数字音视频编解码技术标准工作组
Audio Video coding Standard Workgroup of China

AITISA 新一代人工智能产业技术创新战略联盟
AVS 音视频产业联盟 AVS INDUSTRY ALLIANCE

AVS3
enabling the efficient video delivery for UHD broadcasting and streaming

Jianhua Zheng

Email: jhzheng@avs.org.cn
zheng_jianhua@126.com

Nov 17th, 2023

Presenter

Dr. Jianhua Zheng

Email:
jhzheng@avs.org.cn
zheng_jianhua@126.com

Dr. Jianhua Zheng has been involved in video coding standardization work for 18 years. He served as the co-chair of AVS video group to lead the development of AVS2/AVS3 video coding standards. He is currently a distinguished researcher in Peking University, serves as the chair of AVS international communication and promotion group.

Outline

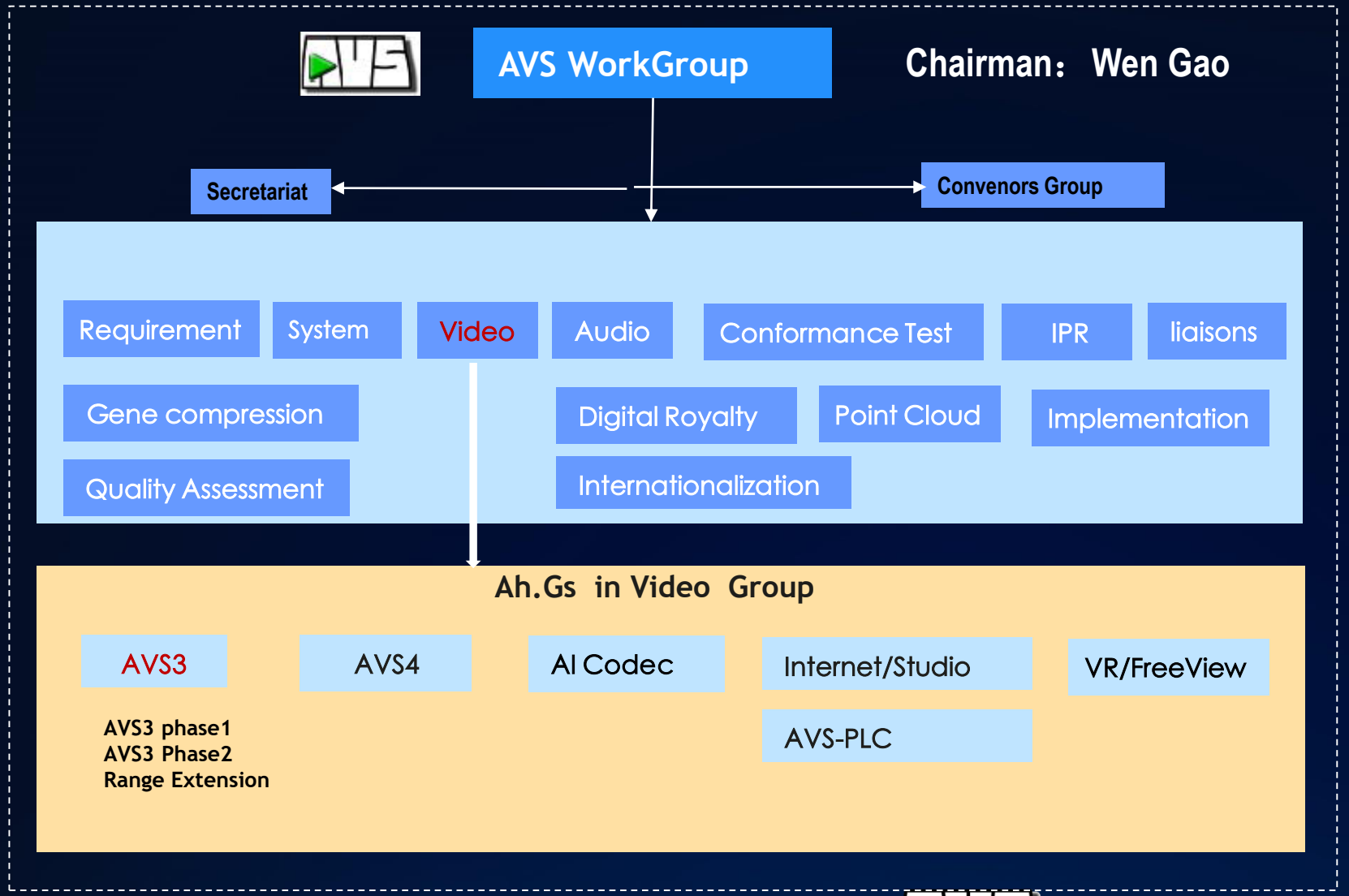
- Background
- Overview of AVS Standards
- Key Features
- Test results
- Deployment
- Licensing
- International Cooperation

Background

What is AVS?

- AVS is a family of video coding standards developed by Audio and Video Coding Standard Workgroup of China.
- AVS has developed three generation video coding standards, AVS1.0/AVS2.0/AVS3.0
- AVS is strongly supported by over 100 members, including manufactures, SoC vendors, operators, etc.
- AVS video coding standards have been widely used in China, AVS+ SDTV/HDTV have covered all China via satellite, cable and terrestrial broadcasting, and AVS2 UHDTV have covered all China via satellite, cable
- Internationally, AVS has expanded outside of China to countries such including Laos, Thailand, Cuba, Kyrgyzstan etc.
- AVS3 will be a key enabler of 8K and OTT in China, with broadcast services of the Beijing Winter Olympics and Kartar World Cup.

AVS WorkGroup



AVS Industry Alliance

音视频产业联盟 AVS INDUSTRY ALLIANCE

Conformance
Deployment
Certification

Alliance standard

Broadcast Industry Standard

National Standard

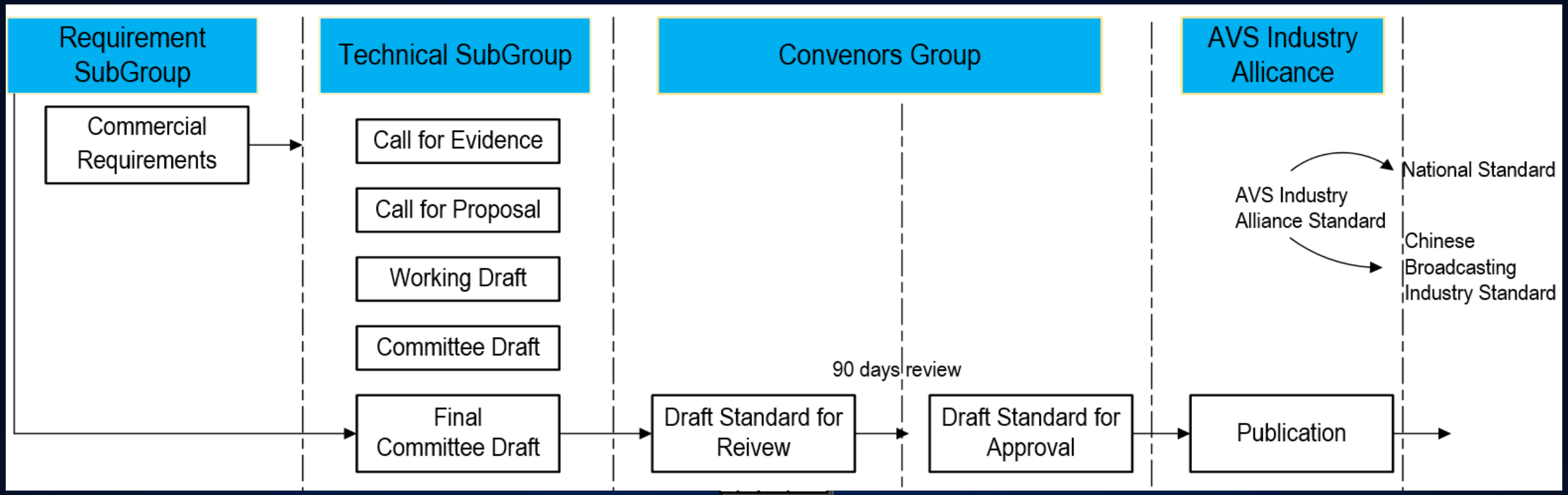
- www.avs.org.cn/en/

AVS Members from Worldwide Industry (100+ members)

http://www.avs.org.cn/en/index/list?catid=16

How AVS Make Specifications

1. Four regular formal meetings per year, usually in Mar/Jun/Aug/Dec
2. Meeting Notice announcement before AVS meeting, e.g. AVS 86th
   Meeting Notice: http://meeting.avswg.org.cn/meeting_notice/86/en/
   Proposal registration: http://meeting.avswg.org.cn/meeting_notice/86/en/ProposalReg.asp
   Meeting Registration http://meeting.avswg.org.cn/meeting_notice/86/en/Register.asp
3. Proposal submitted using Chinese or English
4. AVS3 specifications publication including both Chinese version and English version.



Overview of AVS3 Standards

AVS Standards

AVS standards are designed to use the technologies from AVS members only, or royalty free technologies.

AVS1 (AVS+)

- Broadcast TV
- Standard Definition
- High Definition
- Internet Streaming

AVS2

- Broadcast TV
- High definition
- Ultra high definition – 4K
- Internet Streaming

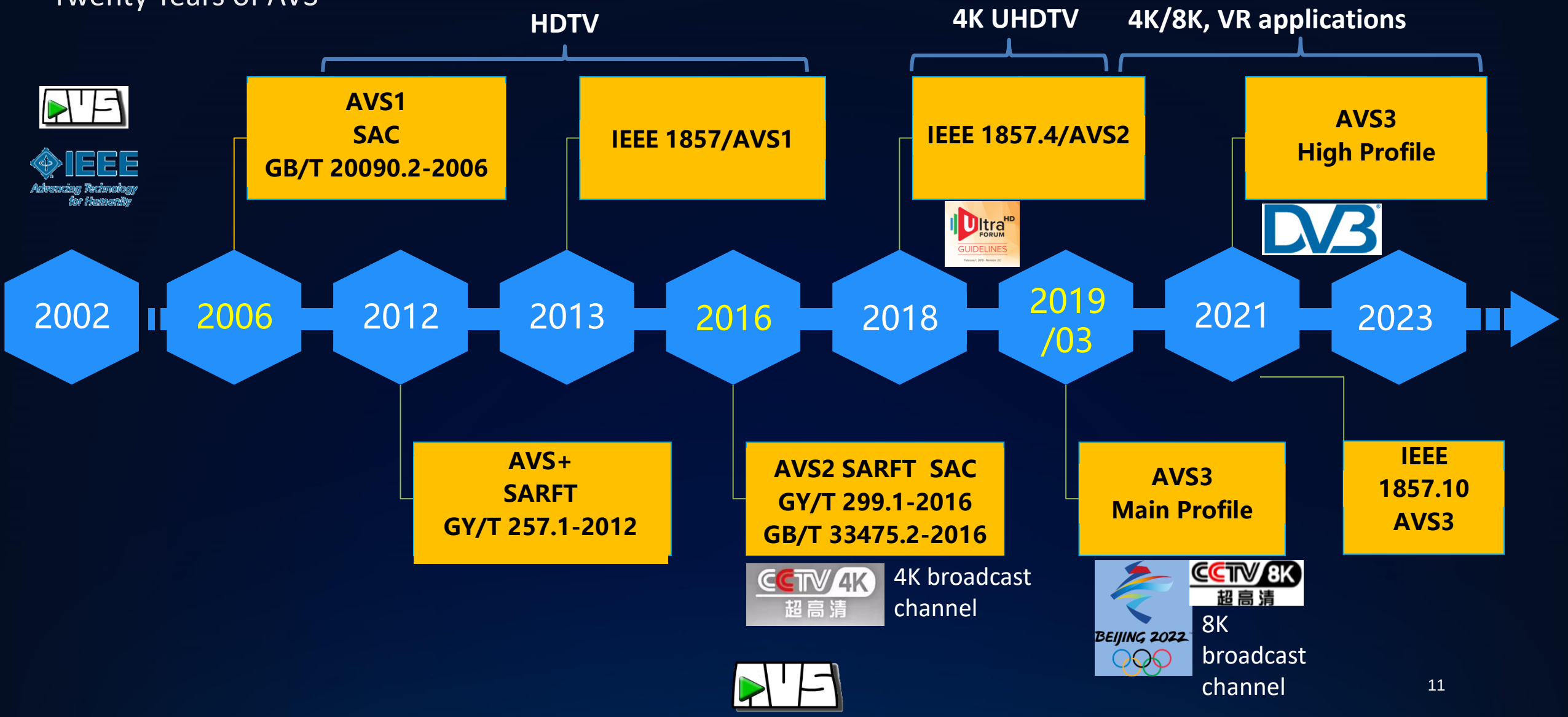
AVS3 **T/AI 109.2-2021**

- Broadcast TV
- High definition
- Ultra high definition – 8K
- Internet Streaming

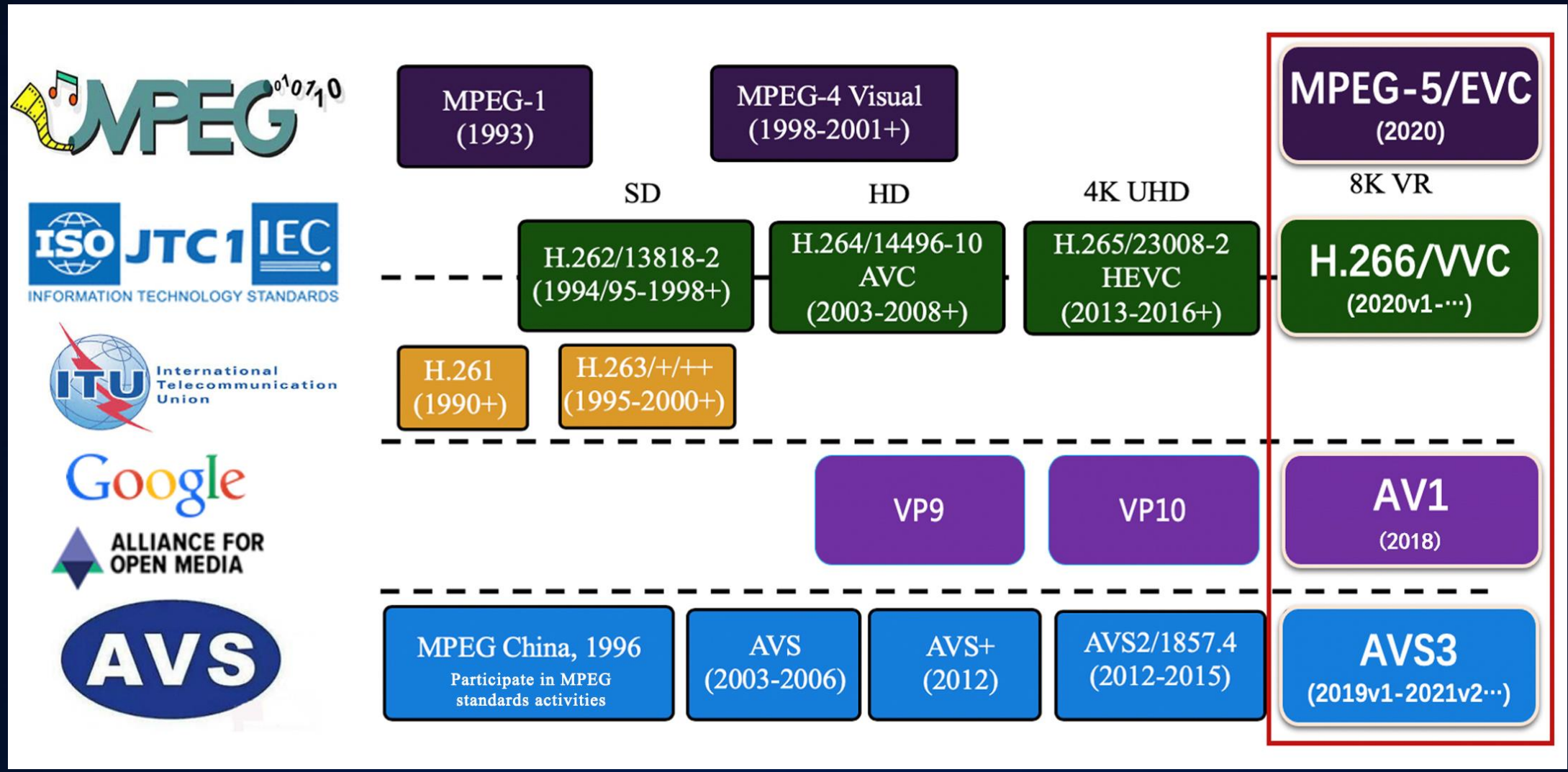
http://www.avs.org.cn/en/index/list?catid=22

AVS Video Coding Standards [2002-2023]

Twenty Years of AVS



AVS Video Coding Standards



AVS3 Standard Development

Started in Dec 2017, two phases:
- Main Profile: finalized in 2019Q1, to achieve a good tradeoff between the complexity increase and the coding gain, about 28% coding gain over HEVC for 4K, friendly for hardware implementation
- High Profile: finalized in 2021.Q3, to continue improve the coding efficiency, 40% bitrate saving over HEVC.

Features

Key Tools in AVS3 Main Profile

- Block partition
  - Quadtree Plus Binary Tree (QTBT)
  - Extended Quad-tree Partitions (EQT)
  - Derived Tree Partition(DT)
- Intra prediction
  - Intra Prediction Filter (IPF)
  - Two-Step Cross-component Prediction (TSCPM)
- Inter prediction
  - History-based Motion Vector Prediction (HMVP)
  - Adaptive Motion Vector Resolution (AMVR)
  - Affine Motion Compensation (AFFINE)
  - Ultimate Motion Vector Expression(UMVE)
  - Symmetric Motion Vector Difference(SMVD)
- Transform
  - Position Based Transform (PBT)
- Others
  - Patch for parallel design, CABAC，Loop filter

For more details:
Zhang, Jiaqi; Jia, Chuanmin; Lei, Meng; Wang, Shanshe; Ma, Siwei; Gao, Wen, Recent Development of AVS Video Coding Standard : AVS3, PCS2019.

Key Tools in AVS3 High Profile

- Intra prediction
  - Extended Intra Prediction Mode(EIPM)
- Inter prediction
  - Bi-directional Optical Flow(BIO)
  - Motion Vector Angle Prediction(MVAP)
  - Decoder-side Motion Vector Refinement(DMVR)
  - United Direct and Intra Mode Prediction (UDIMP)
- Transform
  - Sub-block Transform(SBT)
  - Implicit Selection of Transform(IST)
- Entropy coding
  - Scan Region based Coefficient Coding(SRCC)
- SCC coding
  - Intra Block Copy(IBC)

AVS3 High Profile is backward compatible to the AVS3 Main profile

Technology / Feature Comparison- AVS3, VVC and AV1

Source: PCS2019 Panel Discussion: Emerging Video Standards http://www.pcs2019.org/Program.aspx#panel

Category	VVC	AV1	AVS3
High-level Picture Partitioning	• Subpictures • Tiles • Raster-scan slices of multiple tiles • Rectangular slices within tiles		• Patch: similar as the rectangular slices, but with unified width/height configuration for the slice
Partition size	• Coding Unit: 4x4 to 128x128 • Pipeline size 64x64	• Superblock: 4x4 to 128x128	• Coding Unit: 4x4 to 128x128 • Pipeline size 64x64
Partitioning	• QTBT + TT (NS, QT, BTx2, TTx2= 6 partitions) • Dual-tree (separate tree for luma and chroma • Partial coverage of prediction regions by transforms (SBT, ISP)	• Recursive tree(10-way split)	• QTBT + EQT (NS, QT, BTx2, EQTx2= 6 partitions) • DT (6 partition modes)
Transform	• DCT2 (4x4 up to 64x64 with zero-out >32) + MTS (<=32x32 with zeroout >16, DST7, DCT8, independent hor./ver.) • Subblock transform (SBT) for inter • Low-frequency non-separable transform (LFNST) • Joint coding of chroma residuals (JCCR) • Transform skip (TS) • Adaptive colour transform for 4:4:4 (ACT) • Coefficient coding: HEVC + parity-based binarization for dependent quantization (DQ)	• DCT2, ADST, Flipped ADST, Identity, H/V Independently & Rectangular • 2-level Transform partitioning Within Prediction Unit	• DCT2 (4x4 up to 64x64) + IST+SBT+PBT (<=32x32, DST7,DCT8 independent H/V) • coefficient coding: scan-region based coefficient coding
Entropy coding	• CABAC • Multi-hypothesis probability estimation	• Multi-symbol Arithmetic Coder • Level map coefficient coding	• Log Domain CABAC
Loop filters	• Deblocking • SAO • ALF • Luma mapping with chroma scaling (LMCS)	• Deblocking • Constrained Directional Enhancement Filter • Loop restoration filters – spatially selected Wiener or Dual Self guided filters	• Deblocking • SAO • ALF
Intra Prediction	• 93 angles + planar + DC • Signalled as 67 modes with 6-MPM + remainder • Matrix-based intra prediction (MIP) • Mode-dependent intra smoothing • Multiple reference lines intra prediction (MRL) • Intra subpartitions (ISP) • Position-dependent intra prediction sample filtering (also for chroma)	• 61 modes: 56 angles + 3 smooths + Paeth + DC	• 65 modes: 62 angular + plane + DC + bilinear • 2-MPMs
	Chroma: • 67 regular modes (same as luma) signalled using 5 modes (planar, ver., hor., DC, same as luma) • Chroma from luma (CCLM)	• Chroma from Luma • Recursive filt-based intra pred • Color palette based intra pred	• Two-Step chroma prediction mode (TSCPM) • IPF • Intra-DT

Technology / Feature Comparison- AVS3, VVC and AV1

Source: PCS2019 Panel Discussion: Emerging Video Standards http://www.pcs2019.org/Program.aspx#panel

Category	VVC	AV1	AVS3
Inter Prediction (MC)	MC: • 1/16 sample precision for derived luma MVs • 1 luma 8-tap DCT-based interpolation filter for regular MC and one alternative 6-tap / switched interpolation filter for 1/2 sample MVs (SIF) • 1 luma 6-tap interpolation filter for affine subblock MVs • 1/32 sample precision for derived chroma MVs in 4:2:0 • 1 chroma 4-tap interpolation filter • Block-level CU weights (BCW) • Triangular prediction with merge (TPM) • Combined intra-inter prediction (CIIP) • Affine prediction refinement with optical flow (PROF) • Bi-directional optical flow prediction (BDOF) • Seven reference frames (or more if operating at a lower resolution)	• 1/8 Pixel luma MV • Hor and Vert interpolation filters for MC can signaled independently among SMOOTH, REGULAR, SHARP. • Seven reference frames	• 1/16 Pixel luma MV • 2 interpolation filters for MC • DMVR • five Seven reference frames
Inter Prediction (Luma MV coding)	Luma MV coding: • Subblock-based temporal merge candidate and affine control point MVPs • Decoder-side motion vector refinement (DMVR) with bi-linear interpolation • Merge mode with pairwise averaging candidates • Merge mode with MVD (MMVD) • History-based MVP for merge and MVP+MVD (HMVP) • Symmetrical MVD (SMVD) • Locally Adaptive motion vector resolution (AMVR) Chroma MVs derived from luma MVs	• Enhanced MV pred: average, wedge, diff-wtd and dist-wtd compound pred, OBMC, Global affine motion, Local Affine motion • InterIntra prediction modes combining inter and intra – 4 gradual and 4 wedge modes.	• AMVR, MMVD, Affine, HMVP, SMVD • EMVR(combine HMVP & AMVR)
Screen Content Coding	• Palette mode for 4:4:4 • Intra block copy (IBC) • Residual coding for transform skip • Block-based delta PCM (BDPCM)	• Palette mode • Intra Block Copy	• Intra block copy
Others	• Film grain synthesis SEI message • Reference sample resampling (RPR) • Spatial, quality and temporal scalability • Bitstream extraction and merging without VCL NAL unit rewriting	• Frame Super-resolution • Film Grain Synthesis • Reference Sample Resampling (RPR) • Spatial, quality and temporal scalability	• Cross RAP referencing(Knowledge based referencing)

AVS3 Profiles and Levels

Profiles

表B. 1　档次

profile_id的值	Profiles
0x00	禁止
0x20	Main 8bit profile
0x22	Main 10bit profile
0x30	High 8bit profile
0x32	High 10bit profile
其他	保留

Levels

表B. 2　级别

level_id的值	级别	
0x00	禁止	
0x10	2. 0. 15	
0x12	2. 0. 30	
0x14	2. 0. 60	
0x20	4. 0. 30	
0x22	4. 0. 60	
0x40	6. 0. 30	
0x42	6. 2. 30	
0x44	6. 0. 60	
0x46	6. 2. 60	
0x48	6. 0. 120	HD
0x4A	6. 2. 120	
0x50	8. 0. 30	
0x52	8. 2. 30	
0x54	8. 0. 60	
0x56	8. 2. 60	4K
0x58	8. 0. 120	
0x5A	8. 2. 120	
0x60	10. 0. 30	
0x62	10. 2. 30	
0x64	10. 0. 60	
0x66	10. 2. 60	8K
0x68	10. 0. 120	
0x6A	10. 2. 120	
其他	保留	

Supported Feature	
HDR EOTF/OETFs	PQ/HLG
WCG	B.T.709/B.T.2020
Metadata	Static metadata Hooks for four types of Dynamic metadata payload
Frame rate	Level x.x.30 : 25/30 fps Level x.x.60 : 50/60 fps Level x.x.120: 100/120 fps
Resolution	HD/4K/8K
Bit Depth	8bit/10bit
Progressive/Interlace	**Progressive/Interlace**

Example setting for typical UHD delivery

	Profile	Level
OTA	Main10	8.0.60 8.2.60
MVPD	Main10	8.0.30 8.0.60
OTT	Main10	8.0.30

Test results

AVS3 Coding Performance – Main Profile

AVS3 Main Profile performance AVS3: uavs3e (opensource)

Anchor1: HEVC reference software HM-16.9, encoder setting, encoder_randomaccess_main10.cfg
Anchor2: AOMedia Project AV1 Encoder 1.0.0-errata1-avif-65-gd0f0d3b17, Dec 24, 2019

AVS3 Main Profile performance, anchor HEVC

Class	Seq	PSNR_Y	PSNR_U	PSNR_V
Class A1 3840×2160 10bit	Campfire	-34.0%	-29.0%	-43.5%
	FoodMarket4	-27.3%	-22.1%	-27.0%
	Tango2	-24.3%	-31.9%	-33.3%
Class A2 3840×2160 10bit	CatRobot1	-31.8%	-34.0%	-30.7%
	DaylightRoad2	-33.3%	-36.7%	-27.4%
	ParkRunning3	-28.3%	-10.6%	-7.6%
Class B 1920×1080 10bit	MarketPlace	-23.3%	-21.0%	-21.8%
	RitualDance	-23.2%	-17.4%	-23.1%
	Avg.	-28.19%	-25.33%	-26.80%

AVS3 Main Profile performance, anchor AV1

Class	Seq	PSNR_Y	PSNR_U	PSNR_V
Class A1 3840×2160 10bit	Campfire	5.5%	3.0%	13.9%
	FoodMarket4	-11.3%	2.6%	4.2%
	Tango2	-12.0%	-1.6%	-10.1%
Class A2 3840×2160 10bit	CatRobot1	-14.4%	-3.0%	-7.5%
	DaylightRoad2	-13.6%	3.7%	2.2%
	ParkRunning3	-8.9%	-8.7%	-6.8%
Class B 1920×1080 10bit	MarketPlace	-7.7%	9.4%	11.1%
	RitualDance	-8.4%	1.5%	-1.0%
	Avg.	-8.85%	0.86%	0.75%

Source: https://ecosystem.avs.org.cn/2020/01/10/avs3

AVS3 Coding Performance

AVS3 Main Profile Opensource

x265 veryslow (anchor)

uAVS3e(Test)

AVS3 Coding Performance – High Profile

AVS3 High Profile performance, HPM 12.2 reference software

Compared with HEVC (HM16.22), AVS3 High Profile (HPM12.2) with GOP32

Anchor: HEVC reference software HM-16.22, encoder setting, encoder_randomaccess_main10.cfg

4K
1080P

GOP32	Random Access 10bit Over HM16.22					
	Y	U	V	YUV	EncT	DecT
4K	-38.32%	-41.49%	-46.82%	-40.09%	2197%	183%
1080P	-33.17%	-45.30%	-41.83%	-35.07%	2379%	182%
720P	-33.01%	-45.69%	-40.18%	-35.00%	1772%	189%
Overall (CTC)	-34.83%	-44.16%	-42.94%	-36.72%	2100%	185%

YUV average PSNR is calculated as follows:

$$PSNR_{avg} = \left(6 \times PSNR_Y + PSNR_U + PSNR_V\right)/8$$

8K

GOP32	Random Access 10bit Over HM16.22					
	Y	U	V	YUV	EncT	DecT
Baseball_player	-29.71%	-19.40%	-51.78%	-30.71%	2169%	191%
Sword_Casting	-32.54%	-38.69%	-41.47%	-33.92%	1039%	182%
Topspeed_Baseball	-44.83%	-23.12%	-47.63%	-41.89%	1395%	181%
8K	-35.69%	-27.07%	-46.96%	-35.51%	1465%	185%
All	-35.69%	-27.07%	-46.96%	-35.51%	1465%	185%

40.09% YUV coding gain over HEVC on 4K
35.07% YUV coding gain over HEVC on 1080P
35.51% YUV coding gain over HEVC on 8K

AVS3 Coding Performance – High/Main Profile

AVS3 High/Main Profile performance， HPM 15.2 reference software

Anchor: HEVC reference software HM-16.23， encoder_randomaccess_main_field_coding.cfg

Interlace

AVS3_HP_GOP32_vs_HEVC

		PSNR BD-rate (piecewise cubic)			
		Y	U	V	YUV
	mobcal	-54.20%	-64.75%	-63.27%	-55.89%
	parkrun	-21.52%	-52.21%	-60.91%	-26.56%
	shields	-54.57%	-43.76%	-39.06%	-52.02%
	stockholm	-42.83%	-49.51%	-42.93%	-43.77%
1080i	Carousel	-30.56%	-36.49%	-41.09%	-31.86%
	Duck	-38.61%	-50.50%	-50.57%	-40.91%
	All	-40.38%	-49.54%	-49.64%	-41.83%

AVS3_MP_GOP32_vs_HEVC

		PSNR BD-rate (piecewise cubic)			
		Y	U	V	YUV
	mobcal	-48.83%	-38.51%	-44.54%	-47.81%
	parkrun	-14.04%	-20.91%	-24.22%	-14.90%
	shields	-49.13%	-5.28%	-18.71%	-43.15%
	stockholm	-36.71%	-18.31%	-25.75%	-33.83%
1080i	Carousel	-19.42%	-23.04%	-24.12%	-19.95%
	Duck	-31.90%	-34.64%	-34.73%	-32.43%
	All	-33.34%	-23.45%	-28.68%	-32.01%

AVS3_HP_GOP16_vs_HEVC

		PSNR BD-rate (piecewise cubic)			
		Y	U	V	YUV
	mobcal	-51.22%	-63.22%	-60.29%	-52.99%
	parkrun	-19.88%	-49.26%	-59.51%	-24.82%
	shields	-49.80%	-40.40%	-34.56%	-47.48%
	stockholm	-38.68%	-46.34%	-38.97%	-39.75%
1080i	Carousel	-29.99%	-34.40%	-38.37%	-30.99%
	Duck	-36.96%	-47.98%	-47.54%	-39.02%
	All	-37.76%	-46.93%	-46.54%	-39.18%

AVS3_MP_GOP16_vs_HEVC

		PSNR BD-rate (piecewise cubic)			
		Y	U	V	YUV
	mobcal	-45.54%	-34.72%	-41.72%	-44.55%
	parkrun	-11.90%	-14.05%	-19.46%	-12.31%
	shields	-44.07%	0.97%	-12.15%	-38.18%
	stockholm	-32.14%	-12.67%	-20.72%	-29.35%
1080i	Carousel	-18.52%	-20.02%	-20.02%	-18.61%
	Duck	-30.10%	-30.91%	-30.87%	-30.25%
	All	-30.38%	-18.57%	-24.16%	-28.88%

Deployments

AVS3 Deployments

- **AVS3.0 Main Profiles and Levels for 4K/8K delivery**
  - IPTV: AVS3.0 Main10/8 profile, level 8.0.30/8.0.60/10.0.30/10.0.60
  - Cable: AVS3.0 Main10/8 profile, level 8.0.60/8.0.120/10.0.60/10.0.120
  - OTT: AVS3.0 Main10/8 profile, level 8.0.30/10.0.30

- **AVS3 4K/8K Vendor:**
  - AVS3 hardware Encoder: 当虹科技 Arcvideo Tech, Sumavision 数码视讯, 博雅华录
  - AVS3 STB/TV SoCs: HISILICON, MEDIATEK, 国科微, REALTEK, amlogic
- **AVS3 STB(4K/8K)** inspur 浪潮 U8B,U8E,U8H; Sunniwell 朝歌科技; 九联科技 UNIONMAN; Hisense IP500N; CHANGHONG 长虹; FiberHome 烽火
- **AVS3 TV(4K/8K)** TCL, mi, KONKA 康佳, HONOR, Hisense

AVS3 Deployments

- **AVS3 conformance streams**

  Commercial streams: Allegro DVT 

  AVS WG Conformance streams: AVS Industry Alliance/AVS WG conformance streams

  DVB AVS3 V&V streams: https://dvb.org/specifications/verification-validation/avs3-test-content

- **AVS3 bitstream tools:**

  Commercial tools: StreamAnalyser (Elecard, Russia) 

  StreamXpert (Dektec, UK), 

  VQ Analyzer (Vicuesoft, Cyprus) 

  Opensource: TSDuck, DVB Inspector, ffmpeg

AVS3 Broadcasting Events

1. **The first domestic 8K ultra-high-definition football match broadcasting in Suzhou. Nov 2020**
   Operator: Jiangsu Cable, AVS3/8K/DVB-C

2. **CMG/CCTV launched AVS3 8K trail channel for Spring Festival events. Feb 2021**
   Operator: China Media Group/CCTV, AVS3/8K/DVB-C
   500+8K outdoors Screens connected in 70 Cities (Beijing, Shanghai, Jiangsu, Fujian, Sichuan, Guangdong, Zhejiang, and etc.)

3. **Beijing Winter Olympics Games, Feb,2022**
   AVS3 8K live broadcasting: Operator China Media Group/CCTV, AVS3/8K/DVB-C
   AVS3 Mobile live streaming: Operator China Mobile/Migu, AVS3/HD

4. **Kartar World Cup, Nov, 2022**
   AVS3 Mobile live streaming: Operator China Mobile/Migu, AVS3/HD
   24 live-broadcasting games/200+ different mobile phone models

5. **Hangzhou 19th Asian Games, Sept, 2023**
   AVS3 8K Broadcasting/Mobile live streaming: Operator China Media Group/CCTV/ China Mobile/Migu

AVS3 Open Source

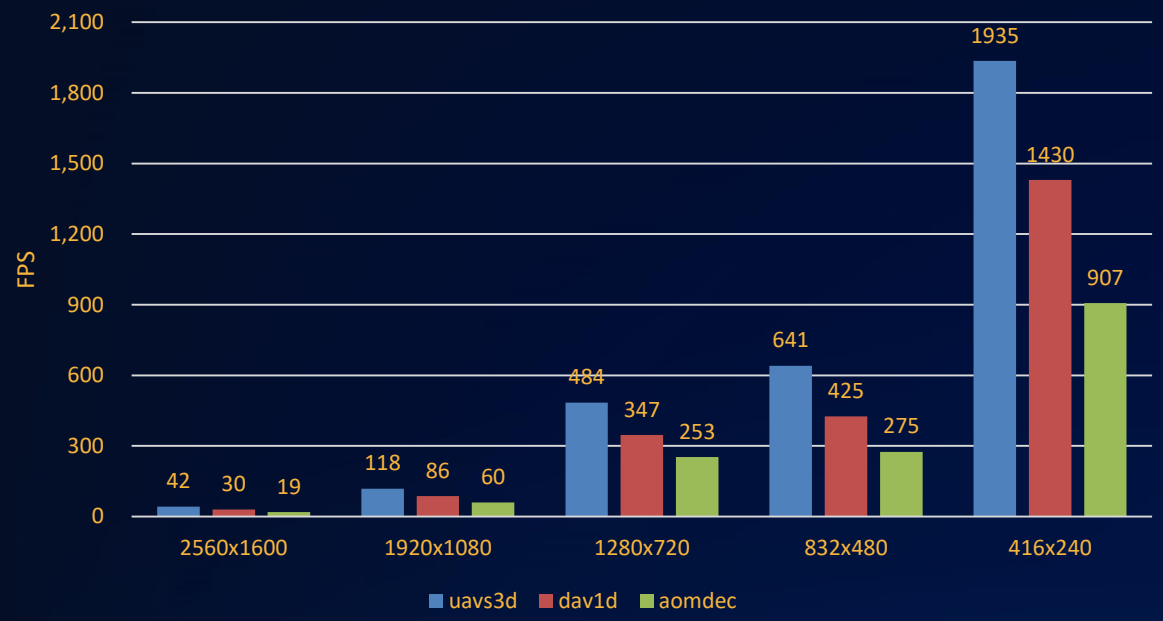
AVS3 open source (AVS3 Main Profile):

Encoder(Github): https://github.com/uavs3/uavs3e.git
https://code.ihub.org.cn/projects/1350/repository/uavs3e

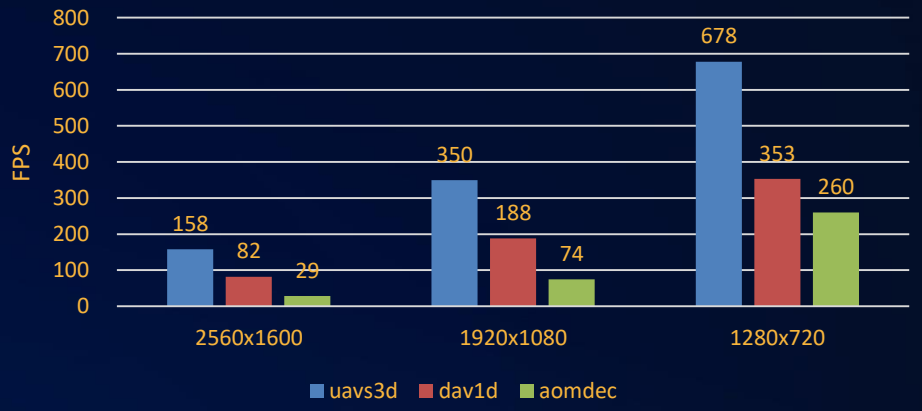
Decoder(Github): https://github.com/uavs3/uavs3d.git
https://openi.org.cn/html/2020/Framework_0325/16.html

ffmpeg: https://ecosystem.avs.org.cn/wp-content/uploads/2020/06/ffmpeg_uavs3d_diff.zip

uavs3d, dav1d and aomdec avx2 single-thread performance



uavs3d, dav1d and aomdec
avx2 multi-thread performance



Reference anchor: AV1 open source

dav1d	0.5.1-4-g9a10026	https://code.videolan.org/videolan/dav1d.git
aomdec	1.0.0-1632-gb6568aa	https://aomedia.googlesource.com/aom

Source: https://ecosystem.avs.org.cn

Licensing

(All information in this presentation is published on the AVS website: http://standard.avswg.org.cn/Licensing/Index.html)

AVS Licensing Overview

AVS IPR Policy

AVS Patent Pool

AVS Standards

Lower Risk

Up-front commitment to license
Up-front declaration of license terms
Obligation to disclose IPR
Standards designed to avoid patent infringement

Simple License

1RMB Royalty-Fee principle
Annual royalty cap
Annual fixed-fee option

AVS IPR Policy

Developed in 2004 by an International team of patent licensing experts and patent attorneys

- Representatives from the consumer, communication and computer industries, the semiconductor and consumer product market segments

Low Risk Innovation Model: build up the licensing model before standardization

- All proponents who would like to propose technologies to AVS, shall disclose their patents and declare their licensing commitment
  - e.g. ”RAND Royalty-Fee" or "Agree to join in the patent pool".

AVS standards are explicitly designed to use the technologies from AVS member only, or use royalty free technologies

Simple Licensing Model:

- ✓ One patent pool
- ✓ One-stop licensing model
- ✓ 1RMB per device for hardware decoder
- ✓ Annual royalty cap; Fixed Annual Fee option
- ✓ Royalty free for software decoder in Internet applications
- ✓ Royalty free for content

In China, the royalty fees of AVS1/AVS+/AVS2 are 1RMB per hardware device

The royalty fee of AVS3 is expected to follow the 1RMB principle

AVS3 Licensing terms and conditions are not available now; AVS3 patent pool was kicked off in Aug, 2020

Up-Front Commitment to AVS IPR Policy

AVS Members sign the AVS Member Agreement which includes the IPR policy

Article 6 of Member Agreement IPR Policy

Up-Front Commitment to License

Contributed technology to a specific standard

No contribution of other party’s technology

Article 6

Up-Front Default Licensing Obligation

Participant in a Subgroup:

- RAND-RF (Most Favorable)
- AVS Pool (Most Favorable)
- RAND

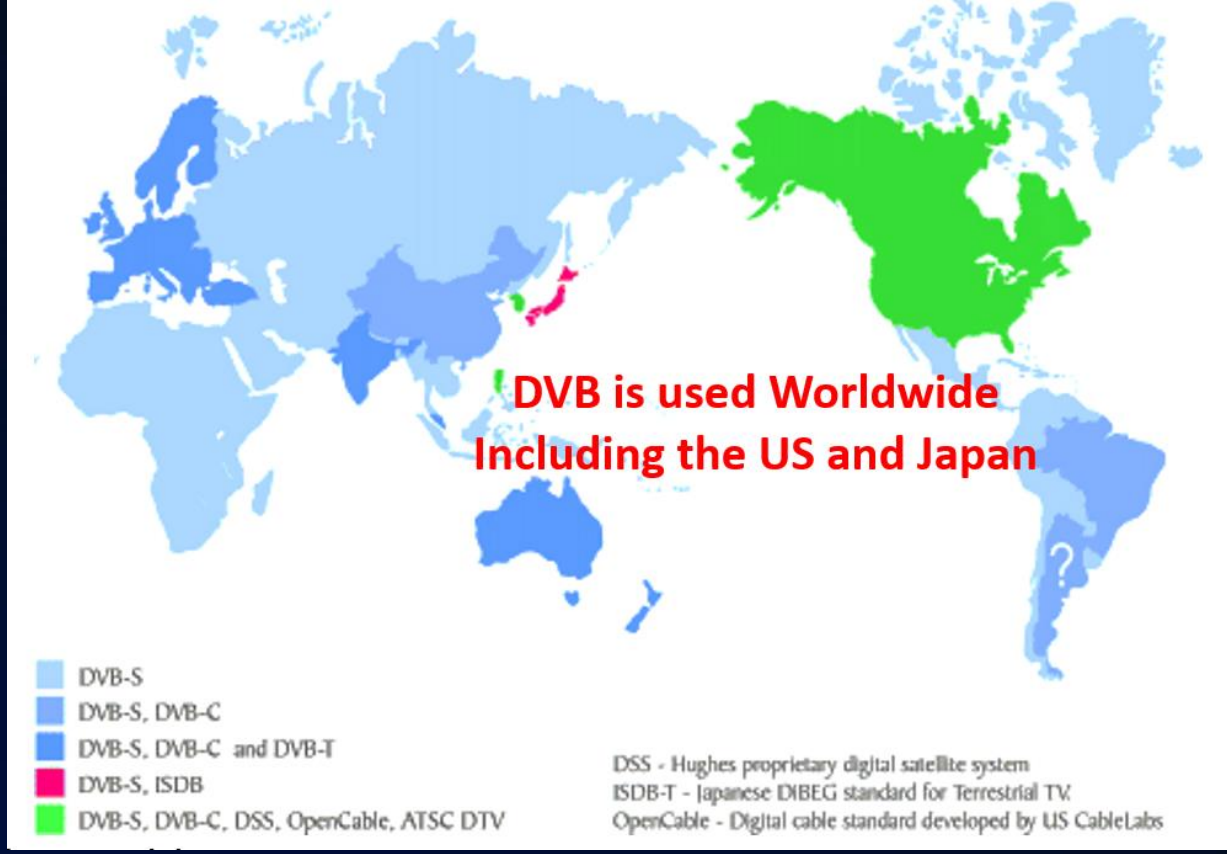
Articles 11, 12, 14

International Cooperation

DVB, an industrial organization with more than 300 members (16 Chinese enterprises), is sponsored by the "Joint Expert Group" jointly formed by ETSI, CENELEC and EBU. The DVB standard is widely used in almost every country (including China)

DVB standards coverage

- DVB-T/T2 is mandated by over 2/3 of the world
- DVB-S/S2 is used worldwide
- DVB-I is coming (IP-based transmission)



AVS and DVB setup formal liaison cooperation

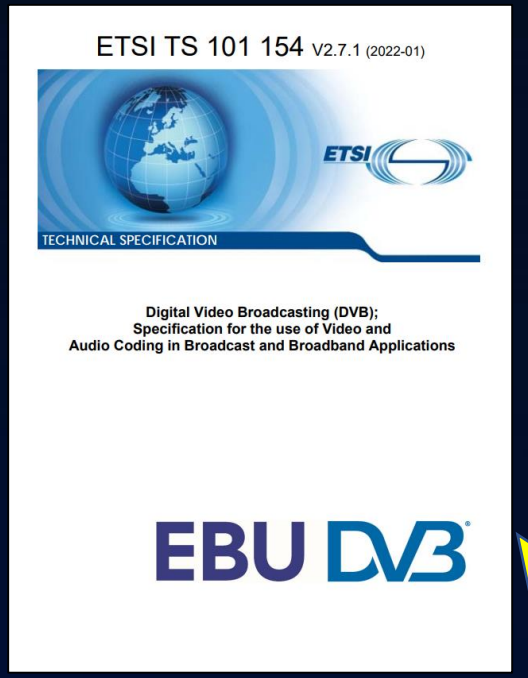
3 years of collaborative work

The two organizations interacted and cooperated well.

- Successful Experience: AVS3 becomes a Global DVB Next Generation Video Coding Standard

DVB/ETSI Specifications relevant for AVS3

Specification title	DVB BlueBook publication	ETSI publication
Use of Video/Audio Coding in Broadcast & Broadband applications **aka: "DVB AVC" or "Codec Toolbox"**	A001(r20) (Published, Jul 2022)	TS 101 154 (v2.8.1) ETSI published in July,2023
Specification for Service Information (SI) in DVB systems **aka: "DVB SI"**	A038(r15) (Published, Jul 2022)	EN 300 468 (v1.18.1) To be published
DASH Profile for Transport of ISO BMFF Based DVB Services over IP Based Networks **aka: "DVB DASH"**	A168(r5) (Published, Nov 2022)	TS 103 285 (v1.4.1) ETSI published In Sept. 2023



T/AI 109.2-2021(AVS3-P2)

T/AI 109.6-2022(AVS3-P6)

AVS References

DVB/ETSI Codec Tool box

DVB /ETSI TS 101 154

Video Coding Technologies in current DVB /ETSI Codec Toolbox

MPEG-2 H.262

AVC H.264

HEVC H.265

NGVC in DVB/ETSI

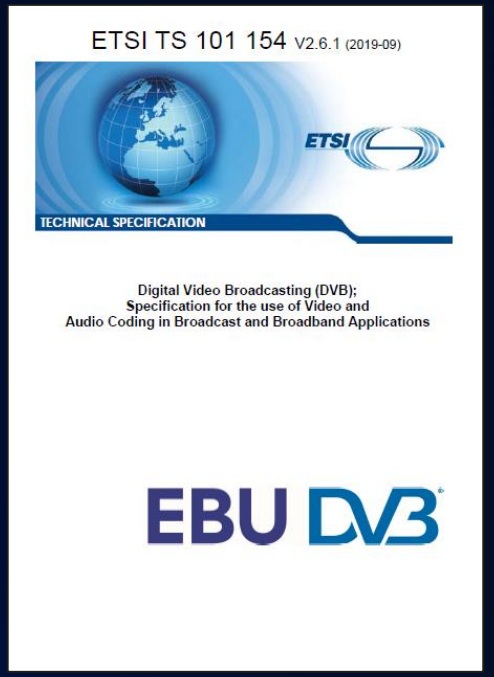
AVS3

VVC

Candidates in Phase2

AV1

LC-EVC



Current DVB Work Areas	2022	2023	2024
Video & Audio Coding	DVB AVC Next gen. video codecs Phase 2 CRs VVC AVS3 AV1	Phase 2 technical work (Enhanced resolution with backwards compatibility to existing receivers)	V&V New updates

AVS3 IRD Profiles in DVB/ETSI UHDTV

AVS3 conformance points

AVS3 HDR HFR UHDTV-2 IRD

AVS3 HDR HFR UHDTV-1 IRD

High 10bit profile, Level 8.0.120/8.4.120
Adds support for high frame rates (up to 120f/s)

AVS3 HDR UHDTV-2 IRD

High 10bit profile, Level 10.0.60/10.4.60
Adds support for resolutions up to 7680x4320

AVS3 HDR UHDTV-1 IRD

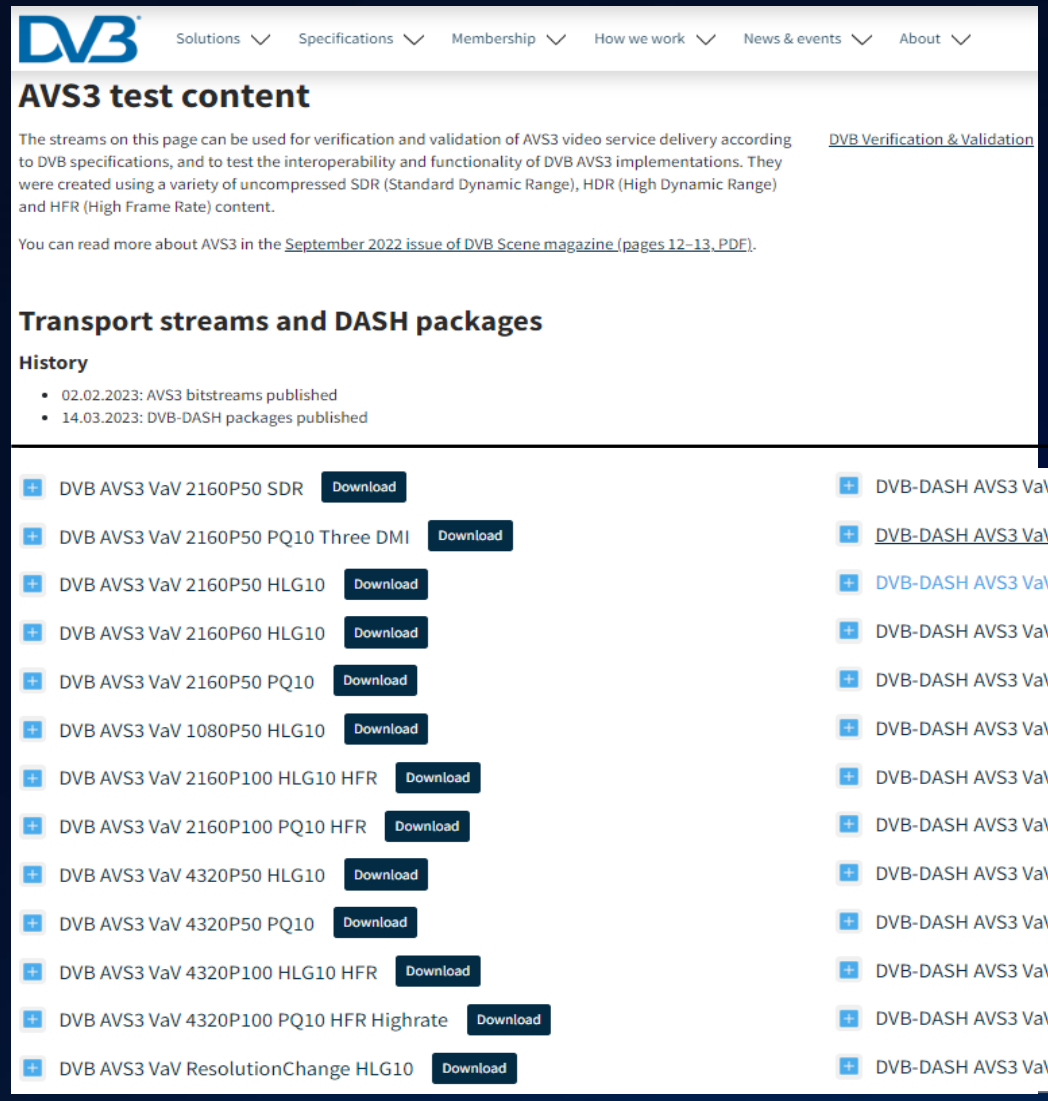
High 10bit profile, Level 8.0.60/8.4.60
Supports:
4:2:0 progressive square pixel formats
with resolutions from 960x540 to 3840x2160
standard frame rate (up to 60f/s)
BT.709 SDR 8-bit or 10-bit
BT.2100 HLG10 10-bit
BT.2100 PQ10 10-bit

High 10bit profile, Level 10.0.120/10.4.120

AVS3 Verification &Validation TS and DASH Streams

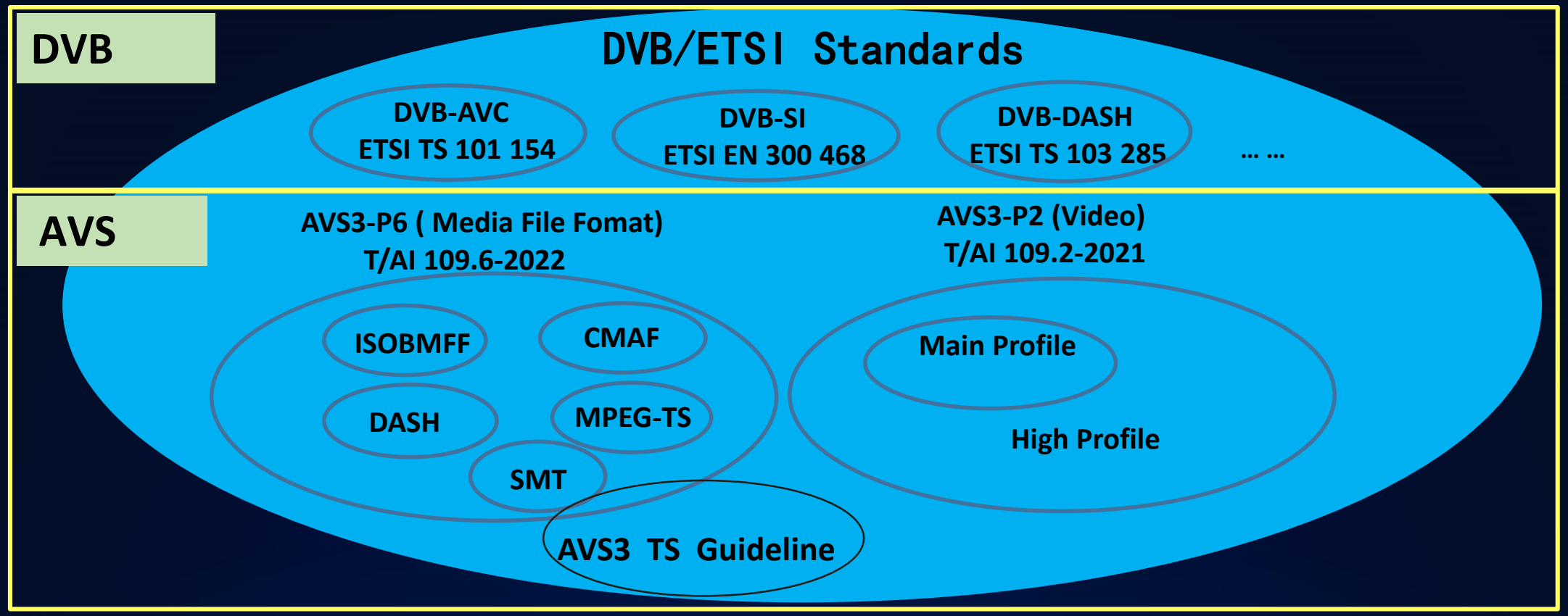
AVS3 V&V TS and DASH streams now available on DVB website:

https://dvb.org/specifications/verification-validation/avs3-test-content



AVS3 V&V: 13 streams for TS,
13 streams for CMAF/DASH,
5 multi video track streams for CMAF/DASH

Relations between AVS3 and DVB/ETSI Specifications



V&V / Conformance

- AVS3 Verification & Validation（TS, CMAF/DASH）
- AVS3 8K/4K Subjective Test

Thank you !

Q&A