VidCheck

Video Test with Intelligent Automated Correction

Webinar 2

Not too Loud, Not too Quiet (or getting the sound right)

Note: all information represents the views of VidCheck personnel: participants should satisfy themselves of the applicability to their particular circumstances

Agenda　　[60 mins total]

Video Test with Intelligent Automated Correction

➢ Logistics

[1 min]

➢ Quick company & speaker background

[1 min]

➢ Not Too Loud, Not Too Quiet

[55 mins]

- ❑ audio loudness, peaks and measurement
- ❑ structure & formats of file-based media
- ❑ QC and types of errors
- ❑ auto QC implementation considerations
- ❑ the VidChecker solutions (incl. demo)

➢ Q & A

[5 mins + ….]

Logistics

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➢ Prior to the Q & A section all participants' microphones are muted:

- ❑ if you have a question prior to Q & A type a question

➢ Meeting is recorded

- ❑ to ensure we record who participates
- ❑ record questions & answers

➢ After the webinar

- ❑ brief feedback questionnaire (to e-mail address used to register): please fill this in and return it
- ❑ more information on VidChecker; or demo; or free trial version

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Company Overview & Speakers

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Video Test with Intelligent Automated Correction

➢ Founded mid-2009 following discussions and experience of broadcasters with 1st generation file-based QC systems

➢ Management

❑ Thomas Dove: 25 years experience in compressed video/video test

- Founded Vqual late 2002: sold to Tektronix late 2005
  - 'industry standard' video codec development tools (used by Microsoft, Sony, Philips, Samsung, Motorola, Harmonic..)
  - inspiration behind and responsible for Cerify

❑ Simon Begent: 20 years experience in compressed video/video test

- previously marketing manager for Vqual products and Tektronix Cerify

➢ Other personnel previously with Vqual/Tektronix – software engineers genuinely expert in file-based video test

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Not too Loud, Not too Quiet (getting the sound right)

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Video Test with Intelligent Automated Correction

Audio Loudness, Peaks and Measurement

(a quick summary only)

What is 'loudness'?

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➢ <u>Perception</u> of how loud audio is

- ❑ subjective – varies from person to person; and situation / context
  - • e.g. commercial between programs is much louder although perhaps not 'loud'
- ❑ correlation between physical intensity of the audio signal and perception

➢ Various methods of calculating this correlation

- ❑ standard currently accepted is **ITU-R.BS 1770**
  - • includes algorithms to measure audio loudness and 'true peak' audio level

➢ Implementation recommendations

- ❑ North America: ATSC A/85 RP   www.atsc.org
- ❑ Europe: EBU R128   http://tech.ebu.ch/loudness
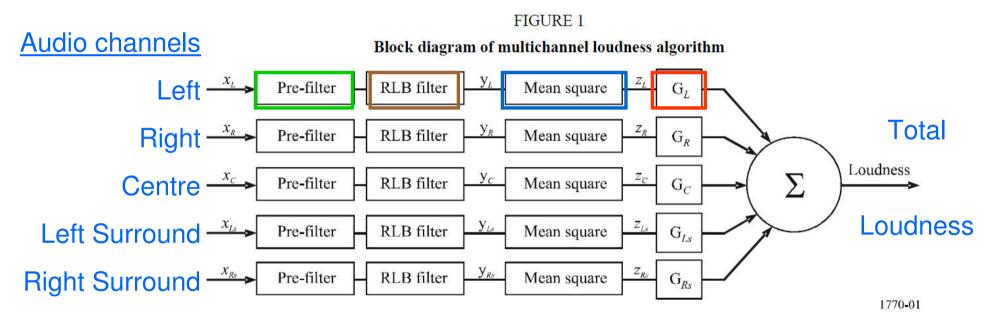 - • and Tech 3341 supplement
- ❑ Take into account 'anchor' elements for setting loudness, e.g. dialog level

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➢ Specifies algorithms for measuring loudness & true-peak

➢ Loudness:

Audio channels

FIGURE 1

Block diagram of multichannel loudness algorithm

Left
Right
Centre
Left Surround
Right Surround

Total

Loudness

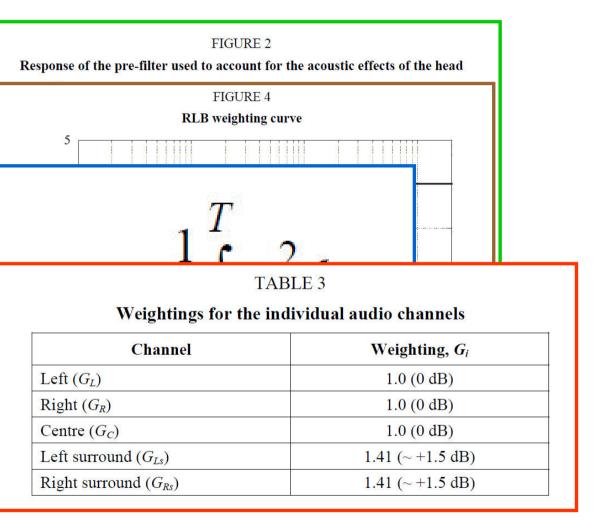*Note: LFE (Low Frequency Effects) channel is not included in Loudness measurement*

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➢ ☐ Pre-filter:

➢ ☐ RLB filter:

➢ Pre-filter +
RLB filter =
'K weighting'

➢ ☐ Mean square:

➢ ☐ Weighting:

FIGURE 2
Response of the pre-filter used to account for the acoustic effects of the head

FIGURE 4
RLB weighting curve

5

$$\frac{1}{T}\int \dots$$

TABLE 3
Weightings for the individual audio channels

Channel	Weighting, G_i
Left (G_L)	1.0 (0 dB)
Right (G_R)	1.0 (0 dB)
Centre (G_C)	1.0 (0 dB)
Left surround (G_{Ls})	1.41 (~ +1.5 dB)
Right surround (G_{Rs})	1.41 (~ +1.5 dB)

Note: only specified at 48kHz audio sampling rate

LKFS / LUFS

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➢ 'LKFS' (North America) = <u>L</u>oudness, <u>K</u> weighted, relative to nominal <u>F</u>ull <u>S</u>cale

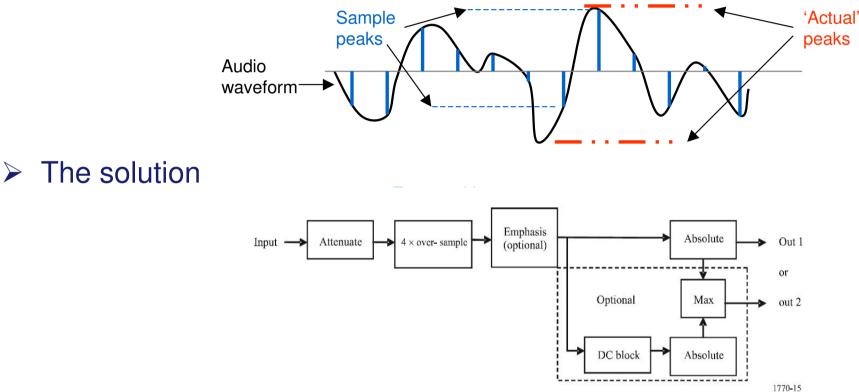➢ 'LUFS' (Europe) = <u>L</u>oudness <u>U</u>nits, relative to <u>F</u>ull Scale

➢ LKFS = LUFS
  - ❑ 0 = maximum; values are negative from this
  - ❑ 1 LKFS / LUFS = 1dB

➢ Channel configuration
  - ❑ Stereo: measure both channels
  - ❑ 5.1:
    - • LEFTsurround & RIGHTsurround channel weightings +1.5dB each
    - • LFE chanel excluded

BS 1770 'True peak'
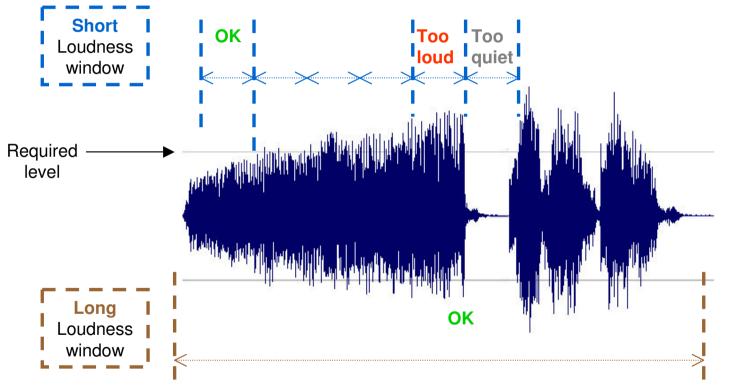
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➤ Peak measurement problem (exaggerated for clarity)

➤ The solution

➤ 'True Peak'

- ❑ measured in dB relative to full scale: 0dB = maximum
- ❑ each channel measured individually

Loudness window

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➤ Measurement affected by time it is *averaged* over

➤ Actually continuous 'rolling' windows are used

ATSC A/85 RP and EBU R128

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➢ ATSC A/85 RP (North America)

- ❑ Loudness: **-24** LKFS +/- **2**
- ❑ True peak: -2dB maximum
- ❑ Loudness windows:
  - • '**short** content': measure whole of content (or can set window e.g. 10 secs)
  - • '**long** form content': measure a part – 'typically' 30 mins
- ❑ Gating: values below **–32** LKFS are not counted

➢ EBU R128 (North America)

- ❑ Loudness: **-23** LUFS +/- **1**
- ❑ True peak: -2dB maximum
- ❑ Loudness windows (EBU document Tech 3341):
  - • Momentary '**M**':   0.4 secs window, no gating
  - • Short-term '**S**':   3 secs window, no gating
  - • Integrated '**I**':   whole program, values below **–31** LUFS are not counted

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Structure & Formats of File-based Media

Structure of file-based media (1)

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Filename: movie_hd.mxf

File 'wrapper' e.g. TS, MOV, MXF…

Compressed
Video

e.g. MPEG-2, H.264,
ProRes..

Audio
**

e.g.
PCM,
AAC,
AC-3

Meta-
data

e.g.
aspect
ratio..

** Audio data volume is much smaller:
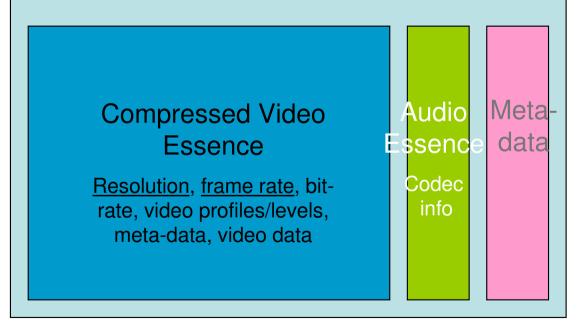may or may not be compressed

Video Test with Intelligent Automated Correction

Filename: movie_hd.mxf

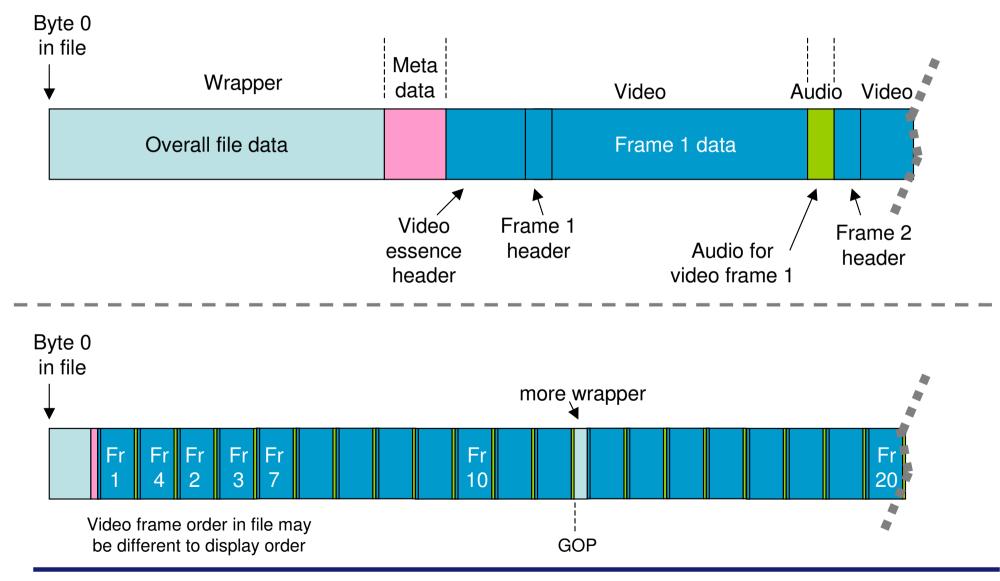## File wrapper – overall file data

Video <u>resolution</u>, <u>frame rate</u>, bit-rate, video & audio codecs used, GOP structure, aspect ratio, other 'header' data, pointers to location of video & audio data, meta-data..

Compressed Video Essence

<u>Resolution</u>, <u>frame rate</u>, bit-rate, video profiles/levels, meta-data, video data

Audio Essence

Codec info

Meta-data

Structure of file-based media   (3)

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Byte 0
in file

Wrapper	Meta data	Video	Audio	Video
Overall file data		Frame 1 data		Frame 2

Video essence header

Frame 1 header

Audio for video frame 1

Frame 2 header

Byte 0
in file

more wrapper

| | Fr 1 | Fr 4 | Fr 2 | Fr 3 | Fr 7 | | | | Fr 10 | | | | | | | | | Fr 20 |

Video frame order in file may be different to display order

GOP

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Examples of formats

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➢ ## Common file wrappers

- ❑ MPEG-2 Transport Stream, MPEG-2 Program Stream, MXF Op1A, MOV (QuickTime), AVI, MP4 ..

➢ ## Common video codecs (formats)

- ❑ MPEG-2 video, AVC/H.264/MPEG-4, IMX, DV25, XDCAM, ProRes, DNxHD/VC-3, VC-1, DVCPro, uncompressed YUV ..

➢ ## Common audio codecs

- ❑ MPEG-1 / MPEG-2 audio, PCM, AAC, AC-3 (Dolby Digital), Dolby Digital Plus, uncompressed WAV

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Audio QC and
Types of Errors

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Back in time

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➢ PPM meters / VU meters

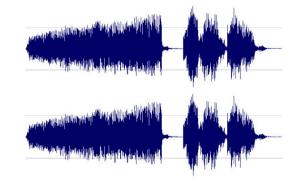 ❑ 'moving needle' [or electronic simulation of] with lag and integration

dB scale

Instant peak

IEC 60268-10 Type I, Nordic scale

IEC 60268-10 Type IIa, British scale

IEC 60268-10 Type IIb, EBU scale

IEC 60268-18, Digital scale

➢

➢ Listen

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Difference with file-based

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➢ File-based is.. just a file!

- ❑ copy, move, delete just like any other file
- ❑ **only way to know what is inside is by reading the file**
  - • read the wrapper and headers to read overall data
  - • decode the video
  - • decode the audio
  - • read the meta data

**11001..
00101..**

➢ Live audio signal (transmission or from video tape deck)

- ❑ Continuous, voltage etc.

Tools no longer relevant

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➢ PPM meter

  ❑ does not measure True Peak

➢ Proc amps

  ❑ no analog levels to 'tweak'

➢ Analog legalizers

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So how to test the audio in a file?

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➢ Can check some info by right-click or load into a media player and get info
  ❑ channels, codec, bit-rate

➢ Manual play-out using a media player to listen
  ❑ sound quality OK
  ❑ audio is OK - or even if any audio there at all
  ❑ if mono instead of stereo or 5.1

➢ But play-out using a media player has problems
  ❑ only real-time
  ❑ needs a person to listen
  ❑ player can hide details e.g. codec type
  ❑ person can't necessarily hear all issues – e.g. if sampling rate or bit-depth is incorrect
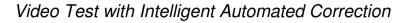
Specific QC software solution is needed

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Tools needed for file-based

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➢ Software that decodes the audio

➢ Implement BS 1770 Loudness measurement

   ❑ ATSC A/85 RP

   ❑ EBU R128 with Tech3341

➢ Implement BS 1770 True Peak measurement

➢ Ideally also a digital 'PPM meter' to correlate with older measurements / methods

➢ … and a way to correct for errors (there **_will_** be audio which is too loud / too quiet)

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What are common audio errors? (1)

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➢ Simple errors in post / rendering / file production

- ❑ incorrect audio codec
- ❑ incorrect sample rate
- ❑ incorrect layout e.g. incorrect timing of tone / silence
- ❑ missing audio or incorrect number of tracks
- ❑ audio on the wrong track
  - e.g. 5.1 on track 1, stereo on track 2 when it should be the other way round
- ❑ the audio track ends too soon or starts too late (audio is shorter than video)
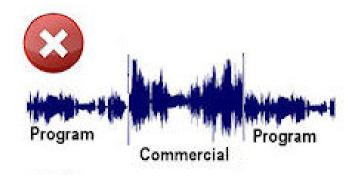- ❑ phase errors e.g. audio is mono (not so easy to detect by listening)

What are common errors? (2)

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➢ 'Artistic' choice in post

    ❑ audio too loud or peak level too high ******

        • post-house: "let's make the audio really punchy!"

> *** the most common error of all in commercials!*
>
> *Already subject to legislation in many countries in Europe; soon to be in US also: CALM (Commercial Audio Loudness Mitigation) Act has passed both Houses, awaits Presidential signature*

Don't correct some errors

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➢ Some errors can't be corrected e.g.

❑ if no audio.. can't add it in

❑ if it should be 5.1 and is stereo only.. can't add it in

➢ Many errors need to be flagged but better <u>not</u> to try to correct, e.g. if audio is incorrect

❑ sampling rate

❑ bit-depth

❑ incorrect codec

⇨ *could transcode but fundamental errors so probably want to reject file*

• *perhaps re-edit or use post-production software to fix*

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Other Implementation Considerations

Video/audio – but now an IT issue

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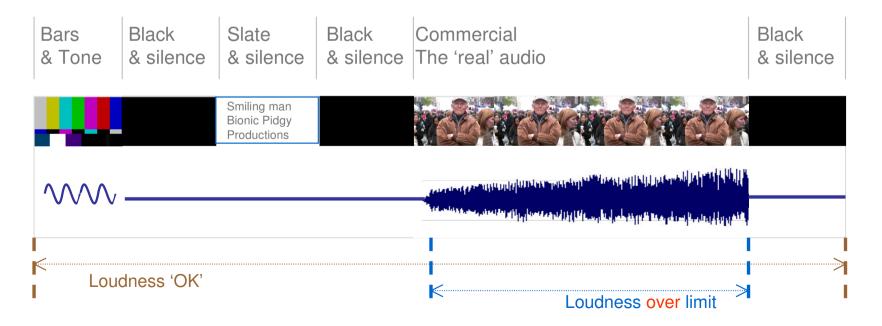
➢ Lots of file-based media to check?

  ❑ Time to process

  ❑ Processing multiple files concurrently

  ❑ Processing files with multiple audio

  • ***don't want to have to repeat for each audio track***

  ⇨ *Can* throw processing power at the problem – relatively cheap to do

  ❑ Time to move large files around internal network; space to store

➢ Video servers – may not do network I/O quickly

  ❑ configured for real-time SDI etc. I/O – so network I/O is constrained

  • ***may need to upgrade video server network I/O capabilities***

➢ IT training / understanding for staff who are transitioning to file-based

Media layout affect on measurement

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➢ ## Need to measure loudness only on program

- ❑ particularly important on commercials when using ATSC A/85 RP when 'whole duration' might be used
  - **loudness over whole duration _is_ within limits *[and including 1kHz Tone]***
  - ***BUT* loudness of program itself is _not_**

Bars & Tone	Black & silence	Slate & silence	Black & silence	Commercial The 'real' audio	Black & silence

Smiling man
Bionic Pidgy
Productions

Loudness 'OK'

Loudness over limit

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What if the audio levels are wrong?

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➢ E.g. if audio
  - ❑ too Loud (or too quiet)
  - ❑ or True Peak is too high (or too low)

  > *} the most common errors*
  > *} of all in file-based media*

➢ The 'old way'
  - ❑ QC software checks and flags errors to operators
  - ❑ operators may then listen, scrub through file and form an opinion
  - ❑ use software to decode the audio, correct the levels – perhaps by hand using manual gain controls
  - ❑ re-encode and re-multiplex
  - ❑ check re-encoded file with QC software – if incorrect go back to step 1

➢ The new way – with ***VidChecker***
  - ❑ QC software checks, **corrects**, **writes corrected file** & **sends report**

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Auto QC is not a person

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➢ ## Auto QC is great for technical issues

- ❑ e.g. checking sampling rates, codecs, audio loudness, true peak, audio phase, minimum levels, audio presence, types of audio on particular channels
- ❑ accurately
- ❑ thoroughly consistently
- ❑ and more extensive as human QC is often beginning-middle-end only

➢ ## But auto QC software cannot e.g.

- ❑ decide that the audio dialog is a bit quiet some of the time
- ❑ the Surround channels should be a bit louder for better effect
- ⇨ these are post-production / editing decisions that must be taken by people

ROI – be realistic

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➢ Auto QC can reduce need for human QC substantially

- ❑ reduce man-hours required
- ❑ leave humans to take decisions on more interesting issues where judgement is required

➢ Auto QC can sort the majority good from the minority bad

- ❑ but will then likely need a person to look at the small amount that is bad
  - • sign-off as OK
  - • or reject, or edit

➢ If auto QC can sort enough of your file-based media so that fewer man-hours are needed

⇨ ***ROI can be very short for auto QC***

(even if auto QC is only on a minority of your media – depends upon cost of QC software of course)

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VidChecker QC Solutions

VidChecker overview

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➢ 2nd generation file-based video auto QC
  - ❑ builds on the experience of earlier products launched 3-5 years ago
  - ❑ flexible software-only solution (Win 7/Vista/XP/Server 2003/08 and virtualization)

➢ 'Automated Intelligent Correction' of video & audio as well as checking

➢ Focuses on the checks 'that people get wrong'
  - ❑ not on the things that are almost invariably correct, such as syntax elements (a problem some years ago, but not now)

➢ Straightforward user interface, designed from the beginning to be easier to understand with user-intelligible error messages

➢ Takes advantage of modern multiple core CPUs & multiple PCs
  - ❑ can run on a single PC on multiple cores
  - ❑ and on multiple PCs in a **VidChecker Grid**

➢ *Low cost* - from $6K + $1K Gold maintenance for processing 4 files at once
  - ❑ e.g. i7 PC processes 3.5 hours of IMX30 SD per hour with almost all tests turned on

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VidChecker correction

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➢ Video is checked and corrected

❑ Luma level incl. black levels; Chroma - color gamut errors; RGB - color problems   using patent-pending algorithms to *intelligently* correct

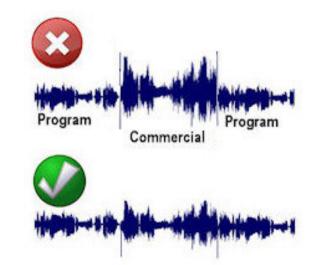Original - over limit highlights

Typical "Legalizer" – color artefacts

VidChecker correction

➢ Audio is checked – and ***corrected***

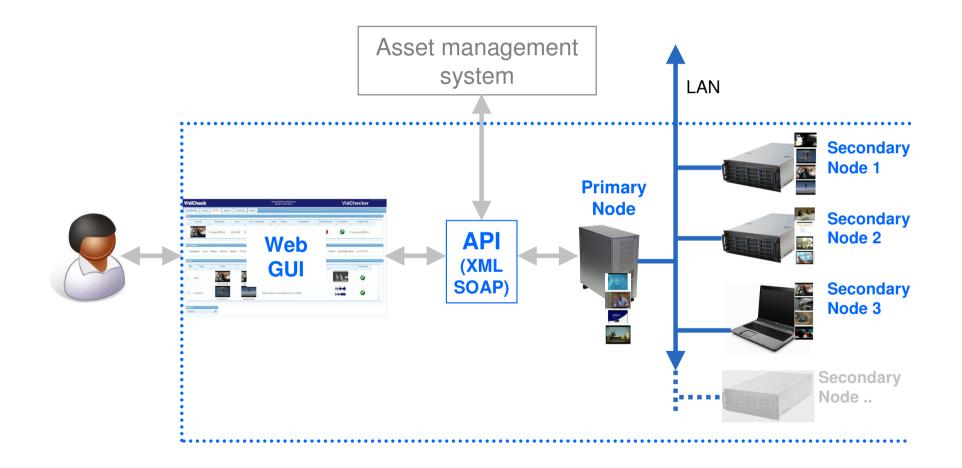❑ peak, loudness to ATSC (ITU) and EBU recommendations

Commercial too **loud**

VidChecker corrected audio

VidChecker Grid

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Asset management system

LAN

Web GUI

API (XML SOAP)

Primary Node

Secondary Node 1

Secondary Node 2

Secondary Node 3

Secondary Node ..

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VidChecker Demo

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Q & A

Next steps

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- ➢ Individual online demos of VidChecker

- ➢ Download a 15-day fully-functional trial

- ➢ Contact Sales
  - ❑ sbegent@vidcheck.com
  - ❑ tel.: 011 44 7502 470 565