SMPTE Annual Technical Conference 2016

Compilation prepared by

Wolfgang Ruppel

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2016 ANNUAL TECHNICAL CONFERENCE & EXHIBITION
HOLLYWOOD, CA.

Through The Smoke

A LOOK AT INDUSTRY TRENDS

Presented By John Footen, Cognizant Business Consulting

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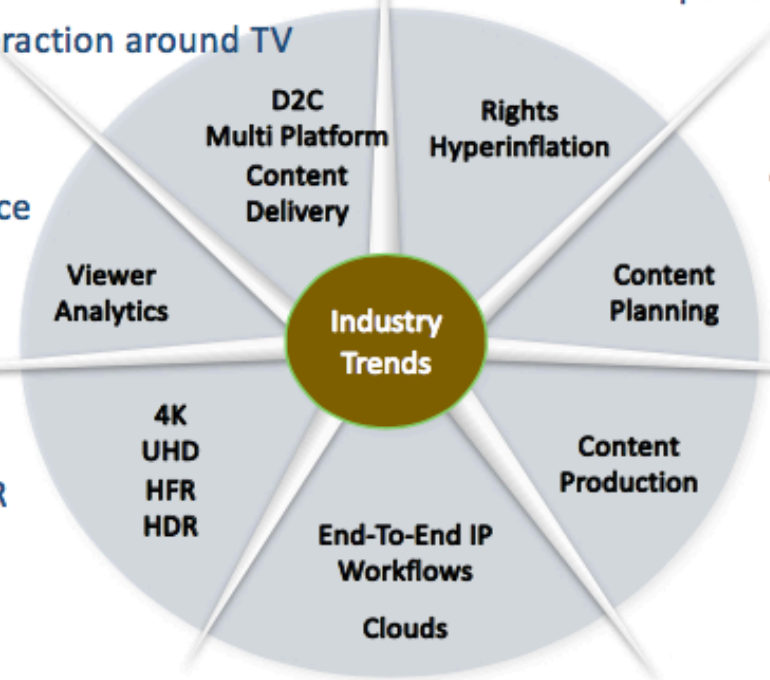
M&E Industry Trends

- Second Screens Used As Extended Viewing Medium
- Increasingly Social Interaction around TV

- Playing Catchup With OTT
- OTT and Sports are Driving

- Analytics Drive Connected Experience
- Get Content Discovery Right First



- Growing Importance Of Content Planning

- Is 4K/UHD/HFR/HDR the Next Game Changer?

- Increased Focus On Content Production

- End-To-End IP Workflows In Need Of Standards
- Move Into The Cloud

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Footen: “Through The Smoke” © SMPTE 2016

Potential to Leverage Viewer Data

Analytics has the potential to be used for decision support in every level of M&E companies today, including better informed programing & targeting decisions

Potential Data Sources:

- TVE/OTT Streaming History
- VOD Viewing & Search History
- Online Page Hits & Click-Thru
- MVPD Data (where possible)
- Social Media Listening
- Opt-in Consumer Profile
- Retail, Website Purchases, Sampling,, Email Marketing Responses, CRM Contact History
- Aggregate Demographic Data by Zip Code or Head End

Use Analytics Applied to Viewer Engagement to:

- Increase Relevance and Stickiness of Programming
- Better Inform Programing Decisions
- Monetize Back Catalog for VOD and Streaming
- Decrease OTT Subscriber Churn
- Increase Relevance of Targeted Advertising Value

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Use Data Better for Programming, Advertising and Product Decisions

Who/What?

- What content is driving the most consumption?
- Who is watching your content?
- What demographic groups does a given program appeal to?

How?

- How is your content being consumed?
- How is the performance of your platform impacting the user experience?

Why?

- Why does a program become a hit?
- Why do some shows find their audience and others don't?

Predictive Analytics for Programming & Product Decisions

- What else might they be interested in?
- How else can we create new revenue streams, gain a competitive advantage and boost customer loyalty?

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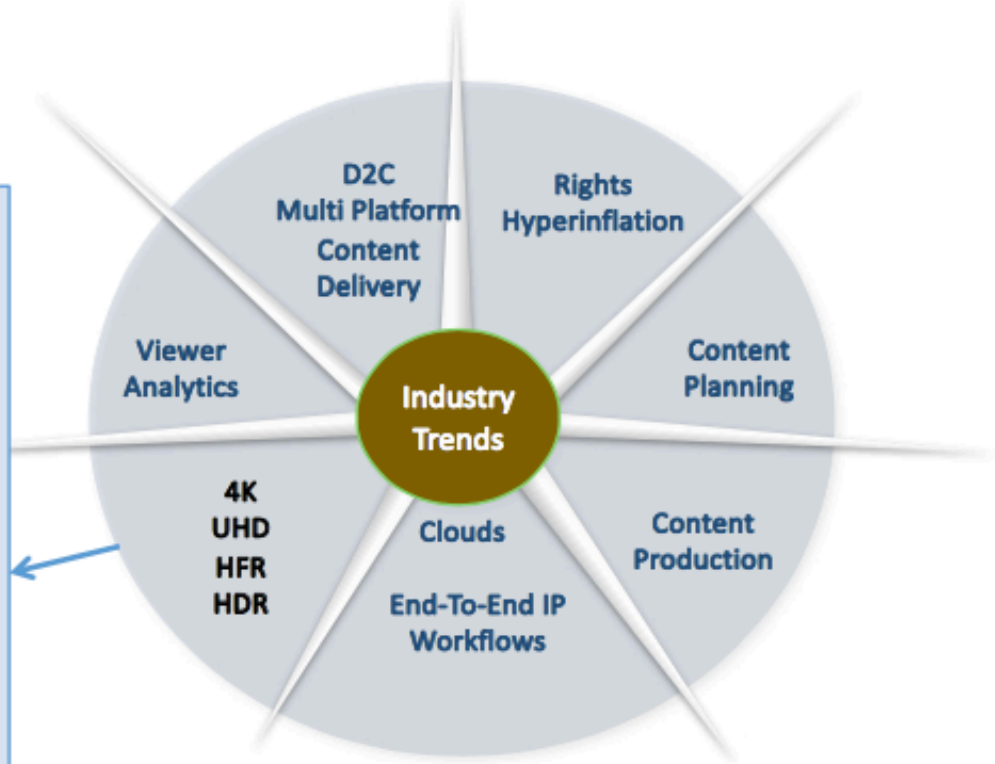
Opportunities and Considerations for your Business

- UHD cannot be ignored, especially for sports
- UHD and HDR require huge investments in cameras, infrastructure, editing, storage, playout, and set-top box upgrades
- Businesses should proceed with caution; consider providing further high-quality HD content as first priority



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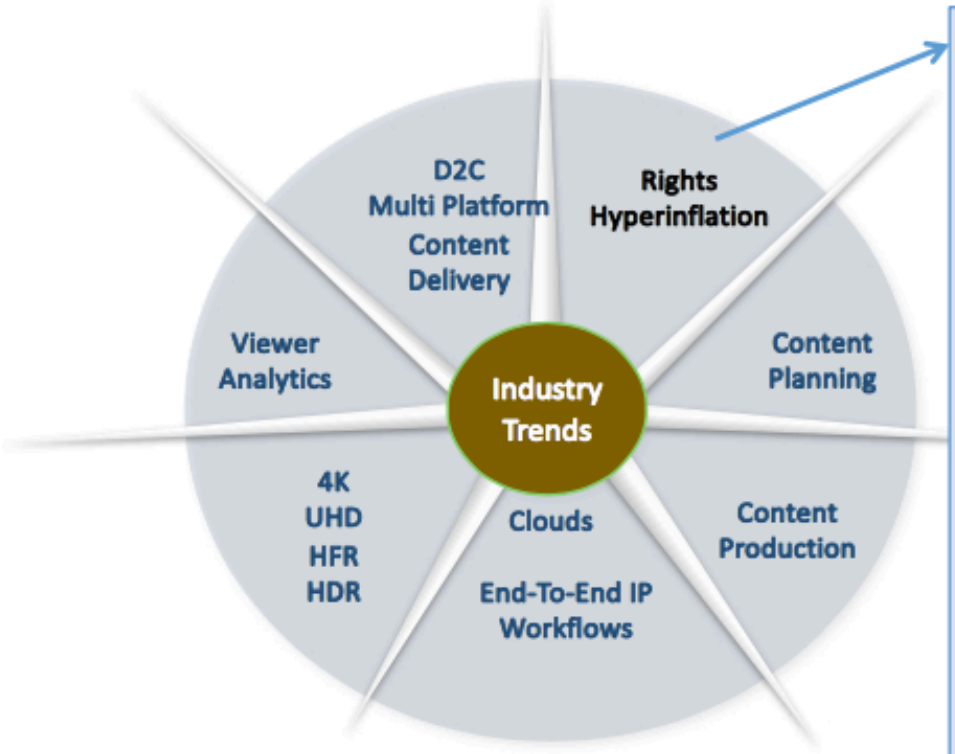
Opportunities and Considerations for your Business



- Optimize to ensure full value from rights purchased
- Rights acquisition at any cost – a "blank check" – could prove retrograde, as the consumers are not willing to pay for the same content on all platforms
- Consumer insights could be incorporated into deal agreements

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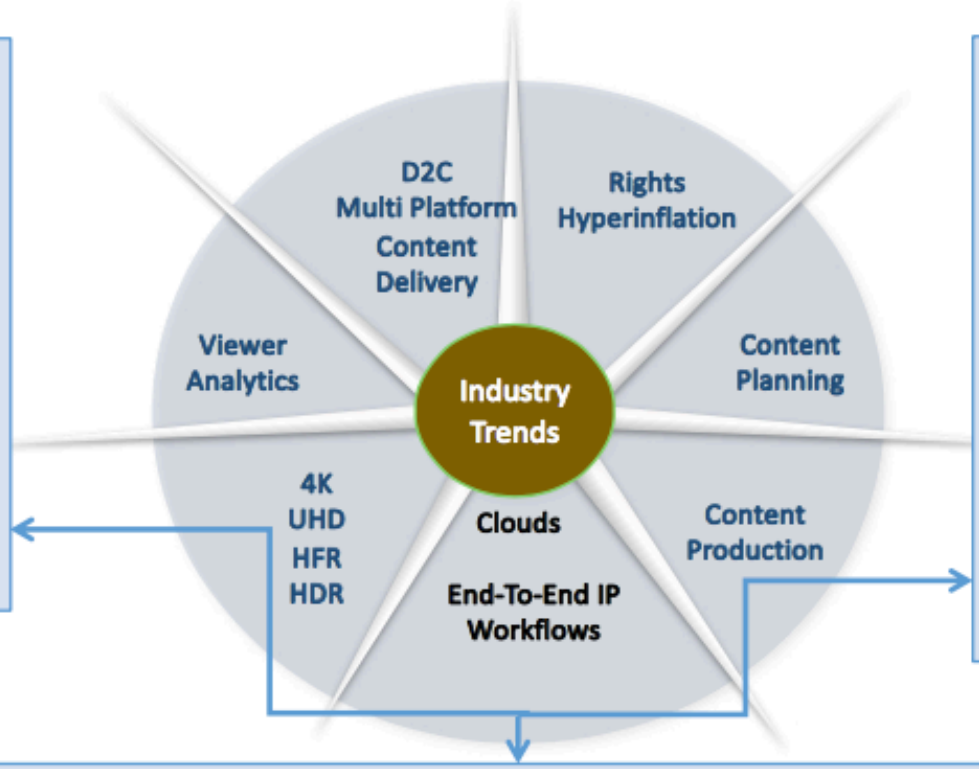
Opportunities and Considerations for your Business

- Use IP infrastructure to lower investments in capital equipment and associated power and HVAC considerations, and to enable to 4K
- Locate storage and compute in the cloud, where practical



- Work to standardize live production, especially around multi-signal timing
- Consider uncompressed streams for live environments and compressed streams in other parts of the facility

Configure and change Software-Defined Networks (SDN) with relatively simple tools

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A Tale of Live IP Formats

Paul Briscoe
Televisionary Consulting + Evertz Microsystems

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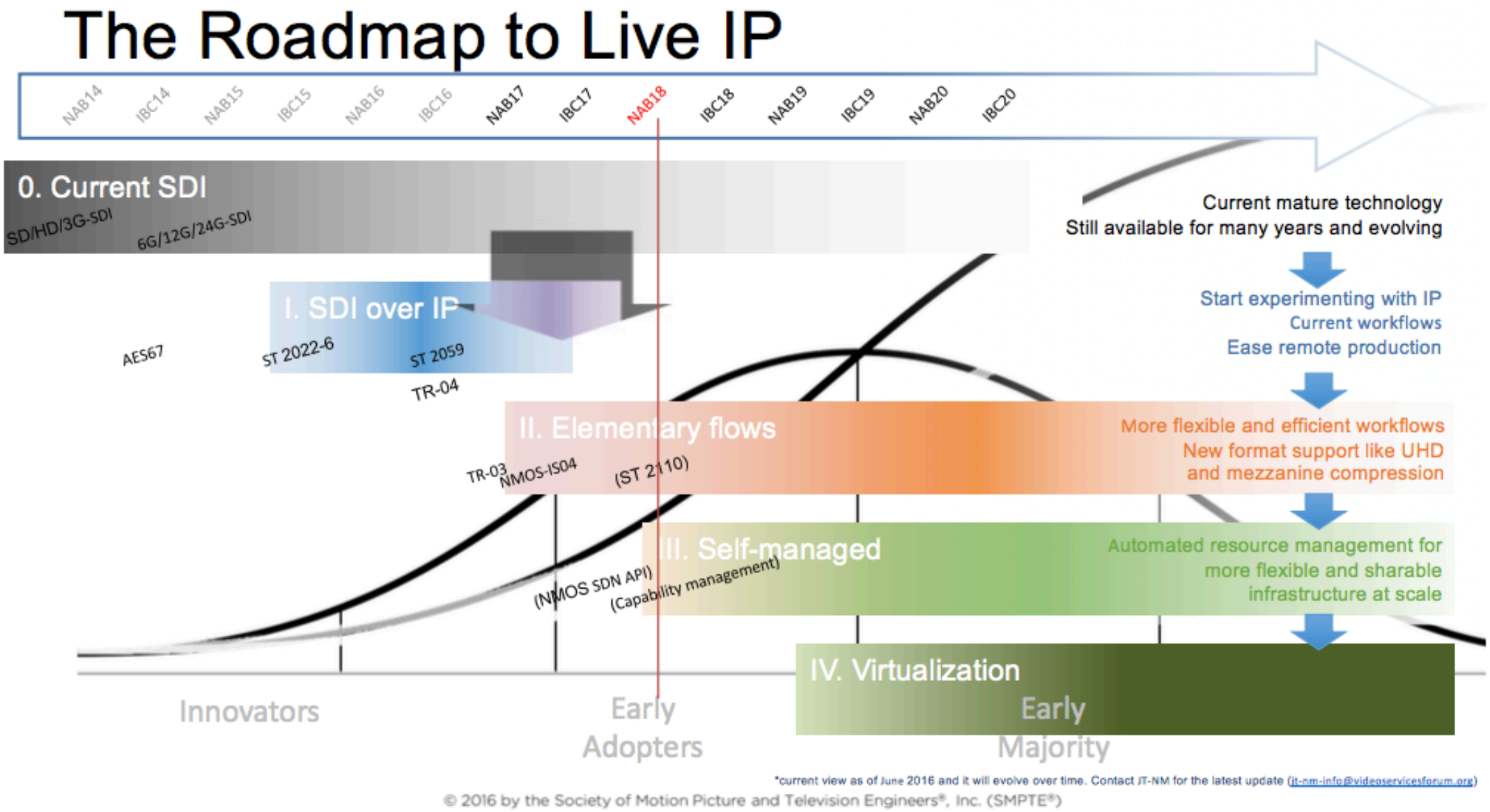

Briscoe: “A Tale of Live IP Formats” © SMPTE 2016

The Standards Workflow

- VSF developed Technical Recommendations TR-03 (and -04)
- Submitted to SMPTE – "Request for Standardization"
- SMPTE assigned to TC 32-NF
- 32NF formed Working Group 32NF-60 SVIP
  - Caution – new acronym: "Studio Video over IP"
- Working Group formed a Drafting Group 32NF-60 DG SVIP

- DG evolves TRs and RFC into Normative Standards
- *Normative Standards enable interoperability*

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Introducing the ST-2110 Document Suite

- A set of documents with room to grow.
- 2110-10 – System
- 2110-20 – Baseband Video
- 2110-30 – Baseband Audio
- 2110-40 – ANC data
- 2110-50 – ST2022-6 in 2110 environment

Each base document type is extensible under its suffix

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Where Does it All End?

- Live IP Infrastructures

- Real hardware
- Virtualized applications
- Distributed architectures
- Datacenter-centric facility design
- Cloud services
- Tight integration with file-based systems
- Global connectivity
- *Opportunity for evolution beyond today's workflows*

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Adapting Content to Different Display Capabilities and Viewing Environments

Jack Holm
TARKUS IMAGING

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WCG & HDR

- A 0.005 to 1,000 cd/m^2 P3 display has a CIELAB color gamut volume 17 times that of a 0.1 to 100 cd/m^2 Rec709 display
  - HUGE increase in the visual storytelling palette
- Not all HDR displays are created equal
  - OLED – excellent blacks but hard to get > 1,000 cd/m^2 (for very long)
  - Backlight – higher minimum black but can get brighter
  - APL limitations can result in dynamic display dimming
- Not all WCGs are the same
  - Encoding supports Rec2020 RGB but most displays range from Rec709 to P3
- Fundamentally different PQ and HLG encodings

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What's a display to do?

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- ✓ Determine what is being received
- ✓ Adapt for display capabilities and viewing environment
- ✓ Deal with encoding differences

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Interpreting the Master

- What EXACTLY is the intended appearance, on what display, and in what viewing environment?
  - Decode the display colorimetry (PQ or HLG)
  - Check for display color gamut and dynamic range metadata
    - Ex: SMPTE ST 2086, IEC 61966-12-1, IEC 61966-12-2
  - If no metadata, assume the most likely reference display
    - Ex: 0.005 to 1,000 cd/m^2, P3 RGB primaries
- *The most important variable in display adaptation is the quality of the master*
  - Precisely defined
  - Exactly conveys the desired creative intent

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Beyond the Limits of Visual Acuity

The Real Reason for 4K & 8K Image Resolution

Edward Reuss – Engineering Consultant

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Introduction

- Several commentators and articles claim:
  - 4K UHDTV is unnecessary
- Because:
  - The human eye cannot see the difference at normal viewing distances
- Therefore 4K UHDTV is:
  - Little more than marketing hype to sell more televisions
  - Wastes pixels, bandwidth, processing cycles and memory that no one can see
- But there is more to watching TV than just perceiving pixels

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Introduction

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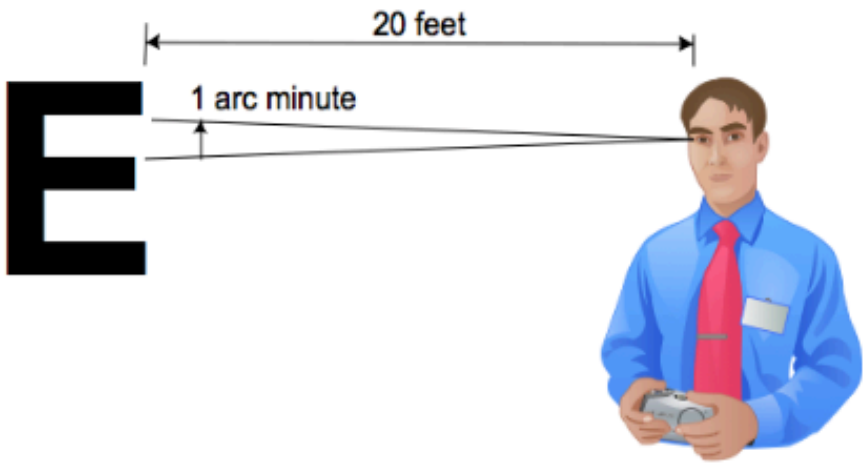
Reading Acuity & Simple Acuity

- "Reading acuity"
  - Viewer's ability to recognize "Snellen optotypes" on an eyechart
  - In other words, the smallest text we can read
- "Simple acuity"
  - The highest resolution under optimal conditions
  - Contrast, illumination, correction, etc.
- Authors who claim 4K television is unnecessary normally cite either reading acuity or simple acuity



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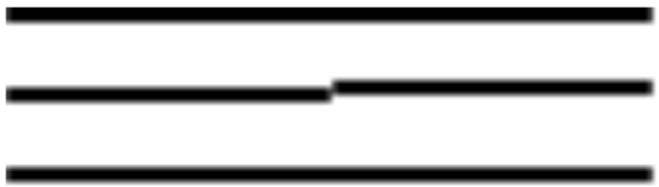
Hyperacuity

- Also called "Vernier acuity"
- Ability to discern abnormalities in an object's shape
  - Image compression artifacts
  - Spatial artifacts & spatial aliasing of hard edges:
    - Stair-step edge artifacts ("jaggies")
    - Moiré patterns



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Summary

- Several authors claim 4K UHD resolutions are unnecessary
  - The pixels are too small to be perceived by the human eye
  - In normal television viewing conditions (living room)
- Audiences often prefer HD and UHD content with sharp edges
  - Sharp edges make an image appear "cleaner"
- Sharp edges can cause spatial artifacts
  - Stair-step edges and moiré patterns
- Eliminating spatial artifacts causes fuzzy edges
  - Making the image appear "murkier"
- Filtering UHD images with very small pixels permits
  - Eliminate spatial artifacts in the "Hyper-acute Image Space"
  - Preserve apparent image sharpness
- HDR/WCG and immersive (VR) workflows benefit most from eliminating spatial artifacts

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Conclusion

- The point of television is to see the image, not the pixels
- Making the pixels too small to perceive them permits:
  - Filtering image artifacts while not degrading the image quality
  - Preserving the suspension of disbelief

- Therefore 4K, 8K, and higher resolutions are useful for the future of digital television

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8K-UHDTV Production Equipment and Workflow which Realize an Unprecedented Video Experience

Tsuyoshi Sakiyama, Kenichiro Ichikawa,

Mayumi Abe, Seiji Mitsuhashi,Takayuki Yamashita and Masayuki Miyazaki

NHK(Japan Broadcasting Corporation)

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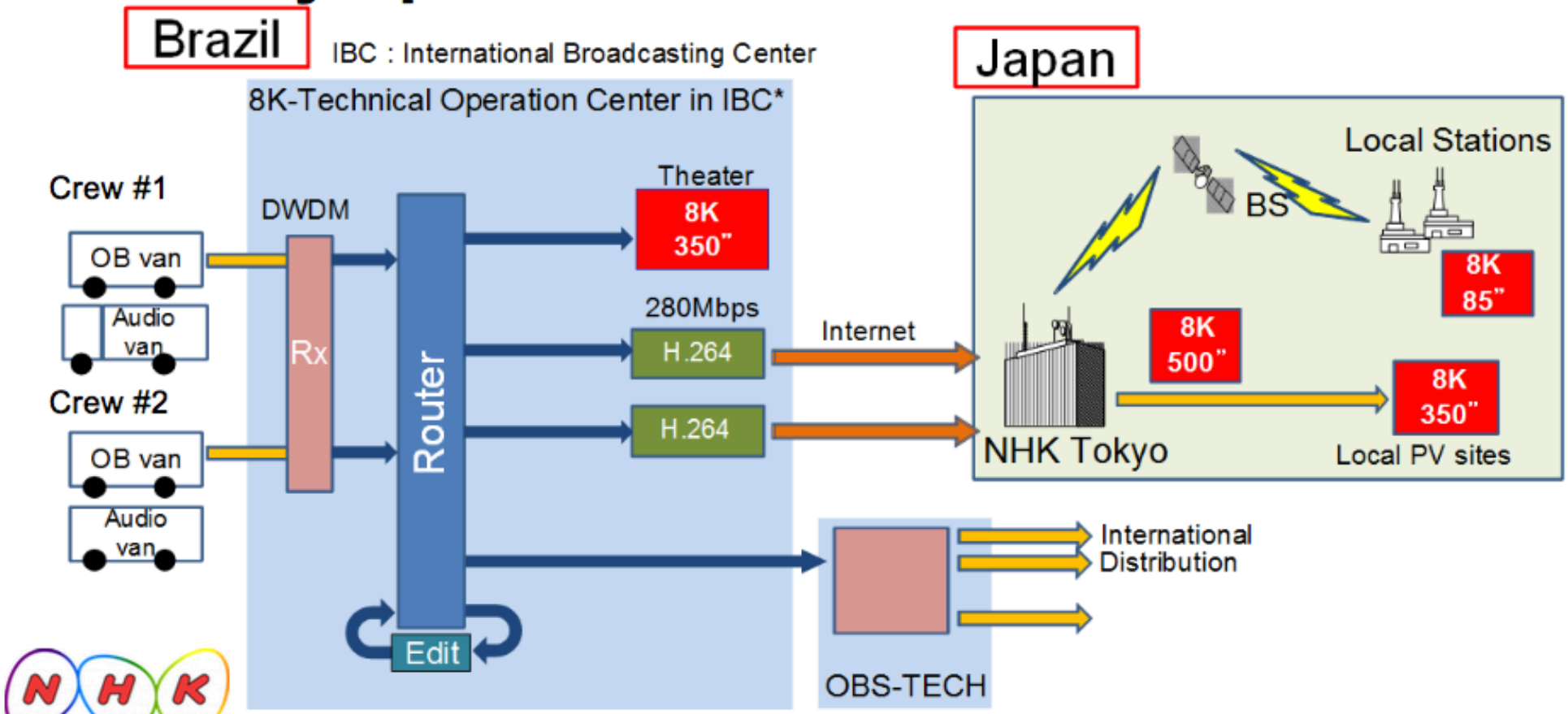
Rio Olympics 8K Live Production



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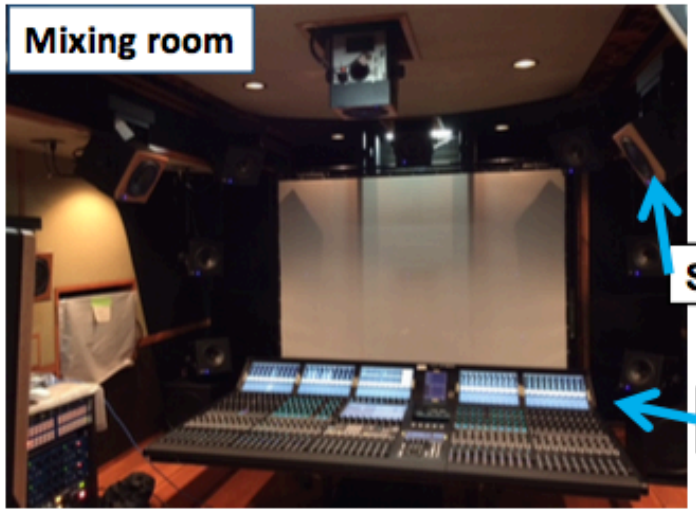
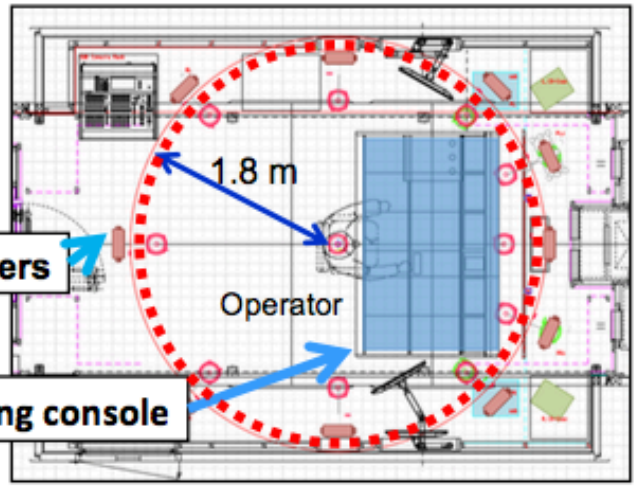
Sakiyama et al., 8K-UHDTV Production Equipment and Workflow, © SMPTE 2016

8K OB vans – Audio Van

- Specifications
  - Mixing room for 3D sound mixing
  - 28 speakers on the semi-spherical surface for multi-format production 22.2ch, 5.1ch, 2ch





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Sakiyama et al., 8K-UHDTV Production Equipment and Workflow, © SMPTE 2016

8K Single-chip Camera for Live Broadcasts

Specifications

	New camera (SHK-810)	Previous camera (SHV-8000)
Manufacturer	IKEGAMI	
# of Sensor(s)	One	Four
Image sensor	33-milion-pixel CMOS	8-milion-pixel CMOS
Optical Format	Super 35 mm	1.25 inch
Sensitivity	F8@2000 lx	F4@2000 lx
S/N (measured from HD cropped)	62 dB	54 dB
Weight	8.5 kg	20 kg
HDR / Color Gamut	HLG / Rec. 2020	Not support / Rec. 709

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Sakiyama et al., 8K-UHDTV Production Equipment and Workflow, © SMPTE 2016

Conclusion

- 8K live production in Rio Olympics was successful
- 8K equipment was introduced
  - OB vans
  - Compact cameras
  - Express-P2 recorder
  - Editing system
- Editing work flow was developed
- Concerns and status about HDR and WCG production were shared

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The Special Challenges of Offering High Quality Experience for VR video

Mary-Luc Champel, Standards Director & Principal Scientist, Technicolor

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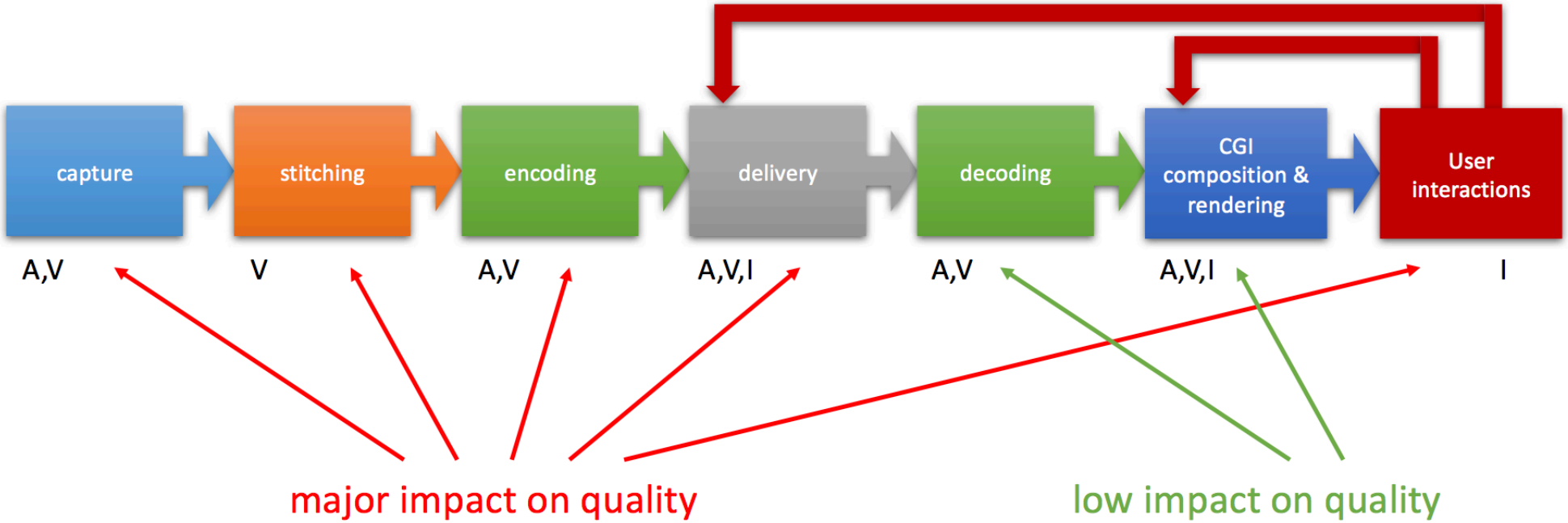
Introduction: VR workflow



impacts on quality: Audio (A), Video (V), Immersiveness (I)

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High Quality VR: Why?

- 2 challenges for VR to become a successful media:
  - offer a unique and novel experience to users,
  - solve issues that could cause rejection of VR (in particular motion sickness).

- Preventing motion sickness is highest challenge.
  - Motion sickness => very low perception of VR experience (no matter what).
  - First studies showed that nearly 50% of people experience some form of it.
  - Two theories to explain it: sensory conflict & postural instability.
  - According to several studies, motion sickness factors are:
    - refresh rate (flicker), system lag (motion-to-photon latency),
    - vection (wide field of view with fast moving objects in near field),
    - and duration of exposure.

Image: TNO

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High Quality VR challenges: delivery (1/2)

- Due to motion-to-photon latency, the whole 360 environment needs to be sent to the end device. Sending only visible viewport is hardly achievable.
- Due to bandwidth constraints or costs, sending full quality for 360 space is often not a possibility (7-10x more bandwidth than traditional AV services) and it would be undesirable anyway.
- Adaptive streaming is the most adapted solution ! It allows:
  - Adjusting quality to not only bandwidth but also with regards to how far the video content is from visible viewport.
  - Visible content would be given highest quality while content at 180° from the visible viewport would be given lowest quality.
  - Optimizations could take into account movements to pre-fetch content.

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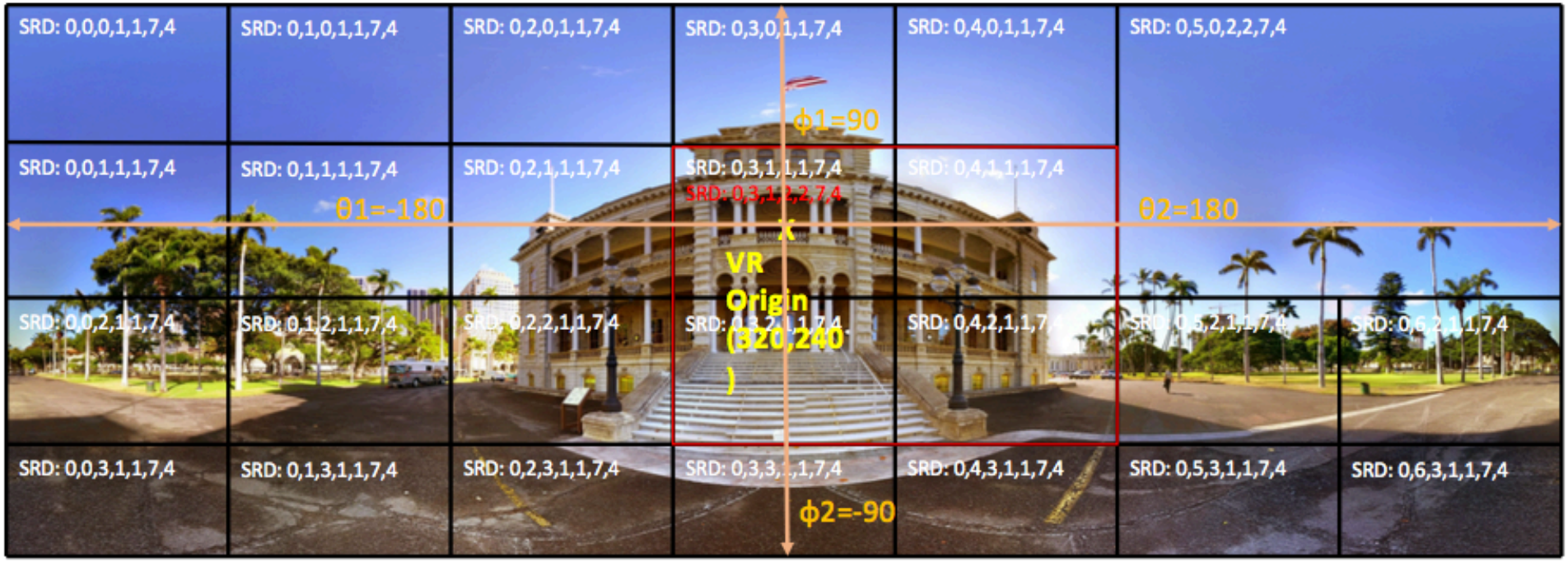
High Quality VR challenges: delivery (2/2)

- MPEG-DASH Amd 2 on Spatial Relationship Description (SRD).
  - Can be used as a basis for VR. Is considered by DASH-VR (new CE).



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Champel: “The Special Challenge of Offering HQ Experience for VR”, © SMPTE 2016

Conclusion

- VR 360 is coming and it is coming fast !
- High Quality is likely to be a condition for its success.
- High Quality VR depends on visual, audio and Immersiveness.
- High Quality VR poses three challenges:
  - Interoperable VR formats, compression & delivery
- Several SDOs are already looking at VR. MPEG is likely to be the first to release standardized solutions:
  - MPEG-OMAF in mid 2017 followed by work in MPEG-JVET & DASH.

- Will this be soon enough to ensure High Quality can be offered with first mass market VR deployments?

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IMF
Interoperable Master Format

Wolfgang Ruppel, wolfgang.ruppel@hs-rm.de

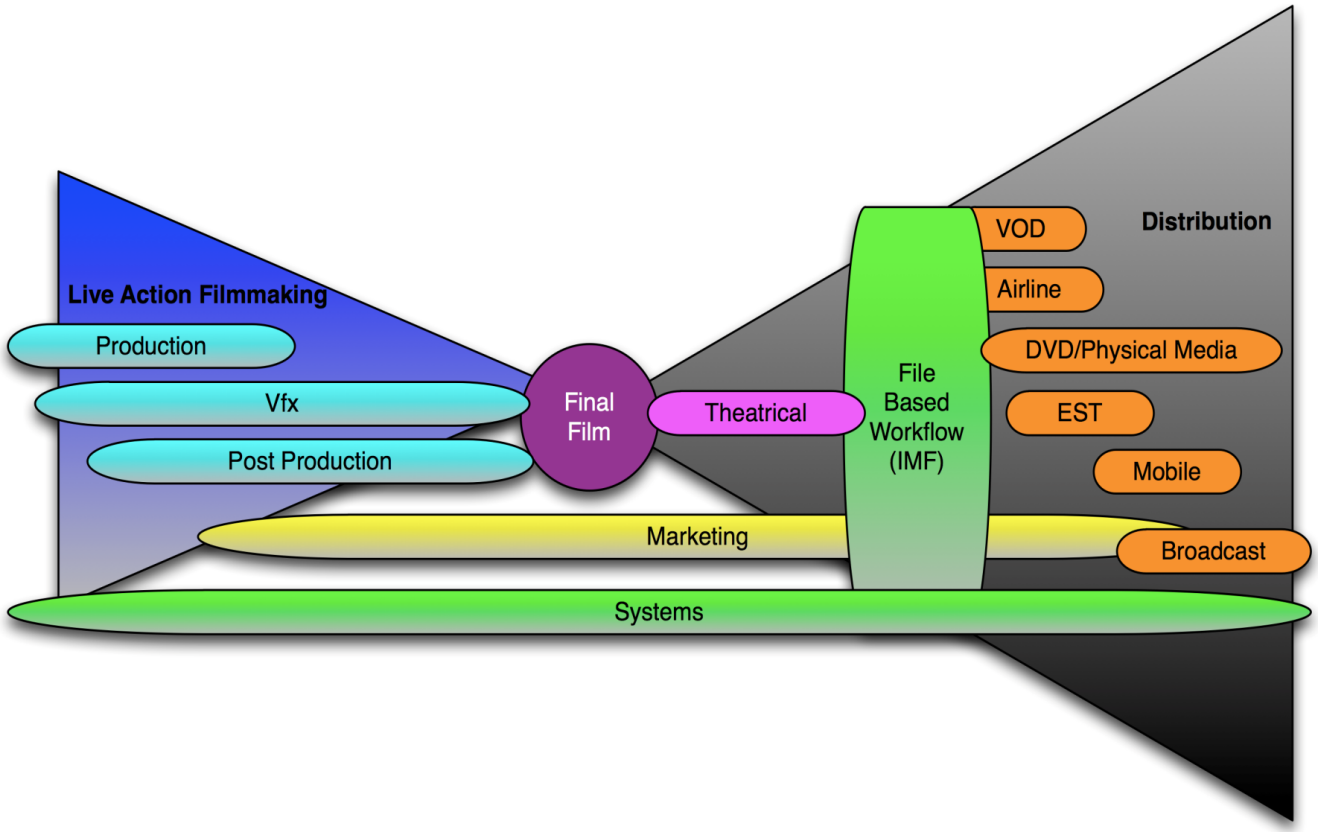
Interoperable Master Format

Motivation

- Inhalteanbieter erstellen derzeit eine Vielzahl von Mastern für unterschiedliche Distributionsmedien:
  - Blu-ray, DVD, VOD, PPV, TV, iTunes, Mobile TV etc.
  - Unterschiedliche Codecs und File-Formate: QT, MXF, MP2, ProRes etc.
  - 1080P, 720P, NTSC, PAL, QVGA etc.
  - 16:9 / 4:3
  - Bis zu 42 Sprachversionen (Hollywood-Studios)
  - Von jedem Master werden Vollversionen gespeichert
  - „Asset management nightmare“
- Postproduktions-Workflows sind vollständig filebasiert
- Idee: Einheitliches, file-basiertes Master-Format als Ersatz für die Verteilung auf Tape (typ. HDCAM-SR)
- „Downstream“-Version werden aus dem einheitlichen Master generiert

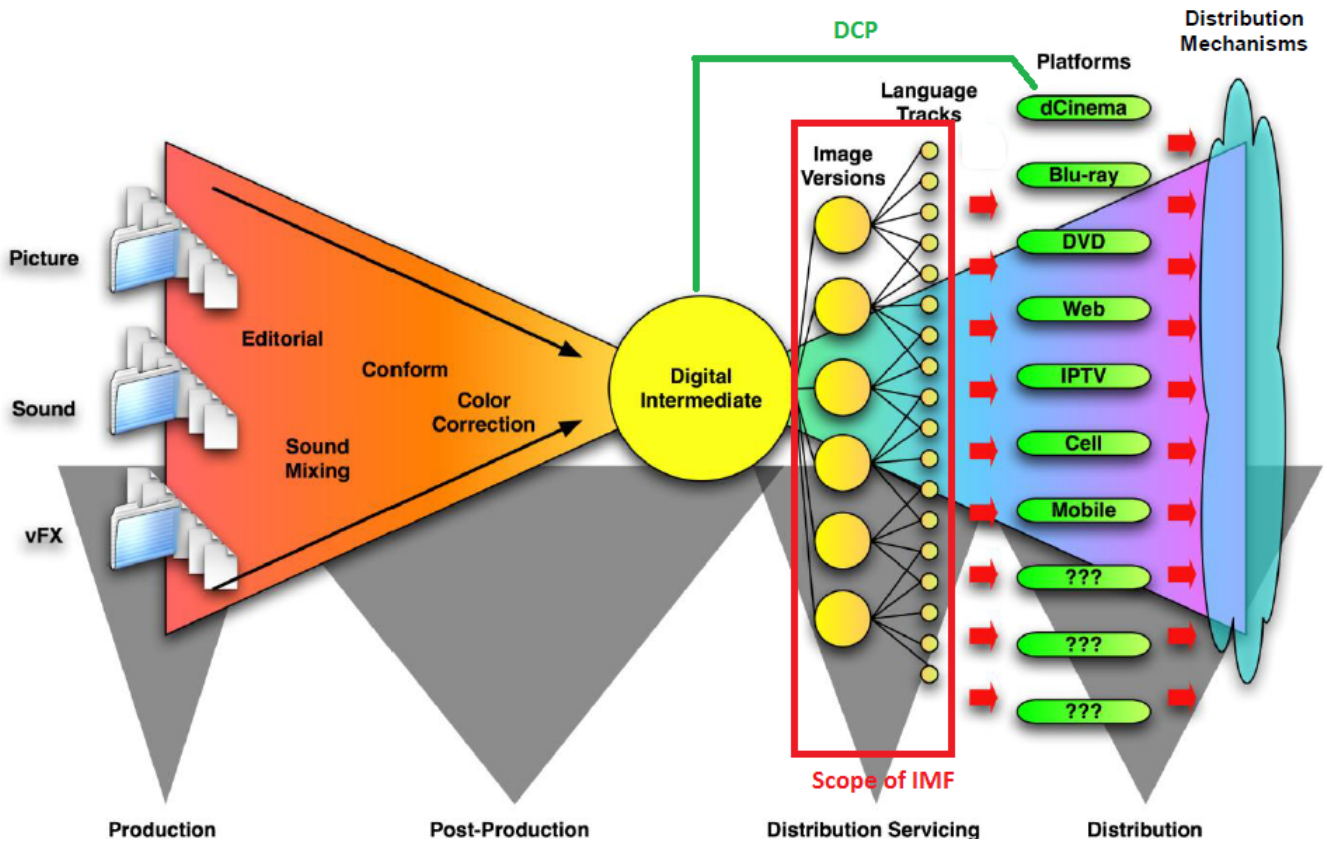
© W. Ruppel

Interoperable Master Format



Quelle: Howard Lukk, Disney

IMF - THE OVERALL CONCEPT



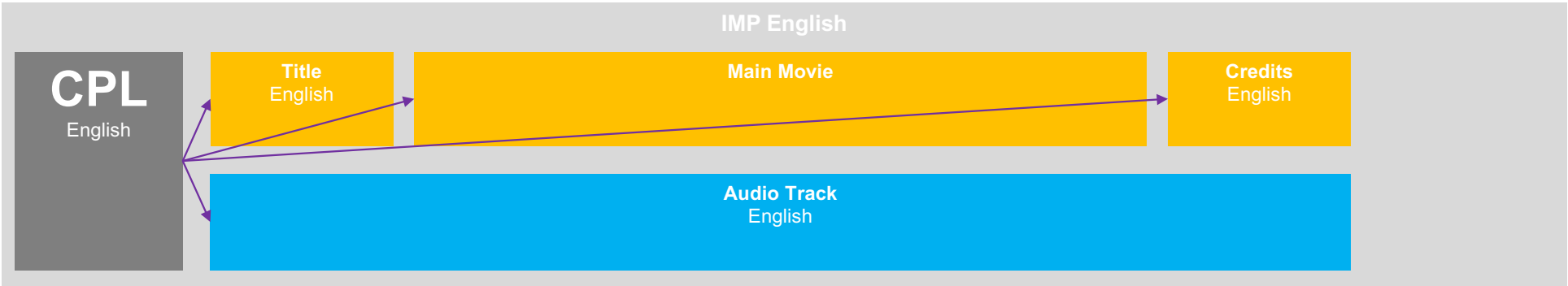
Source: ETC, www.etcenter.org (with modifications)

IMF - THE OVERALL CONCEPT

- Essence components of IMF to be wrapped into MXF track files
- Image, Audio, Timed Text, Dynamic Metadata
- Timeline is represented by a Composition Play List (CPL)
  - Kind of “recipe” how an IMF package is to be read (played)
  - Constructs a single “virtual track” for the image essence
  - May contain one or more virtual tracks for audio (e.g. language versions)
  - May contain zero or more virtual tracks for data
  - Somehow similar to an EDL created by an editing tool

Versioning – Master

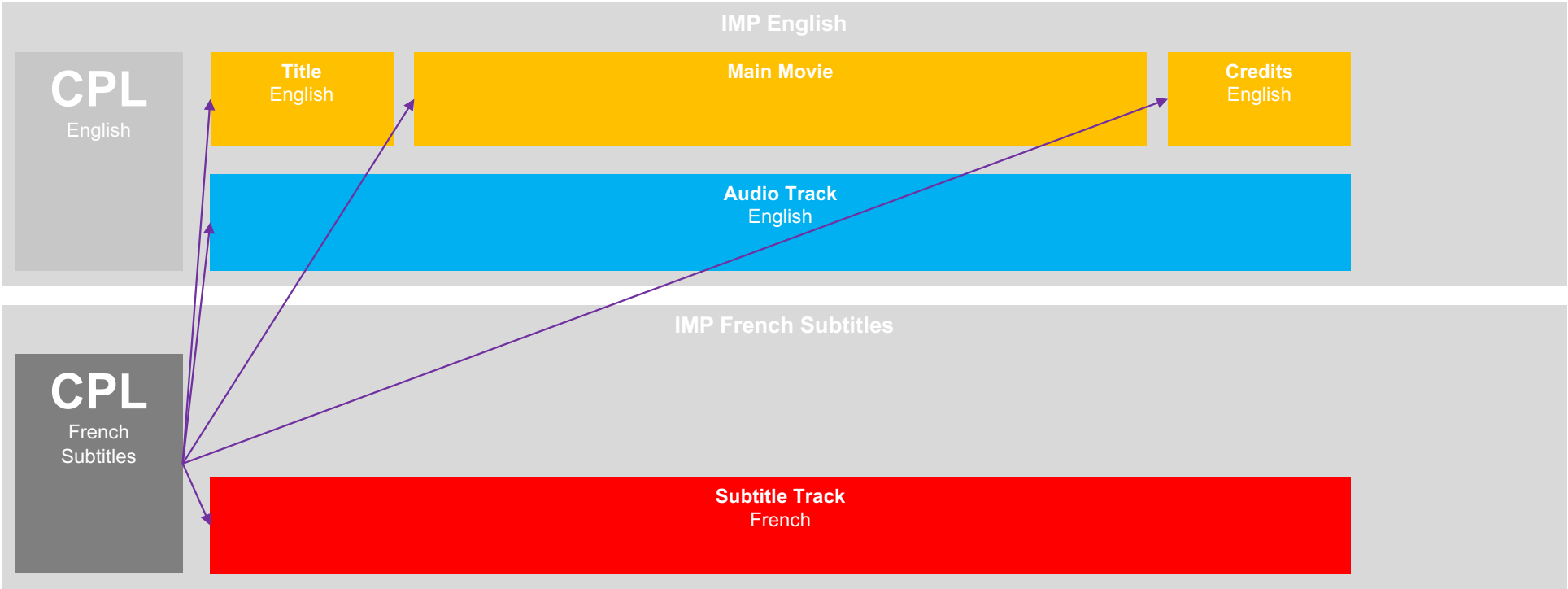
- English Version (Master)



Quelle: André Vent, Rohde & Schwarz

Versioning – Subtitles

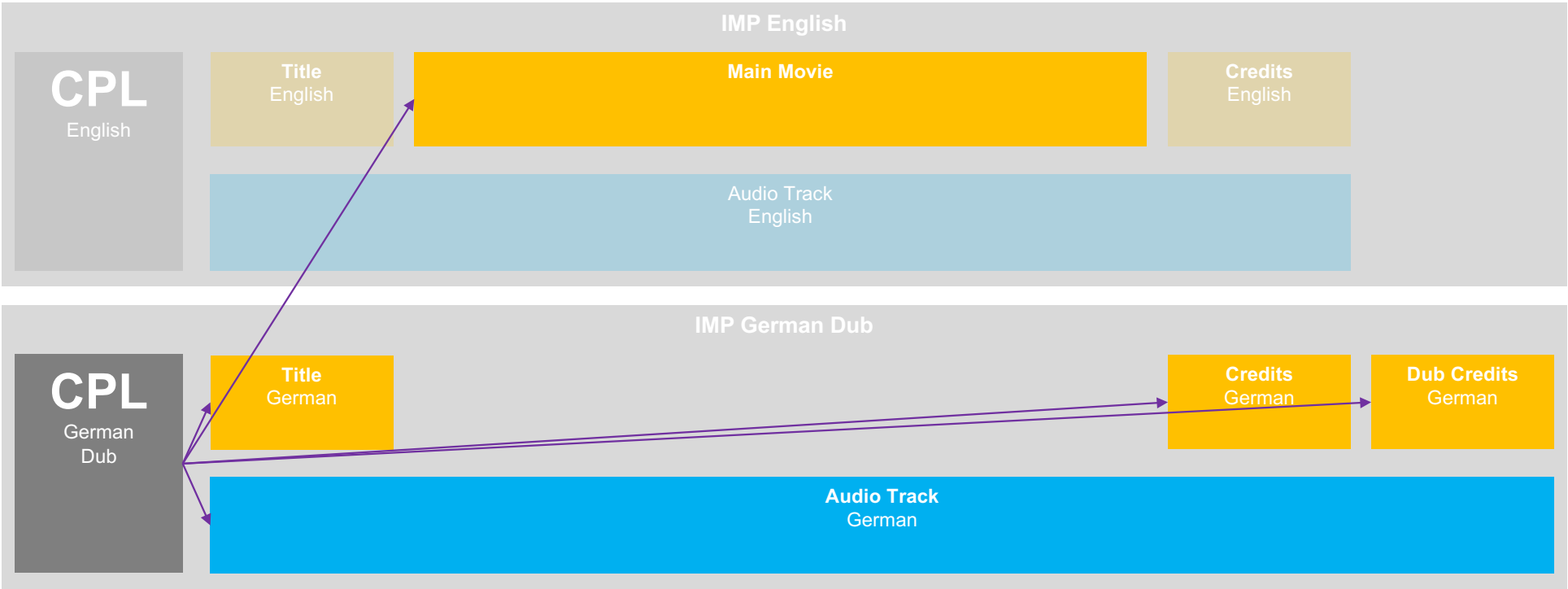
- French SubtitleVersion (Supplement)



Quelle: André Vent, Rohde & Schwarz

Versioning – Dubbing

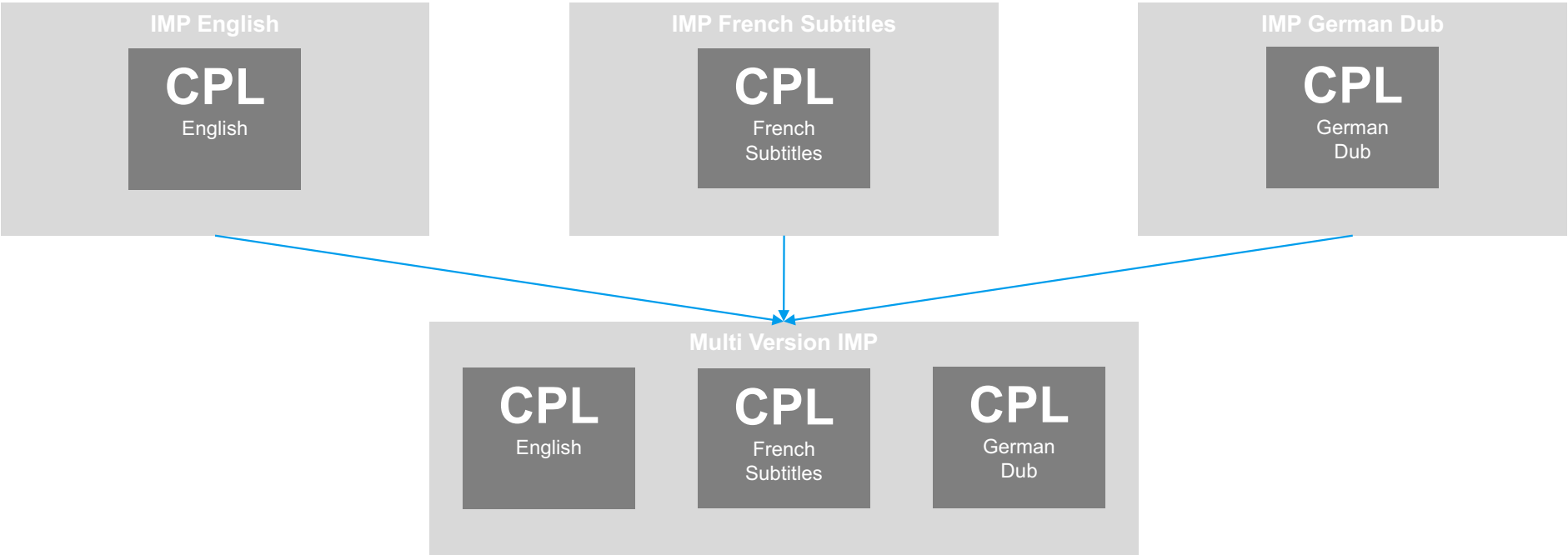
- German Dub Version (Supplement)



Quelle: André Vent, Rohde & Schwarz

Contribution – Seperate Packages

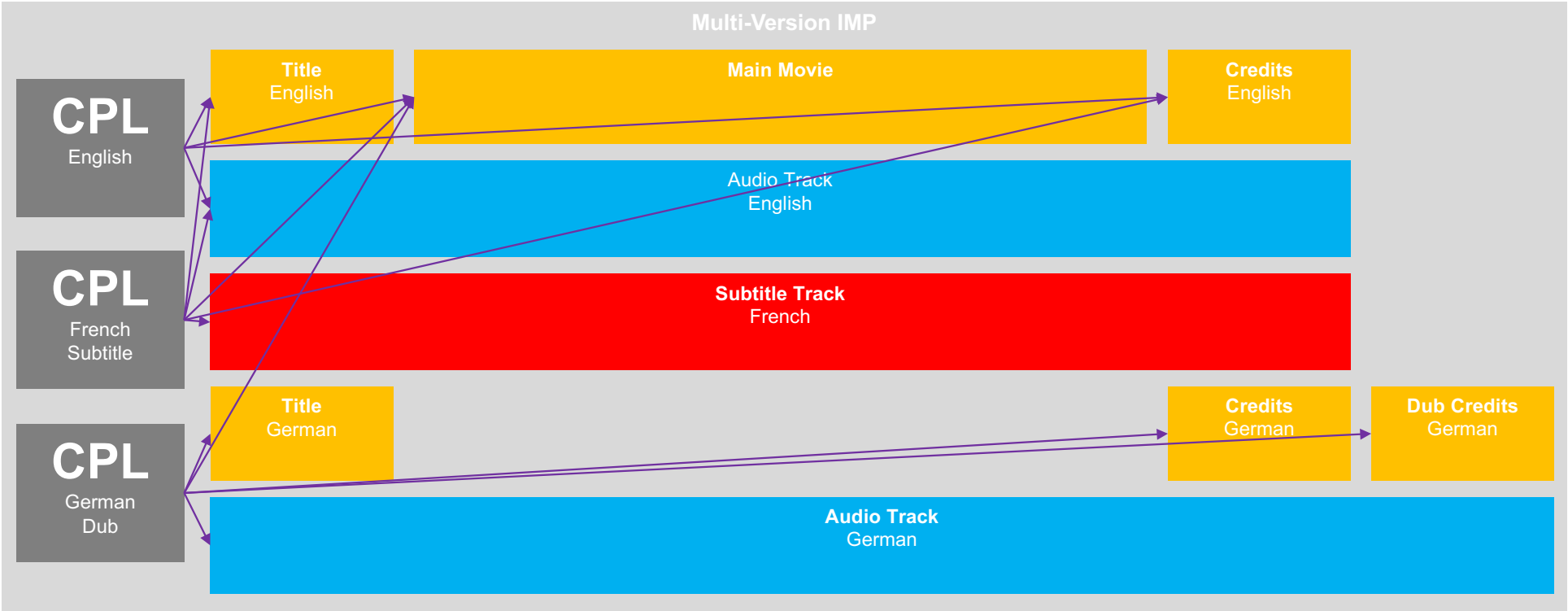
- English master, French subtitle and German dub version in seperate packages



Quelle: André Vent, Rohde & Schwarz

Contribution – Multi-Version IMP

- All assets merged into one IMP for contribution



Quelle: André Vent, Rohde & Schwarz

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Extension of the Output Profile List

for Semi-automated Quality Control using IMF

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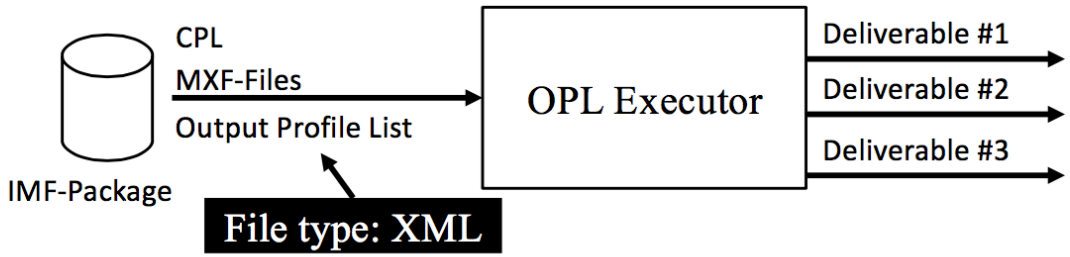
Key components of the IMF

- Assets
- Packing List (PKL)
- Composition Playlist (CPL)
- Output Profile List



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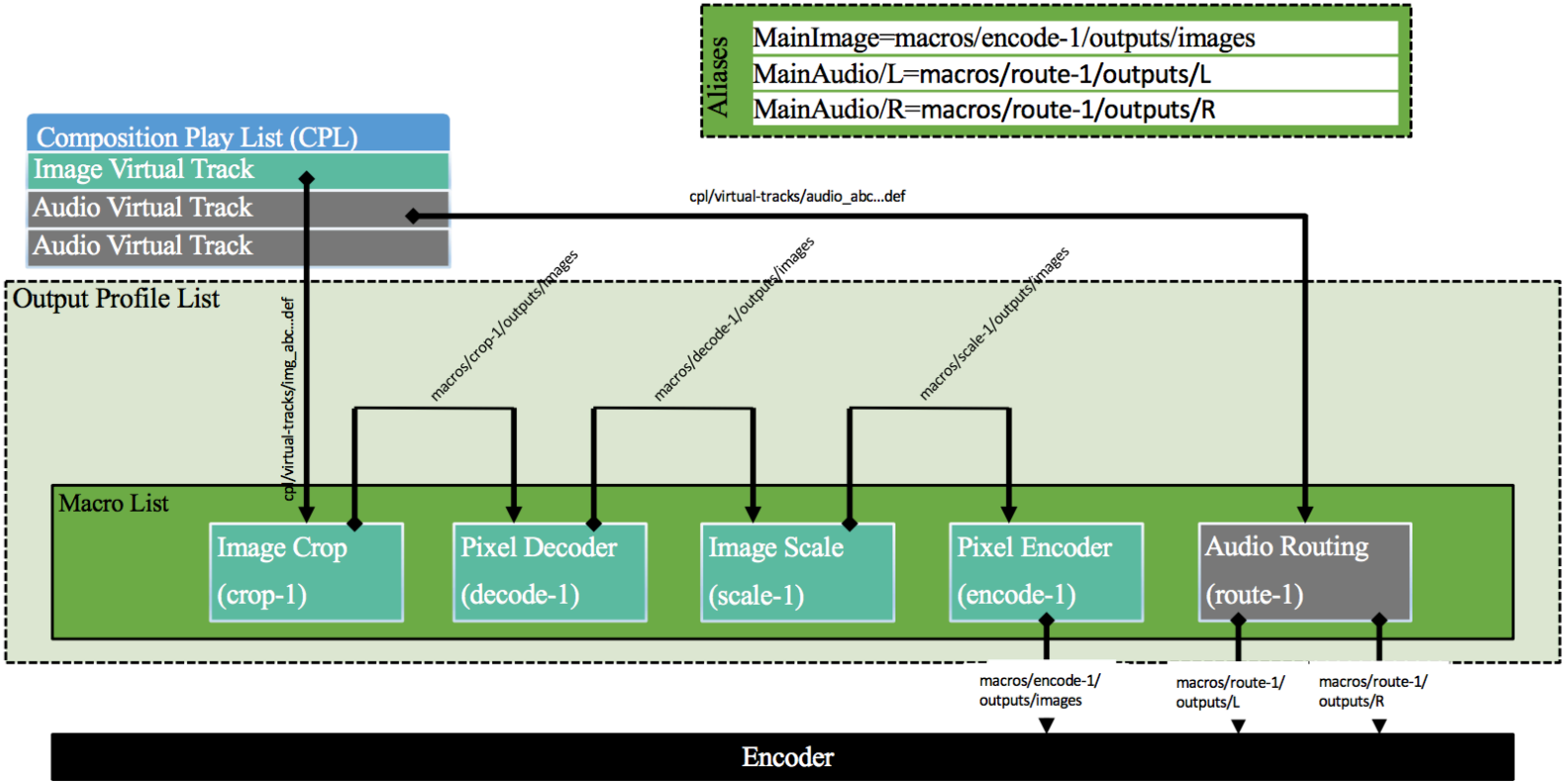
Key components of the IMF



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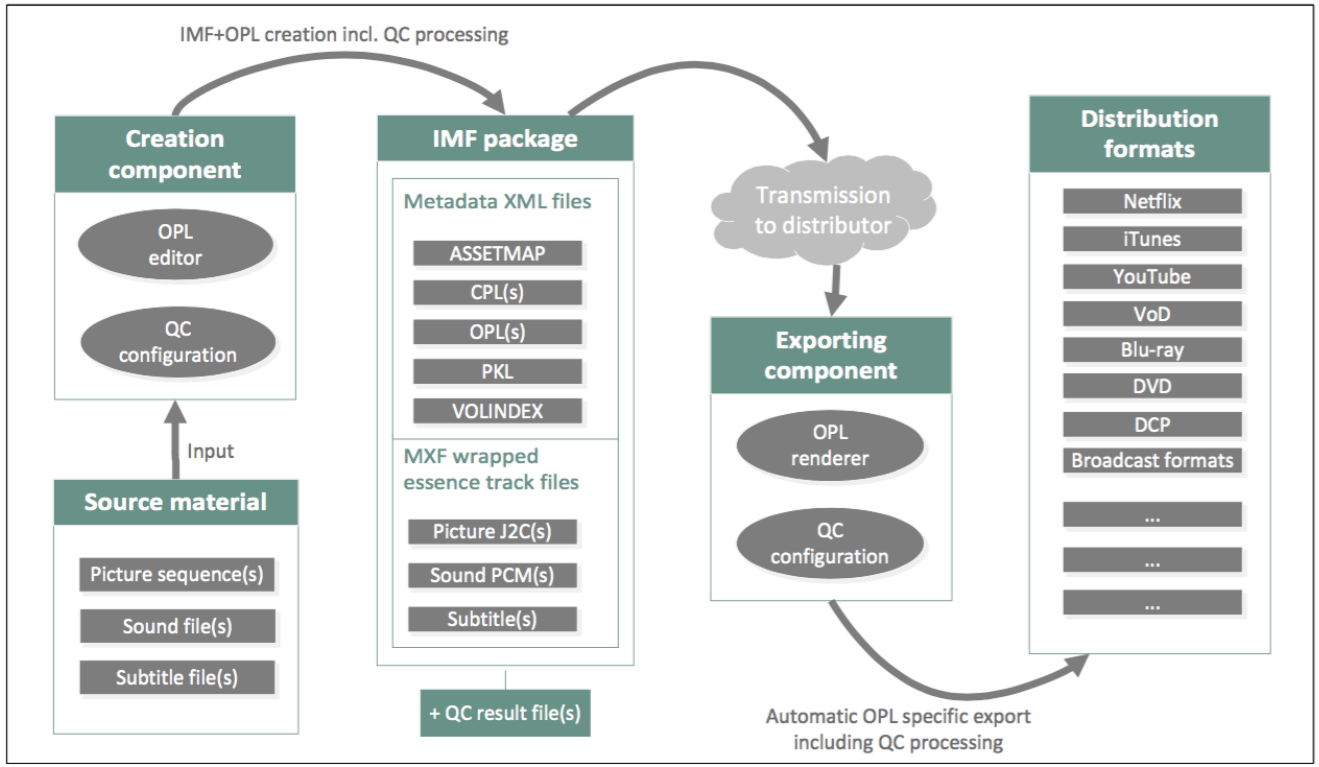
Sparenberg: "Extension of the Output Profile List" © SMPTE 2016

System Design



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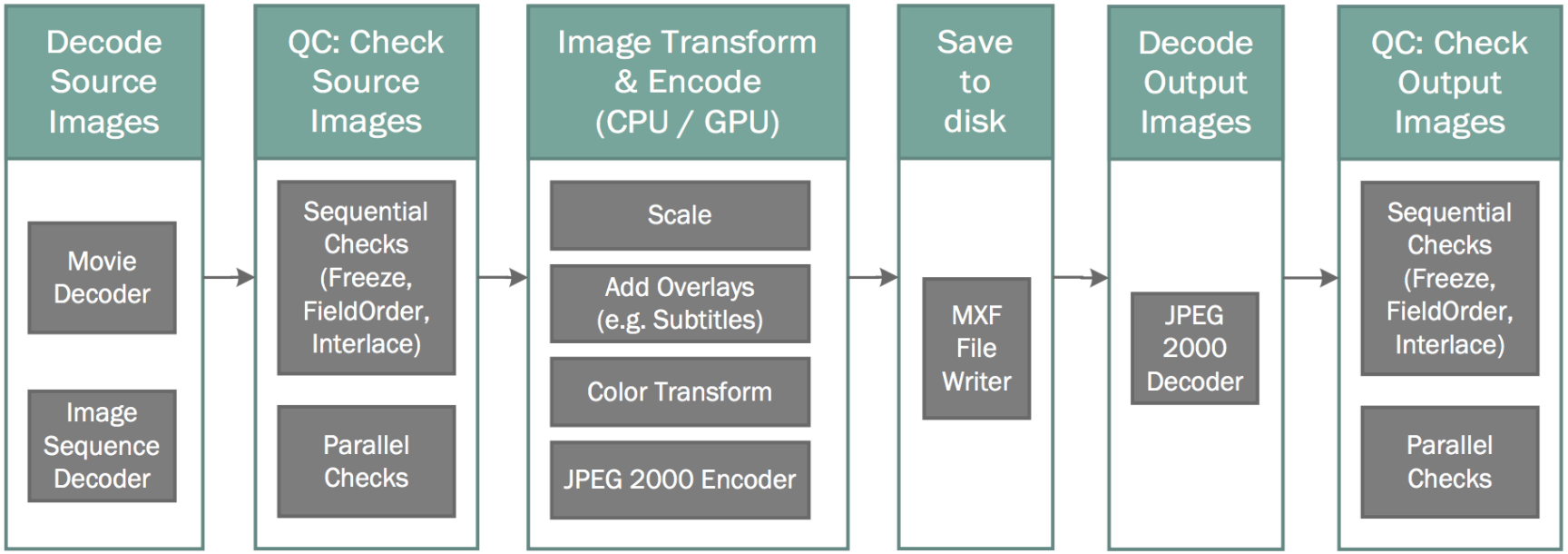
System Design



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A comparison of intra-frame codecs considered for IMF

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Why another study on codec performance?

- JPEG 2000 scales nicely from 1080i25 at 100 Mbps up to UHD WCG HDR and lossless compression
- IMF App #2 / #2E provides a wide choice of encoding profiles
- However, there appears to be some interest in adding more codecs to the IMF family of standards
- Amongst the few standardized candidates, AVC Intra is frequently mentioned
- Earlier comparisons between AVC Intra and JPEG 2000 have shown advantages for AVCI at lower data rates
- No published comparisons using
  (a) IMF profiles and
  (b) industry standard cutting-edge encoders
- Adding HEVC Intra for UHDTV encoding to the study
- Also looking into multi-generation re-encoding and transcoding performance

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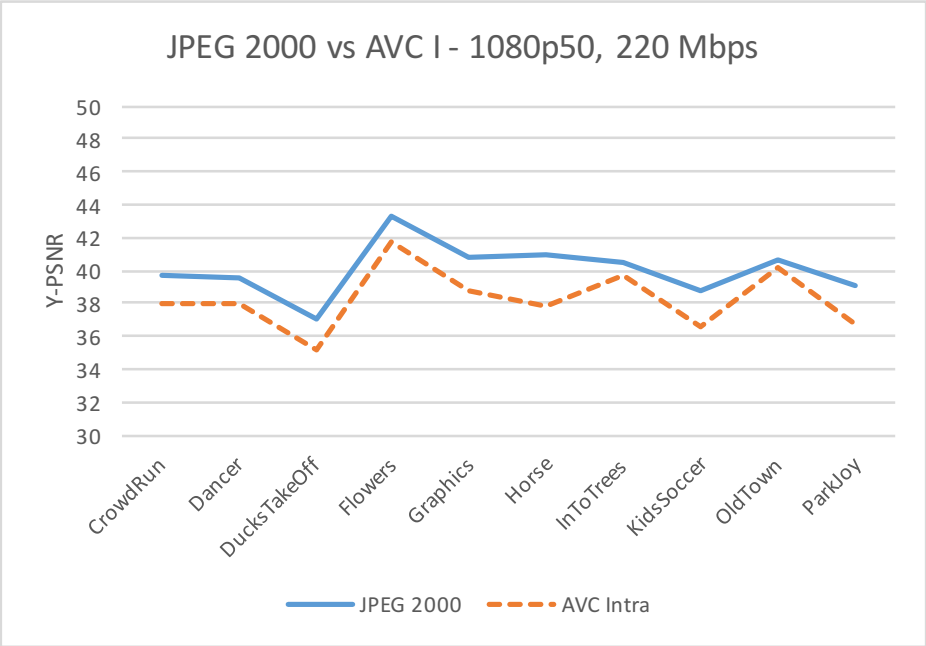
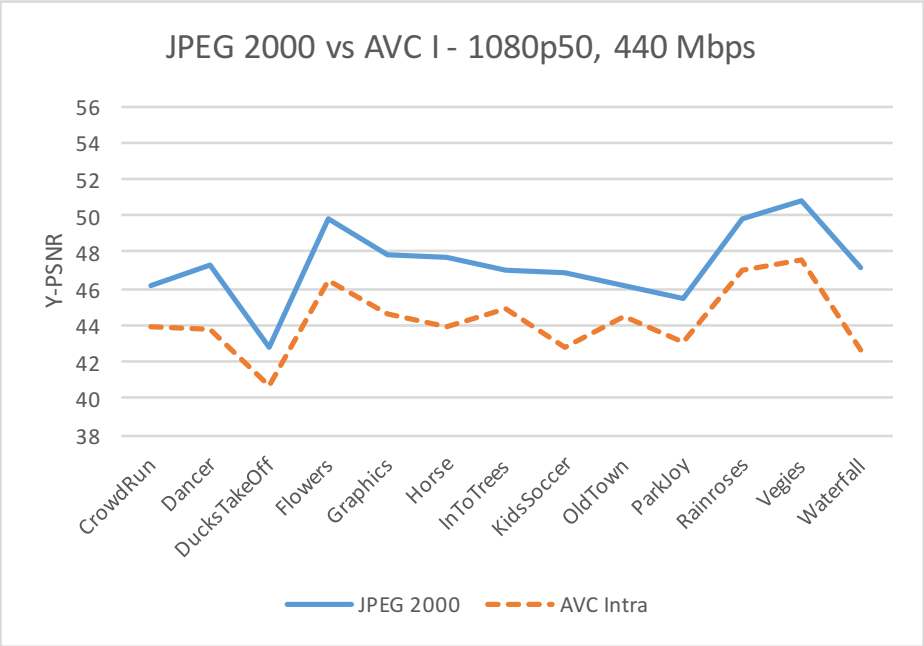
HDTV PSNR results: 1080p @ 220/440 Mbps





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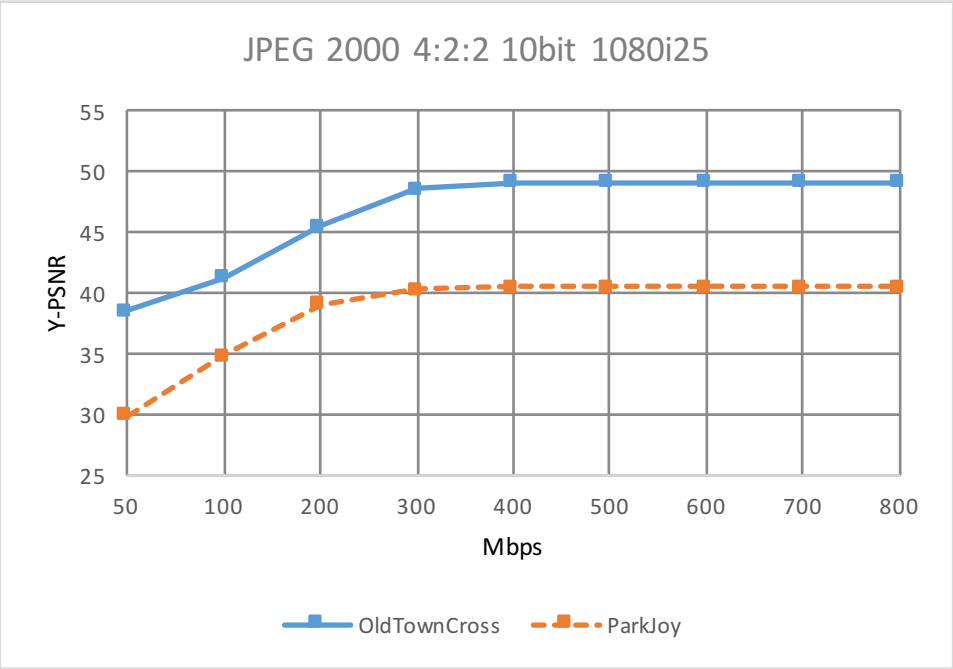
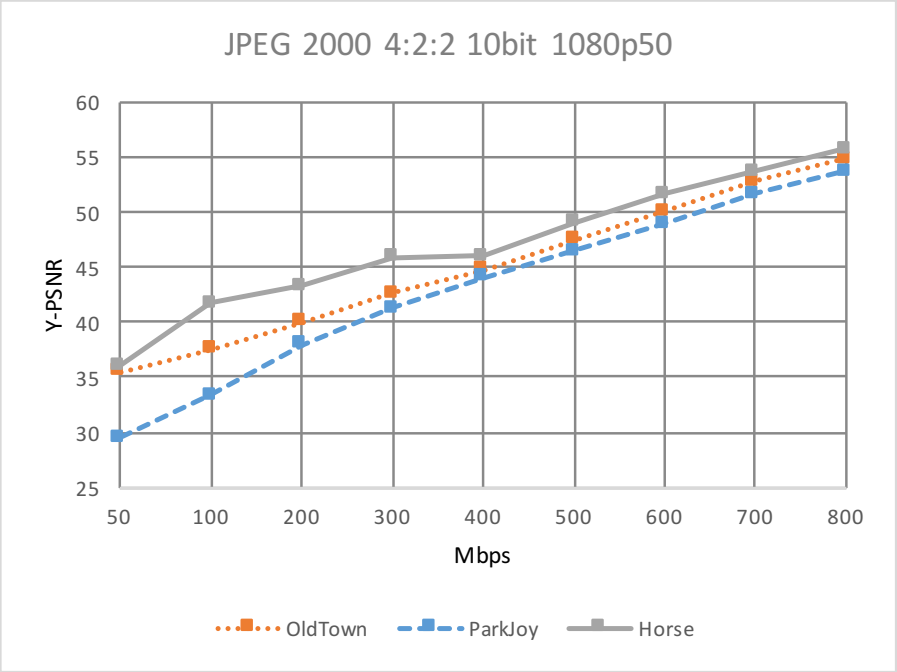
HDTV PSNR results





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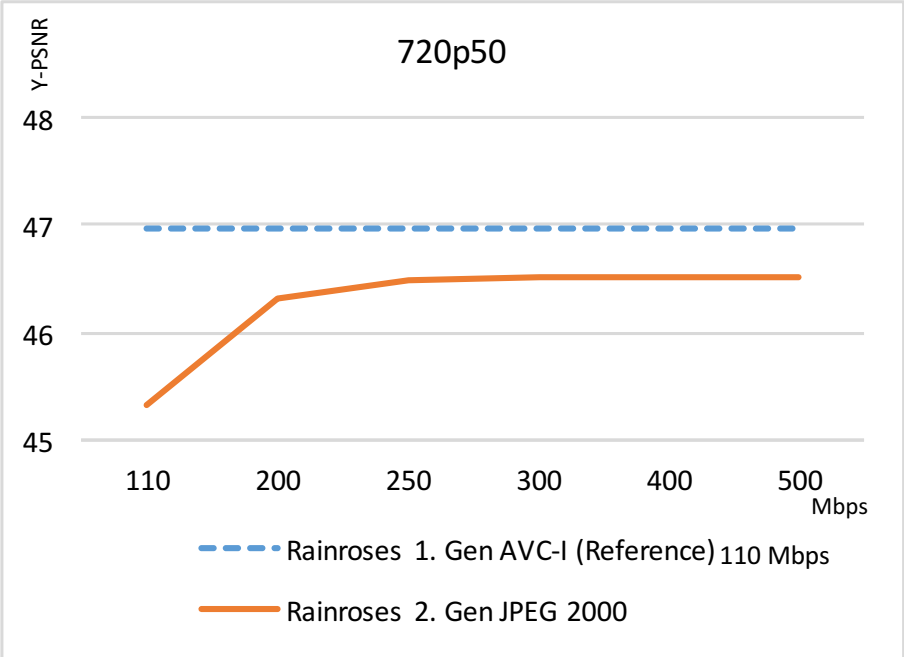
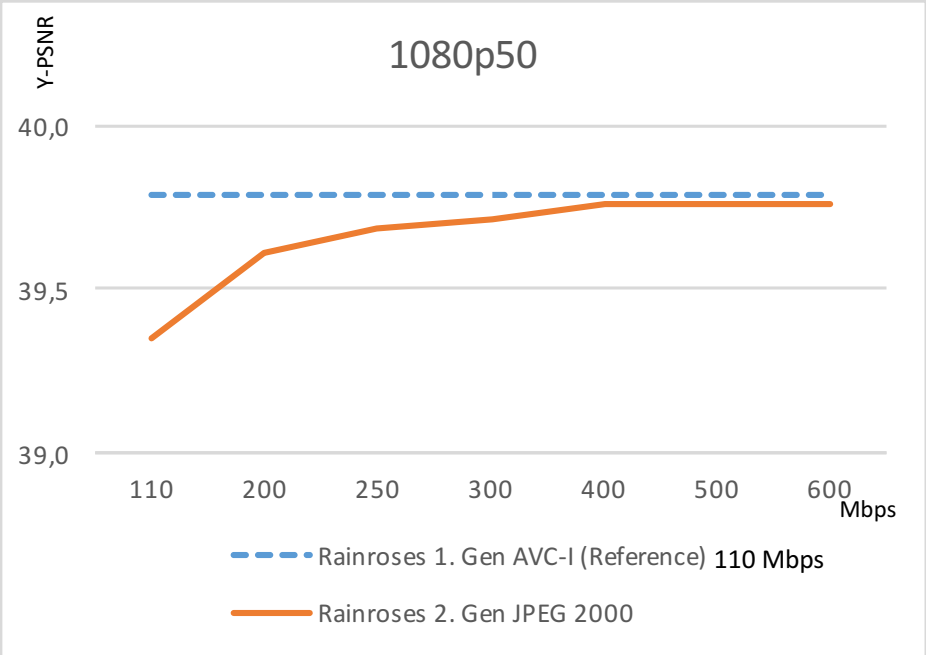
Transcoding AVC Intra into JPEG 2000





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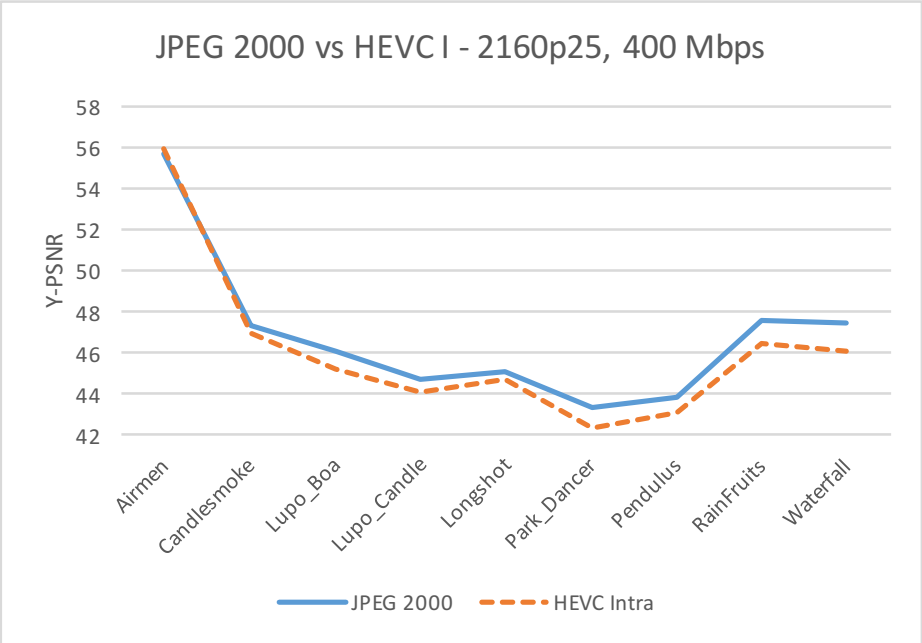
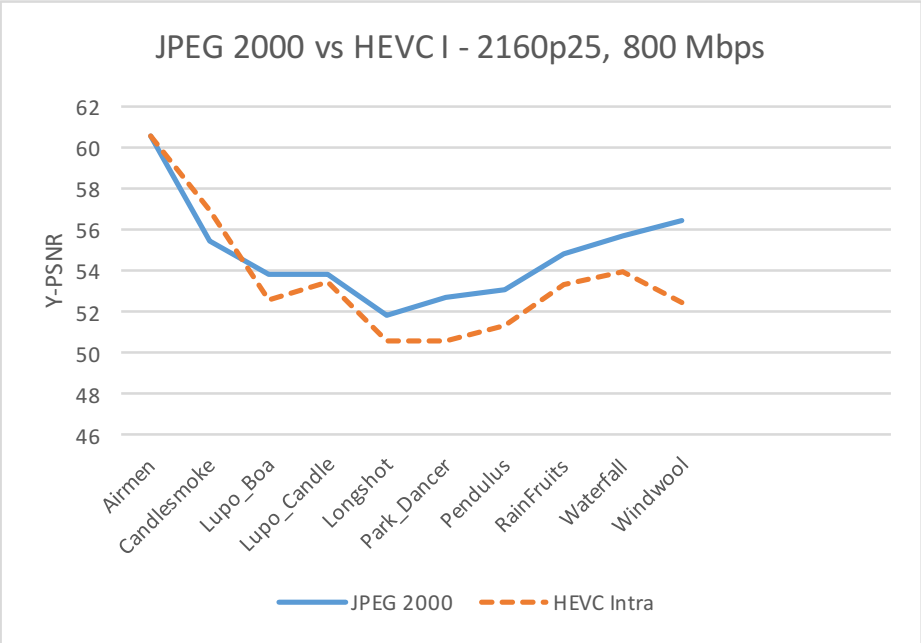
UHDTV PSNR results





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Conclusions

- HDTV (AVC Intra vs. JPEG 2000)
  - 720p/1080i: AVC Intra and JPEG 2000 show similar encoding performance
  - 1080p: Slight advantage towards JPEG 2000 in terms of Y-PSNR values. However, again subjective assessments have not shown a statistically significant advantage of either of the codecs over the other
  - Multiple generations: JPEG 2000 does not degrade from one generation to the next. AVC Intra shows a slight loss of about 1 dB Y-PSNR from generation to generation.
  - Multiple generations with transcoding: Loss of Y-PSNR, bitrate should be increased in order to mitigate the effect

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Conclusions

- UHDTV (HEVCIntra vs. JPEG 2000)
  - HEVC Intra and JPEG 2000 show similar encoding performance
  - For 2160p25, Y-PSNR increases up to 800 Mbps.
  - For 2160p50, Y-PSNR increases up to 1600 Mbps

- Overall:
  - Current IMF toolset (App #2 / #2E) appears to provide adequate profiles for the use cases under study.
  - No bit rate savings or quality gain to be expected when using AVC I or HEVC I.

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