



Etere

a consistent system

BENCHMARKING AND
RECOMMENDATIONS FOR
ANALYSIS SPEED
OPTIMIZATION

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INTRODUCTION

This document records some recommendations of minimum hardware specifications as well as some operation tips to guarantee a smooth operation of the software.

ETERE Advance QC performs a deep analysis of the Audio/video content, so it makes an extensive use of CPU power. Although CPU power can be modulated by selecting different speed options in the Project Configuration, the ideal situation is that ETERE Advance QC can do the complete analysis in Real Time. That is, 2 hour long content should not take longer than 2 hours to be analyzed.

ETERE Advance QC is optimized to work on Google Chrome Web Browser and ETERE Advance QC is designed to work on a Windows machine, running windows 7 or above. ETERE Advance QC is a web application, so in certain cases network overload may affect ETERE Advance QC operation from a different computer.

ETERE Advance QC allows to enable/disable different parameter groups. Parameter groups are organized so all groups need same video values to detect all parameters in the group. That is, for Luminance level and Chroma level, the YUV (or YCbCr) values are measured, and will also be used for Contrast and brightness (as an example). Blockiness, Blurriness, Black frames, etc will need same measurements to be made. So, disabling only one parameter in a group, would not speed up the analysis process with respect to enabling the complete parameter group.

The groups are organized as follows:

FORMAT CHECKS:

Format Checks			
Container Format (?)	+ - +	Pixel Format (?)	+ - +
Duration (?)	+ - +	Has Video (?)	+ - +
Video Bit Rate (?)	+ - +	Frame Rate (?)	+ - +
Coded Aspect Ratio (?)	+ - +	Display Aspect Ratio (?)	+ - +
Audio Bit Rate (?)	+ - +	Number Of Audio Streams (?)	+ - +
Sample Rate (?)	+ - +	File Size (?)	+ - +
		Video Codec (?)	+ - +
		Resolution (?)	+ - +
		Audio Codec (?)	+ - +
		Number Of Channels (?)	+ - +

FRAME STATISTICS

Frame Statistics			
Picture Coding Type (?)	+ - +	Is Keyframe (?)	+ - +
Stream Syntax Errors (?)	+ - +	Bytes Per Frame (?)	+ - +

BASEBAND/WAVEFORM

Baseband/Waveform			
Highest Luminance Level (?)	+ - +	Lowest Luminance Level (?)	+ - +
Contrast (?)	+ - +	Luma Footroom Violations (?)	+ - +
Chroma Headroom Violations (?)	+ - +	Highest Chroma Level (?)	+ - +
		Brightness (?)	+ - +
		Luma Headroom Violations (?)	+ - +
		Gamut Errors (?)	+ - +

VIDEO CONTENT

Video Content			
Blackness (?)	+ - +	Freeze (?)	+ - +
Blurriness (?)	+ - +	Interlacing Artifacts (?)	+ - +
Temporal Complexity (?)	+ - +	Field Dominance Error (?)	+ - +
Constant Color Frame (?)	+ - +	Blackness (?)	+ - +
		Field Order (?)	+ - +
		Test Pattern (?)	+ - +

VIDEO QUALITY

Video Quality			
DigiBeta Error (?)	+ - +	Digital Dropouts (?)	+ - +
Chrominance Line Errors (?)	+ - +	Picture Quality Score (?)	+ - +
Dead Pixel Detection (?)	+ - +	Luminance Line Errors (?)	+ - +
		Flash/Strobe/PSE (?)	+ - +

AUDIO

Audio			
Level (?)	+ - +	Mute (?)	+ - +
Clipping (?)	+ - +	Sample Clipping (?)	+ - +
		No Audio (?)	+ - +

LOUDNESS

Loudness			
Loudness M (?)	+ - +	Loudness S (?)	+ - +
Loudness LRA (?)	+ - +	Loudness I (?)	+ - +

BENCHMARKS: ALL FILE FORMATS

Several benchmarking performance tests were done both in physical machines, as well as Virtual Machines running in Microsoft's Azure.

- The tests were performed using different Machine profiles, with different processors and memory characteristics.
- All machines were running Windows 7, and the browser used was Google Chrome.
- The evaluation was done for different **file types** to benchmark how this also affects the speed.
- It should be also noted, that depending on whether all analysis parameters are enabled, or only a few, greatly affects the analysis speed. That is why all tests were done enabling all parameters, and then disabling some of them.
- Analysis of simultaneous files also affects analysis speed. That is why, different tables are shown depending on whether only one file at a time is analyzed or various simultaneous files.

Coloured fields shown on the tables have the following meaning:

Highest speed with specified parameters

Lowest Speed with specified parameters

Highest speed for specific format

Lowest speed for specific format

Highest speed combination Format/parameters

Lowest Speed combination format/parameters

In the next tables results are shown:

2.1 I7-4770@3,4 GHZ. 1 FILE

- File Duration: 00:09:56.0 (hh:mm:ss:f)
- Resolution: 1920x1080p
- Processor: i7-4770@2,4GHz
- Memory 8GB
- HDD: SATA Drive
- Simultaneous files: 1

		AVC_Intra 100	DNxHD 185	mp4	P2_DVCPR O 100	TS MPEG-2	TS H.264	XDCAM 50
ETERE ADVANCE QC VERSION		2.5.18	2.5.18	2.5.18	2.5.18	2.5.18	2.5.18	2.5.18
ALL PARAMETERS	Time	08:44.0	08:28.0	08:10.0	09:16.0	02:11.0	08:08.0	08:24.0
	Speed (xRT)	1,14	1,17	1,22	1,07	4,55	1,22	1,18
ONLY BASEBAND + AUDIO	Time	04:00.0	04:17.0	02:49.0	05:02.0	01:01.0	02:56.0	02:44.0
	Speed (xRT)	2,48	2,32	3,53	1,97	9,77	3,39	3,63
BASEBAND + VIDEO CONTENT + AUDIO	Time	05:05.0	05:11.00	04:29.0	06:08.0	01:30.0	04:38.0	04:40.0
	Speed (xRT)	1,95	1,92	2,22	1,62	6,62	2,14	2,13
VIDEO CONTENT + VIDOE QUALITY + AUDIO	Time	08:02.0	07:50.0	07:25.0	08:43.0	01:55.0	07:10.0	07:41.0
	Speed (xRT)	1,24	1,27	1,34	1,14	5,18	1,39	1,29
ONLY VIDEO CONTENNT + AUDIO	Time	04:35.0	04:42.0	03:49.0	06:00.0	01:22.0	03:56.0	03:48.0
	Speed (xRT)	2,17	2,11	2,60	1,66	7,27	2,53	2,61
ONLY VIDEO QUALITY + AUDIO	Time	06:20.0	05:50.0	05:35.0	07:24.0	01:45.0	05:25.0	05:49.0
	Speed (xRT)	1,57	1,70	1,78	1,34	5,68	1,83	1,71
ONLY FRAME STATS + AUDIO	Time	04:00.0	04:53.0	07:53.0	09:50.0	01:35.0	08:42.0	06:57.0
	Speed (xRT)	2,48	2,03	1,26	1,01	6,27	1,14	1,43
NO BASEBAND	Time	08:00.0	07:35.0	07:17.0	08:31.0	01:54.0	07:22.0	07:39.0
	Speed (xRT)	1,24	1,31	1,36	1,17	5,23	1,35	1,30
NO VIDEO CONTENT	Time	07:18.0	06:57.0	06:25.0	08:20.0	02:31.0	06:30.0	06:25.0
	Speed (xRT)	1,36	1,43	1,55	1,19	3,95	1,53	1,55
NO VIDEO QUALITY	Time	05:30.0	05:08.0	04:36.0	05:54.0	01:21.0	04:53.0	04:24.0
	Speed (xRT)	1,81	1,94	2,16	1,68	7,36	2,03	2,26
NO FRAME STATISTICS	Time	08:50.0	08:40.0	08:08.0	09:12.0	02:09.0	07:40.0	08:25.0
	Speed (xRT)	1,12	1,15	1,22	1,08	4,62	1,30	1,18
No AUDIO	Time	09:00.0	08:32.0	07:55.0	09:01.0	02:03.0	08:10.0	08:30.0
	Speed (xRT)	1,10	1,16	1,25	1,10	4,85	1,22	1,17

2.2 I7-4770@3,4 GHZ. 2 FILES

- File Duration: 00:09:56.0 (hh:mm:ss:f)
- Resolution: 1920x1080p
- Processor: i7-4770@2,4GHz
- Memory 8GB
- HDD: SATA Drive
- Simultaneous files: 2

	AVC_Intra 100	DNxHD 185	mp4	P2_DVCPRO 100	TS MPEG- 2	TS H.264	XDCAM_50
ETERE ADVANCE QC version	2.5.18	2.5.18	2.5.18	2.5.18	2.5.18	2.5.18	2.5.18
ALL PARAMETERS ENABLED	17:30.0	16:33.0	16:03.0	13:28.0	03:32.0	16:03.0	17:10.0
SPEED (x REAL TIME))	1,14	1,20	1,24	1,48	5,62	1,24	1,16

NOTE: Speed is calculated considering the total time for all files, and comparing with the time it takes to process all of them in parallel.

2.3 I7-4770@3,4 GHZ. 3 FILES

- File Duration: 00:09:56.0 (hh:mm:ss:f)
- Resolution: 1920x1080p
- Processor: i7-4770@2,4GHz
- Memory 8GB
- HDD: SATA Drive
- Simultaneous files: 3

	AVC_Intra 100	DNxHD 185	mp4	P2_DVCPRO 100	TS MPEG- 2	TS H.264	XDCAM 50
ETERE ADVANCE QC version	2.5.18	2.5.18	2.5.18	2.5.18	2.5.18	2.5.18	2.5.18
ALL PARAMETER S ENABLED	26:09.0	23:50.0	26:30.0	22:16.0	04:50.0	23:18.0	25:26.0
SPEED (X REAL TIME)	1,14	1,25	1,12	1,34	6,17	1,28	1,17

NOTE: Speed is calculated considering the total time for all files, and comparing with the time it takes to process all of them in parallel.

2.4 2 X INTEL XEON E5-2620V3@2,4 GHZ. 3 FILES

- File Duration: 00:09:56.0 (hh:mm:ss:f)
- Resolution: 1920x1080p
- Processor: 2 x Intel Xeon E5-2620v3@2,4GHz (6 Cores/processor)
- Memory 16GB
- HDD: SATA Drive
- Simultaneous files: 3

	AVC_Intra 100	DNxHD 185	mp4	TS MPEG-2	TS H.264	XDCAM 50
ETERE ADVANCE QC version	2.5.18	2.5.18	2.5.18	2.5.18	2.5.18	2.5.18
ALL PARAMETERS ENABLED	13:18.0	12:20.0	11:30.0	02:25.0	11:30.0	12:07.0
SPEED (X REAL TIME)	2,24	2,42	2,59	12,33	2,59	2,46

NOTE: Speed is calculated considering the total time for all files, and comparing with the time it takes to process all of them in parallel.

2.5 CONCLUSIONS:

- P2_DVCPRO 100 provides the slowest analysis speed for any parameter selection
- TS-MPEG2 provides the fastest analysis speed (reaching up to 12 times Real Time Speed for 12 core machine.
- Using a 12 core Machine (2x 6 core processors), opposed to 8 core machine, provides real advantage when analyzing 2 or more simultaneous files.
- When only one file is being analyzed, the gain of using 12 core instead of 8 core is not so big, since the analysis of only one file will not use processor power to 100% (due to the decoder limitations)
- An 8 Core machine will still give advantage of simultaneous analysis with respect to sequential analysis, although the gain is low, compared to the 12 core machine.
- Only Baseband analysis (and audio) provides the fastest analysis speed

3 BENCHMARKS: MP4 AND TS ANALYSIS

These tests only focus on specific file formats MP4 and TS, with H.264 codec. The tests were performed in two different machines, and for different resolutions (720p, 1080i, 1080p). The objective was to benchmark how the resolution and the machine affect the analysis speed.

ONLY VIDEO CONTENT PARAMETERS AND AUDIO WERE ACTIVE

VERSION 2.6 was used for this benchmark

3.1 I7 4910MQ @2.9GHZ (8 CORES)

- File Duration: 00:15:42.0 (hh:mm:ss:f)
- Processor: i7 4910MQ @2.9GHz (8 Cores)
- Memory 16GB
- HDD: SATA Drive
- PARAMETERS: Only video content (blockiness, blurring, freeze, etc) and audio parameters enabled.

Container Format		720p 1 File at a time	720p 4 simultaneous files	1080i 1 File at a time	1080i 3 simultaneous files	1080p 1 file at a time	1080p 3 simultaneous files
MP4	File Duration	15:42.0	15:42.0	15:42.0	15:42.0		
	Analysis duration	03:06.0	12:17.0	06:34.0	18:42.0		
	Speed (X Real Time)	5,06	1,28	2,39	0,84		
TS	File Duration	15:42.0	15:42.0	15:42.0	15:42.0	15:42.0	15:42.0
	Analysis duration	02:57.47	11:48.49	06:22.99	19:14.90	06:08.56	18:53.0
	Speed (X Real Time)	5,32	1,33	2,47	0,82	2,56	0,83

NOTE: speed in this case is calculated considering the duration of only 1 file, thus calculating how faster the analysis of all simultaneous files is with respect to one file

3.2 VM MACHINE 16 CORE XEON ES-2698BV3 @2GHZ

- FILE DURATION: 00:15:42.0 (HH:MM:SS:F)
- PROCESSOR: MICROSOFT AZURE VM 16 CORE XEON ES-2698BV3@2GHZ
- MEMORY: 224 GB
- HDD: SATA DRIVE
- PARAMETERS: ONLY VIDEO CONTENT (BLOCKINESS, BLURRING, FREEZE, ETC) AND AUDIO PARAMETERS ENABLED

		720p Simultaneous Files (Points)						
Container Format		1 File		4 Files		8 Files		10 Files
TS	File Duration	15:42.0		15:42.0		15:42.0		15:42.0
	Analysis duration	02:27.67		04:50.0		09:36.92		12:17.33
	Speed (X Real Time)	6,41		12,99		13,08		12,78

		1080i Simultaneous Files (Points)					
Container Format		1 File		4 Files		6 Files	
TS	File Duration	15:42.0		15:42.0		15:42.0	
	Analysis duration	04:42.0		09:52.0		15:33.60	
	Speed (X Real Time)	3,34		6,36		6,06	

		1080p Simultaneous Files (Points)			
Container Format		1 File		4 Files	6 Files
TS	File Duration	15:42.0		15:42.0	15:42.0
	Analysis duration	03:51.70		09:53.23	14:16.72
	Speed (X Real Time)	4,08		6,35	6,60

NOTE: speed in this case is calculated considering the accumulated time of all simultaneous files being analyzed vs the total time to analyze all files.

3.3 CONCLUSIONS:

- FASTEST SPEEDS ARE ACHIEVED WHEN 720P FORMAT IS USED
- SPEEDS BETWEEN H.264 IN TS OR MP4 ARE VERY SIMILAR
- SPEED WITH A 16 CORE MACHINE IS MORE THAN TWICE FASTER THAN SPEED WITH I7 MACHINE **WHEN SEVERAL SIMULTANEOUS FILES ARE ANALYZED.**
- MORE THAN 10 FILES CAN BE ANALYZED AT THE SAME TIME WITH A 16 CORE MACHINE WHEN 720P FORMAT IS ANALYZED, KEEPING OVERALL ANALYSIS DURATION (ALL 10 FILES) BELOW DURATION OF ONE FILE.
- ANALYZING 1 FILE AT A TIME WITH A 16 CORE MACHINE DOES NOT REALLY BRING SIGNIFICANT INCREASE IN SPEED OF ANALYSIS, DUE TO DECODER LIMITATIONS
- 1080I SEEMS TO BE THE SLOWEST FORMAT TO BE ANALYZED.
- MORE THAN 6 1080 FILES (BOTH 1080I AND 1080P) AT A TIME CAN BE ANALYZED SIMULTANEOUSLY WHEN USING A 16 CORE MACHINE, WITH OVERALL ANALYSIS TIME (ALL 6 FILES) SHORTER THAN ONE FILE DURATION.

4 TIPS TO IMPROVE ANALYSIS

In order to improve analysis some tips are suggested:

- Make sure no other processes are running in the background
- Make sure you adapt your parameters to the workflow stage that you are at, so analysis speed is optimized. Some examples:
 - o If you are not analyzing content coming from tape ingest processes, you may disable Digital Betacam Channel Condition Errors, and Digital Dropouts (VIDEO QUALITY PARAMETERS).
 - o If you are analyzing content coming from encoding, it is always useful to disable BASEBAND analysis (luminance/chrominance analysis) provided that they were already checked for after production/postproduction/edit phases.
 - o Assuming you are not considering analysis of frame statistics such as frame types, or keyframes, you can disable all frame related content.
- Set analysis to high speed
- Higher processing power machines (12 core or above) guarantee effective time saving in analysis of several simultaneous files, but not so much for sequential analysis of one file at a time. So, make sure that you run simultaneous (concurrent) analysis when you have more than 8 cores in your processor.
- SSD Disks are recommended, to prevent disk access of being the bottleneck
- RAID Disk configuration is recommended
- Other Disk architectures are also recommended: NAS, SAN, etc.
- It is always wise to use more than one node for simultaneous analysis of several files when you run ETERE ADVANCE QC on 8 core or less machines.
- Analysis using several nodes will require high speed network connections (GB network)