Streaming Learning Center

C202: How To Build Your Own Cloud Encoder With FFmpeg

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About Your Speakers

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INTRO

The WIIFM

WHO IS THIS PRESENTATION FOR?

- You have lots of video to transcode
- You distribute via one or more adaptive bitrate technologies
- You're familiar with concepts like codecs and packaging
- You're familiar with creating command line executions and JavaScript doesn't offend you
- You understand some very basics of servers and how to work with them

Streaming Learning Center

Intro to FFmpeg

Jan Ozer
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Introduction

- There are always multiple ways; seldom is there a single correct “one”
- We’re showing minimum necessary commands; there are lots more configuration options
- Location of configuration option in string typically doesn’t matter
- If you don’t choose a configuration option, FFmpeg uses the default
- Configurations in command line override defaults

Script 1: Choosing Codec

```
ffmpeg -i TOS_1080p.MOV  -c:v libx264      TOS_s1.mp4
```

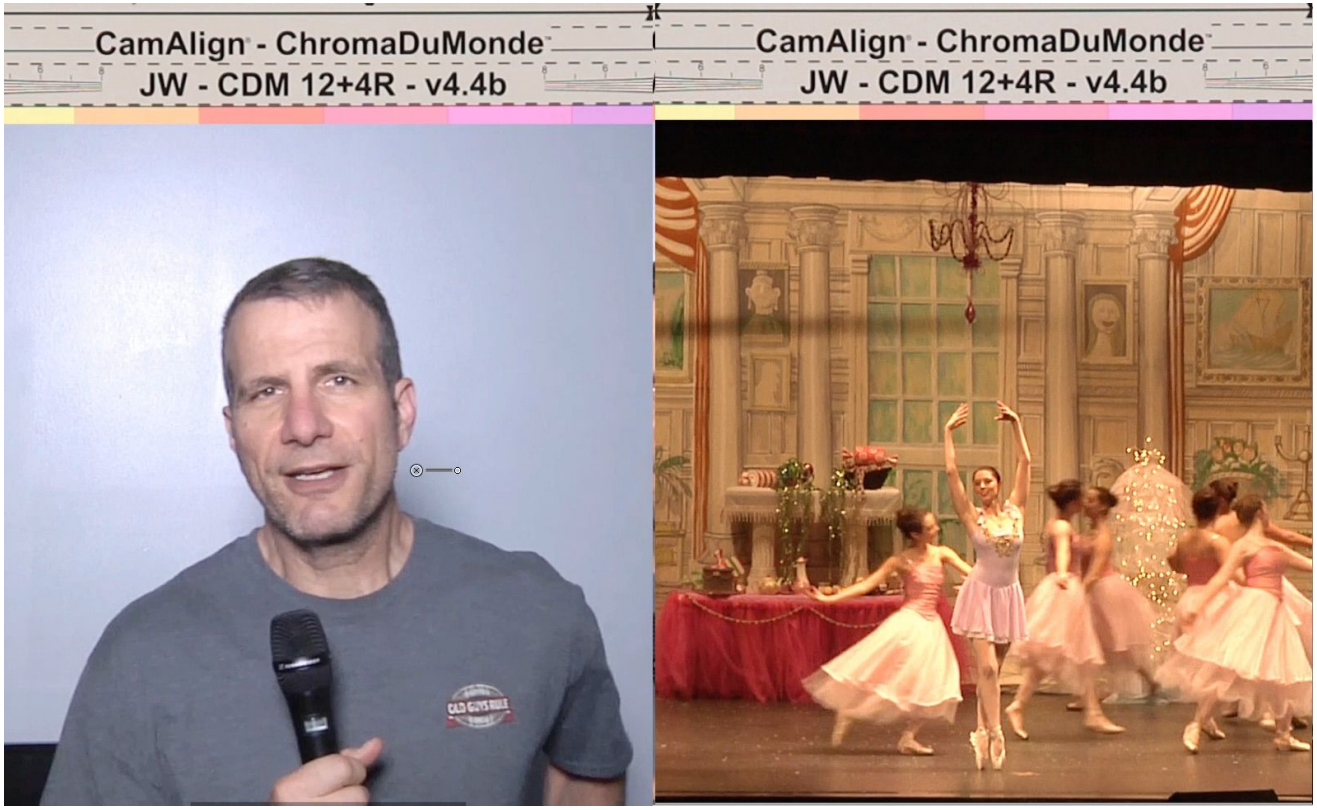
Program input file video codec Output file

- Input file: 1080p file in MOV format
  - YUV video
  - PCM audio
- Simple script means that you accept all FFmpeg defaults
- Generally acceptable for home movies; not acceptable for streaming, particularly adaptive streaming

Encoding Output - Simple

- Codec: x264
  - Data rate: 15 Mbps
  - Bitrate control: average bitrate
  - Key frame: 250
  - Scene change: Yes
  - Resolution: same (1080p)
  - Frame rate: same (24)
  - Profile: High
  - CABAC: Yes
  - x264 preset: Medium
  - B-frames: preset (3)
  - B-adapt: preset (1)
  - Reference frames preset (3)
- Audio codec: AAC
  - Audio channels: 2
  - Audio samples: 48 khz
  - Audio bitrate: 2277 b/s
- Other Topics
  - Encoding multiple files
  - Converting to HLS

Bitrate control

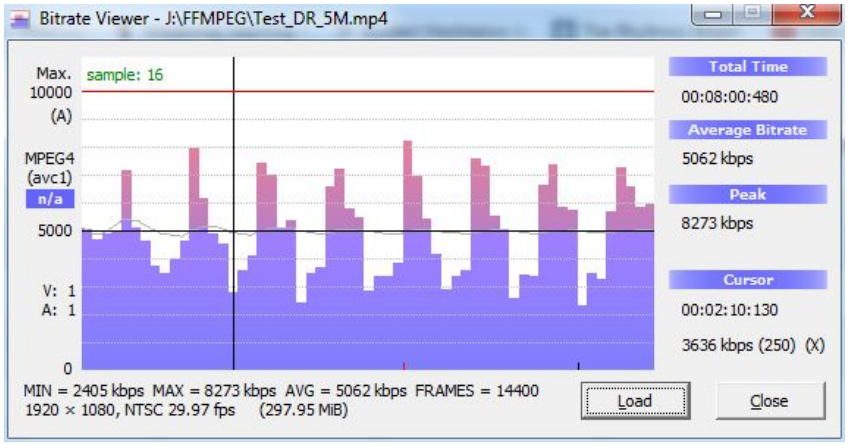


30 seconds talking head/30 seconds ballet

Setting Data Rate-Video

```
-b:v 5000k
```

bitrate video



- Sets video bitrate to 5 mbps

- No real bitrate control
- Spikes may make file hard to play

Images from Bitrate Viewer

Setting Data Rate-Two-Pass

```
ffmpeg -y -i Test_1080p.MOV -c:v libx264 -b:v 5000k -pass 1  -f mp4 NUL && \

ffmpeg -i  Test_1080p.MOV -c:v libx264 -b:v 5000k -pass 2   Test_1080p_2P.mp4
```

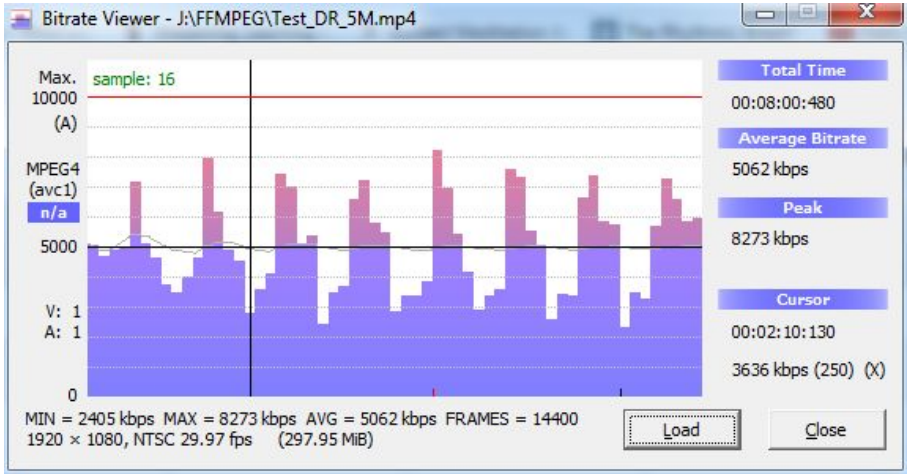
Line 1:

- `-y` - overwrite existing log file
- `- pass 1` - first pass, no output file
- `-f mp4` - output format second pass
- `NUL` - creates log file cataloguing encoding complexity (can name log file if desired)
- `&& \` - run second pass if first successful

Line 2:

- `-pass 2` - find and use log file for encode
- `Test_1080p_2P.mp4` - output file name
- Note - all commands in first pass must be in second file; can add additional commands in second line (more later)

Setting Data Rate-Two-Pass



- Two-Pass Encode
  - Improved bitrate control (5007 kbps)
  - Higher peak!
- Single-Pass Encode
  - Poor data rate control (5062 kbps)

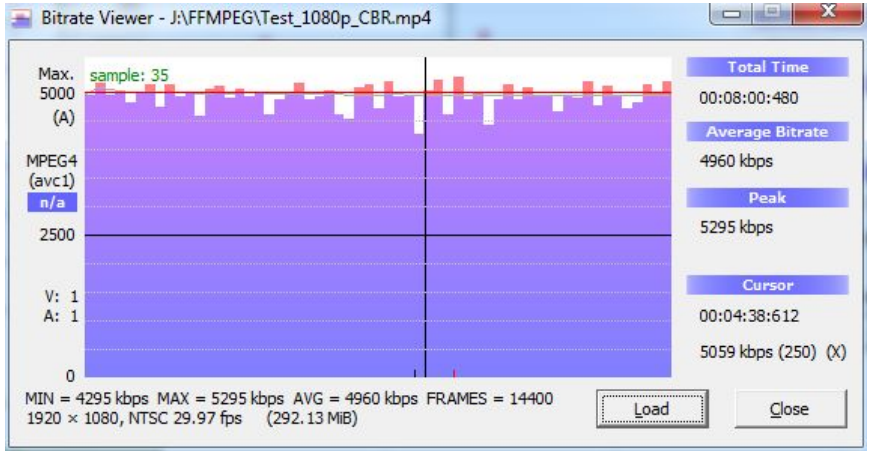
Setting Data Rate-CBR

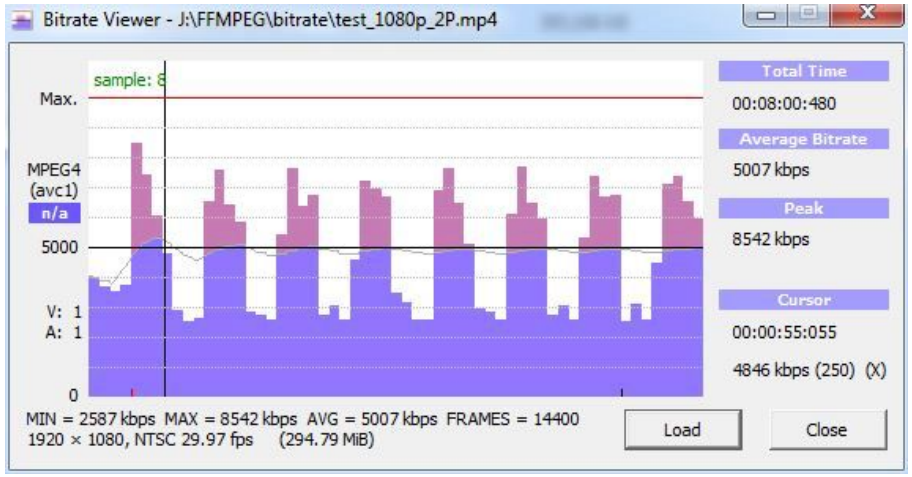
```
ffmpeg -y -i  test_1080p.MOV -c:v libx264  -b:v 5000k -pass 1  -f mp4 NUL && \
(same)

ffmpeg -i  test_1080p.MOV -c:v libx264   -b:v 5000k -maxrate 5000k -bufsize 5000k
-pass 2  test_1080p_CBR.mp4
```

Line 2:

- `- maxrate 5000k` - maximum rate same as target
- `- bufsize 5000k` - VBV (Video Buffering Verifying) buffer set to one second of video (limits stream variability)

Setting Data Rate-Two-Pass





- CBR - not flat line
  - Peak is 5295
  - Much less variability
  - Lower overall quality (not much)
  - Can show transient quality issues
- Two-pass ABR
  - Poor data rate control
  - Better overall quality

CBR Can Show Transient Quality Issues

- bit.ly/VBR_not_CBR

Setting Data Rate-Constrained VBR

```
ffmpeg -y -i  Test_1080p.MOV -c:v libx264  -b:v 5000k -pass 1  -f mp4 NUL && \
(same)

ffmpeg -i  Test_1080p.MOV -c:v libx264  -b:v 5000k -maxrate  10000k -bufsize 10000k
-pass 2  Test_1080p_200p_CVBR.mp4

ffmpeg -i  Test_1080p.MOV -c:v libx264  -b:v 5000k -maxrate  5500k -bufsize 5000k
-pass 2  Test_1080p_110p_CVBR.mp4
```

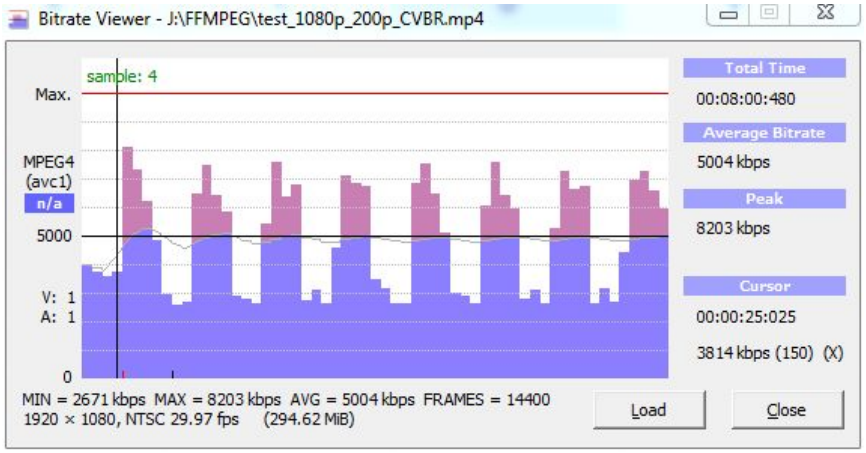
Line 2: 200% Constrained VBR

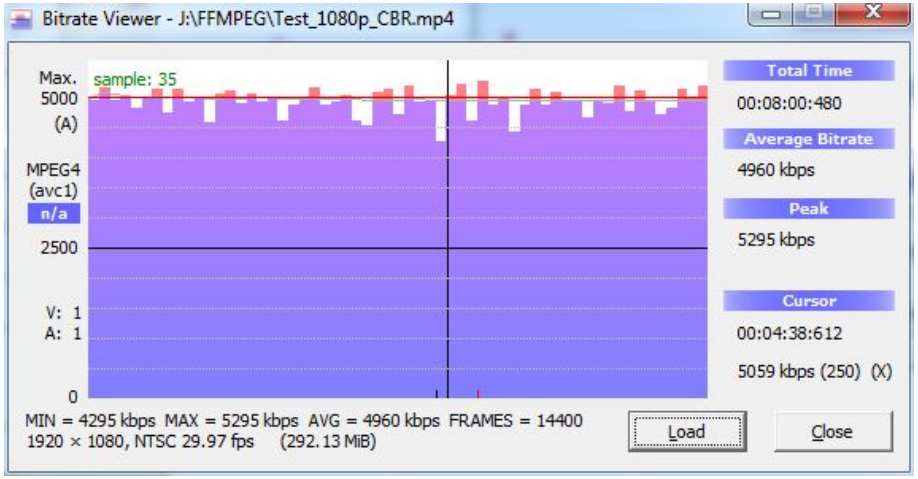
- `- maxrate 10000k` - 200% of target
- `- bufsize 10000k` - VBV buffer set to two seconds of video (more variability)

Line 2: 110% Constrained VBR

- `- maxrate 5500k` - 110% of target
- `- bufsize 10000k` - VBV buffer set to one second of video (less variability)

Setting Data Rate-Constrained VBR

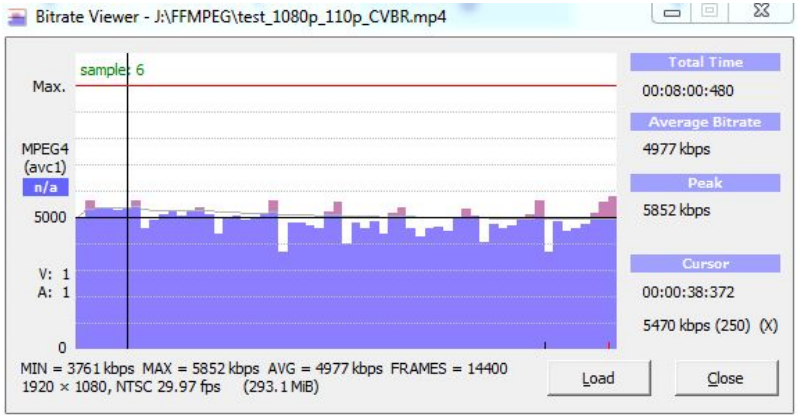


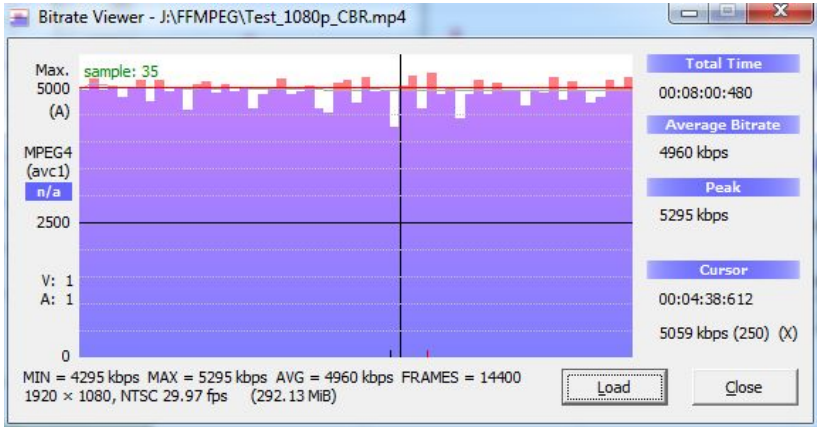


- 200% Constrained VBR - more stream variability
  - slightly higher quality
  - Avoids transient problems
- Too much variability

- Peak is 5295
- Much less variability
- Lower overall quality (not much)
- Can show transient quality issues

Setting Data Rate-Constrained VBR





- 110 Constrained VBR
  - Slightly higher quality than CBR
  - Slightly higher peak
  - Avoids transient frame issues
  - More easily deliverable than 200% constrained
  - Required by Apple TN2224

- Peak is 5295
- Much less variability
- Lower overall quality (not much)
- Can show transient quality issues

Bottom Line

- Technique is pretty simple
- My tests
  - CBR delivers best QoE (bit.ly/BRcontrol_QoE)
  - CBR can introduce transient quality issues (bit.ly/VBR_not_CBR)
  - Bottom line: recommend 110% CVR
    - Very deliverable
    - Avoids transient quality issues

Key Frame/Scene Change - Single File

`-g 250` — GOP Size

`-keyint_min 25` — Minimum Space B/T Keys

`-sc_threshold 40` — Sensitivity to Scene Change

- Default is:
  - Interval of 250
  - Scene change enabled
  - Minimum interval between 25
  - Sensitivity of 40
- Don’t have to do add anything; FFmpeg will deliver these defaults with or without entries

Key Frame/Scene Change - Single File

`-g 250`

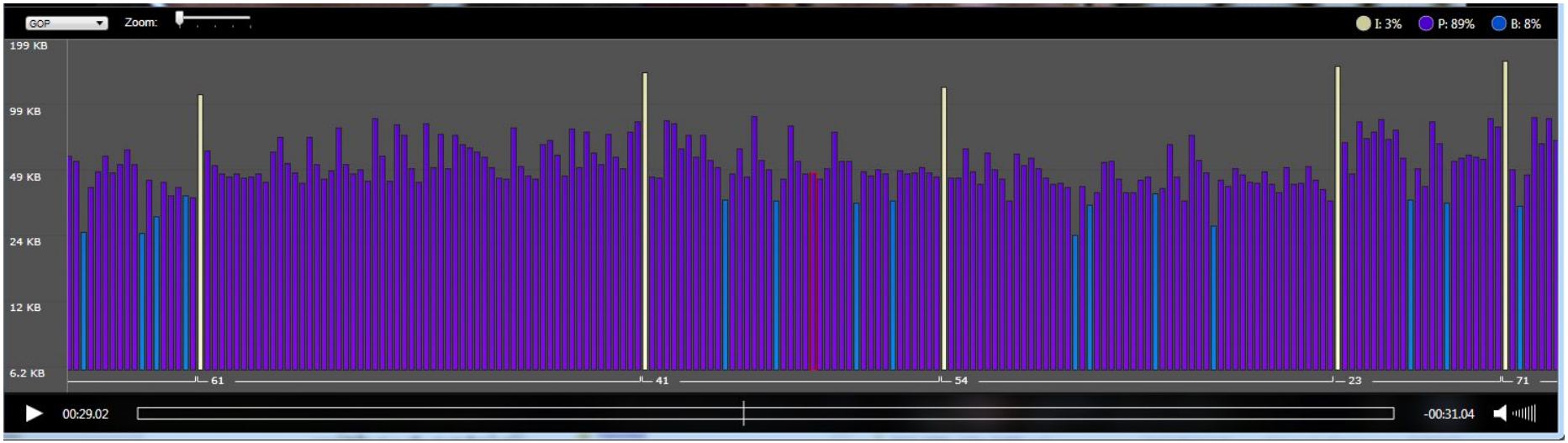
GOP Size

`-keyint_min 25`

Minimum Space B/T Keys

`-sc_threshold 40`

Sensitivity to Scene Change



Irregular Keyframes

Images from Telestream Switch

Key Frame/Scene Change - ABR - Alt 1

`-g 72` — GOP Size

`-keyint_min 72` — Minimum Space B/T Keys

`-sc_threshold 0` — Sensitivity to Scene Change

- ABR
  - Need smaller GOP so can switch to different streams much faster
  - Need consistent keyframe interval
    - Have to be at the start of all segments
- GOP 72 (3 seconds)
  - 72 is about the longest; many use 2-seconds
  - Adjust for frame rate
- Minimum 72 e.g. no scene changes
- -sc_threshold 0 - no scene changes
- Need in Pass 1 and Pass 2

Key Frame/Scene Change - ABR - Alt 1

`-g 72`

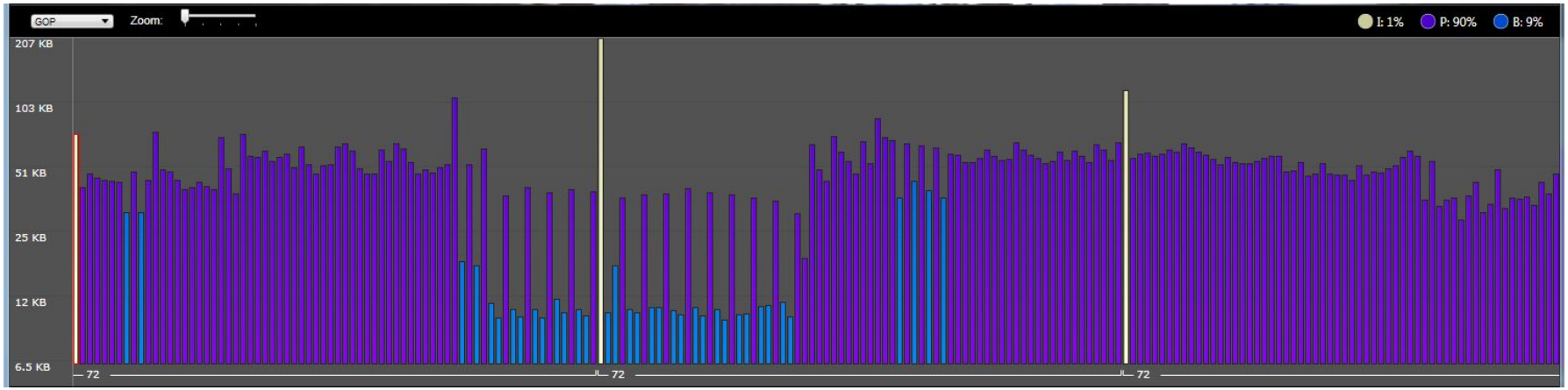
GOP Size

`-keyint_min 72`

Minimum Space
B/T Keys

`-sc_threshold 0`

Sensitivity to
Scene Change



Regular Keyframes but none at scene changes

Key Frame/Scene Change - ABR - Alt 2

`-force_key_frames expr:gte(t,n_forced*3)` `-keyint_min 25` `-sc_threshold 40`

Force Keyframe every 3 seconds

Default Minimum

Default Sensitivity

- Should deliver
  - Keyframe every 72 frames
- Green are defaults
  - Don’t really need to be there

Key Frame/Scene Change - ABR - Alt 2

`-force_key_frames expr:gte(t,n_forced*3)`

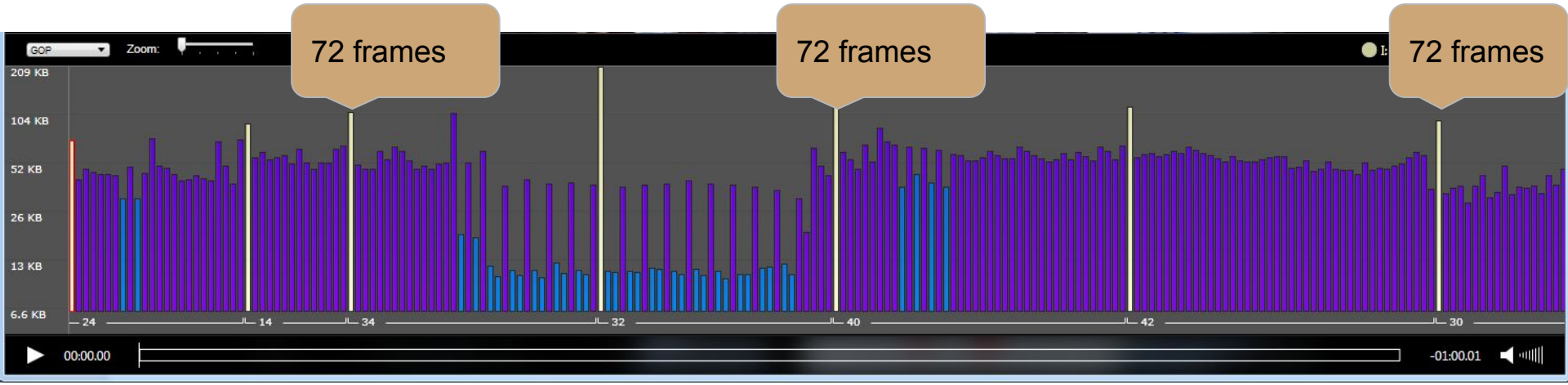
Force Keyframe every 3 seconds

`-keyint_min 25`

Default Minimum

`-sc_threshold 40`

Default Sensitivity



Regular Keyframes, and keyframes at scene changes

(realeyes)

Which Alternative is Better?

Static (no scene change)

PSNR - 41.22207

Scene Change Detection

PSNR - 41.25565

.08% better

Resolution

```
-s 1280x720
```

Resolution

```
-vf  scale=1280:trunc(ow/a/2)*2
```

Video Filtergraph

Set width

Compute height
Same aspect ratio
Multiple of 2

Simple

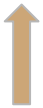
- Default is same as original; if not changing resolution can leave out
- Set size directly
- Simple and easy
- Will distort if aspect ratio changes

More Complex

- More flexible approach
- Preserves aspect ratio
- Makes sure height is multiple of 2 (mod 2)
  - If odd value can cause encoding problems

Frame Rate

```
-r 12
```



- Don’t need to include
  - Default is use source frame rate
  - Typically used to cut frame rate on lower quality streams
    - 480x270@12 fps

Profile/Level

`-profile:v Baseline, Main or High`
`-profile:v Baseline`

- Default is High; need to use baseline for files created for Android and older iOS devices

`-level:v number`
`-level:v 4.2`

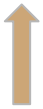
- Use when encoding for constrained devices (mobile)
- Simply inserts level in file metadata; does not restrict encode to level parameters

x264 Preset/Tuning

`-preset preset name (slow)`
`- preset slow`

- x264 has collections of encoding parameters called presets
  - Ultrafast to placebo
  - Trade encoding speed against quality (see next page)
- Default is medium - if no entry, medium parameters are applied

`-tune tune name (animation)`
`- tune animation`



- Tune encoding parameters for different footage types
  - Animation, film, still images, PSNR, SSIM, grain
- My experience - animation works pretty well, the rest not so much
- Default is no tuning

x264 Preset

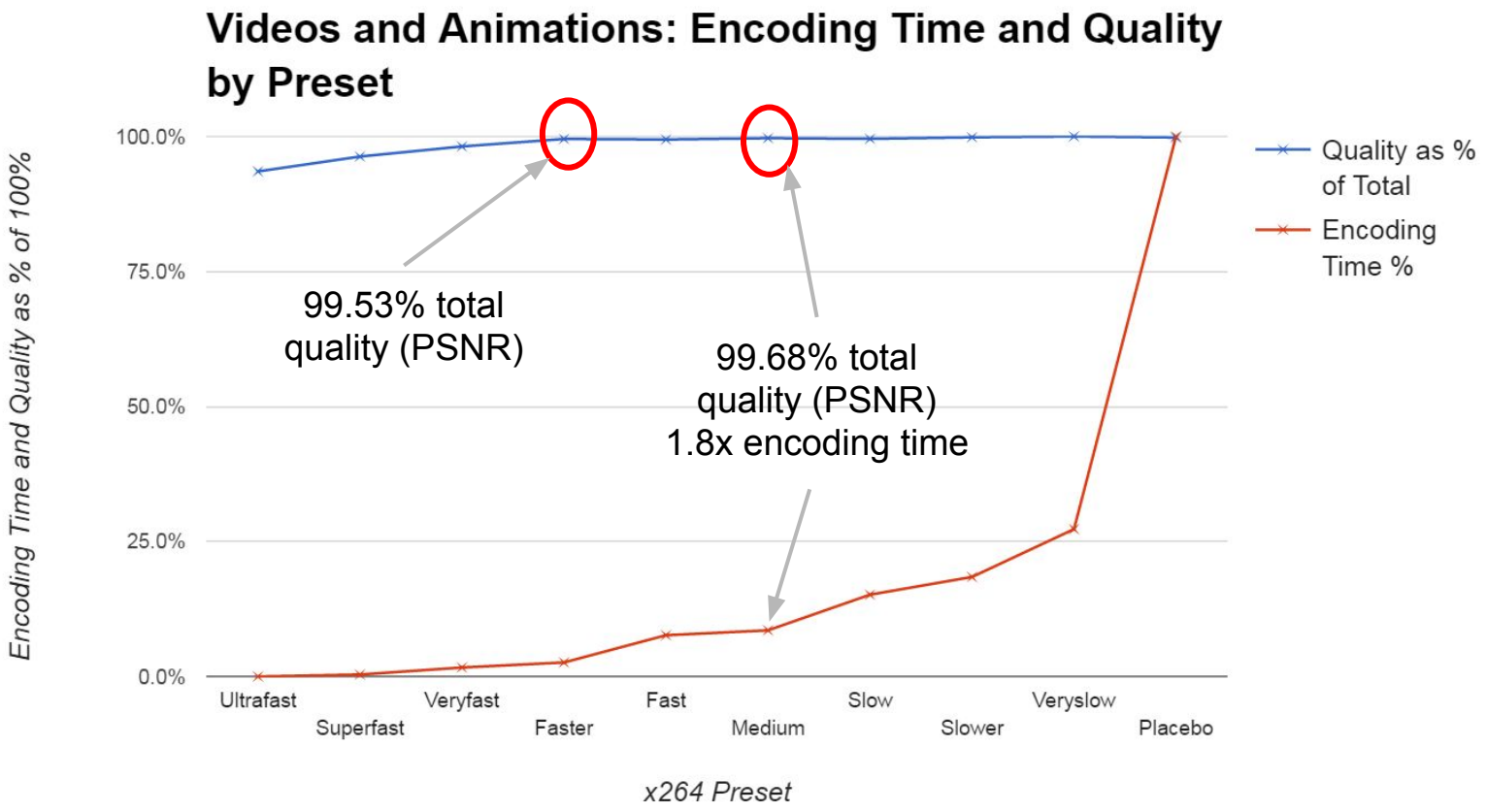
Option	ultrafast	superfast	veryfast	faster	fast	medium	slow	slower	veryslow	placebo
aq-mode	0*	1	1	1	1	**1**	1	1	1	1
b-adapt	0*	1	1	1	1	**1**	2*	2*	2*	2*
bframes	0*	3	3	3	3	**3**	3	3	8*	16*
deblock	[0:0:0]*	[1:0:0]	[1:0:0]	[1:0:0]	[1:0:0]	**[1:0:0]**	[1:0:0]	[1:0:0]	[1:0:0]	[1:0:0]
direct	spatial	spatial	spatial	spatial	spatial	**spatial**	auto*	auto*	auto*	auto*
me	dia*	dia*	hex	hex	hex	**hex**	umh*	umh*	umh*	tesa*
merange	16	16	16	16	16	**16**	16	16	24*	24*
cabac	0	1	1	1	1	**1**	1	1	1	1
partitions	none*	i8x8,i4x4*	p8x8,b8x8,i8x8,i4x4	p8x8,b8x8,i8x8,i4x4	p8x8,b8x8,i8x8,i4x4	**p8x8,b8x8,i8x8,i4x4**	all*	all*	all*	all*
rc-lookahead	0*	0*	10*	20*	30*	**40**	50*	60*	60*	60*
ref	**1***	**1***	**1***	**2***	**2***	**3**	**5***	**8***	**16***	**16***
scenecut	0*	40	40	40	40	**40**	40	40	40	40
subme	0*	1*	2*	4*	6*	**7**	8*	9*	10*	11*
trellis	0*	0*	0*	1	1	**1**	1	2*	2*	2*
weightp	0*	1*	1*	1*	1*	**2**	2	2	2	2

- Yellow - default
- Green - ones that you may adjust with

* - are differing values from medium.

excerpted from http://dev.beandog.org/x264_preset_reference.html

x264 Preset

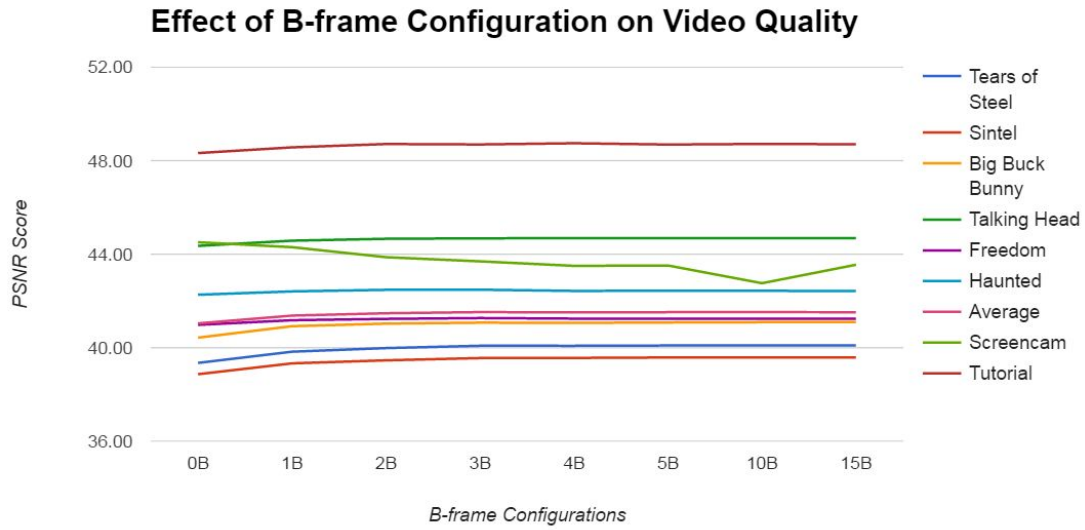

Videos and Animations: Encoding Time and Quality by Preset
Encoding Time and Quality as % of 100%
100.0%
75.0%
50.0%
25.0%
0.0%
99.53% total quality (PSNR)
99.68% total quality (PSNR) 1.8x encoding time
Quality as % of Total
Encoding Time %
Ultrafast
Superfast
Veryfast
Faster
Fast
Medium
Slow
Slower
Veryslow
Placebo
x264 Preset

x264 Preset

- Medium is default; works well in most cases
- If capacity becomes an issue, consider switching to Faster
  - ~99.84% of the quality
  - 58% of encoding time

(realeyes)

About B-frames



- Bi-directional interpolated
  - Can seek redundancies from before and after frame position
  - Most efficient frame

- More is better to a point
- Can cause compatibility issues
- No significant quality difference in quality after 2 or 3

B-frame

`-bf 5`

Set B-frame interval

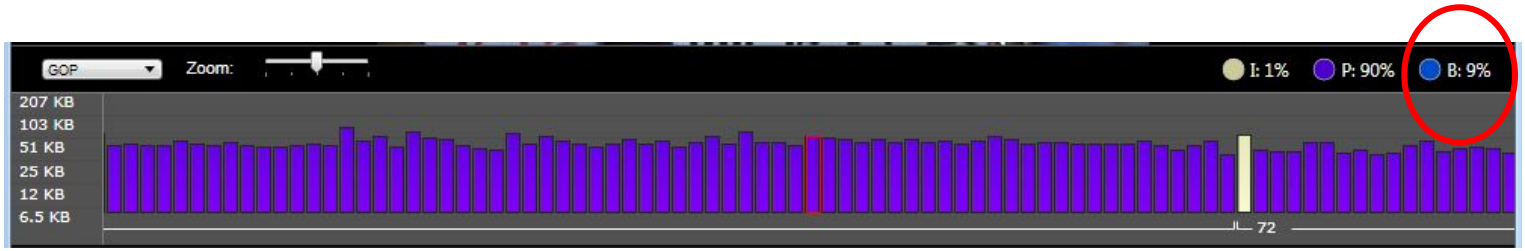
- Here's how you set interval

`-b_strategy 0, 1, 2`

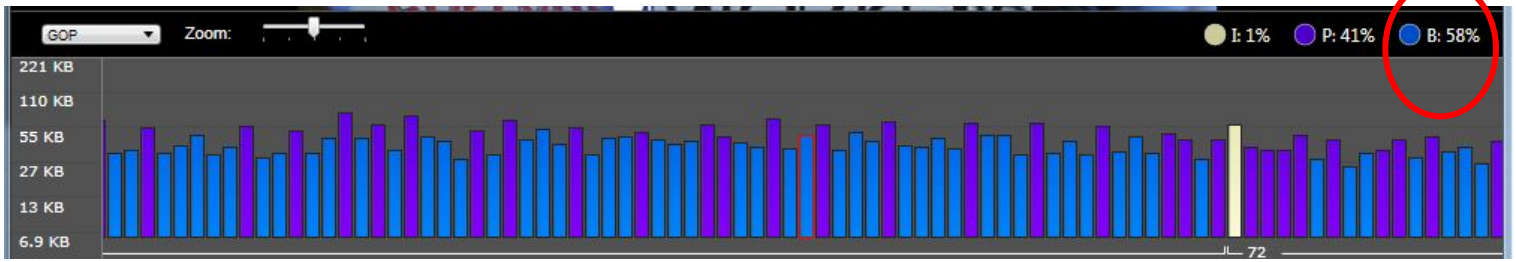
B-frame Selection strategy

- How encoder chooses which frames will be b frames
  - 0 - fastest, not recommended
  - 1 - Fast, default
  - 2 - Slowest, but more accurate

B-frame (Both with -bf 5)



`-b_strategy 1` 9% B frames PSNR 36.62



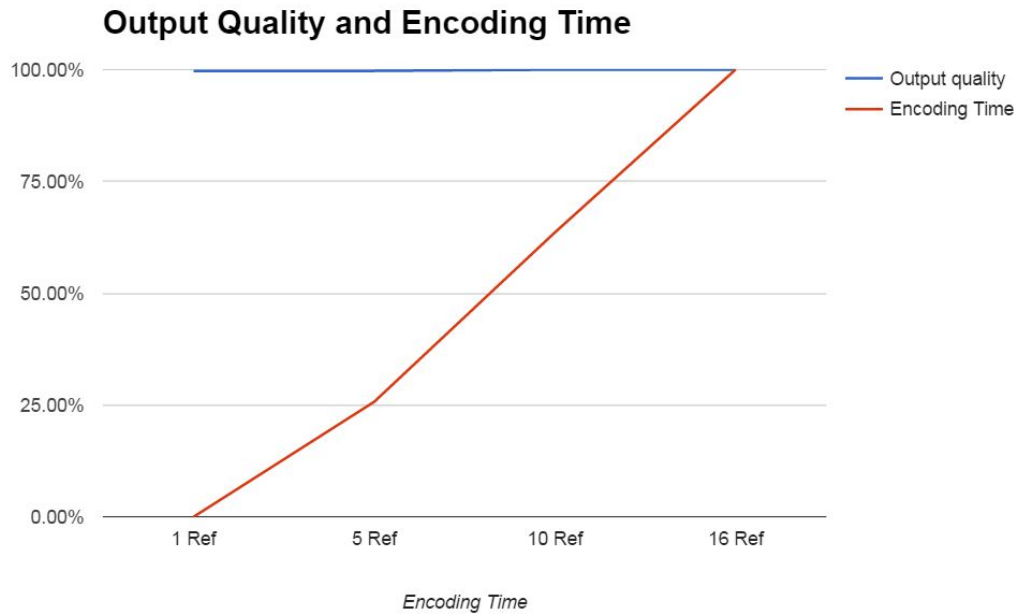
`-b_strategy 2` 58% B-frames PSNR 36.69 (.01% higher)

Images from Telestream Switch

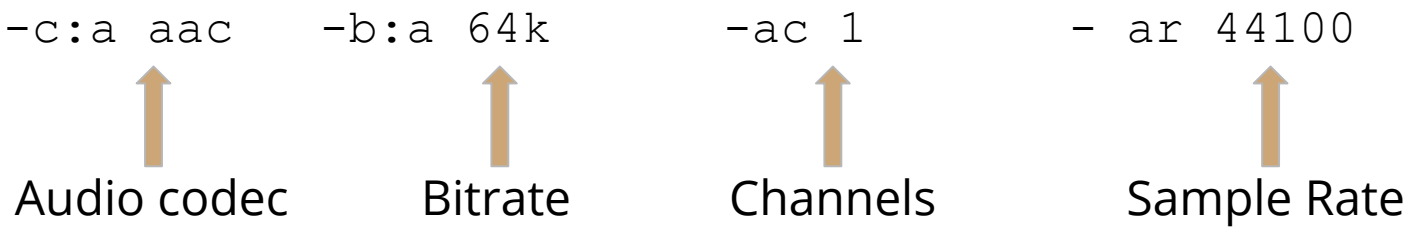
Reference Frames

```
-refs number of refs
-refs 5
```

- Usually use default
- Trade off encoding time vs. quality
  - very, very, minor quality differences across range of footage types



Audio



- Default:
  - AAC for MP4
  - Channels: source
  - Sample rate: source
  - Data rate: inconsistent
- HE, HE2 are different codecs
- Channels
  - 1 = mono
  - 2 - stereo

Multipass Encoding ABR Streams

- Can run first pass once, and apply to multiple encodes
- Which config options must be in first pass?
  - Frame settings (B-frame/Key frame)
  - Target data rate
  - Some say audio settings
    - My tests haven't shown this is true

Which Config in First Pass?

Pass 1 (1080 config): ffmpeg -y -i Test_1080p.mov -c:v libx264 -preset medium -g 72 -keyint_min 72 -sc_threshold 0 -bf 3 -b_strategy 2 -b:v 3000k -c:a aac -b:a 64k -ac 1 -ar 44100 -pass 1 -f mp4 NUL && \

Pass 2: ffmpeg -i Test_1080p.mov -c:v libx264 -preset medium -g 72 -keyint_min 72 -sc_threshold 0 -bf 3 -b_strategy 2 -b:v 3000k -maxrate 3300k -bufsize 3000k -c:a aac -b:a 64k -ac 1 -ar 44100 -pass 2 Test_1080p.mp4

Pass 2: ffmpeg -i Test_1080p.mov -c:v libx264 -s 1280x720 -preset medium -g 72 -keyint_min 72 -sc_threshold 0 -bf 3 -b_strategy 2 -b:v 1500k -maxrate 1650k -bufsize 1500k -c:a aac -b:a 64k -ac 1 -ar 44100 -pass 2 Test_720p.mp4

Pass 2: ffmpeg -i Test_1080p.mov -c:v libx264 -s 640x360 -preset medium -g 72 -keyint_min 72 -sc_threshold 0 -bf 3 -b_strategy 2 -b:v 1000k -maxrate 1100k -bufsize 1000k -c:a aac -b:a 64k -ac 1 -ar 44100 -pass 2 Test_360p.mp4

(realeyes)

Which Config in First Pass? Three Tests

Pass 1: 1080p params
Pass 2: 1080p
Pass 2: 720p
Pass 2: 360p

Pass 1: 720p params
Pass 2: 1080p
Pass 2: 720p
Pass 2: 360p

Pass 1: 360p params
Pass 2: 1080p
Pass 2: 720p
Pass 2: 360p

TOS	1080p First Pass	720p First Pass	360p First Pass	Delta
1080p	34.99	35.14	35.09	0.41%
720p	33.36	33.24	33.46	0.65%
360p	32.93	33.00	32.97	0.20%
Average	33.76	33.79	33.84	0.42%

- Most resources say use file in the middle 720p
- 360p produced highest results in my tests
- Not a huge difference

HLS Packaging

```
-f hls  -hls_time 6  -hls_list_size 0  -hls_flags single_file
```

Format: HLS

Segment Length

Max segments in playlist.

One file (byte-range)

- Format: Must be in first and second pass
- Segment length
  - Keyframe interval must divide evenly into segment size
  - Shorter improves responsiveness
- -HLS_list_size
  - Typically set to 0 which means all
- HLS_Flags
  - When single_file, one TS file with byte-range requests
  - When left out, individual .ts segments
- Creates individual .m3u8 files; you have to create master

HLS Encoding: Updated TN2224

Clients			Dimensions for 16:9 aspect ratio	Dimensions for 4:3 aspect ratio	Frame rate	Video bit rate (average)	Video bit rate (peak)	Audio bit rate	Total bit rate
	CELL		416 x 234	400 x 300	12	145	200	64	264
	CELL	ATV	480 x 270	480 x 360	15	365	400	64	464
WiFi	CELL	ATV	640 x 360	640 x 480	29.97	730	800	64	864
WiFi	CELL	ATV	768 x 432	640 x 480	29.97	1100	1200	96	1296
WiFi		ATV	960 x 540	960 x 720	29.97 or source	2000	2200	96	2296
WiFi		ATV	1280 x 720	960 x 720	29.97 or source	3000	3300	96	3396
WiFi		ATV	1280 x 720 or source	1280 x 960 or source	29.97 or source	4500	5000	128	5128
WiFi		ATV	1280 x 720 or source	1280 x 960 or source	29.97 or source	6000	6500	128	6628
WiFi		ATV	1920 x 1080	1920 x 1440	29.97 or source	7800	8600	128	8728

Source frame rate may be as high as 60 fps
Audio sample rate: 48 khz
Keyframe: Every 2 seconds (i.e., frame rate × 2)
Segment Size: 6 seconds

Bit Rate Variability - Should not exceed 10% of target bit rate

- In practice you should expect that all devices will support HLS version 4
  - can use single file
- You should also expect that all devices will be able to play content encoded using High Profile Level 4.1.

HLS Command Line for First Three Files

Pass 1: ffmpeg -y -i Test_1080p.mov -c:v libx264 -s 1280x720 -preset medium -g 48 -keyint_min 48 -sc_threshold 0 -bf 3 -b_strategy 2 -b:v 3000k -c:a aac -b:a 128k -ac 2 -ar 48000 -pass 1 -f HLS -hls_time 6 -hls_list_size 0 -hls_flags single_file NUL && \

Pass 2: ffmpeg -i Test_1080p.mov -c:v libx264 -preset medium -g 48 -keyint_min 48 -sc_threshold 0 -bf 3 -b_strategy 2 -b:v 7800k -maxrate 8600k -bufsize 7800k -c:a aac -b:a 128k -ac 2 -ar 48000 -pass 2 -f hls -hls_time 6 -hls_list_size 0 -hls_flags single_file Test_1080p.m3u8

Pass 2: ffmpeg -i Test_1080p.mov -c:v libx264 -s 1280x720 -preset medium -g 48 -keyint_min 48 -sc_threshold 0 -bf 3 -b_strategy 2 -b:v 6000k -maxrate 6500k -bufsize 6000k -c:a aac -b:a 128k -ac 2 -ar 48000 -pass 2 -f hls -hls_time 6 -hls_list_size 0 -hls_flags single_file Test_720p_H.m3u8

Pass 2: ffmpeg -i Test_1080p.mov -c:v libx264 -s 1280x720 -preset medium -g 48 -keyint_min 48 -sc_threshold 0 -bf 3 -b_strategy 2 -b:v 4500k -maxrate 5000k -bufsize 4500k -c:a aac -b:a 128k -ac 2 -ar 48000 -pass 2 -f hls -hls_time 6 -hls_list_size 0 -hls_flags single_file Test_720p_M.m3u8

DASH: MP4 Box (You're On Your Own)

- Encode with FFmpeg
- Most producers use MP4Box for packaging
  - https://gpac.wp.mines-telecom.fr/mp4box/

Cloud Encoding (The Server)

TIME FOR SYSADMIN

OVERVIEW

- Choose your Cloud:
  - AWS
  - Azure
  - RackSpace
  - IBM SoftLayer
- Or don’t (On-prem)
- Or a hybrid (e.g. - On-prem and S3)

SIZING YOUR SERVER

- General
  - What general bitrates are you dealing with?
- Live
  - How many concurrent live streams?
  - Are you also transcoding optional renditions for ABR?
- VOD
  - How many concurrent videos being processed?
  - Is it transcoding or just transmuxing?
  - Do you need to create sidecar assets?

OUR EXPERIENCE

- In AWS we've found m3.large to be a pretty cost effective, decently performant and reliable instance size
- We made our decision in Azure based on AWS and went with as similar a match we could find, DS2_V2
- We use Linux as our base since it's friendlier with our software stack. Mostly RHEL.

STARTING POINT

- Get started with ec2 instances: http://docs.aws.amazon.com/AWSEC2/latest/UserGuide/EC2_GetStarted.html

- Get started with Azure VMs: https://azure.microsoft.com/en-us/documentation/articles/virtual-machines-linux-quick-create-portal/

GPU PIPELINE

Offload processing from CPU to dedicated hardware

- FFmpeg has some support for GPU Acceleration

- You need to have specific supported hardware
  - Example: AWS EC2 g2.2xlarge + CUDA + FFmpeg with -hwaccel option specified

GETTING THE SOFTWARE

You'll need to download and install software

- Our preferred toolset:
  - **FFmpeg** (Video processing and Static Builds are easy install)
  - **ImageMagick** (spritesheets, thumbnails and image manipulation)
  - **Node.js** (You need an application server wrapper)
  - **MongoDB** (You need some data persistence)
  - **Cloud Provider SDK** (e.g. AWS SDK for JavaScript in Node.js)

DIRECT LOADING

Getting started with FFmpeg

1. Select your static build: https://ffmpeg.org/download.html
2. Download, extract, and verify:

```
jheider@manage:~$ wget https://johnvansickle.com/ffmpeg/releases/ffmpeg-release-64bit-static.tar.xz

jheider@manage:~$ tar xf ffmpeg-release-64bit-static.tar.xz

jheider@manage:~$ cd ffmpeg-3.1.5-64bit-static/

jheider@manage:~/ffmpeg-3.1.5-64bit-static$ ./ffmpeg

ffmpeg version 3.1.5-static http://johnvansickle.com/ffmpeg/  Copyright (c) 2000-2016 the FFmpeg developers
  built with gcc 5.4.1 (Debian 5.4.1-2) 20160904
```

Cloud Workflow

MAKING IT HAPPEN

DESIGNING A WORKFLOW - API

You need a good workflow architecture

- Similar to AWS Simple Workflow Service for logical and atomic chunks:
  - Workflow (End to End Execution)
  - Steps (Ingestion, Processing, Transfer)
  - Tasks (Create alternate bitrate rendition, Thumbnails)
  - Adaptors (We added this to be agnostic.
    E.g. AWS S3 vs. Azure Blob vs. On-prem)

WORKFLOW: FILE TRANSFER

Try to leverage any performance enhancements available

- Day to Day Ingestion
  - AWS Multipart Upload
  - Azure Streaming Put a BlockBlob
- Initial Content Migration
  - AWS Import/Export Snowball
  - Azure Import/Export Service

WORKFLOW: QUEUE

Gracefully handle all your users

- Processing takes time. You need to line up requests.
- Queuing w/persistence also lets you keep track of job status and what's pending in case of restart.

OPEN SOURCE LIBRARIES

When there's a vibrant community you never have to reinvent the wheel

- We use Node.js which has node modules.
  - **aws-sdk**: AWS JavaScript Library for Node.js
  - **fluent-ffmpeg**: A node wrapper for the FFmpeg command line tool
  - **q**: A node promise library
  - **async**: Asynchronous JavaScript helper

SAMPLE CODE

Check out the demo:
https://github.com/realeyes-media/demo-encoder

- Here's a snippet

```
input.inputOptions = options.inputOptions;
output.outputOptions = ["-hls_time 8", "-hls_list_size 0", "-bsf:v
h264_mp4toannexb", "-threads 0"];
input.inputURI = path.join(__dirname, '../../' + options.inputURI);
output.outputURI = directory + '/' + options.fileName + options.timestamp + '_' +
bitrate + '.' + options.outputType;
options.outputURI = output.outputURI;
output.outputOptions.push('-b:v ' + bitrate + 'k', '-r ' + options.fps);

// Use options to call ffmpeg executions in parallel
executeFfmpeg(input, output)
```

Scaling

TIME TO GROW

SCALING & CONCURRENCY

How high can we go?

- FFmpeg will not error when the CPU is busy, just takes longer to process.
- First - Determine the Scenario:
  - The volume of files you need to simultaneously process
  - The average size of the files you need to process
  - The processing time that's acceptable for you org
  - The kinds of operations that need to occur (e.g. Just transmux? Transcode to 4 renditions?)
- Second - Run Performance Tests

SCALING - MULTIPLE INSTANCES

Bigger instance or more instances?

- Bigger Instance
  - PRO: Handles more concurrency
  - CONS: Can be more costly

- More Instances
  - PRO: Cheaper - Can be scaled up and down to only pay when needed
  - CONS: More complicated to manage

MULTI INSTANCE BALANCING

Scale Horizontally Transparently

- Clients hit a load balancer
- You can add more instances as needs grow in a transparent and simple way
- If your architecture is sound there's no need for session stickiness between the clients and the transcoding system
- AWS Elastic Load Balancer: https://aws.amazon.com/elasticloadbalancing/
- Azure Load Balancing: https://azure.microsoft.com/en-us/documentation/articles/virtual-machines-linux-load-balance/

AUTO-SCALING

Leverage Auto Scaling Features

- Automate the spin up/down of instances based on a number of criteria:
  - Instance Load
  - Periodic Need for Faster Processing
  - Time of Day
  - Specific Events
- AWS Auto Scaling: https://aws.amazon.com/autoscaling
- Azure Auto Scale: https://azure.microsoft.com/en-us/documentation/articles/cloud-services-how-to-scale-portal/

CONTAINER SWARMS

Docker is all the rage. Swarms and Service Discovery

- Create a swarm of Docker containers for a highly repeatable processing server snapshot that utilizes system resources efficiently
- Further increase automation through service discovery
- Implement “auto scaling” on steroids

Conclusion

THINGS TO TAKE AWAY

THANK YOU!

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