

EBU TECHNICAL



HDTV

**State of the art & perspectives for
European public broadcasters**

-
- HDTV technology strategies
 - Options for production, distribution and CE
 - Standardisation work
 - Future aspects



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HDTV

Technology strategies

EBU HDTV strategy

- Assumption: HDTV's selling argument is quality
 - Emphasis on quality in all EBU activities

- Short term goal
 - Ensure a future-proof, economic, interoperable, IT based, mainstream HDTV production platform

- Longer term goals
 - Investigate next generation HDTV formats for high-end applications
 - Drive towards a fully progressive, multi-delivery platform for PSBs



EBU work

- Project Groups
 - Members & Non-Members
 - Focus on key topics
 - Typically results are Recommendations

- Dissemination
 - Publications
 - Workshops / Seminars

- Sharing experiences
 - Site-visits



Example publications

- 2002 I 034 The 'potential impact' of FPDs
- 2003 I 035 More FPD impact
- 2004 I 039 Maximising SDTV quality
- 2004 R 112 720p/50 emission, 1080p/50 option
- 2004 Tech 3298 HDTV Route-map
- 2004 Tech 3299 HDTV image formats
- 2005 R 115 1080 production equipment
- 2005 Tech 3307 Service requirements for receivers
- 2005 Tech 3308 Broadband TV



Compression formats

- 2006 Tech 3311 Multichannel audio in DVB
- 2006 Tech 3312 DTT HDTV in Europe
- 2006 BPN 070 Programme making costs
- 2006 Tech 3315 Archive transfer
- 2007 Tech 3321 Consumer Flat Panel Displays
- 2007 Tech 3324 Multi-channel audio codecs
- 2007 BPN 076-079 Studio Compression formats tests



Measurements

- 2008 BPN 085-087 Distribution encoder tests
- 2008 Tech 3320 “New Grade-1”
- 2008 R 124 Compression algorithm & bitrate
- 2008 R 095 Safe areas
- 2008 Tech 3325 Studio monitors measurements
- 2008 Tech 3325s Test patterns

+ test material library



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European Public Service Broadcasters



European public broadcasters

- Almost all plan to migrate to HDTV
- Timescales differ
- Typically coupled to big events (2010, 2012)

- Early costs increase indication:
 - 20% for mainstream productions
 - Public broadcasters will not earn more money because of HDTV (different with colour TV introduction)
 - This requires careful investment strategies



Critical questions

- At what market penetration of FPDs should I start HDTV?
- Simulcast or dedicated HD channels?
- How much upconversion?
- How do I manage the transition schedule and costs?
- DVB-S(2) / DVB-C / DVB-T(2) / IPTV / Open Internet?
- Which public event to use for the launch?



Technology issues

1. Interoperability in production

- Compression formats
- Storage media

too many, too vendor specific
not interoperable, closed (servers)

2. Equipment issues

- Cameras
- Lenses

sensitivity, not all formats supported
quality, dependent on iris value

3. Infrastructure

Unsure about future-proof choice



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Options for production, distribution and CE

Technology options



Capture

Cameras (3G?)

Infrastructure

HD-SDI (1.5 Gb/s)

HD-SDI (3 Gb/s)

Dual-link HD-SDI?

DiracPro

1G Ethernet

10G Ethernet

Files & protocols

AAF

MXF

FTP

Streaming

Storage

Processing

Progressive / interlaced

1080p/24 / 1080p/25

1080i/25 / 720p/50

1080p/50

(60 Hz exchange)

Compression format

Contribution

MPEG-2 422P@HL

Encoder

Distribution

Platform

DVB-T(2)

DVB-C

DVB-S(2)

IPTV

Open Internet

Emission

H.264/AVC

SVC

720p/50

1080i/25

1080p/50?

Set-top boxes

HDTV (720p/1080i)

H.264/AVC

SVC?

No standard for IPTV?

Game machines

E.g. 1080p/60 PS3 !

Displays

HD Ready (720p/1080i)

HD Ready 1080p



Quality impact



- Film transfer age, grain, ...
 - SD upconversion SD quality, compression, 4:3?
 - HD contribution bit-rate, compression, format, cascading
 - Cameras lens, sensor, signal processing
 - Creative staff HD experience, training
- Strict quality assurance checks needed
 - Especially for externally created content

Design decisions



- **Bit-rate**
 - High-end: 200 – 440 Mbit/s
 - Mainstream: 50 Mbit/s Long-GOP, 100 Mbit/s I-frame only
- **Studio infrastructures**
 - 1.5 / 3 Gbps HD-SDI based or Ethernet (compressed + research)
 - Optical not there yet (vendors adoption not yet clear – costs)
 - DiracPro?
- **Interoperability**
 - File formats MXF (but also Quicktime, MPEG4 container ...)

Compression



- AVC-I, DNxHD, J2K, XDCAM HD422
 - EBU / IRT / RAI tested these last year – 7 generations with shifts
- Overall conclusions
 - Intra-coding relies on bit-rate, whatever technology
 - Intra-coding provides easier manipulation (jog-shuttle, latency, ...)
 - Inter-coding provides better visual quality at lower bitrates
 - Inter-coding is prone to GOP-related effects and maybe post issues
- Next: ProRes 422 and chains of concatenated systems



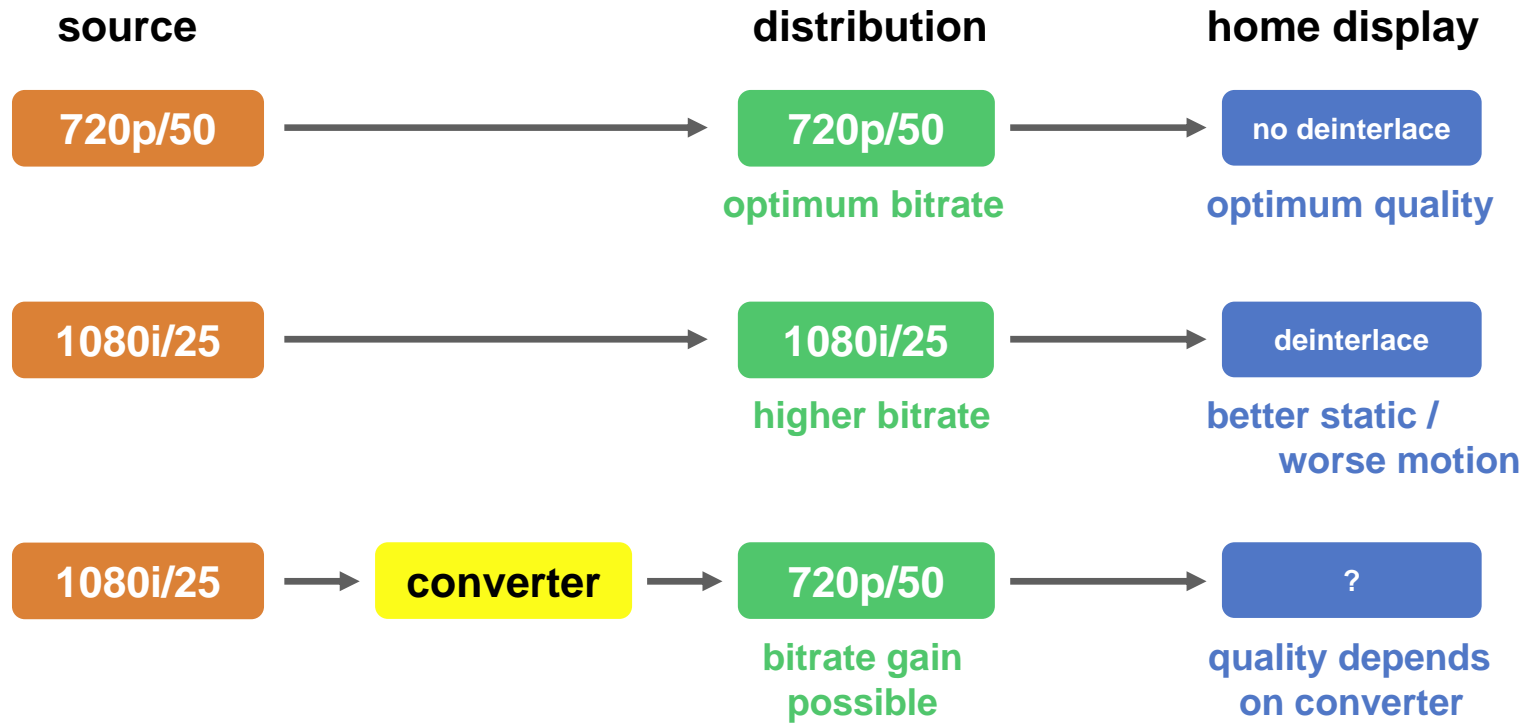
Distribution encoder



- H264/AVC
 - EBU / IRT / NRK / RAI tested 4 this year
- Overall conclusions
 - Clear quality differences between the encoders
 - Headroom negligence in production will be visible in the home!
 - Recommended minimum bitrates:

720p/50	10 Mbit/s
1080i/25 (subs 1440)	12 Mbit/s
1080i/25	12-14 Mbit/s

Standards converter impact



Distribution platforms



- DVB-C & DVB-S2
 - Ok, well tested, enough space available
- DVB-T2
 - Main DVB spec approved, first receivers expected next year
 - High expectations: OFCOM UK thinks about 30 channels (in 2017)
- IPTV
 - Limited capacity, standardisation
- Open Internet
 - Don't ignore HD downloads (NRK)
 - Definition of "HD quality", rights



Decoders



▪ Set-top boxes

- Available from many vendors, with HDTV logo
- All support 1080i/25 and 720p/50
- Image quality, zapping times, etc. differ
- Home user has more complaints
 - Analogue output switched off
 - No VPS recording
 - No Teletext
 - Lip-sync errors



- Note: HDTV 1080p receivers do NOT receive 1080p/50



Set-top box spec

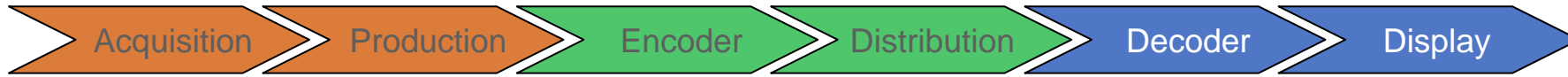


■ EBU HDRec Group

- Priority is DVB delivery, but IPTV is included
- Aspect ratio conversions, subtitling
- Data services (Teletext!), interactivity
- Multi-channel audio, including levels
- 90% ready, but home content management is tricky (DRM)
- Dialogue with the industry (e.g. EICTA)
- Equipment tests
- European receiver spec due by end 2008



Home displays



- Popular labels



- at least 720 lines
- can do HDCP via HDMI/DVI

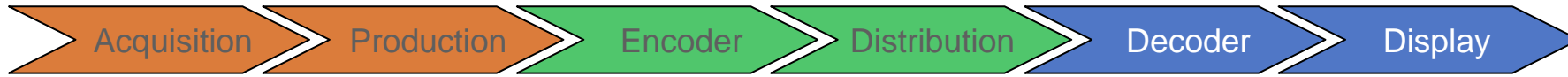


- at least 1080 lines
- can do 24p, 50p, 60p via HDMI/DVI

- Probably even more popular: “Full HD”
 - E.g. in cameras and displays
 - Meaningless if not clear what framerates are supported...
- Most popular: overselling sales people
 - User at home disappointed with the SD images on his HDTV



Display quality



- Display quality varies widely (but so do their prices!)
- Measuring is essential for professional use

- EBU Tech 3320 Professional displays reqs
- EBU Tech 3321 Consumer displays reqs
- EBU Tech 3325 How to measure

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Standardisation work



HDTV baseband standards

- EBU Tech 3299 defines the 4 currently relevant:
 1. 1280 x 720p/50 SMPTE 296M / ITU-R BT.xxx
 2. 1920 x 1080p/25 SMPTE 274M / ITU-R BT.709
 3. 1920 x 1080i/25 SMPTE 274M / ITU-R BT.709
 4. 1920 x 1080p/50 SMPTE 274M / ITU-R BT.709



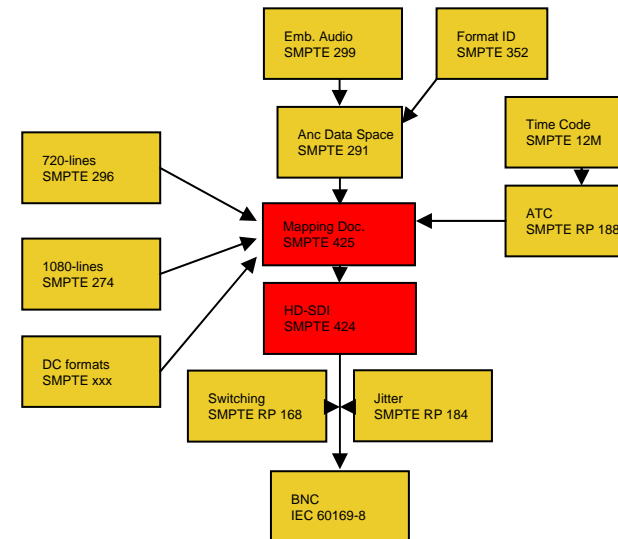
Compression formats

- Work in progress
 - HDCAM SR currently a closed format
 - ProRes422 not an open standard, not even open source
 - DNxHD for 1080p/50-60 soon under investigation
- EBU priorities
 - Interoperability in mainstream HDTV production
 - Approach on how to use HD in archives



HD-SDI standard

- Easy realtime HD interconnect @ 1.5 Gbit/s
- For 1080p/50 you need almost 3 Gbit/s
- Options:
 - Dual-link HD-SDI (unpractical, expensive, heavy!)
 - 3G HD-SDI (single vendor, 70-100 m)
 - DiracPro (almost lossless, promising)
 - 10G Ethernet (unclear acceptance)
- General question:
 - How much SDI needed with IT-based?



Time & Sync

- EBU & SMPTE Joint Task Force
- To make a new timeref for production
- To 'replace' S12M + Blackburst
- IT Network oriented
- Evaluating proposals
- Tests foreseen

- Rest is secret
- Join the Group!



Distribution

- DVB
 - DVB AVC has standardised the 1080p/50 and /60 formats
 - It also has gratified SVC for use in distribution
 - Useful (but not all needed) prerequisites for 1080p/50



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Future aspects

Main directions

1. More colours

- In production & distribution
- CE equipment can do more than broadcasters

2. More pixels

- 1080p/50 in production
 - More future proof, more headroom, more costs -> high-end production
- 1080p/50 in distribution
 - If competition starts?
- UHD TV
 - 10 – 15 years from now? But important for research direction!



Main directions

3. More frames

- BBC demo at EBU Village this year
 - 300 to get rid of 50-60 Hz?
 - Can it be sold?
-
- Other
 - Smell?
 - Touch?



3DTV

- More attractive for Hollywood than for broadcasters
- No clear winning home technology yet?
- Business model?

- Not an EBU priority
- Tracking the situation



Track the EBU articles, recs, groups, webinars, ...

The screenshot shows the EBU TECHNICAL website interface. At the top left is the EBU-UER logo and the text "EBU TECHNICAL MEDIA TECHNOLOGY & INNOVATION". On the top right, it says "Welcome Frans De Jong" and "my ebu | log out". Below this is a navigation menu with tabs for HOME, NEWS, EVENTS, PUBLICATIONS, GROUPS, EBU NETWORK, and MY EBU. A search bar is located to the right of the menu. The main content area is divided into several sections: "WHAT'S NEW?" featuring three articles with icons and brief descriptions; "UPCOMING EVENTS" listing "Wireless Broadband workshop", "Forecast 2008", and "Production Technology 2009"; "LATEST PUBLICATIONS" displaying five document covers with titles like "Tech Review 2008 i SVC scalable AVC"; "WORKSPACE" with icons for wikis, EBU Network, and forums; and "MORE ON..." with links for "Spectrum SOA DVB-T2 Metadata HDTV P2P". The footer contains "About us www.ebu.ch" and "© EBU 2008".



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HDTV webinar on 31 Oct @ 14:00 hrs (Berlin time)

