

May 2023
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VVC ENCODING - TRIALS AND DEPLOYMENTS

ATEME
Captivate your audience

AGENDA

VVC Encoding - Trials and Deployments

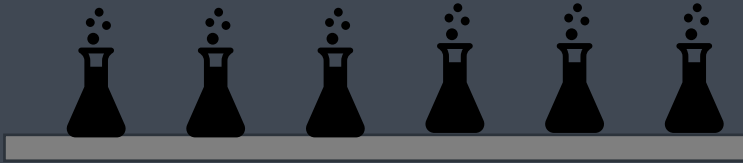
1. Practical Implementation of codecs
2. VVC in action
3. Standards & Deployments Update
4. Conclusion



01 Practical Implementation of codecs

HOW TO „COOK“ A LIVE ENCODER FOR A NEW CODEC

Tools of the Standard



„Own grown“ Ingredients



„Ingredients“ set

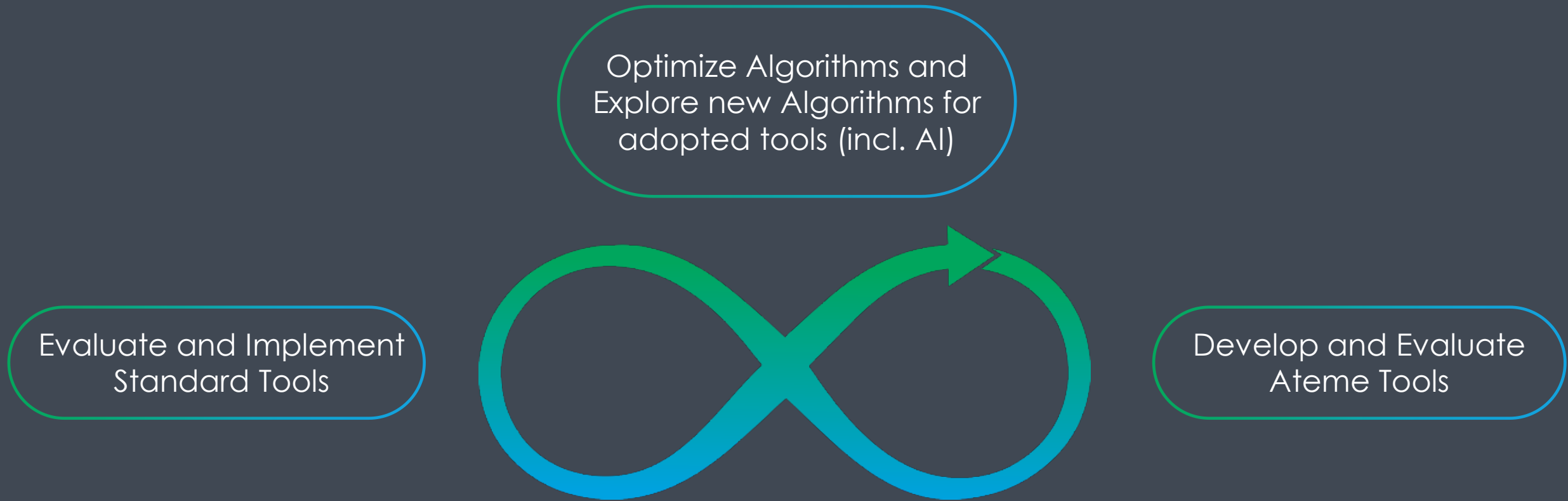
- > brings coding efficiency leap
- > still practical in real time
- > without „exploding“ CPU resources



Optimization of adopted set:
continuous effort to allow
additions of more tools

DEVELOPMENT OF A „NEW“ CODEC

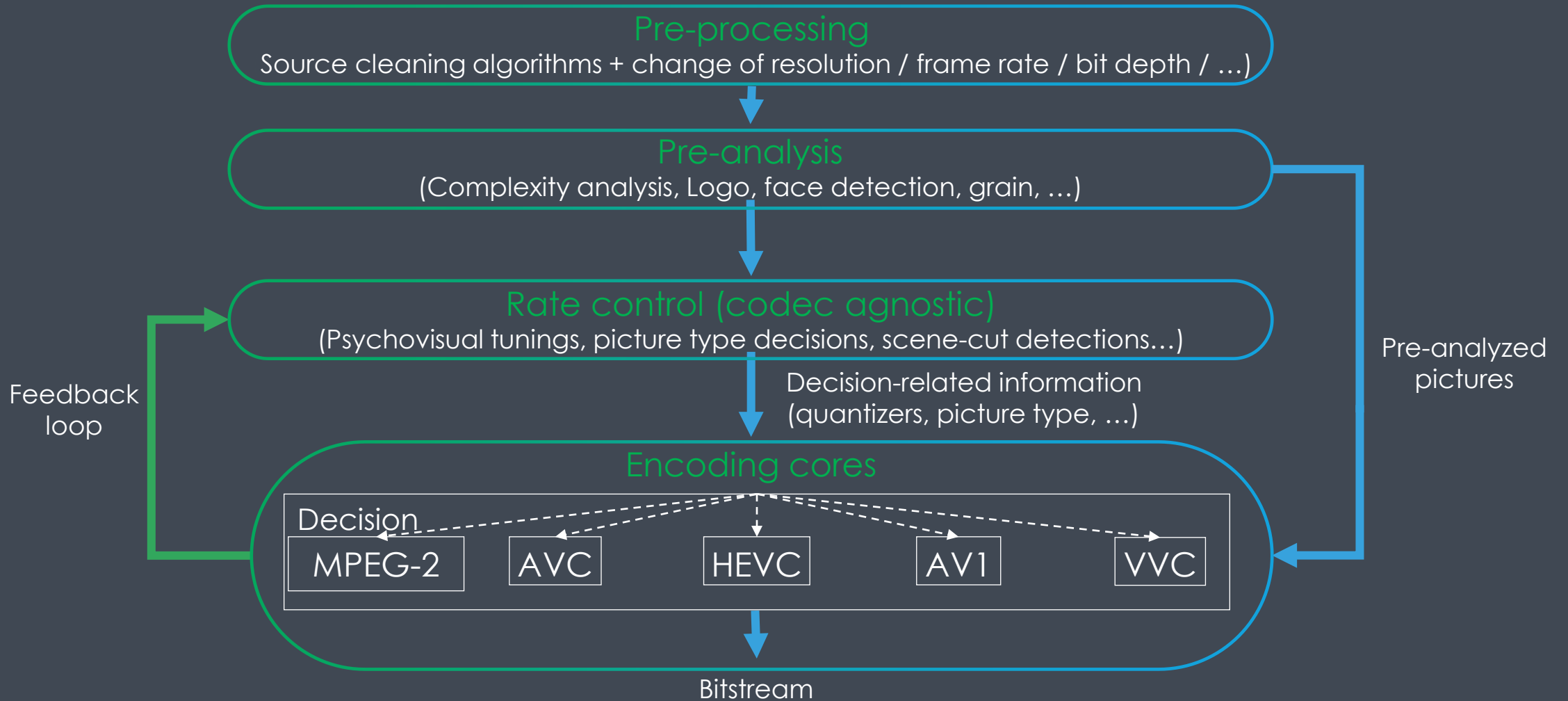
A continous process



NOTE: HEVC can still be seen as new codec!

ENCODER IMPLEMENTATION

Commonalities helped early availability of VVC



vvc in action

ATEME ALREADY TRIALED VVC IN 2020

Lab Tests

- > Objective was to gain first assessment on practical performance
 - > Limited toolset on top of HEVC, VVC syntax

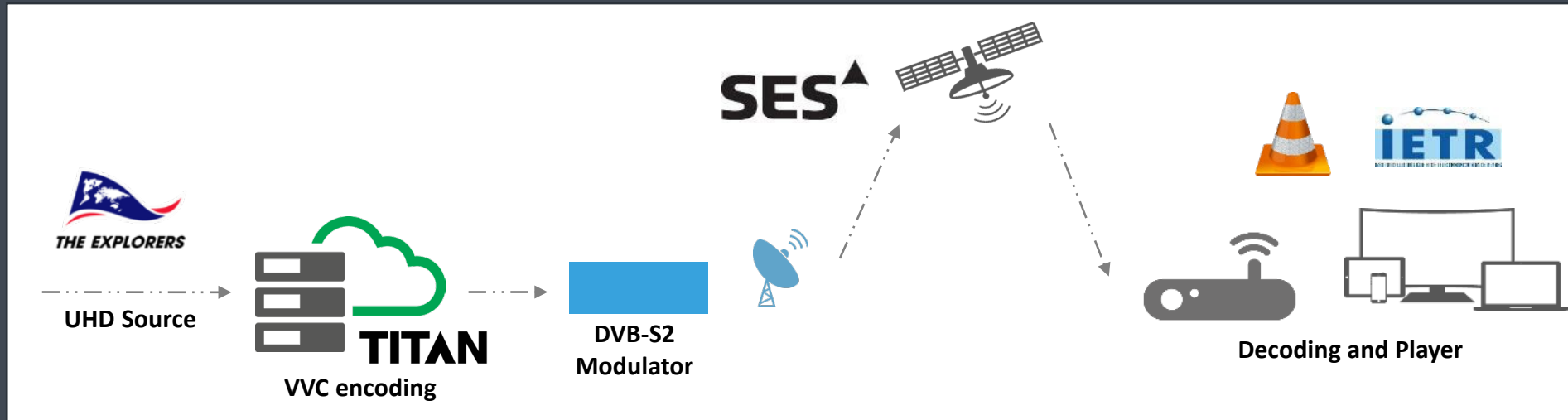
VVC-live over HEVC-live	Fly over Mountain	Fly over harbor	Fly over Island Town	Elephant	Rotating Trees	Leopard in Water
Bitrate saving	-16 %	-17 %	-21 %	-24%	-15 %	-28 %

- > „The Explorers“ content: 8K, HDR10, BT2020
- > Overall practical gain 20 % compared to HEVC for 8K

ATEME ALREADY TRIALED VVC IN 2020

First Broadcast Trial

- > June 2020: World first 4K VVC broadcasting over the air*
 - > Partners: The Explorers, SES, VLC, IETR
 - > Implementation of VVC VTM-6.1 compliant live encoder + MPEG-TS packager for VVC, DAM2
 - > Offline encoding of 4K UHD content, real-time decoding

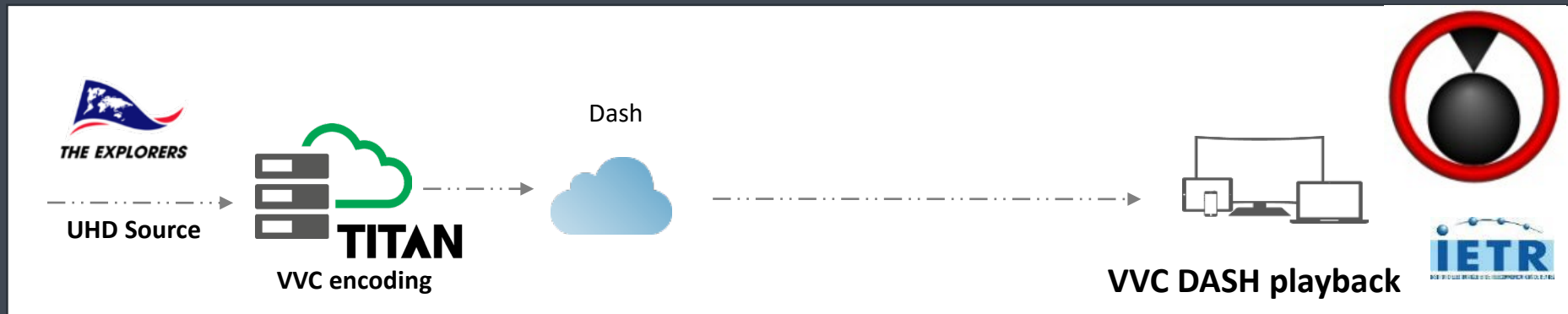


* [m54377](#), Thibaud Biatek, Mohsen Abdoli, Thomas Guionnet, Mickael Raulet (ATEME), Thomas Wrede, Jan Outters, Tom Christophory (SES), Hugo Beauzée-Luyssen, Simon Latapie, Jean-Baptiste Kempf (VideoLabs), Pierre-Loup Cabarat and Wassim Hamidouche (IETR), « End-to-end UHD satellite broadcast transmission using VVC », june 2020.

ATEME ALREADY TRIALED VVC IN 2020

First OTT trial

- > June 2020: World first VVC OTT streaming*
 - > Partners: The Explorers, IETR, TelecomParis
 - > Implementation of VTM-6.1 compliant offline encoder and ISO BMFF encapsulation for DASH delivery (working draft)
 - > Offline encoding of 480p to 2160p content, real-time decoding



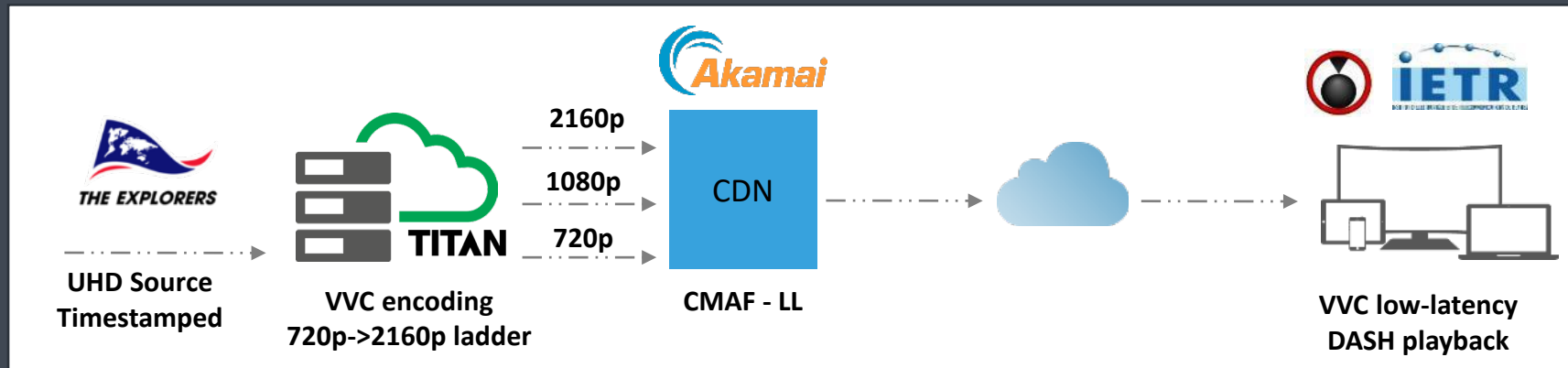
* [m54379](#), Thibaud Biatek, Mohsen Abdoli, Thomas Guionnet, Mickael Raulet (ATEME), Jean Le Feuvre (Telecom Paris), Pierre-Loup Cabarat, Wassim Hamidouche (IETR), « End-to-end OTT streaming using DASH/VVC », june 2020.

ATEME ALREADY TRIALED VVC IN 2020

World first live 4K-VVC low-latency OTT streaming

> November 2020:

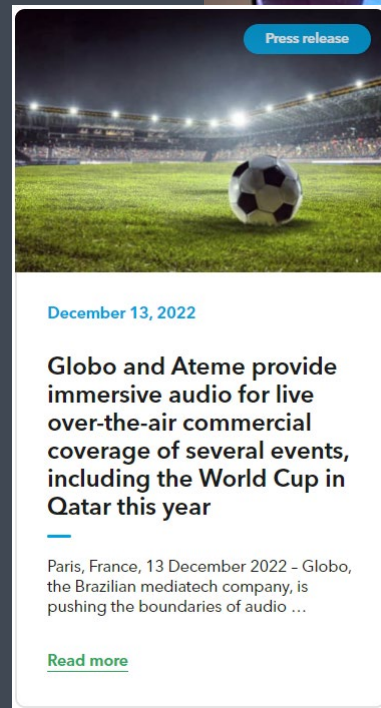
- > Partners: The Explorers, Akamai, IETR, TelecomParis
- > Implementation of VVC FDIS compliant live encoder and ISOBMFF encapsulation for DASH delivery, DAM2
- > Live encoding of 720p to 2160p ladder, real-time decoding



WORLD CUP 22 TRIAL

TV 3.0 Brazil

- > VVC 4K HDR live encoding @15 Mbps
- > Distributed in MPEG DASH
- > AUDIO MPEG-H Immersive
- > Decoded on LGTV



Courtesy Carlos Cosme / TV Globo

Standards & Deployments Update

DVB SENT SPECIFICATIONS TO ETSI FOR PUBLICATION

VVC Update Overview

Set of 3 specifications

ETSI TS 101 154
Implementation guidelines

ETSI TS 103 285
DVB DASH

ETSI EN 300 468
Service Information in DVB systems

4 conformance points

	Up to 3840 x2160	Up to 7680x4320
Up to 60 fps	VVC HDR UHDTV-1	VVC HDR UHDTV-2
Up to 120 fps	VVC HDR HFR UHDTV-1	VVC HDR HFR UHDTV-2

Test signals available on dvb.org

DVB SENT SPECIFICATIONS TO ETSI FOR PUBLICATION

VVC update Key characteristics

High Dynamic Range

PQ10 and HLG10

Optional Static Metadata for PQ10: Mastering display colour, volume, SEI message, CLL

Optional Dynamic Metadata:), ST2094-10 (Dolby Vision), ST2094-20/30 (SL-HDR2), ST-2094-40 (HDR10+)

Constraints for practical implementation

Limited set of resolutions

Only square pixels and progressive frames

Transition constraints for practical implementation

Resolution change (incl. RPR)

HDR on /off

Frame rate changes

DMI on /off

Additional Optional Features

Mosaic composition

Picture in picture composition

VVC DEPLOYMENTS IN EUROPE?

DIFFICULT PREDICTIONS

- > Strong Interest from DVB members
- > Tests conducted with European Broadcaster
- > VVC provides the necessary leap in Efficiency
- > Good Timing with UHD content / production

- > Strong Install Base of HEVC / AVC
- > Progress in HEVC encoder Efficiency



- WRC-23 outcomes / beyond 2030 horizon?
- DVB-T2, 5G, 5G broadcast?
- France T2 HEVC UHD launch 2024
- Italy just transitioned to T2 / AVC



- Take off of DVB-I as an opportunity?
- „Automatic“ HbbTV inclusion



- Overwhelming majority in AVC / MPEG-2
- Sometimes triple Simulcast?

Potential „Accelerators“ for VVC?



Green Initiatives



Immersive / AR / VR

BRAZIL

TV 3.0

- > 2020, VVC proposed by a consortium formed by Ateme, DiBEG, Fraunhofer HHI and InterDigital as the coding technology for TV3.0
- > VVC selected as video base layer
- > Specifications work ongoing
- > Key features:
 - > up to 7680x4320, HDR10, optional Dynamic Metadata
 - > Transport DASH ROUTE / FLUTE
- > Commercial Start in 2025



OTHER COMPANIES WORKING ON VVC ENCODERS

- > ByteDance BVC
- > KDDI Research
- > Ali266 encoder
- > Tencent RT-One (Tencent Cloud)
- > Spin Digital
- > Mainconcept SDK

Source:JVET

04 CONCLUSION

KEY MESSAGES

- > Ateame pioneered with first VVC transmission in 2020
 - > Gathered strong experience with number of trials (4K and 8K)
 - > Continued to improve and optimize VVC implementation
- > VVC markets are preparing
 - > DVB bluebook published and ETSI under way
 - > TV3.0 Specifications (Brazil) work ongoing
 - > ATSC decision to include VVC
- > VVC now mature for live deployments
 - > Still some way to leverage full potential for live
 - > Ateame continuous effort to optimize
 - > Leap in performance soon!

**Start
Experimenting
VVC with us!**



THANK YOU.

REFERENCE PICTURE RESAMPLING (RPR)

Definition

- > Versatile Video Coding (2020)
- > Temporal prediction as usual
- > With a new capability:
- > Reference Picture Resampling
 - > Allowing a reference frame of a different resolution
 - > Not constrained on IRAP
 - > **Resolution change at any moment**
 - > Enabling scalability from start



RPR PERFORMANCE

- > Objective performance
 - > From -3.2% to -22.3% bitrate savings
- > Subjective performance: standard test
 - > GOP based RPR control is beneficial
 - > No loss
 - > Worst case is identical to regular single resolution encoding
- > Subjective performance: expert viewing
 - > Reaching the same conclusion
 - > Resolution change is visually seamless