JOANNEUM RESEARCH DIGITAL

DIGITAL – Institute for Information and Communication Technologies

Essence Quality Control for AV Archive Digitisation, Migration and Exploitation

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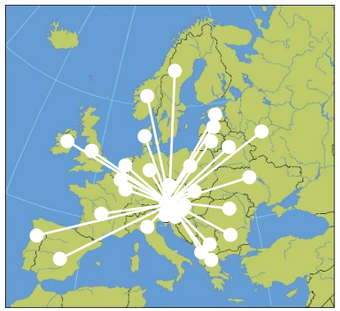
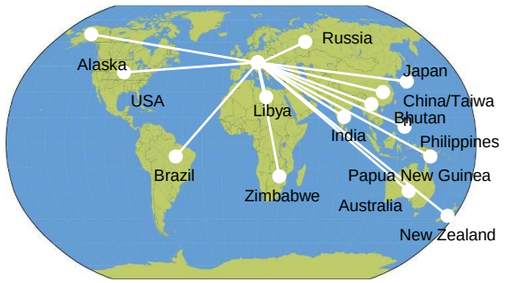
Overview

- Who is JR, DIGITAL, AVM
- File QC Layers
  - File/Wrapper/Bitstream/**Essence**
- Essence Quality Control in AV Archives
  - Use cases
  - Automation - workflow
  - Automatic and Interactive Essence QC Tools
- How to use QC results
- QC standardisation initiatives

THE INNOVATION COMPANY

- Applied R&D for industry and public bodies
- Shareholders
  - Province of Styria (90 %)
  - TNO (10 %)
- ~450 staff
- Research Institutes
  - MATERIALS - Surface Technologies and Photonics
  - HEALTH - Biomedicine and Health Sciences
  - RESOURCES - Water, Energy and Sustainability
  - POLICIES - Economic and Innovation Research
  - ROBOTICS - Core Unit Robotics
  - DIGITAL - Information and Communication Technologies





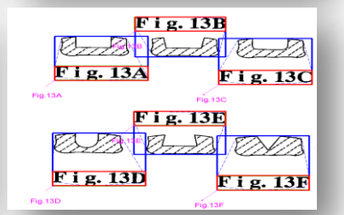
DIGITAL
Institute for Information and Communication Technologies

- Remote Sensing and Geoinformation
- Machine Vision Applications
- Space and Communication Technology
- Intelligent Information Systems
- Intelligent Acuostic Solutions
- AudioVisual Media

Located in Graz , ~130 staff

Research Group **A**udio**V**isual **M**edia

- Image Processing, Computer Vision, Machine Learning
  - Media Archives: film/video restoration, quality assessment/control
  - Media Production: content structuring, media similarity, logo detection
  - Security & Traffic: wrong-way driver detection, person flows, traffic intensity
- Metadata
  - Modelling, Validation, Mapping
  - Standardisation, e.g. EBU-QC, FIMS-QA&AME, MPEG-7 AVDP & MP-AF
- Research Projects
  - DIAMANT, PrestoSpace, PrestoPRIME, Presto4U, DAVID FascinatE, TOSCA-MP, ICoSOLE…



AVM
Selected Products

- 

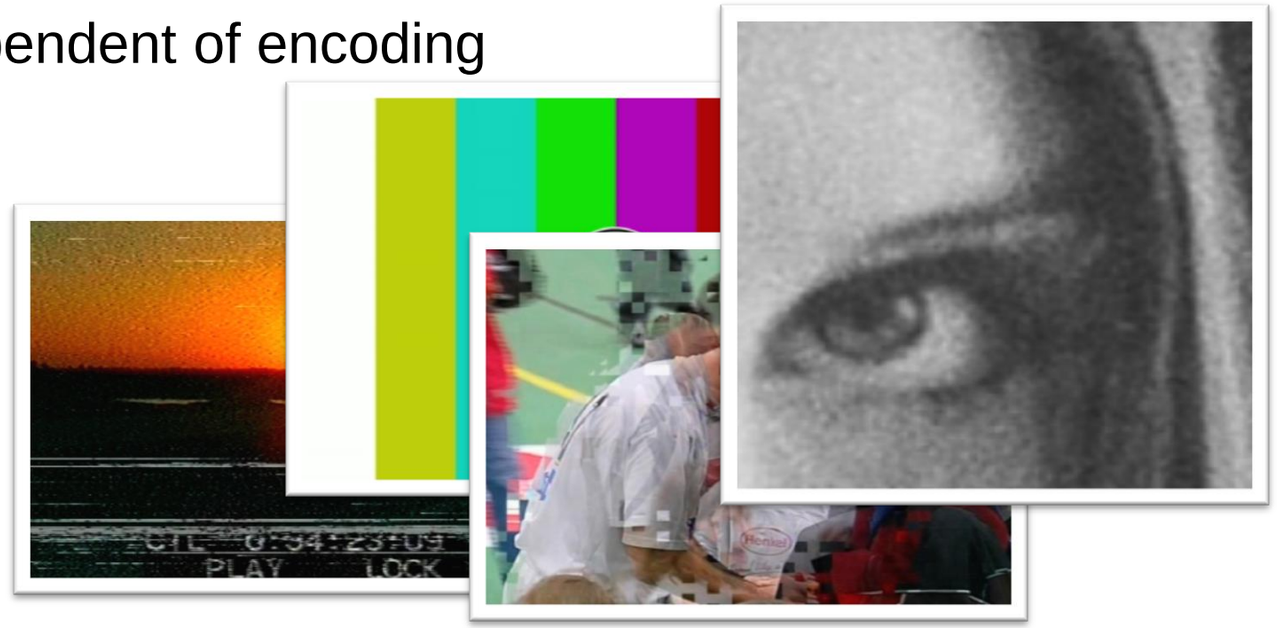
  - DIAMANT Film Restoration
- BRAND DETECTOR
  - Logo Recognition
- viasense
  - Wrong way driver detection

State Prize for Transport 2009

- VidiCert
  - Efficient Video and Film Essence Quality Control

Our focus on Essence QC

- File integrity
- Wrapper (MXF, MOV, AVI…) standards compliance
- Bitstream (MPEG,....) standards compliance
- Essence (base band, content based) quality assessment
  - Analysis of raw image data – independent of encoding
  - Video and movie degradations
  - Detects multi-generation defects
  - Analogue and digitally born
  - Resolution independent
  - No reference video required



Archive Use Cases for Essence Quality Checking (I)

- AV Digitisation and Digital Migration
  - monitor if the video player shows problems (due to head clogging, unclean tape)
    - Analogue Video (off-lock, line dropouts, video breakup, TBC hit)
    - Digital Video Tapes (different types of block drop-outs)
  - monitor the film scanning process
    - instability, out of focus, white/black point, ...

Archive Use Cases for Essence Quality Checking (II)

- Archive/MAM File Ingest
  - ingest only essence fulfilling certain quality criteria
    - no up-scaled essence (e.g. upscaled SD in an HD archive)
    - is expected scanning type present (interlaced, progressive, pulldown)
    - is expected field order present
  - ensure consistency between file content and its MAM description
    - do the digitised file has the correct content at all?
    - are file and MAM start/end timecodes consistent?
    - is the file audio channel allocation/encoding/content consistent with MAM?

Archive Use Cases for Essence Quality Checking (III)

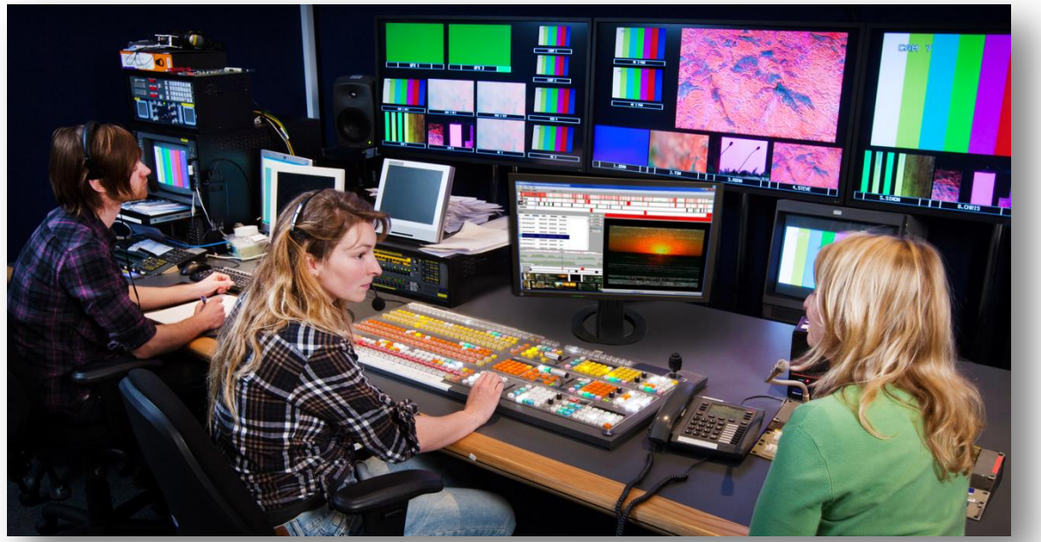
- Archive Content Selection/Access/Search
  - select my ‘best quality copy’
  - search for a video with minimum quality for a certain usage
    - Sharpness high enough for HD program or Blu-ray disc?
    - Noise reduction necessary?
- Restoration Planning
  - estimate costs
  - select tools/systems

The Essence QC Challenge

- **The challenge**

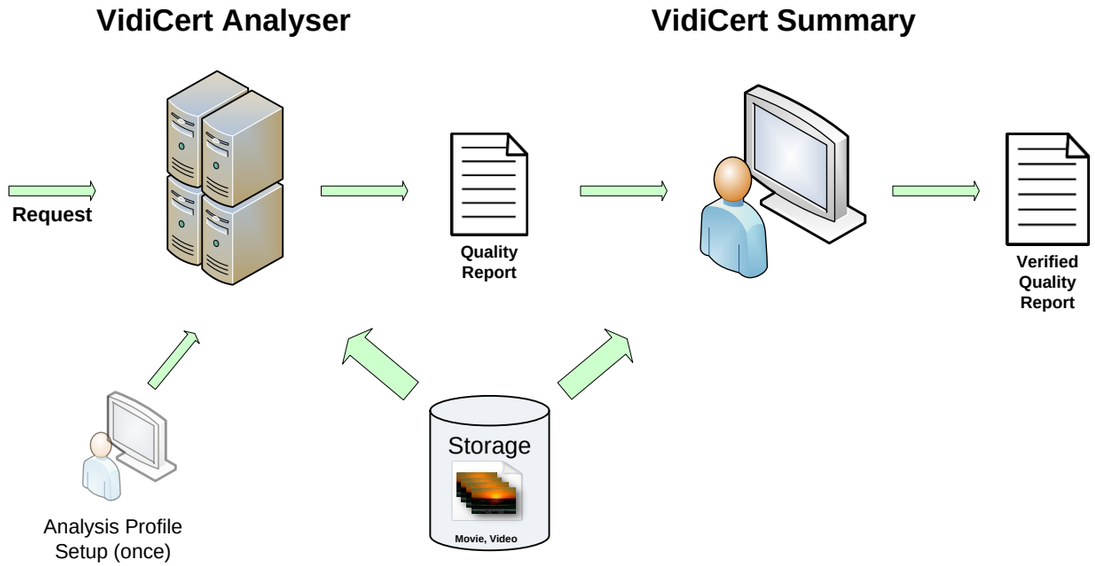
  for essence QC (image & audio)

  is operator job time



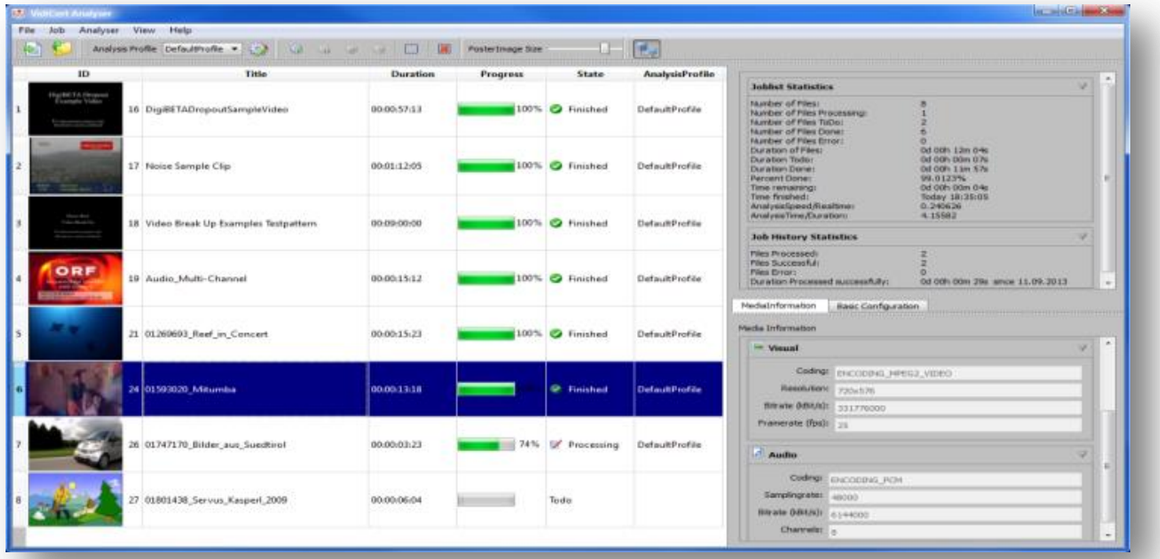
Automation of Essence Checking

- Fully manual
  - Highest quality, extremely expensive
- Fully automatic
  - Limited functionality, very cheap
- Automatic analysis + Human verified
  - Cost efficient and high quality



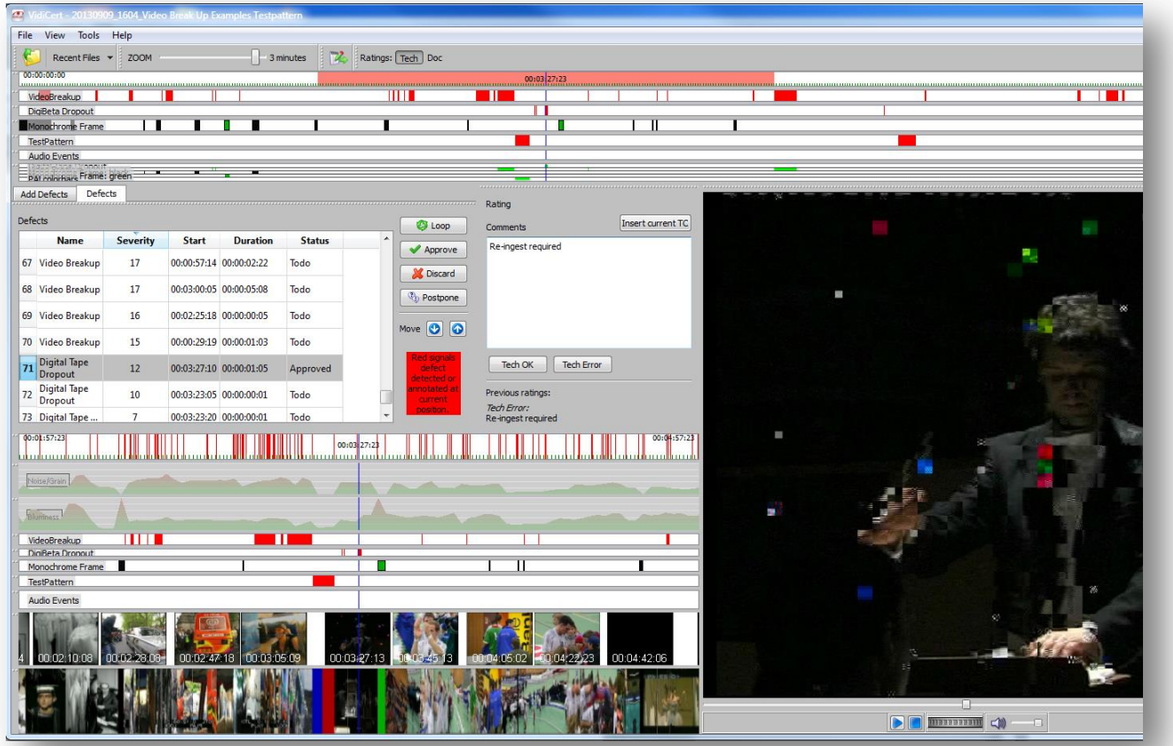
Automatic Quality Analysis

- VidiCert Analyser
  - Detectors
    - Video Breakup (major analogue video disruptions)
    - Noise/Grain (electronic & film grain)
    - Digital Tape Dropouts (e.g. Digital BETACAM™)
    - Blurriness
    - Monochrome Frames
    - Test Pattern
    - Silence
    - Dolby®E™
    - Field Order Errors
    - Scanning Type Errors (Progressive/Interlaced/3:2 Pull Down)
    - Customised solutions, e.g. Line Dropout Detection
  - Metadata fully compliant to MPEG-7/AVDP (XML)
  - Customizable analysis profiles
  - Highly optimised GPU accelerated algorithms
  - Workflow integration via web service & drop folder



Efficient Interactive Essence Quality Verification

- VidiCert Summary
  - Advanced summarisation and navigation by various timeline based metadata views
  - Fully customizable user interface (including full screen video player support on second monitor)
  - Job-time optimistation capability – trade-off human effort against verification accuracy
  - Efficient time based annotation
  - Rating support, including multi-stage QC



How to use Essence QC Results (I)

Depends on Workflow/Task

- Digitisation/Migration
  - Re-play video tape
    - with cleaned tape
    - on cleaned VTR
    - on another VTR
    - with correct TP-In/Out
  - Re-scan with different parameters (e.g. light, focus)
- Re-ject at Archive/MAM File Ingest
  - If digitised file shows wrong content at all or has wrong start/end TC
  - If audio channel allocation/encoding/content is not correct
  - If content has been delivered upscaled instead of full resolution (contracted)

How to use Essence QC Results (II)

- Document defects
  - For lateron restoration or at least to know which video segments cannot be used
- Re-Store
  - Established systems on market, e.g. DIAMANT-Film
  - New restoration functionality, e.g. from DAVID DIGITAL AV MEDIA DAMAGE PREVENTION AND REPAIR

Restoration
Digital BETACAM Dropout

Restoration
Digital BETACAM Dropout

Standardisation Initiatives relevant for Video QC

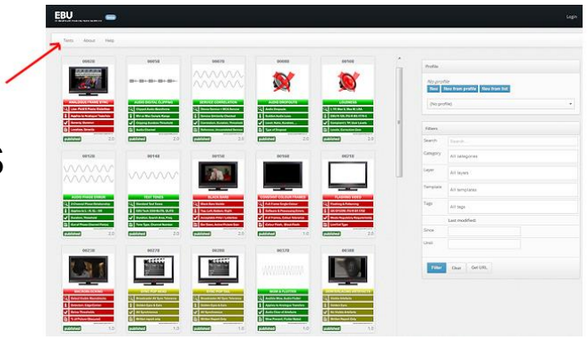
EBU Strategic Programme on QC (EBU QC)

- Goals
  - Define for file based QC a list of QC checks (wrapper, bitstream, essence, cross-checks)
  - Define a data model for exchanging QC metadata
  - Guidelines on how to best set up QC for files in your facility
- Use cases
  - Ingest
  - Archive migration/digitalisation
  - Programme exchange
  - Final Programme delivery
- Support from many broadcasters and all major QC system manufacturers

- http://tech.ebu.ch/groups/qc

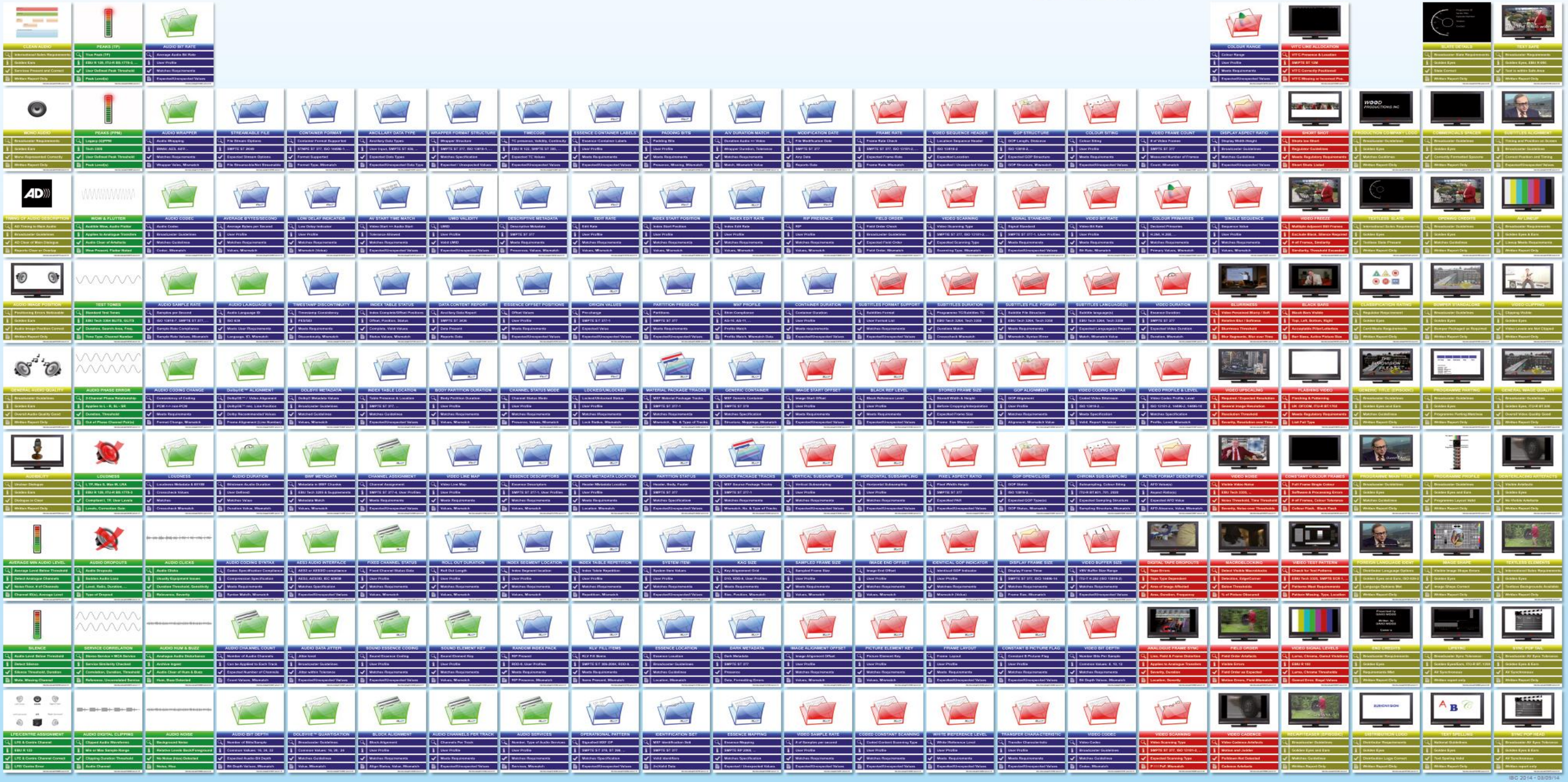
EBU QC

- Draft of ~200 QC checks published at IBC 2014
  - http://ebu.io/qc/about/
  - Available are definition of check, input parameter, output values
  - All details online accessible via ebu.io
- Finalisation of draft checks and further check definitions in progress
- QC Metadata model
  - QC Profile
  - QC Report
  - XML implementation in FIMS QA and MPEG MP-AF



EBU QC TEST ITEMS

EBU.IO/QC

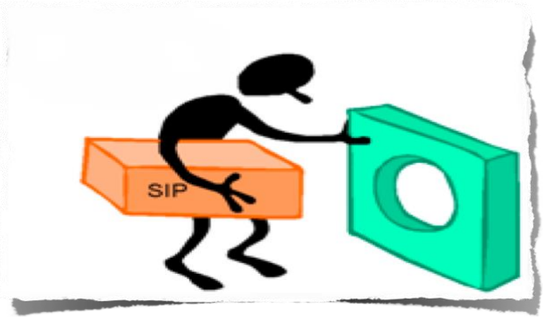


EBU/AMWA Framework for Interoperable Media Services – Quality Analysis (FIMS-QA)

- Standardising interfaces for SOA in media production
  - Transfer, Transform, Repository v1.1 ready
  - Time code, QA, AME in progress
- QA Service Interface
  - Group started in spring 2013
  - Definition of use cases and requirements finished
  - Draft interface definition available building on EBU QC Items
  - Interface and reference implementation expected in 2015

MPEG Multimedia Preservation Application Format (MP-AF)

- Defines an interoperable set of preservation metadata for multimedia objects
  - Exchange between preservation systems/repositories
  - Exchange with service providers
- Data Model
  - Hierarchy of Digital Items
    - Preservation Object, Representation, **Essence, Bitstream**
  - Preservation Processes
    - Activities, Operators, Parameters
  - Metadata Types
    - Provenance, Context, Reference, **Quality**, Integrity, Authenticity, Fixity, Rights
- Uses existing MPEG technologies, e.g. MPEG-7, MPEG-21
- **Liaison with EBU-QC**
- **Quality description based on MPEG-7 AVDP and EBU-QC** data model
- Draft MP-AF specifications available



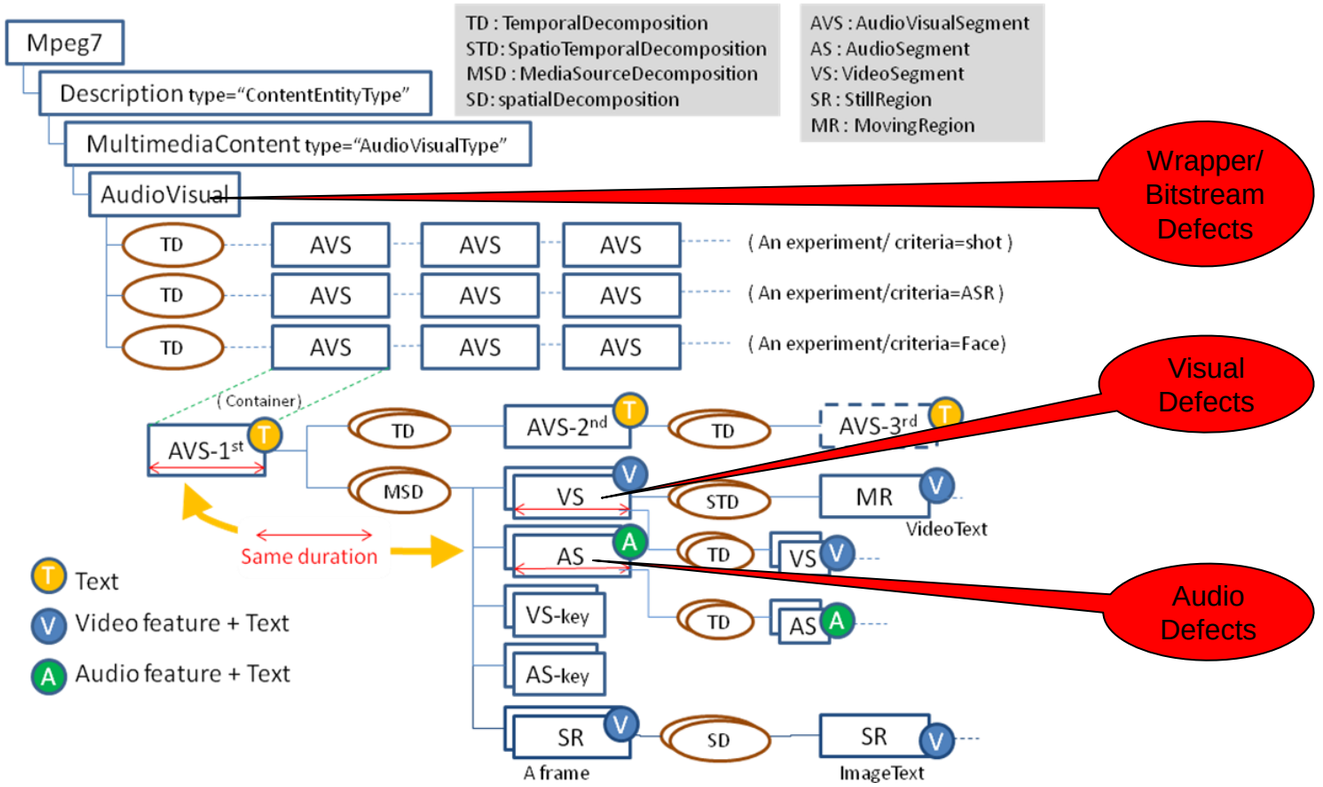
MPEG-7 AVDP

- MPEG-7 Audiovisual Description Profile (AVDP)
  - Profile is subset of MPEG-7 standard, targeting a specific application area
  - Tailored to media production and archiving applications
  - For describing detailed time-based metadata produced by AIE tools
  - Joint work of EBU, NHK, RAI, VRT, JRS
  - Standardised by ISO in 2012
  - Allows metadata interoperability for detailed time-based metadata between tools, systems and organisations
  - QA metadata fit in very well

Free, open source
MPEG-7 C++ library available at
http://mpeg7.joanneum.at/

MPEG-7 extensions for Quality Metadata

- MPEG-7 provides already tools for audio essence quality metadata (part 4/AMD1)
- MPEG-7 part 5 (MDS) AMD 5 is currently being defined in course of MP-AF activity
  - Extensions for visual essence and bitstream/wrapper/cross-check defect metadata
  - XML serialisation of EBU QC metadata model



AVDP Content Description Structure

Summary on Essence QC for AV Archive Digitisation and Exploitation

- Digitisation, digital migration and archive ingest and access can benefit from essence QC tools
- Automation of QC is essential to reduce costs
- Reliable detection algorithms are required
  - Video Breakup, Noise/Grain Level, Blurriness, DigiBETA Dropouts, Scanning Type ….
- Efficient human verification tools are required
  - Timeline based summarisation and navigation
  - Job time optimisation by severity based verification
- QC standardisation is hot topic now
  - MPEG, EBU, AMWA….

The DAVID Project (david-preservation.eu)

- Goals
  - What types of damage are common in digital video archive content and workflows and what are its consequences on the re-usability of that content?
  - Which solutions are there to detect and repair MXF errors?
  - Which solutions are there to detect and repair video essence damage and to improving the picture quality beyond its original state?
  - How to apply risk management to prevent from digital damage in the future?

The DAVID Results

- Outcomes
  - MXF D10 File Repair (operational ORF workflow)
  - Detection of DigiBETA Dropout, Field Order and Interlaced/Progressive/Pull-Down Errors integrated in the VidiCert Essence QC System
  - Noise and DigiBETA Dropout Repair integrated into DIAMANT-Film Restoration System
  - Advanced Field Processor
  - De-blurring and Super-Resolution of Archive Content
  - Risk Modelling & Management tools for digital damage prevention within archives
- DAVID Workshop @ FIAT/IFTA, 25. Oct. 2014, Amsterdam
  - Presentation and discussion of the outcomes
- DAVID User Test-Workshop, 28.-29. April 2015, Vienna
  - Evaluate the tools and discuss your needs about
  - Registration info at david-preservation.eu/news

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http://www.joanneum.at/digital