

Video Compression and Codecs



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Why do we need Codecs

- Videos produce large amounts of data that must be compressed for *transmission* and *storage* purposes.

(A 1920 x1080HD picture at 25 f/s would produce about 420 Gbytes/hour)

What is a Codec

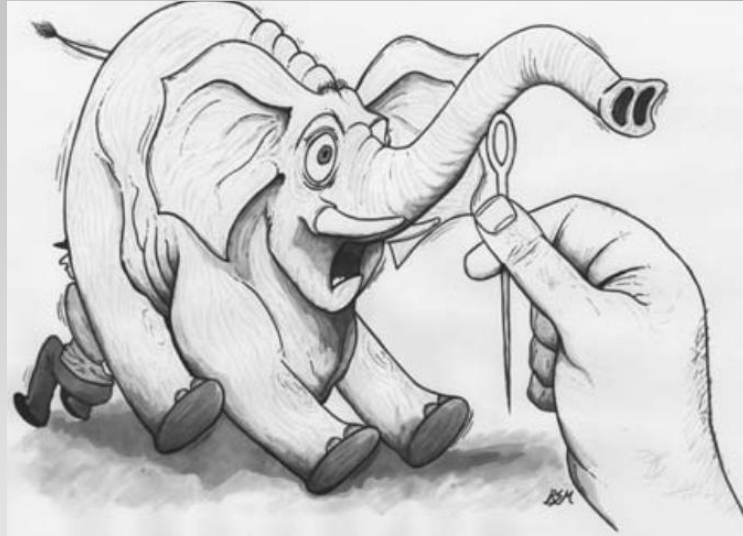


A compression system consists of a compressor or coder, a transmission channel and a matching expander or decoder.

The combination of coder and decoder is known as a **CODEC**

Compression Is All About Trade Offs

- Keeping files size small
- Optimizing data throughput to -
- Keep picture smooth and realistic
-no artifacts



Can be a complex process !

Video Codecs

A CAN OF WORMS



Some Basic Terms

File Formats: Combination of Codecs and file structure.

Players: Programs that can play encoded files.

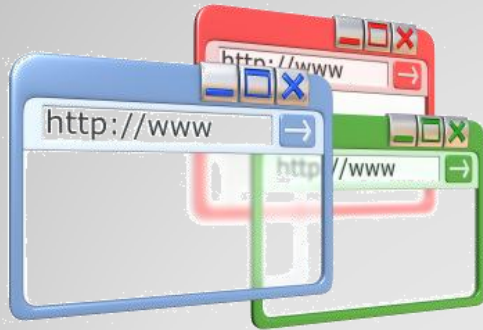
e.g Windows Media Player, Quicktime, VLC Player

Platforms: E.g. Windows, Macs, Linux

Cross Platforms: Windows, Quicktime, RealPlayer

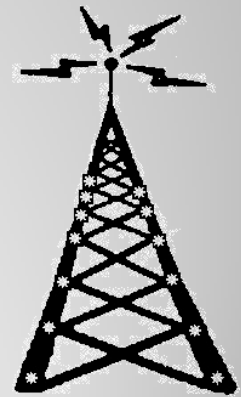
Types of Delivery

- CD/ DVD / Blu-Ray



* Web Based

Digital TV (DTB)



AVI

- Microsoft **A**udio/**V**ideo **I**nterleaved
- Early format allowing audio and video to be combined within single files for playing of CD-ROM.
 - Legacy Codecs
 - Indeo 5, 3.2, 4.4
 - Cinepak
 - Audio Codecs MP3,
 - Ulaw, A-Law

Windows Media VIDEO

- **Windows Media Video** (WMV) Is a compressed video compression format.
 - Initially for Internet Streaming
 - Now (WMV9) also called VC-1 Mandatory on BD-ROM)
 - Also older versions e.g. WMV V7, V8

Container Formats. A file format that “wraps up” another format

Advanced System Format (.ASF)

Matroska (.MKV)

Windows Media Coding Performance

<i>Type</i>	<i>Format</i>	<i>Codec</i>	<i>Bit rate (min)</i>	<i>Bit rate (max)</i>
Vision	720 × 480 × 24p movie	WMV Pro 9	1.3 Mbps	2 Mbps
Vision	720 × 480 × 30i video	WMV Pro 9	2 Mbps	4 Mbps
Vision	1280 × 720 × 24p HDTV	WMV Pro 9	5 Mbps	8 Mbps
Sound	2 channels, 20 bits sampled at 48 KHz	WMA Pro 9	128 Kbps	128 Kbps
Sound	6 channels, 20 bits sampled at 48 KHz	WMA Pro 9	192 Kbps	256 Kbps
Sound	6 channels, 24 bits sampled at 48 KHz.	WMA Pro 9	768 Kbps	768 Kbps

Video Compression

MPEG

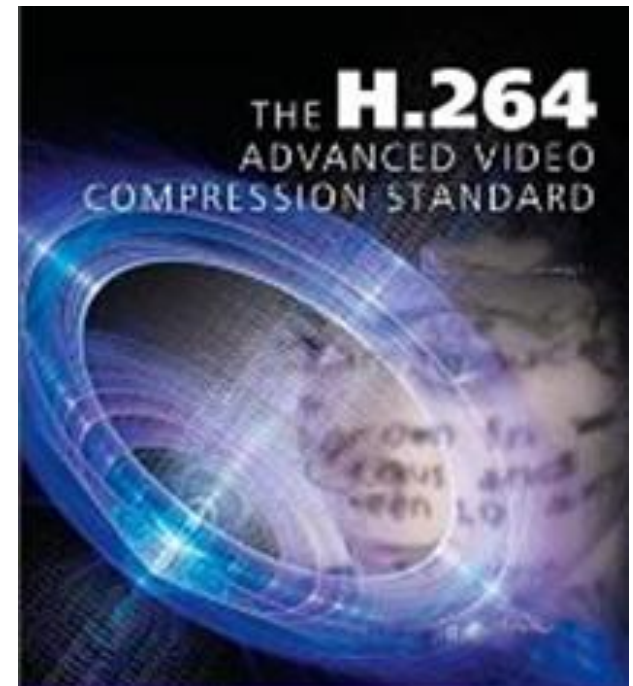
Mpeg-1 Use for CD and Web delivery

Mpeg-2 Used for DVD and broadcast TV

Mpeg- 4(part 10) (AVC)

H264

Is King



Streams

MPEG-1	Elementary (video or audio)	.mpv .m1v .mpa .m1a
MPEG-1	System Stream Video /or Audio	.mpg
MPEG-2	Elementary Stream	.m2v .m2a
MPEG-2	Program Stream	.mp2
MPEG-2	Transport Stream* (TS)	.m2t .ts .tp
MPEG-4	Streams	.mpeg-4

*May contain 1 or more streams plus other extra data for robustness (PVR)

Miscellaneous - Bits and Pieces

AVCHD Uses MPEG-4 /H264 (AVC) and Dolby AC-3/
uncompressed Linear PCM. (Originally for BD Production)

Flash Video A file container to delivery video over internet using Adobe Flash Player
- .FLV .F4V (uses Sorenson or VP6 codecs)

Widely used for web imbedded video YouTube, Google Video, etc.

Players VLC, Media Player Classic, Adobe Media layer

Quicktime Initially developed for Macs some of the best architecture for
handling video.

Used many Sorenson codecs - V2 v3.1

Versions for Windows.

RealNetworks Initial developer of streaming video systems
Realplayer .Rv, .Rm

Video Codec *Profile*

A profile for a codec is a set of features of that codec identified to meet a certain set of specifications of intended applications.

Levels

a "level" is a specified set of constraints indicating a degree of required decoder performance for a profile.

- the maximum picture resolution
- frame rate
- bit rate

Profiles and Levels for VC-1

Profile	Level	Max Bit Rate	Representative Resolutions by Frame Rate
Simple	Low	96 Kbps	176 × 144 @ 15 Hz (QCIF)
	Medium	384 Kbps	240 × 176 @ 30 Hz 352 × 288 @ 15 Hz (CIF)
Main	Low	2 Mbps	320 × 240 @ 24 Hz (QVGA)
	Medium	10 Mbps	720 × 480 @ 30 Hz (480p) 720 × 576 @ 25 Hz (576p)
	High	20 Mbps	1920 × 1080 @ 30 Hz (1080p)
Advanced	L0	2 Mbps	352 × 288 @ 30 Hz (CIF)
	L1	10 Mbps	720 × 480 @ 30 Hz (NTSC-SD) 720 × 576 @ 25 Hz (PAL-SD)
	L2	20 Mbps	720 × 480 @ 60 Hz (480p) 1280 × 720 @ 30 Hz (720p)
	L3	45 Mbps	1920 × 1080 @ 24 Hz (1080p) 1920 × 1080 @ 30 Hz (1080i) 1280 × 720 @ 60 Hz (720p)
	L4	135 Mbps	1920 × 1080 @ 60 Hz (1080p) 2048 × 1536 @ 24 Hz

Some Programs & Tools

- Canopus ProCoder
- Adobe Media Encoder
- Xilisoft Video Converter
- VideoReDo