/s. Film is shot at the slower frame rate of 24 photograms/s, which complicates slightly the process of transferring a cinematic motion picture to video. The minimum frame rate to achieve a comfortable illusion of a moving images about sixteen frames per second.

Interlaced vs. progressive encoding

Video can be interlaced or progressive. Interlacing was invented as a way to reduce flicker in early mechanical and CRT video displays without increasing the number of complete frames per second, which would have required sacrificing image detail in order to remain within the limitations of a narrow bandwidth. The horizontal scan lines of each complete frame are treated as if numbered consecutively and captured as two fields: an odd field (upper field) consisting of the odd-numbered lines and an even field (lower field) consisting of the even-numbered lines.

Analog display devices reproduce each frame in the same way, effectively doubling the frame rate as far as perceptible overall flicker is concerned. When the image capture device acquires the fields one at a time, rather than dividing up a complete frame after it is captured, the frame rate for motion is effectively doubled as well, resulting in smoother, more lifelike reproduction (although with halved detail) of rapidly moving parts of the image when viewed on an interlaced CRT display, but the display of such a signal on a progressive scan device is problematic.

NTSC, PAL and SECAM are interlaced formats. Abbreviated video resolution specifications often include an i to indicate interlacing. For example, PAL video format is often specified as 576i50, where 576indicates the total number of horizontal scan lines, i indicates interlacing, and 50 indicates 50 fields (half-frames) per second.

In progressive scan systems, each refresh period updates all of the scan lines of each frame in sequence. When displaying a natively progressive broadcast or recorded signal, the result is optimum spatial resolution of both the stationary and moving parts of the image. When displaying a natively interlaced signal, however, overall spatial resolution will be degraded by simple line doubling and artifacts such as flickering or "comb" effects in moving parts of the image will be seen unless special signal processing is applied to eliminate them. A procedure known as deinterlacing can be used to optimize the display of an interlaced video signal from an analog, DVD or satellite source on a progressive scan device such as an LCD Television, digital video projector or plasma panel. Deinterlacing cannot, however, produce video quality that is equivalent to true progressive scan source material.

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Video compression method (digital only)

Video compression

Uncompressed video delivers maximum quality, but with a very high data rate. A variety of methods are used to compress video streams, with the most effective ones using a Group Of Pictures (GOP) to reduce spatial and temporal redundancy. Broadly speaking, spatial redundancy is reduced by registering differences between parts of a single frame; this task is known as intraframe compression and is closely related to image compression. Likewise, temporal redundancy can be reduced by registering differences between frames; this task is known as interframe compression, including motion compensation and other techniques. The most common modern standards are MPEG-2, used for DVD, Blu-ray and satellite television, and MPEG-4, used for AVCHD, Mobile phones (3GP) and Internet.

Video formats

There are different layers of video transmission and storage, each with its own set of formats to choose from.

For transmission, there is a physical connector and signal protocol. A given physical link can carry certain "display standards" which specify a particular refresh rate, display resolution, and color space.

Many analog and digital recording formats are in use, and digital video clips can also be stored on a computer file system as files which have their own formats. In addition to the physical format used by the data storage device or transmission medium, the stream of ones and zeros that is sent must be in a particular digital "video encoding", of which a number are available.

Multimedia Container Format

Multimedia Container Format (MCF) was the first project to create an open and flexible media container format that could encapsulate multiple video, audio and subtitle streams in one file. The project was started in 2000 as an attempt to improve the aging AVI format. At first the project generated some confusion about its intended goals. This was solved when the lead developer created a simple player for the format which supported embedded subtitles, which sparked interest and the community began to grow. Several new features were added and the specification refined.

One of the objectives of the new format was to simplify its handling by players. This was to be done by making it feature-complete, eliminating the need for third-party extensions and actively discouraging them. Because of the simple, fixed structure, the time required to read and parse the header information was minimal. The small size of the header (2.5 kB), which at the same time contained all the important data, facilitated quick scanning of collections of MCF files, even over slow network links.

The key feature of MCF was being able to store several chapters of video, menus, subtitles in several languages and multiple audio streams (e.g. for different languages) in the same file. At the same time, the content could be split between several files called segments; assembling the segments into a complete movie was automatic, given the segments were all present. Segments could also be played separately,

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and overlap between segments was customizable. The format also allowed for variable frame rate video. To verify integrity, checksums were embedded into the file, and digital signatures were supported. A degree of resilience was built into the parser, allowing for playback of partially corrupted movies.