CAN UHD OTT BE COMPLEMENTARY TO TERRESTRIAL UHD BROADCAST?

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AGENDA

Scope

Hybrid UHD/OTT

Delivery architectures

Test case France UHD 2024

Cost comparison

mABR option

Conclusion
SCOPE

- Not all channels available in UHD during simulcast
- Investigate a full UHD OTT scenario
- Test case France UHD 2024
- Focus on Delivery technology capability
- Info based on real market data
## UHD Definition

<table>
<thead>
<tr>
<th>FORMAT</th>
<th>RESOLUTION</th>
<th>FRAME RATE</th>
<th>COLOR SPACE</th>
<th>HDR</th>
</tr>
</thead>
<tbody>
<tr>
<td>4K SDR</td>
<td>2160p</td>
<td>P50/60</td>
<td>BT.709</td>
<td>No</td>
</tr>
<tr>
<td>1080p HDR</td>
<td>1080p</td>
<td>P50/60/120</td>
<td>BT.2100</td>
<td>Yes</td>
</tr>
<tr>
<td>4K HDR</td>
<td>2160p</td>
<td>P50/60</td>
<td>BT.2100</td>
<td>Yes</td>
</tr>
<tr>
<td>1080i SDR</td>
<td>1080i</td>
<td>P50/60</td>
<td>BT.709</td>
<td>No</td>
</tr>
</tbody>
</table>
ARCHITECTURE HYBRID SYSTEM (DVB)

UHD → Playout → Compression (HEVC, TS) → Mux (SI, ENC) → Modulation (TX) → OTA NW → DVB-I Hybrid Receiver

Origin (DASH) → CDN → OTT NW → UHD
RECENT BREAKTHROUGHS

Hybrid Service in OTA: ATSC 3.0 native IP

DVB-I Specification (OTT bolt on)

Low Latency for Hybrid

HEVC codec efficiency

CDN as a Service

mABR option
OTT DISTRIBUTION: PUBLIC CDN ARCHITECTURE

Standard Broadcast Delivery
OTT DISTRIBUTION: PRIVATE CENTRALIZED CDN ARCHITECTURE

Deployed at some broadcasters for VOD & Live
OTT DISTRIBUTION: PRIVATE DECENTRALIZED CDN ARCHITECTURE

Deployed by Netflix (VOD)
<table>
<thead>
<tr>
<th>SPECIFICATION</th>
<th>VALUE</th>
<th>NOTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Users</td>
<td>15 million</td>
<td>OTA households</td>
</tr>
<tr>
<td>Concurrency peak</td>
<td>5.7 million</td>
<td>OTA households watching TV</td>
</tr>
<tr>
<td>Formats</td>
<td>CMAF</td>
<td>CENC</td>
</tr>
<tr>
<td>Resolution</td>
<td>2160p</td>
<td></td>
</tr>
<tr>
<td>Codec</td>
<td>HEVC</td>
<td></td>
</tr>
<tr>
<td>UHD average VBR bitrate</td>
<td>8.5 Mbps</td>
<td>(1)</td>
</tr>
<tr>
<td>ABR aggregated bitrate</td>
<td>25.5 Mbps</td>
<td></td>
</tr>
<tr>
<td># of channels</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td># of PoPs</td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>

(1) : Bitrates derived from French CSA, 11M/s UHD in 2019
STREAMING COSTS COMPARISON

Cost/year (MUSD)

- Public CDN
- Private centralised CDN
- Private decentralised CDN

Private decentralized solution best solution

National DTT carriage cost
ALTERATIVE SCENARIO: MULTICAST ABR

Complex and unproven
CONCLUSIONS

Full UHD OTT delivery possible

CDN more expensive than DTT

Private centralized CDN lower marginal cost

Private decentralized CDN lower and attractive cost

UHD OTT feasible and economical in 2024
THANK YOU