References

- Advanced Video Deposition Support for Videographers, Thomas Lorenzen, inData Corporation, October 2007
- Digital Video Fundamentals, Aldo Cagnini and Alan Cavallerano, Broadcast Engineering, 2011
- MPEG-4, Utilizing New Video Formats, Thomas Lorenzen, inData Corporation, January 2012
- Time for a Tuneup, Jan Ozer, Streaming Media, January/February 2014
What is Typically Delivered?

- Current Production House Digital Deliverables
  - Authored DVD (Captured Live on Recorder)
  - MPEG-2 file with settings that mimic or are similar to a standard play (SP) DVD
  - Captured digital assets (less often)
    - AVCHD
    - MPEG-2 TS
    - DV in an AVI-T2 wrapper
  - H.264/MPEG-4

Video in the Legal Environment
What is Typically Delivered?

- Typical End User Digital Deliverable
- Authored DVD
- MPEG-1
  - 352x240
  - 720x480
- MPEG-2 file with very specific settings
- H.264 MPEG-4 (for iPad)
- MOV
  - 640x480
- Videosynced versions of the above
What’s Important?

- **Video Specifications**
  - Display Aspect Ratio (DAR)
    - a.k.a. Frame Size
  - Pixel Aspect Ratio (PAR)
  - Bitrate
  - Rate Control
    - Variable v. Constant
  - Frame Rate
  - Interlaced v. Progressive
  - GOP (Group of Pictures)
  - Profiles and Levels

- **Audio Specifications**
  - Codec
  - Sample Rate
    - 44.1 v. 48 kHz
  - Bit Depth
    - 12, 16, 24 bits
  - Channels
  - Data Rate

Video in the Legal Environment
Typical Legal Video Deliverables

- MPEG-1
- MPEG-2
- MPEG-4
- Authored DVD

- Add “videosynced” to all deliverables, but not by all engines
- All can be delivered in standard or wide screen display aspect ratio
- Standard definition 4:3 remains the dominant deliverable for depositions
- HD and MPEG-4 are the newcomers and will become more relevant in 2014/2015
MPEG-1 Video

- Basic specs
  - 352x240 non-square pixel
  - Bitrate: 800 to 1200 Kbps
    - YesLaw: 600 to 1500 Kbps
    - Livenote recommends 1200 Kbps
  - Normal bitrate target is 1150 Kbps
  - Lower bitrates can work with lower motion subjects, like depositions
  - 600 Kbps does not look good blown up on a screen
MPEG-1 Video

- Better product
  - NTSC 720x480, non-square pixel
    - Bitrate:
      - 1725 to 3500 Kbps
      - 3500 Kbps recommended by inData
        » inData White Paper “Advanced Video Deposition Support for Videographers”
      - 2800 to 3200 Kbps recommended by speaker
    - Results in nice looking source that can run on any computer
    - Can be exported by inData, YesLaw clip creation applications
      - Don’t use to make YesLaw DVD. It may or may not work
      - Do not offer with WestLaw software users – not supported

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MPEG-1 Video

- Frame Rate – 29.976 fps (NTSC)
- PAR: Normally anamorphic (non-square) pixel
  - If you deliver square pixel, use 640x480 aspect ratio
- Use Constant Rate Control
- Progressive only (interlaced not available)
- Open GOP, with 15 frames per GOP
  - Rule of thumb for MPEG-1/2 – 0.5 sec per keyframe
- Use System Stream file format
- .mpg file extension

Video in the Legal Environment
MPEG-1 Audio

- Codec: MPEG-1 Layer II
  - Use 44.1 KHz, 16 bits to improve compatibility with older players
  - Use 48.0 KHz, 16 bits if clips may end up being re-encoded to a DVD for trial or deliverable
  - If audio out of sync with video, change sample rate.
  - 224 Kbps Stereo (2 channels) maximum
    * 96 Kbps Mono
    * 192 Kbps minimum – inData recommendation
    * 128 Kbps minimum – YesLaw recommendation
MPEG-2 Video

- Higher quality video (than 352x240 MPEG-1)
  - Can be shown on large screen without looking blocky
  - Can support better quality audio
  - Wrapper used in broadcast with different codecs
- Does not work with all syncing software
- Does not play on all computers
  - Codecs sometimes have to be downloaded from web, which can be a problem behind a lawyer’s firewall
  - Can be less responsive during playback, particularly with less powerful systems
- Higher bit rate means larger storage requirements
  - No longer a big problem with large capacity drives
MPEG-2 Video

- Basic specs for delivery
  - 720x480 DAR anamorphic pixel (NTSC Standard)
  - 640x480 DAR square pixel (computer/tablet)
    - Bitrate: 3,000 - 4,400 Kbps constant rate control
      - Standard play on DVDs typically 4,200-4,400 Kbps
      - Degradation begins to be seen below 3,400 Kbps
      - Lean towards progressive but interlaced will work
      - YesLaw spec: 2,500 Kbps for depositions
    - If you’re doing interlaced and see strobing, try changing the
      field order from top first to bottom first, or vice versa.
  - Frame Rate
    - 29.976, 30 fps interlaced or progressive

MPEG-2 Video

- Use Constant Rate Control
- NTSC DVD has maximum of 18 frames per GOP
  - Typical setting is 15 frames, or 0.5 seconds at 30 fps
- Use Program Stream file format
  - One file contains both audio and video streams
- CLVS suggests limit of 2 hours per file
  (SP setting) at this point in time
- Better source for production house
- .mpg/mp2/m2p/mpeg file extension

Video in the Legal Environment
MPEG-2 Audio

- Codec: MPEG-1 Layer II
  - 48.0 KHz, 16 bits
  - 192 Kbps Stereo (2 channels) minimum
    - 96 Kbps Mono
  - 224 Kbps Stereo is max needed for depositions
    - 112 Kbps Mono
  - May not play in older players

- Codec: AC-3 Audio (a.k.a. Dolby Digital)
  - US DVD recorders must support AC-3

Video in the Legal Environment
Special Notes on DVD / MPEG-2 Video for Syncing

- inData has a 3000 Kbps spec for MPEG-2 video.
  - The video does not really look good at this rate.
  - Through trial and error, the syncing engine inData uses appears to force a re-encode at a file size of around 3.0 GB.
  - Keep your video file below this file size, and the re-encode trigger does not appear to fire.
  - The author has passed a 2:00:34 long file through inData’s MPEG-2/DVD process without re-encoding at 3200 Kbps by keeping the file size at 2.97 GB
  - This is as much an efficiency issue as it is a visual issue. The video is re-encoded one file at a time, where TMPGenc Video Mastering Works can process as many files as the computer has cores.
Video OBJect Files

- Also known as an (authored) DVD
  - Higher quality video
    - Can be shown on large screen without looking blocky
    - Source can be MPEG-1, MPEG-2
      - If you want it to look really bad, use MPEG-1 352x240 source
  - Works with desktop players/computers
  - Needs player to be used on computer
    - VLC is a reasonable choice
      - Interlacing settings in player can sometimes make video look bad.
    - Codecs sometimes have to be downloaded from web, which can be a problem behind a lawyer’s firewall
  - Limited to 1 GB per file
    - Encoder multiplexes (muxes) video, audio, and subtitle streams together during playback
  - Current default deliverable for most courts
Video OBject Files

- Use MPEG-2 specs
  - If your source is interlaced, keep it interlaced
  - If your source is progressive, keep it progressive
  - Do not shortchange bitrate for production house
    - No more than 2 hours on a disk
      - Production house will have difficulty creating a decent looking MPEG-1 from an extended play EP (4 hours +) DVD
    - Use Standard Play SP for DVD recorder
  - See comments in MPEG-2 section about how to keep re-encode from occurring during burn process.
Video OBJect Files

- My preferences for post production DVD:
  - 4 to 5 minute chapters
  - No menu
  - Autostart
  - No looping
  - 4200 Kbps Constant Progressive
  - 2 hours of video max
  - MPEG-1 Layer II 48.0 kHz 224 Kbps
  - DVD-5

Video in the Legal Environment
**Video OBject Files**

- **DVD Creation Software**
  - TMPGEnc Authoring Works 5
    - Will pass through encoded video and perform smart render
    - Processes in batch mode
    - Has DVD, ISO DVD, and file burner
  - Grass Valley ProCoder 3 (no longer available)
    - Created VOB folders with chapters in batch mode

- **Don’t like:**
  - DVD Flick, NCH Burn, Nero, Roxio
    - Wants to re-encode
  - Vegas, Final Cut Pro, Premiere Pro, DVD Studio, etc.
    - Too tedious
MPEG-4 Part 10 Video

- Higher quality video at low bit rates
  - Better compression than MPEG-2
  - Can be shown on large screen without looking blocky
  - Gets softer, and not blockier, under heavy compression

- Plays on multiple platforms
  - PC/Mac
  - iPad

- Supports High Definition / Standard Definition
Basic specs
- Assumes H.264 codec – ALWAYS Progressive
  - H.264 Main Profile to Level 3.0 for 640x480 SD delivery
  - H.264 Main Profile to Level 5.1 for 720p iPad 1&2 delivery
  - H.264 High Profile to Level 4.1 for 1080p iPad delivery
- Compatible to MPEG-I
  - Video: 352x240, 30 fps @ 610 Kbps, 4 reference frames
    - CABAC Entropy Mode
  - Audio: AAC-LC; 128 Kbps (160 Kbps max), 48 Khz, 2 channels
    - Advanced Audio Coding Low Complexity (AAC-LC)

MPEG-4 Part 10 Video

- Basic specs
  - MPEG-2 Compatible (4:3)
    - Video: 720x480, 30 fps @ 1200 Kbps 4 reference frames
      - CABAC Entropy Mode
      - Ozer recommends 1400-1500 Kbps
    - Audio: AAC-LC, 160 Kbps, 48 Khz, 2 channels
  - MPEG-2 Widescreen Compatible (16:9)
    - Video: 720x408, 30 fps @ 1200 Kbps 4 reference frames
      - CABAC Entropy Mode
      - Ozer recommends 1400-1500 Kbps
    - Audio: AAC-LC, 160 Kbps, 48 Khz, 2 channels
  - Use 1200 Kbps for DepoView for iPad distribution, 1500 Kbps for general use with a Mac

MPEG-4 Part 10 Video

Basic specs:

- HD Deliverable 1—PROGRESSIVE ONLY
  - Video: 1280x720p, 30 fps @ 2600 Kbps
    - CABAC Entropy Mode
    - Ozer recommends 2750 Kbps
  - Audio: AAC-LC, 160 Kbps, 48 Khz, 2 channels
  - Best choice for Legal Video
  - Only HD format that inData DepoView supports!

- HD Deliverable 2—PROGRESSIVE ONLY
  - Video: 1920x1080p, 30 fps @ 3500 Kbps
    - CABAC Entropy Mode
    - Ozer recommends 4900 Kbps
  - Audio: AAC-LC, 160 Kbps, 48 Khz, 2 channels


“Time for a Tuneup”, Jan Ozer, Streaming Media, p. 22, January/February 2014
MPEG-4 Part 10 Video

- May have licensing costs
- Limited support in syncing engines
  - inData released DepoView for iPad – late Feb. 2013
  - TrialDirector supports very specific H.264 formats
  - YesLaw is introducing MPEG-4 cloud delivery now. Please contact the vendor for more information, specifications.
- Requires higher end computer and video card for editing
- Slower encoding speed, depending on source and target deliverable
MPEG-4 Part 10 Video

- H.264 is a lossy format, just like MPEG-1 and -2.
  - The more you compress, the worse it will look.
- Use the right codec
  - Apple’s H.264 codec is subpar (found in Compressor)
  - x264 Encoder is better choice
  - MainConcept H.264 codec is better choice
  - x264 open source codec is best choice
  - MainConcept and others’ CUDA H.264 will always generate a quality compromised image. They’re useful for fast drafts, but may not preferred to software-based codecs.
  - You can get away with CUDA and talking head video.
  - Don’t use it with video & exhibits, or video & ELMO/Pan

“Time for a Tuneup”, Jan Ozer, Streaming Media, p. 25-26, January/February 2014
Converting HD to SD

- Frame for SD during capture
- Create pseudo mezzanine process by cropping source and then allowing encoder to resize deliverable
  - For digital card sources, you may have to pre-process and stitch to minimize source filters
  - TMPGEnc Smart Renderer (HD, mpeg or m2t)
  - Sony Content Management Utility
- If you can do this in one pass, apply the cropping filter ahead of the resizing filter
Converting HD to SD

- If properly framed, you do not have to letterbox. Apply pillar or side crop instead.
  - Always crop by factor of 16 (macroblock)
  - Always allow for resize without maintaining aspect ratio
- Capture 1280x720p, crop to 960x720
  - Remove 160 pixels from each side
- Capture 1920x1080i/p, crop to 1440x1080
  - Remove 240 pixels from each side
- Capture 1440x1080i/p, crop to 1080x1080
  - Remove 180 pixels from each side
- Resize to 720x480 or 352x240

- Make sure the audio codec is appropriate for the deliverable

Compression for Great Video, Ben Waggoner, p. 119
Side Pillars Disappear If Resize Done Without Keeping Aspect Ratio

Note Black Side Pillars On Left Picture
Note No Side Pillars On Right Picture
Audio Specifications

- **Codecs**
  - MPEG-1 Layer II
  - Dolby Digital AC3
  - AAC-LC

- **Sample Rate**
  - 44.1 kHz
  - 48.0 kHz

- **Bit Depth**
  - 12, 16, 24 bits

- **Channels**
  - Mono
  - Stereo
  - Dual mono

- **Data Rate**
  - 96 Kbps Mono
  - 128 Kbps min Stereo
  - 192 Kbps preferred
  - 224 Kbps max

Video in the Legal Environment
Best Practices
Legal Video Capture

• Record 48kHz 16-bit audio when possible
  – Matches deliverable
  – Avoid 12-bit capture
  – PCM consumes bandwidth and may add issues during editing
Setting Up TMPGEnc - HD
Choose Folder or Card

[Image of a computer interface for selecting a folder or card]
Touch Next – File will be presented as one take or multiple takes

__________
Select Either Playlist or Clip by Clip
Click Next, and 
Clips Will Be Added
Clips Are Added. Highlight Clip
Click Next – Change Clip Name
Click Enable Crop
Apply Crop -160 Left, 160 Right

Assumes 720p Source
Click on Picture Resize
Unclick Keep Aspect Ratio and
Output Interlace
Click Format
Select DVD-Video Standard MPEG file

Assumes you are making video for a DVD
Prepare to Change Video Format
Change to Progressive if Desired
Individual Files Instead of Clips
Setting Up TMPGEnc - SD
Select folder with card contents

As seen on a hard drive

[Image of computer window showing a folder with card contents]
Select folder with card contents
As seen on a card
TMPGEnc finds all media files in folder and presents them in captured order. Note different file types (avi & bmp).
Pick clips you want avi, not bmp
Allow system to import clips without clip editor.
Clips are added
Clips will be imported in time order. Select all clips that should be stitched together.
Follow procedure shown previously

Assumes you are making video for a DVD