UHDTV Production Standards: SDI vs IP

Hans Hoffmann, EBU Head of Media technology
UHDTV PRODUCTION STANDARDS: SDI VS. IP

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1. Short review on UHDTV parameters
2. Beyond the resolution debate
3. Chicken-and-Egg – Challenge for production
4. Infrastructure debate not only an UHD issue
5. Roadmap of JTNM
6. Summary
Consumers are buying 4K TVs today

From a given size, only 4Ks are on sale.

Some events are being produced in UHDTV e.g. EURO 2016 Semi Finals and Finals 2016

BT Sport, Sky, Netflix, Amazon SwissCom, all have a UHD strategy

Broadcasters just begin.....
• In 2013 the industry realized that a resolution increase only will NOT provide a significant better perceived image quality

• We needed a perceptible quality improvement also at wider viewing distances!
HDR to solve this problem
WHY DO WE NEED DYNAMIC RANGE

- Details in dark or bright not perceptible
- Can even lose important information
- Research has shown that HDR is a significant perceptible parameter for UHD and HDTV
- First standards are defined
  - ITU-BT 2100, SMPTE 2084, ARIB67
  - ATSC and DVB getting there…..

But there are open issues

- IMAGE DEPENDENT DYNAMIC METADATA
- OPERATIONAL IMPACT
- HDR CROSS CONVERSIONS
- SDR-HDR
Higher Frame Rate

- 100 Hz, 120 Hz in the standards
- For fast motion, sport etc.
- Sharpness effect and clearly perceptible for certain genre
- In baseband significant bitrate increase
- In distribution, only 10..20 % increase due to entropy benefits
- DVB Phase 2 will define the standards

Source: BBC
HFR SHUTTER SETTING VISUAL QUALITY ASSESSMENT

• Comparing 60Hz, 120Hz at different shutter settings with a 240Hz 100% shutter content (high anchor/reference).

![Image of graph showing quality scale against different shutter settings.](image-url)
6. Recommended image formats overview

The following table outlines the potential image formats that could be used during the migration from current HDTV formats to a fully specified UHDTV format.

<table>
<thead>
<tr>
<th>Image format</th>
<th>Resolution</th>
<th>Frame Rate (fps)</th>
<th>Higher Dynamic Range</th>
<th>Bit-Depth</th>
<th>Colorimetry</th>
</tr>
</thead>
<tbody>
<tr>
<td>1080p Advanced 1</td>
<td>1920 x 1080</td>
<td>24, 25, 50, 60*</td>
<td>ITU-R BT.[HDR-TV]</td>
<td>10, 12</td>
<td>ITU-R BT.2020</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>(PQ10, HLG10)</td>
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<tr>
<td>UHD-1 Phase 2</td>
<td>3840 x 2160</td>
<td>24, 25, 50, 60*</td>
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</table>

* This includes the fractional frame rate variants.
THE OLD CHICKEN AND EGG PROBLEM ...
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DISPLAYS & DISTRIBUTION

BUSINESS MODEL and CONTENT

PRODUCTION INFRASTRUCTURES

PRODUCTION COSTS
TODAY’S COMPLEX VIDEO & AUDIO INFRASTRUCTURE

From this…
THE IP STUDIO OF THE FUTURE ALLOWS

The future IP studio will allow remote production over fiber networks, reducing facilities and personnel on-site.
### SDI based production Infrastructures
- Point to Point
- Unidirectional
- Easy to use, PnP
- Less flexible to changing workflows
- 3G, 12G is state of the art (4k, 60p, 10 bit)
- Multi-links (multi 12Gs etc)
- Uncompressed (usually)
- SMPTE Standards suite

### IP based production Infrastructures
- Bi-directional
- Scalable (10G, 25G, 40G, etc)
- Based on ICT industry
- Real Time Live PTP (SMPTE 2059)
- Multiformat
- Flexible to agile workflows
- Complex
- Compressed and Uncompressed
- The way into the cloud
- The way into virtualization
The debate is actually not a debate

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Decision point is based on the application
• Cost pressure and efficiency
• Distributed production
• More programmes, agile, faster and for cross-media
• More software less specific hardware
• Everything more and everything faster
SDI = SERIAL BITSTREAM OF THE RASTER – SMPTE 2022 SERIES
Current industry status is to replace SDI with tunneling over IP.

- SMPTE 2022 Series of standards
- Industry commitments and implementation
- First advancements in workflows
- Remote production also in UHDTV
- Learn to handle timing and sync via IP
COMPLEX INTERNATIONAL CONTEXT

JOINT TASK FORCE NETWORKED MEDIA

- NMOS Project
- Plug Fests
- Several Working groups e.g. SMPTE 2110 or PTP Time and Sync
- SP-FNS AND TECHNICAL COMMITTEE
- TR03..04

Vatican City – October 7, 2016
### BEYOND TUNNELLING SDI: THE NETWORKED MEDIA REFERENCE ARCHITECTURE (JT-NM)

#### Workflows

<table>
<thead>
<tr>
<th>Live</th>
<th>Non-Live</th>
<th>Near-Live</th>
<th>Remote / Distributed</th>
<th>Object-Based</th>
<th>User Generated Content</th>
</tr>
</thead>
</table>

#### Applications

- Apps, UI & Control Surfaces
- Monitors & Multiviewers
- Management Dashboards

#### Platforms

<table>
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<th>Media Transport</th>
<th>Resources Management</th>
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<tr>
<td>Time &amp; Sync</td>
<td>Discovery &amp; Registration</td>
</tr>
</tbody>
</table>

#### Infrastructure

- Common IT HW
- Speciality HW & Gateways
- COTS Switches (LAN)
- Inter Networks (WAN)
- Best Effort Networks (Internet)
WHAT WE LEARNED?
(FROM FIRST “SDI OVER IP” POCs)

- **Confidence** that IP can work
- **Current workflows:** transparent for the **users**
- **Remote** production easier
- Cabling **simpler** but Configuration more **complex**
- “**Clean enough**” switching is accepted for most operations
- Need **hybrid broadcast/network teams** (for system design and tech. support)
- **Training** and re-training!
- Lack of proper monitoring **tools** for quick **troubleshooting**
- **PTP** still have **implementation** and **practical** issues
- **FEC** apparently **not needed** on managed (e.g., SDN) networks
WHAT WE DON’T KNOW YET

• What is the new **cost model** and how to generate savings and efficiencies?
• What is missing for **interoperable cloud-based** production and first experiences?
• What **new workflows** and new types of **content** will be enabled?
• **Security**: what are the best practices adapted to media orgs
• How does it **scale up** to large systems and facilities?
• What will be the common **network orchestration**, SDN or COTS?
• What will be the impact on **power consumption**?
• What is the new “**good enough**” performance and quality?
• How much **redundancy** do we need to get desired reliability?
• More long-haul **distributed** production experiences
• How to **update** systems in operations
• How can we better **organize** the work?, etc.
UHD and IP – there is no escape

– Just a question of time...
– Standards safeguard investments

Impact:
Editorial-Technical-Organizational Changes, Skills-Level of complexity, Retraining

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Thank You

OUR WORKING GROUPS

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