Codecs, standards and UHD formats – where is the industry headed?
The video technology ecosystem and the HEVC lifecycle

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Outline

- UHD - Technology Perspective for Video
  - HEVC timeline and market
  - UHD application standards
    - DVB UHD TS 101 154
    - Country specific complementary specifications
  - Ultra HD Forum Guidelines
- UHD – what do we need to reach the next level ?
  - Better video compression – rationale, use cases & requirements for VVC
  - Handling of non-technical aspects for VVC by MC-IF
- Beyond UHD

HEVC Timeline

- 12/2004: VCEG key technical areas studies started, including software codebase
- 2009: MPEG and VCEG Call for Evidence (CfE)
- 01/2010: creation of JCT-VC, issue of joint CfP
- 01/2013: V1 of HEVC completed
  - 06/2013: Publication in ITU-T
  - 11/2013: Publication in ISO/IEC
- 2014-2016: Extensions, more profiles, tiers and levels

JCT-VC Project & Process

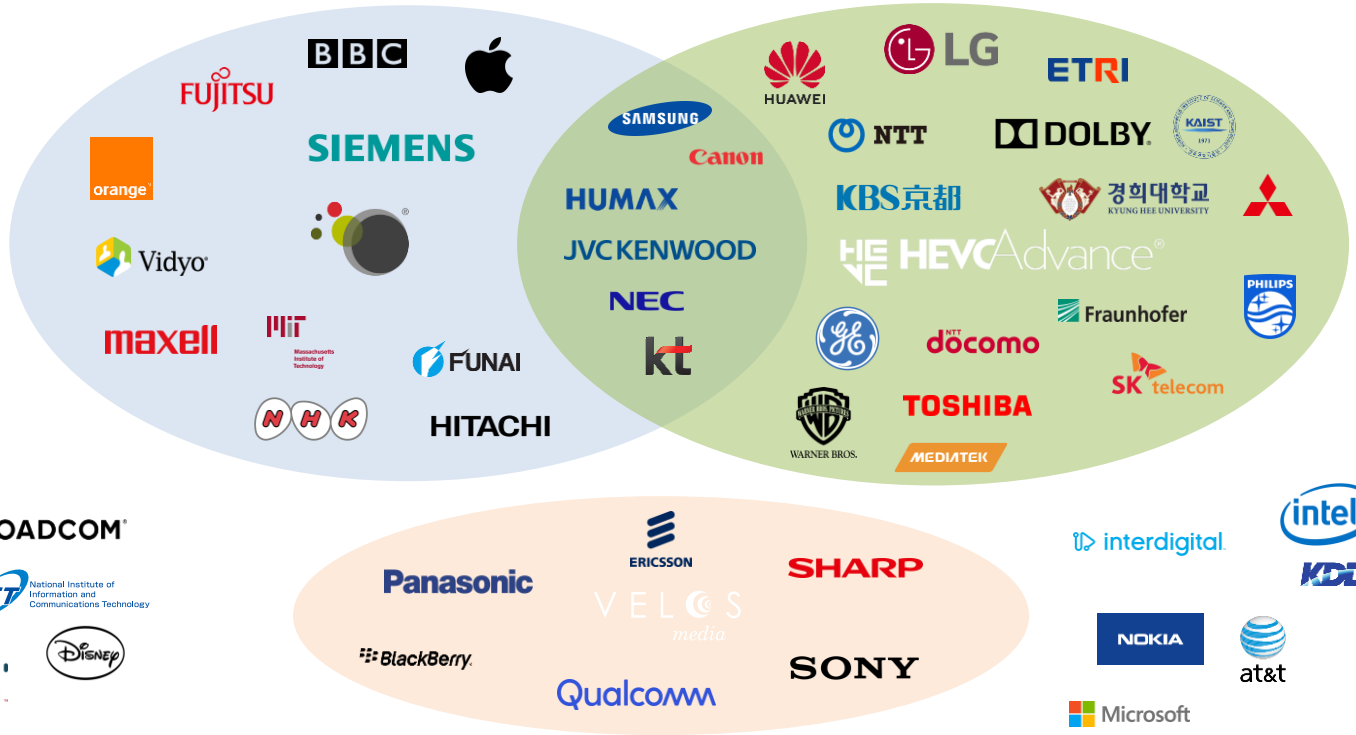
Performance

Elements of the Standard

Profiles, Tiers, Levels

Extensions

HEVC Licensing*



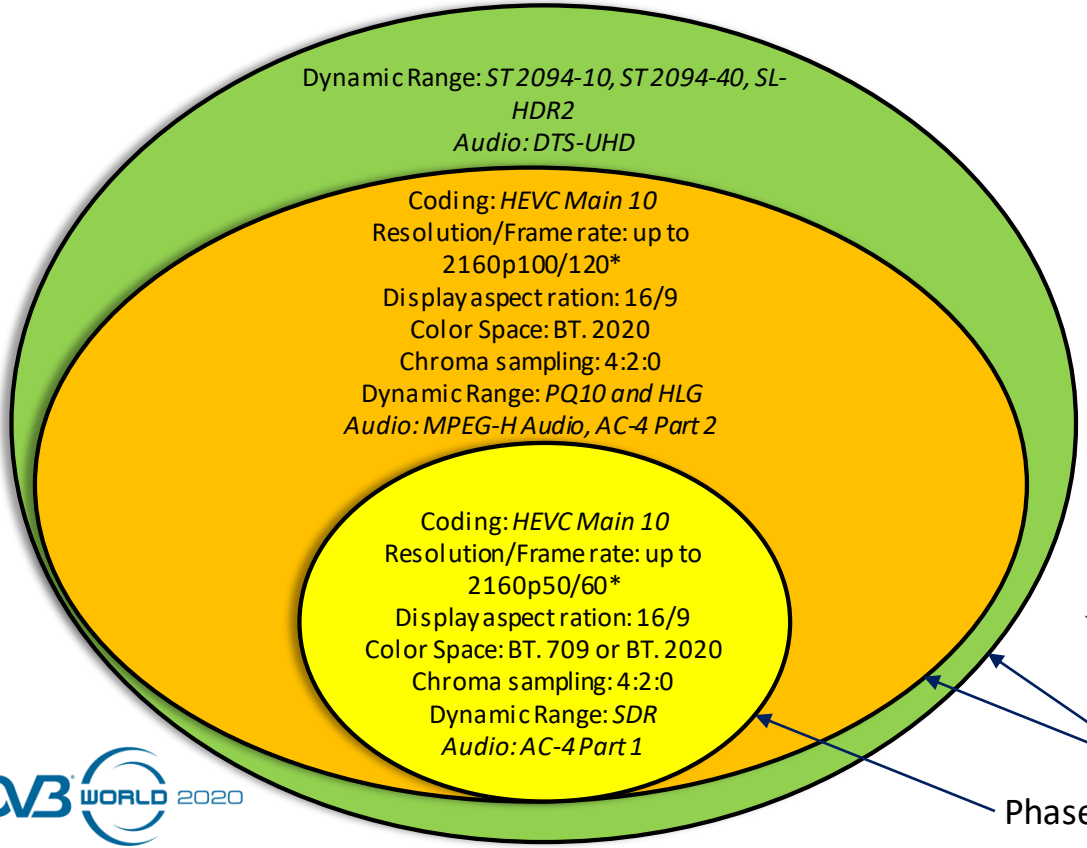
* List not fully complete, source is website from licensing pool administrators

HEVC in the market

- HEVC is basically in all latest generation TV sets in Europe
- HEVC plays in about 17% of all web browsers
- HW accelerated HEVC is on >78% iOS devices and in >57% Android devices

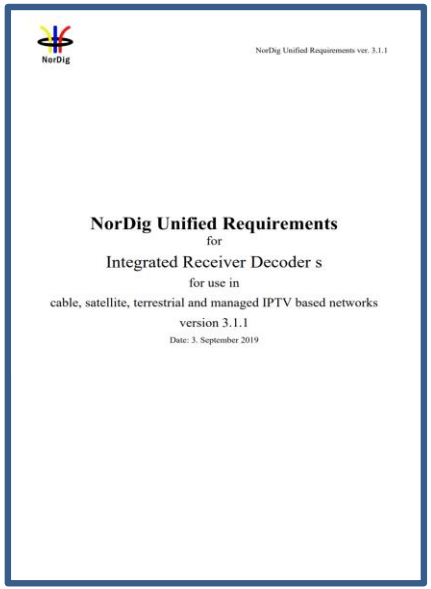
Source: Streaming Media

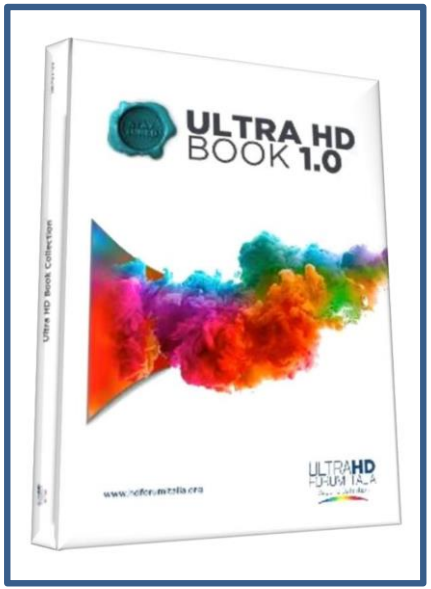
UHD application standards
TS 101 154

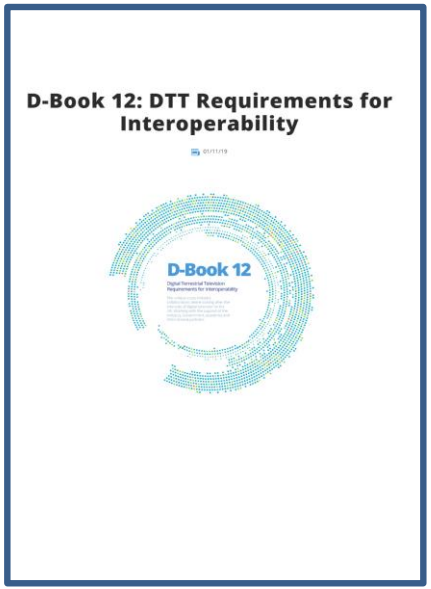


- 09/12: Start of UHD in DVB
- 05/13: Fact finding workshop
- 11/13: CR for Phase-1
- 06/15: TS 101 154 v2.2.1 (Phase-1)
- 11/15: CR for Phase-2
- 02/17: TS 101 154 v2.3.1 (Phase-2)
- 10/17: Report on HDR Dynamic Mapping (DM)
- 02/18: TS 101 154 v2.4.1 (DASH)
- 01/19: TS 101 154 v2.5.1 (DTS-UHD)
- 01/19: CR for HDR-DM
- 09/19: TS 101 154 v2.6.1 (HDR-DM)

Country specific UHD specifications





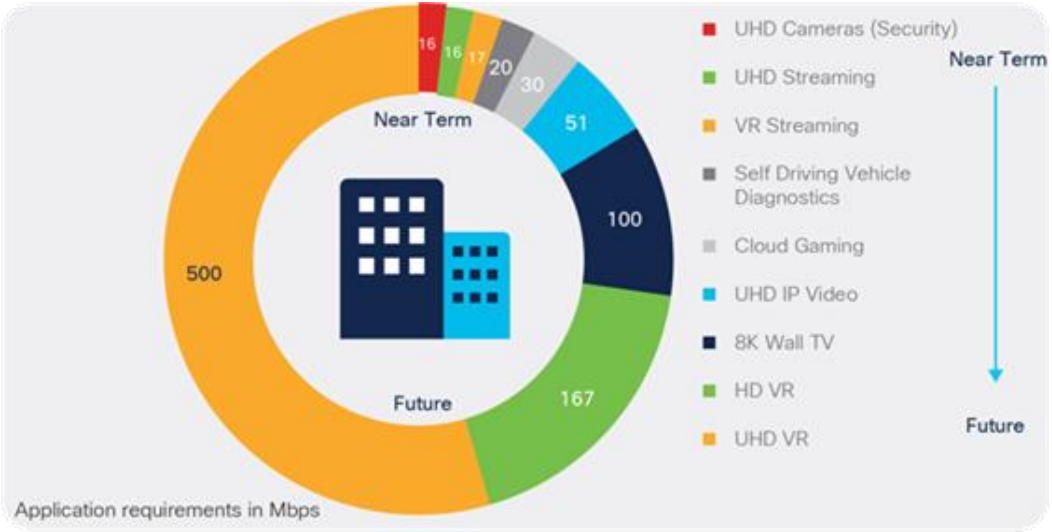


Ultra HD Forum Guidelines

- Develop and publish Guidelines to document best practices for end-to-end systems
  - Production, distribution and rendering
  - Ultra HD, HDR, WCG, HFR and Immersive Audio
- Conduct interoperability tests and plugfests
- Inform industry at major industry events (IBC, NAB, …)
- Informational Master Classes
- Demonstrations of end-to-end solutions and proof-of-concept systems

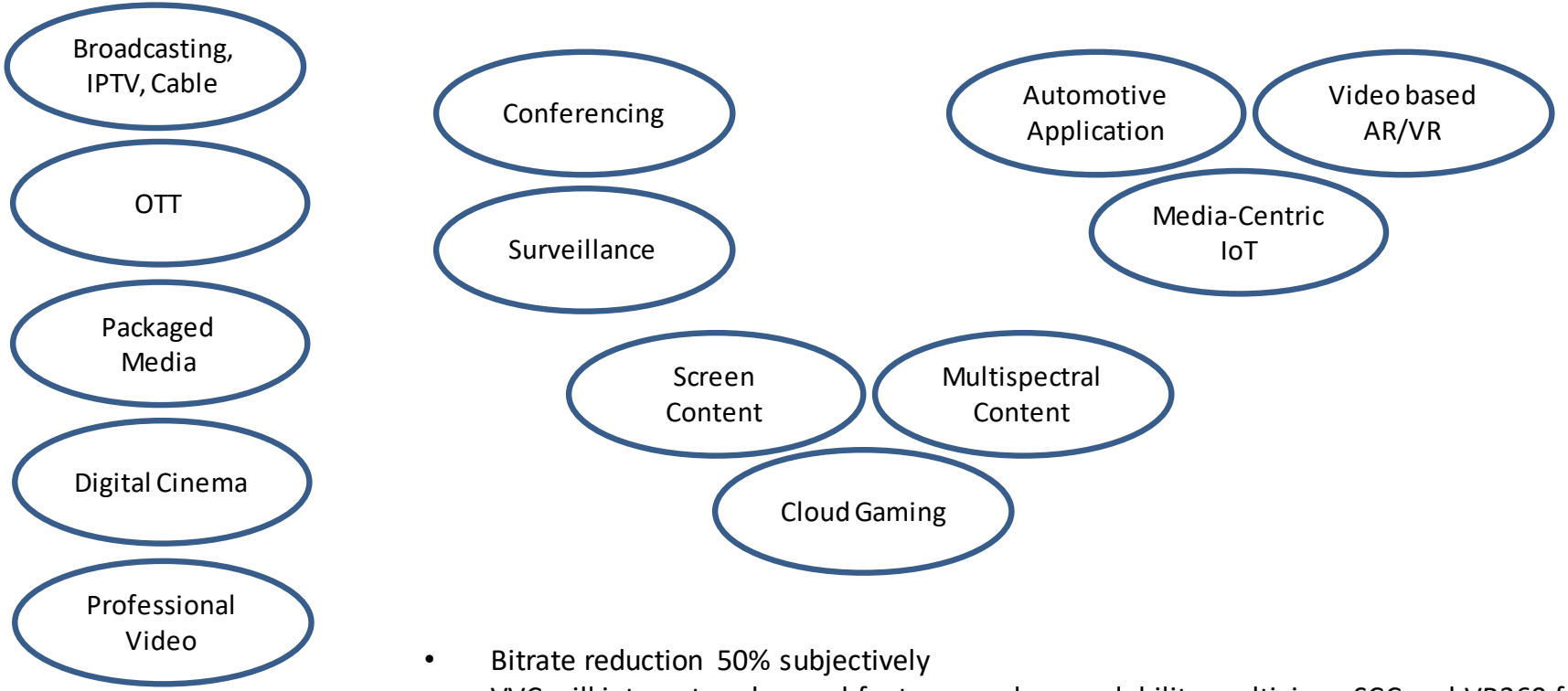
Better video compression

- In 2023 there are 5.3 billion internet users – up from 3.0 in 2018
- In 2023 there are around 900 million 4K TVs – up from around 300 million in 2018



Source: Cisco Annual Internet Report, 2018-2023

VVC Use Cases & Requirements



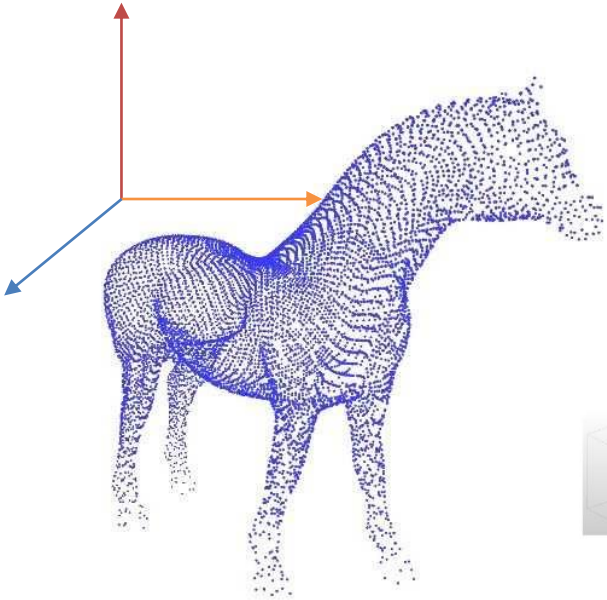
- Bitrate reduction 50% subjectively
- VVC will integrate advanced features such as scalability, multiview, SCC and VR360 from the beginning

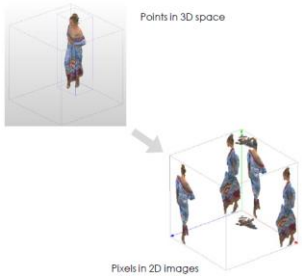
Non-technical aspects of VVC - MC-IF

- MC-IF was formed in September 2018
- Goals and Objectives
  - Promotion of standards covered by MC-IF
  - Provide a forum and encourage the discussion of issues related to lawful aspects of licensing of intellectual property rights
  - Contribute the results to MPEG, ITU-T and other applicable standards bodies
- MC-IF held a number of events, latest beginning March 2020 in Culver City
- Forum consists of four work groups that regularly organize online and face-to-face meetings:
  - IP Ecosystem WG
  - Interoperability WG
  - Profiling WG
  - Marketing and Outreach WG

Beyond UHD – Volumetric Video

Point Cloud is one of the volumetric video formats





800000 points per point cloud frame
1500 Mbit/s uncompressed

MPEG V-PCC leverages existing video codec for coding Point Clouds

http://www.mpeg-pcc.org/

Thanks for your attention