Producing Top Quality Flash Content

Jan Ozer
Doceo Publishing
jozer@doceo.com
276-238-9135

Agenda

- About the clips
- Rating Flash codecs
- Rating Flash encoders
- Maximizing production quality
  - The shoot
  - Editing
  - Pre-processing
  - Encoding
- Case studies
About the Clips

- Mixed content – business/action/entertainment
- Four encoding params
  - 3GPP – 80 kbps, 176x144, 15 fps, 68 kbps video/12 kbps, audio, 11 kHz mono
  - 100 kbps - 320x240, 15 fps, 88/12/22 kHz stereo
  - 300 kbps - 320x240, 30 fps, 260/32/44 kHz stereo
  - 500 kbps – 640x480, 30 fps, 468/32/44 kHz stereo
- From Flash Codecs 2006 report
  - All figures and clips from that report

Rating Flash Codecs

- On2 is easily the best codec
  - Better than Spark
  - Better than Wildform
- As compared to other codecs;
  - On2 trails Real in all trials
  - On2 beats Windows Media in all trials
  - On2 beats Apple’s H.264 at most low bit/pixel rates
# On2 vs. Spark

- Sorenson Spark was first real Flash codec
- Superseded by On2
- Don’t encode any new videos to Spark format
  - Some Flash Encoder presets use Spark
- If you have any mission critical videos in Spark format, consider re-encoding to On2

<table>
<thead>
<tr>
<th>Still Image Example</th>
<th>Video Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Spark On2 300 kbps</td>
</tr>
</tbody>
</table>

# On2 vs. Wildform

- Codec available in Autodesk Cleaner 1.5
- The initial release had poor data rate control for VBR output
- CBR results are spotty
- Go with On2 until proven otherwise

<table>
<thead>
<tr>
<th>Still Image Example</th>
<th>Video Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>WildF On2 300 kbps</td>
</tr>
</tbody>
</table>
On2 vs. Real

- Real has its issues, but quality is best across the board
- Advantage varies by data rate and content type

<table>
<thead>
<tr>
<th>Still Image Example (300 kbps)</th>
<th>Video Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semin Alex Barb</td>
<td>Real On2</td>
</tr>
<tr>
<td></td>
<td>300 kbps</td>
</tr>
<tr>
<td></td>
<td>Real On2</td>
</tr>
<tr>
<td></td>
<td>500 kbps</td>
</tr>
</tbody>
</table>

Rating Flash Encoders

- Constant vs. variable bit rate (technology interlude)
- Adobe Flash Video Encoder
- Sorenson Squeeze
- Flix Pro
Constant vs. Variable Bit Rate

- **Constant bit rate (CBR)**
  - One bit rate applied to entire video irrespective of motion within video
  - Pros: Easy and fast
  - Cons: Doesn’t optimize disk space or quality

- **Variable bit rate (VBR)**
  - Dynamic bit rate applied to match motion in video
  - Pros: Best quality/bit rate optimization (in theory)
  - Cons: Slow, can produce inconsistent stream
Variable Bit Rate Parameters

- Number of passes
  - Two is optimal
  - Obviously, can’t do real time two pass
  - Note target/max/min bitrate settings
- Bit rate
  - Overall target
  - Maximum (also know as Peak)
    - Useful for streaming or DVDs
  - Minimum

Adobe Flash Video Encoder

- Very poor at de-interlacing
  - So de-interlace (or encode) in your editor
- Only performs CBR (not VBR) encoding
  - Fast encoder (only one pass)
  - Not absolute top quality at lower data rates
  - Performed very well at 500 kbps
  - Very good with low motion video (simple may be better for talking head), but only with good pre-processing

<table>
<thead>
<tr>
<th>Still Image Example (poor de-int)</th>
<th>Video Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flash On2 300 kbps</td>
<td>Flash On2 500 kbps</td>
</tr>
</tbody>
</table>
Sorenson Squeeze Encoder

- Best third party encoder for Real, WMV
- Trailed Flix Pro in FLV quality
  - Biggest problem was noise in the background, so plan background carefully (Taimo 1:40)
  - Good color vibrancy, but could over-saturate

Still Image Example (500 kbps)
- Boucher
- Taimo

Video Examples
- Squeeze 300 kbps
- Squeeze On2 500 kbps

On2 Flix Pro Encoder

- Best Flash Encoder overall
- Observations
  - Tended to dull the colors a bit on some videos

Still Image Example (500 kbps)
- Seminar
- Alex 1:31
- Taimo 1:40

Video Examples
- Squeeze 300 kbps
- Squeeze On2 500 kbps
Maximizing Production Quality

- The shoot
- Pre-processing
- Encoding
  - Adobe Flash 8 Video Encoder
  - Sorenson Squeeze
  - On2 Flix Pro

The Shoot

- The effect of motion on video quality
  - Bandwidth (technology interlude)
  - Minimizing motion in the shoot
- Setup
- Lighting
- Camera settings
Bandwidth Capacity

Size of the pipe between your data and your remote client

File Bandwidth/Data Rate

Size of the file transferred from storage to your client
The Immutable Bandwidth Rule

- When producing streaming files, you always choose a bandwidth
- Encoding tool encodes file to that bandwidth, irrespective of the amount of motion in the video
  - If lots of motion, can degrade quality
  - If minimal, quality always better

Camera Motion

- Inter-frame compression
  - Defined
  - Key and delta frames
- Effect of motion
Inter-frame Compression

Key Frame
Delta Frame
Key Frame
Delta Frame
Delta Frame
Delta Frame
Delta Frame

Camera Motion

- Inter-frame compression
  - Defined
  - Key and delta frames
- Effect of motion
  - Jan Black (100 kbps)
  - Skateboard (100 kbps)
  - Skateboard (500 kbps)
**Motion and Bandwidth (Flash)**

What’s this Mean?

- Motion is the enemy of interframe compression
  - Producing for 750 kbps and higher, no worries, quality should be good even with significant motion (assume SD resolution)
  - Producing for 500 kbps and lower
    - "Whenever possible, shoot original footage for the Internet. There are different techniques for shooting video for TV versus the Web, and it is sometimes hard to take TV footage and convert it to usable footage for the web." Journal of Computing in Teacher Education
    - "If possible, shoot exclusively for streaming. If streaming media is not the primary objective of the shoot, you might not end up with any footage at all that will stream well." Adobe, A Streaming Media Primer.
  - At lower bitrates, you have to eliminate extraneous motion in shooting, content and editing.
What’s this Mean?

- Manage expectations
  - Pure conversion jobs – sometimes high bit rate is only option
  - Original shoots:
    - Can produce very good quality at low bit rates if you manage motion and other critical elements
- Focus on the money shots
  - Use motion where absolutely necessary
  - Eliminate the extraneous

Eliminating Extraneous Motion

- Camera - shooting techniques
  - Use a tripod
  - Avoid panning and zooming whenever possible. Cuts are better (multiple cameras help)
  - If possible, soften background (see Positioning)
- Limit on-screen motion
  - Talent – consider sitting, and advise against excessive motion
  - Background – limit motion
    - Shoot indoors with stable background
Setup

- Backgrounds matter
- Positioning
- Dressing your talent
- Framing your shots

Backgrounds Matter - Flash

- Adding bandwidth cures motion ills, but not background issues
- Backgrounds to watch in particular for Flash
  - Open backgrounds (codecs abhor a vacuum)
  - Graduated lighting
  - Highly saturated colors (reds)
- Goal
  - Slight clutter but minimal detail

100 kbps  500 kbps
Avoid open spaces. This wall was actually smooth beige, but codecs tend to inject motion into open spaces, creating distracting background noise.

Avoid graduated lighting – especially with a flat background.
Backgrounds – Rules to Live By

- Avoid highly saturated colors – Which tended to create motion in the background

Backgrounds – Rules to Live By

- KISS (Keep It Simple, Stupid). This clip was challenging to compress because of the fine wallpaper pattern. This created almost constant background motion, even in top-performing codecs at generous data rates
Backgrounds – Rules to Live By

- KISS 2. More irrelevant high contrast detail. The brick wall seemed like a good idea at the time, but between that and the grass, this image has tons of irrelevant detail to preserve, inevitably degrading the money shot.

Backgrounds – Rules to Live By

- *Think contrast.* Here we have facial skin against a mauve wall. Throw in poor lighting, and the doctor looks like he’s in a witness protection program.
Backgrounds – Rules to Live By

- *Avoid motion.* Shooting against a moving background is also a bad idea.

- *You look wonderful against black.* The best background is a flat black, light-absorbing background like that used in the Jan Black clip.
  - Check for fading, however.
Backgrounds – Rules to Live By

- *Embrace clutter.* If you can’t go flat black, avoid backgrounds with large open spaces, which seem to attract artifacts. This background is ideal, containing the type of large-item clutter that seems to localize and minimize compression artifacts.

Backgrounds Matter - General

- Other rules
  - Avoid complex textures and shapes (no herringbones, bookshelves, etc)
  - Ensure some contrast between subject and background, but not too much:
    - Martian against a green background
    - Black suit, white background
  - Background:
    - Should not move (trees, people, cars, etc.)
    - Should not be brighter than ambient light in the scene (backlighting, as in windows, doors, spotlights)
Backgrounds Matter

- Mind the general rules, but test, test, test
  - Can’t predict what will go wrong when codecs are involved
    - Some codecs (like Apple’s H.264) had issues with black backgrounds
  - Encode test video to final parameters before finalizing set design

Positioning

- To soften background
  - Move camera away from subject
  - Move subject away from background
  - Obviously, mind audio quality
  - Tough to do with 1/3” CCD camcorders
Dressing Your Talent

- Simple, natural colors with minimal detail (e.g. avoid pinstripes, herringbone, etc.)
- Avoid high contrast colors (black suit, white shirt, red tie)
- Avoid “hot colors” that glare under lights and “bloom” when compressed (red, orange, yellow, bright green)
- Remove shiny objects like dangling earrings, necklaces and bracelets (sorry, Mr. T)
- Glasses may require special lighting (generally from the side) to avoid glare

Framing Your Shots

- Different than TV or DVD
  - No safe zone – so can put titles at lower edges
  - Much smaller viewing – so frame more closely
    - Or zoom in in editor
  - Note – for high value videos, consider using a professional tool for scaling
Coaching Your Talent

- Tight framing leaves little room for motion, which codecs can’t handle anyway
- Use voice modulation rather than hand and body motion to convey pacing and retain interest
Lighting

- In general
- Light positioning
  - Three point
  - Flat
- Hard vs. soft
  - Creating soft lights

In General

- Lighting is the single most important determinant of video quality
  - Low lighting creates noise in the video, complicating low bitrate compression
  - Better cameras do better with low light; consumer camcorders need more light
- Hierarchy of considerations
  - Ensure lighting is adequate
  - Then worry about style and mood
Techniques - Three Point Lighting

- Key-major light source
  - "Hard" light
  - 45° angle from camera, pointing down at 45°
- Fill-moderates shadows
  - "Soft light
  - 45° angle from camera, pointing down at 45°
- Back light-creates contrast
  - "hard" light
  - Shining down from back on head and shoulders

Three Point Lighting

- Key Only
- Key and Fill
- Key, Fill, Back

- Mind the nose "caret"
- Should never cross lips (light too high)
- Should never cross into cheek (light too far to the side)
Flat Lighting

- 2 keys and a back light
  - Typically, 2 soft lights
  - 45° angle from camera, pointing down at 45°
- Back light - create contrast
  - Shining down from back on head and shoulders

Techniques - Flat Lighting

- No shadows (except under the chin on the left)
  - Minimized on the right with a bounce card
Three Point or Flat?

- Go with flat
  - Three point usually involves incandescent lights
    - Very hot
    - Seem to burn out frequently
  - Three point is really hard with multiple subjects and when subjects move
  - Shadows and contrast can degrade during compression

Creating Soft Lights

- Use fluorescent lights
- Bounce lights off reflectors or umbrellas (light kits)
- Diffuse hard light with fabric softener sheets or diffusion paper (held with clamps or wooden clothes hangars)
- Bounce the light off a wall or foam core
Camera Settings

- AGC off
  - Don’t want minor movements to trigger gain reaction
- Format
  - Use DV or higher if possible
  - Avoid HDV and HD for SD output
- Progressive vs. interlaced

Progressive vs. Interlaced

- Theory
- Tests
- Results
- Analysis
Theory

- Flash is FRAME based (as are most streaming formats)
- Shooting in a progressive (frame) based format will deliver optimal quality (more later)
- Especially compared to interlaced, which is field based, with fields merged during editing or encoding to create frame

Tests

- Shoot image with side by side cameras;
  - Progressive – JVC GYHD100
  - Interlaced – Canon XL H1
- Low to moderate motion
- Processing
  - Both output via Adobe Media Encoder (CBR)
  - JVC processed with Cineform preset
Low motion

- No major difference (none expected)
  - JVC a bit sharper

More motion

- Perhaps more detail in progressive shot
- Definitely more blocks in progressive shot
Even more motion

- Perhaps more detail in progressive shot
- Definitely more blocks

Premiere Frame – No Encoding

- Premiere’s de-interlacing is very accurate
  - Even before compression, unipod images look very similar
Analysis

- Preliminarily (limited tests)
  - For lower motion clips, shouldn’t see a difference
  - For higher motion clips, improved de-interlacing algorithms improves quality of interlaced source (minimizing difference with progressive video)
- If it was me?
  - I wouldn’t buy a camera solely because it had progressive capabilities
  - If I had a camera with progressive, I would shoot in progressive mode
    - Pay attention to the workflow! Easy to hose progressive video if using wrong presets

Pre-processing

- De-interlacing
- Scaling
- Noise Reduction Filtering
- Other image adjustments (color correction, etc.)
De-interlacing

- Most cameras capture interlaced video
  - 60 fields per second, not 30 frames
  - Fields are captured 1/60th of a second apart
- Flash is frame based
- Converting from fields to frames can cause a stair step or Venetian blind artifacts which de-interlacing can resolve
De-interlacing

- Always de-interlace when producing Flash videos
- Encoders all have different controls, but typically, you may need to:
  - Output a progressive frame
  - Select de-interlacing
- De-interlacing artifacts are easy to spot; once seen and recognized, you can resolve

De-interlacing – Third Party Tools

- Benefit of third party tools most apparent at 640x480 (left), less so at 320x240 (right)
- AlgoSuite from Algolith ~ $1,500 tool with great noise reduction, scaling and de-interlacing
Third Party Scalers Tools

- Consider third party tools when
  - Not time critical (filtering takes lots of time)
  - Producing at full resolution (720x480 to 640x480)
    - Probably not worth time/effort at 320x240

Scaling

- Scaling is when you convert from source to output resolutions
- All encoder tools scale; but qualitative differences exist (AlgoSuite from Algolith)
  - Most visible in images with lots of lines and edges (drawings and animations)
  - Much less difference in real world videos
Scaling

- Conclusion:
  - If you can build a high quality scaler into your workflow, you'll improve quality
    - Generally takes time
  - Most benefit at large resolutions, and when combined with a de-interlacing tool.

Noise Reduction

- Many encoders offer noise reduction features
  - Generally low quality tools that blur entire frame, potentially losing detail
Noise Reduction

- Best tools are usually third party (and expensive)
  - Use adaptive techniques that distinguish between noise and true motion
  - This reduces noise without blurring or other artifacts
- Generally worth a try when image is noisy from chroma gain or poor quality source

AlgoSuite from Algolith

- Concert shot with poor lighting
  - Some noise obvious from back camera
  - Trophy video, so worth the effort
Other Adjustments

- Compression is highly GIGO
  - Boost video quality before encoding
    - Color correction
    - Boost brightness if encoded image looks too dark (gamma or brightness/contrast)
  - Black/white restore – which make colors close to black, totally black, and ditto for white
- Customize for encoding tool (more for each encoding tool)

Encoding

- Adobe Flash 8 Video Encoder
- On2 Flix Pro
- Sorenson Squeeze
Flash 8 Video Encoder

- Basics
- Exporting for Flash 8 Video Encoder
- Pre-processing tips
- Using the encoder

Flash 8 - Basics

- Again, CBR only, no VBR
- Scale/de-interlace in a third party tool before encoding
  - Otherwise, results during even moderate motion sequences will be unacceptable

- Consider encoding in Premiere Pro 2.0, which has the same features as the Flash 8 Encoder (but no batch)
Exporting for Flash 8

- Scale to target resolution and frame rate
  - S/be square pixel (640x480/320x240/176x132)
- Use raw codec (AVI or QuickTime)
- Always de-interlace
- Use high quality scaling if an option
- Be sure to output progressive frames

Flash 8 Pre-Processing tips

- Clips encoded with the Flash 8 Encoder often became slightly faded and a touch dark
- Consider boosting color saturation in your video editor
Using the Flash 8 Video Encoder

- Several presets still use Spark codec
  - Always go with VP6
- Presets are weak – go custom
  - See about our clips for suggested rez/data rates
- Great batch function aids testing

On2 Flix Pro Encoder

- Basics
- Optimizing Flix Pro
Flix Pro - Basics

- Very easy to use with good scaling and de-interlacing, but you have to set the switch in the Video Filters dialog
- Saw minimal color fading

Optimizing Flix Pro

- What worked/what didn’t
  - Flix Pro Noise Reduce filter was neutral to negative, producing blurry footage
Optimizing Flix Pro

- What worked/what didn’t
  - Flix Pro Noise Reduce filter produced artifacts around Alex’s waist
  - Also removed some background noise in some clips (worth a try for noisy footage)

Optimizing Flix Pro

- What worked/what didn’t
  - Filtering, scaling and de-interlacing in AlgoSuite improved results in images with lots of sharp edges
Optimizing Flix Pro

- Use caution with low motion footage
  - Flix Pro tended to drop data rates to very low levels in both CBR and VBR, producing pulsing video
  - Consider Flash 8 Video Encoder for low motion videos, especially at higher target bit rates.

Sorenson Squeeze

- Basics
- Optimizing Squeeze
Squeeze - Basics

- In default mode, Squeeze disables "Auto Key frames enabled", which prevents Squeeze from inserting key frames to improve quality.

Optimizing Squeeze - Quality

- Squeeze noise reduction filter had little effect, good or bad
- AlgoSuite filter was neutral to positive
Optimizing Squeeze - Color

- Squeeze tended to brighten colors and resist dullness

![Color Comparison](image)

Optimizing Squeeze

- Very good CBR encoder for low motion clips
- Advanced users
  - Adjust minimum VBR data rate from 40% to 80%
  - Could improve low motion quality

<table>
<thead>
<tr>
<th>Default</th>
<th>Adjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum 2 Pass VBR Data Rate</td>
<td>40</td>
</tr>
<tr>
<td>Maximum 2 Pass VBR Data Rate</td>
<td>400</td>
</tr>
<tr>
<td>Key Frame Data Rate</td>
<td>110</td>
</tr>
<tr>
<td>Data Rate Undershoot</td>
<td>100</td>
</tr>
<tr>
<td>Percent</td>
<td></td>
</tr>
</tbody>
</table>
## Recommendations – 300 kbps

<table>
<thead>
<tr>
<th>300Kbps</th>
<th>Flash 8</th>
<th>Real</th>
<th>Squeeze</th>
<th>Flix Pro</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business (Low motion)</td>
<td>2.00</td>
<td>1.00</td>
<td>2.33</td>
<td>2.00</td>
</tr>
<tr>
<td>Action (high motion)</td>
<td>3.00</td>
<td>1.00</td>
<td>2.00</td>
<td>1.67</td>
</tr>
<tr>
<td>Entertainment (mix)</td>
<td>2.00</td>
<td>1.00</td>
<td>2.00</td>
<td>2.33</td>
</tr>
<tr>
<td>Overall</td>
<td>2.07</td>
<td>1.07</td>
<td>2.33</td>
<td>1.87</td>
</tr>
<tr>
<td>Total points</td>
<td>78</td>
<td>118</td>
<td>74</td>
<td>89</td>
</tr>
<tr>
<td>Percentage behind leader</td>
<td>-34%</td>
<td>0%</td>
<td>-37%</td>
<td>-25%</td>
</tr>
<tr>
<td>Percentage behind Flash leader</td>
<td>-12%</td>
<td>NA</td>
<td>-17%</td>
<td>0%</td>
</tr>
</tbody>
</table>

## Recommendations – 500 kbps

<table>
<thead>
<tr>
<th>500Kbps</th>
<th>Flash 8</th>
<th>Real</th>
<th>Squeeze</th>
<th>Flix Pro</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business</td>
<td>1.67</td>
<td>1.00</td>
<td>3.00</td>
<td>2.33</td>
</tr>
<tr>
<td>Action</td>
<td>2.00</td>
<td>2.50</td>
<td>2.33</td>
<td>1.33</td>
</tr>
<tr>
<td>Entertainment</td>
<td>2.33</td>
<td>1.17</td>
<td>2.67</td>
<td>2.33</td>
</tr>
<tr>
<td>Overall</td>
<td>1.63</td>
<td>1.87</td>
<td>2.47</td>
<td>1.97</td>
</tr>
<tr>
<td>Total points</td>
<td>91</td>
<td>92</td>
<td>76</td>
<td>83</td>
</tr>
<tr>
<td>Percentage behind leader</td>
<td>-1%</td>
<td>0%</td>
<td>-17%</td>
<td>-10%</td>
</tr>
<tr>
<td>Percentage behind Flash leader</td>
<td>0%</td>
<td>NA</td>
<td>-16%</td>
<td>-9%</td>
</tr>
</tbody>
</table>

*Remember: Flash 8 preprocessed with AlgoSuite*
Questions?