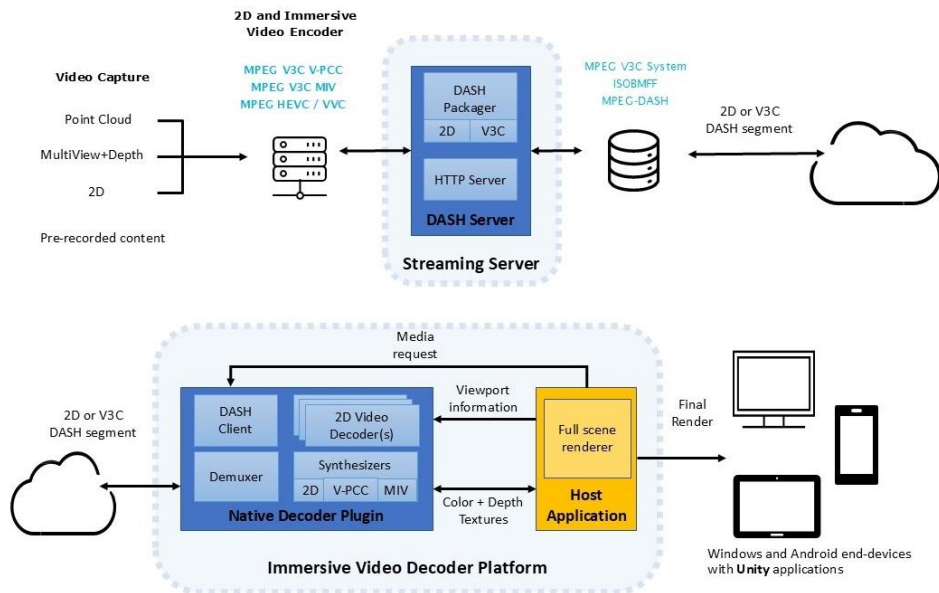# Volumetric Video Experiences with MPEG V3C
Reference Tools, what is being implemented?

- A **Unity project** is provided to decode and play V3C contents in Unity. The V3C Player can render in real-time 2D and volumetric video format : MPEG-I V-PCC, MPEG-I MIV.

- The Unity player uses the **decoder plugin library**. Also provided in that repository are V-PCC and MIV (MVD and MPI) synthesizers plugins needed for the rendering of the V3C contents.

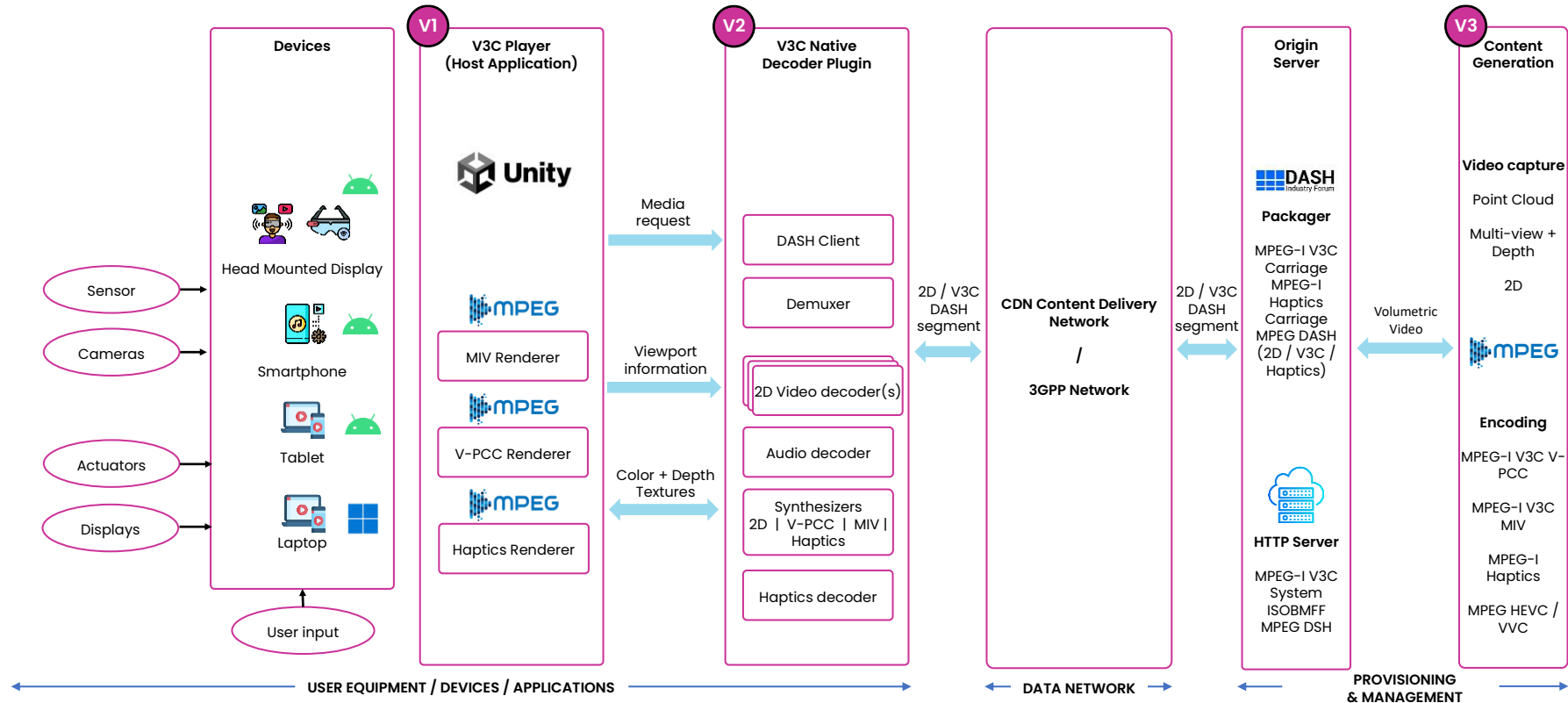- A library with **test V3C content** is provided to load content in the player.

WHERE TO LOOK AT?

All the Technical Resources
Information on Standards
Reference Tools available:
- **Project: V3C Immersive Platform**

Volumetric Video Experiences with MPEG V3C
Reference Tools, what is being implemented?

V1 · **V2** · **V3**

Devices

Head Mounted Display

Smartphone

Tablet

Laptop

- Sensor
- Cameras
- Actuators
- Displays

User input

V3C Player (Host Application)

Unity

MPEG
MIV Renderer

MPEG
V-PCC Renderer

MPEG
Haptics Renderer

V3C Native Decoder Plugin

DASH Client

Demuxer

2D Video decoder(s)

Audio decoder

Synthesizers
2D | V-PCC | MIV | Haptics

Haptics decoder

Media request

Viewport information

Color + Depth Textures

CDN Content Delivery Network
/
3GPP Network

2D / V3C DASH segment

2D / V3C DASH segment

Origin Server

DASH Industry Forum

Packager

MPEG-I V3C Carriage MPEG-I Haptics Carriage MPEG DASH (2D / V3C / Haptics)

HTTP Server

MPEG-I V3C System ISOBMFF MPEG DSH

Volumetric Video

Content Generation

Video capture

Point Cloud

Multi-view + Depth

2D

MPEG

Encoding

MPEG-I V3C V-PCC

MPEG-I V3C MIV

MPEG-I Haptics

MPEG HEVC / VVC

USER EQUIPMENT / DEVICES / APPLICATIONS — DATA NETWORK — PROVISIONING & MANAGEMENT

V MPEG Visual Volumetric Video-based Coding (V3C)

Volumetric Video Experiences with MPEG V3C
Reference Tools, what is being implemented?

#	Repository	Standards	License	Dependencies	Software
V1 ✅	**rt-v3c-unity-player** (V3C Unity Player)	⏩MPEG	5G-MAG PLv1.0	🎮 Unity®	🪟 🤖
V2 ✅	**rt-v3c-decoder-plugin** (V3C Decoder plugin)	⏩MPEG	5G-MAG PLv1.0		🪟 🤖
V3 ✅	**rt-v3c-content** (V3C Pre-encoded Test Content)	⏩MPEG	Multiple		🪟 🤖

Operating System: 🐧 🪟 🤖
(Linux, Windows, Android)

Packages: 📦 🔧
(APK, Docker)

Cloud Installation Support ☁️

API Tool Support 🔧

Web Interface Support 🌐

Volumetric Video Experiences with MPEG V3C
Reference Tools, what is being implemented?

Content Playback & Rendering

- A **Unity package** (rt-v3c-unity-player) is provided to decode and play V3C contents in Unity. The V3C Player can render in real-time 2D and volumetric video format : MPEG-I V-PCC, MPEG-I MIV.

- The Unity player uses the **decoder plugin library** (rt-v3c-decoder-plugin). Also provided in that repository are V-PCC and MIV (MVD and MPI) synthesizers plugins needed for the rendering of the V3C contents.

- The V3C Player will help developers to get started with standardized technologies and their integration into 5G-MAG
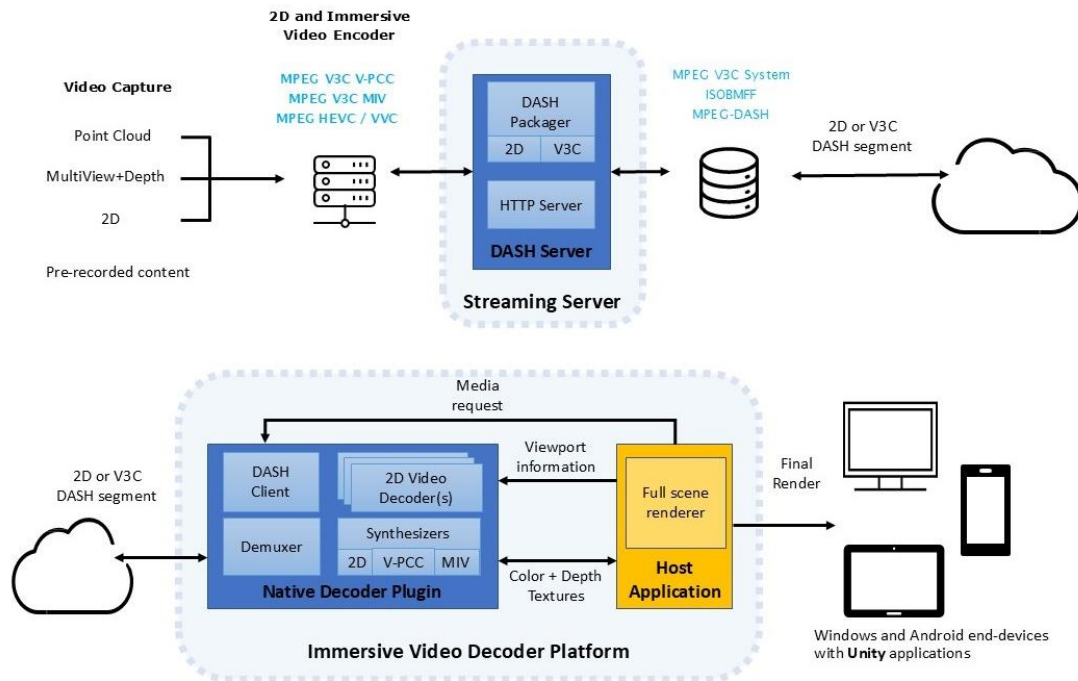
Content Streaming

- MPEG-DASH is an international standard widely used for 2D VOD streaming
- MPEG-I/V3C Carriage adds V3C support to MPEG DASH

Volumetric Video Experiences with MPEG V3C
Reference Tools, what is being implemented?

**Ingest pre-recorded 2D and Volumetric Video content
Real-time streaming and rendering**

Volumetric Video Experiences with MPEG V3C
Reference Tools, what is being implemented?

- A V3C simple player (Unity application) is available to visualize volumetric video contents and dynamically interact with them
- V3C test contents are provided for V-PCC, MIV MVD and MIV MPI

Content Courtesy from XD productions, Philips, InterDigital

V-PCC test content - Soccer Red
- Point cloud frames quantized to 1024-sized cube
- 60 4K cameras hemispheric rig
- 32 frames at 25 FPS
- Dynamic point cloud object
- **Encoded with V-PCC test model R24.0**
- Profile HEVC Main10 V-PCC Basic Rec0
- **XD Productions Content**

MIV MVD test content - DanceB
- Acquired using 6 physical cameras
- Estimation of depth maps, object label maps, and background view.
- 128 frames at 15 FPS
- Geometry, Texture and Transparency atlases
- **Encoded with MIV test model v19.1**
- HEVC Main10 MIV Extended Level 2.5
- **Philips content**

MIV MPI test content - Mannequin
- CGI content recorded in Unity
- 15 FHD virtual cameras in Unity
- 32 frames at 25 FPS
- Texture and Transparency atlases
- **Encoded with MIV test model v19.1**
- Profile MIV Extended MPI
- **InterDigital content**

REFERENCE TOOLS />

Volumetric Video Experiences with MPEG V3C
Reference Tools, what is being implemented?

V3C Decoder Plugin with support of ISO/IEC 23090-5

- v0.5 :
  - added support error handling (nw access)
- v0.4 :
  - updated tools, build & doc, local and remote test content
- v0.3 :
  - support for V3C DASH streaming (Client) on Windows and Android
- v0.2 :
  - support of V3C MIV (MVD) bitstream defined in 23090-12,
  - support of Carriage of V3C data defined in 23090-10 (Windows)
- v0.1 : Initial version
  - V3C decoder and renderer of V-PCC bitstream defined in ISO/IEC 23090-5,
  - V3C MIV (MPI) bitstream defined in 23090-12,
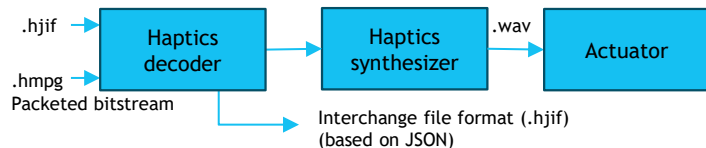 - local playback on Windows and Android
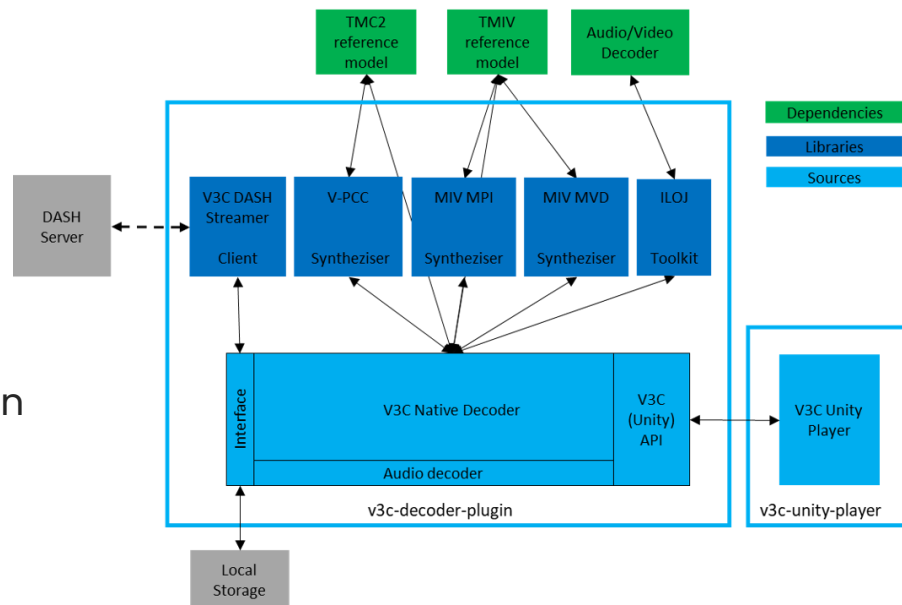
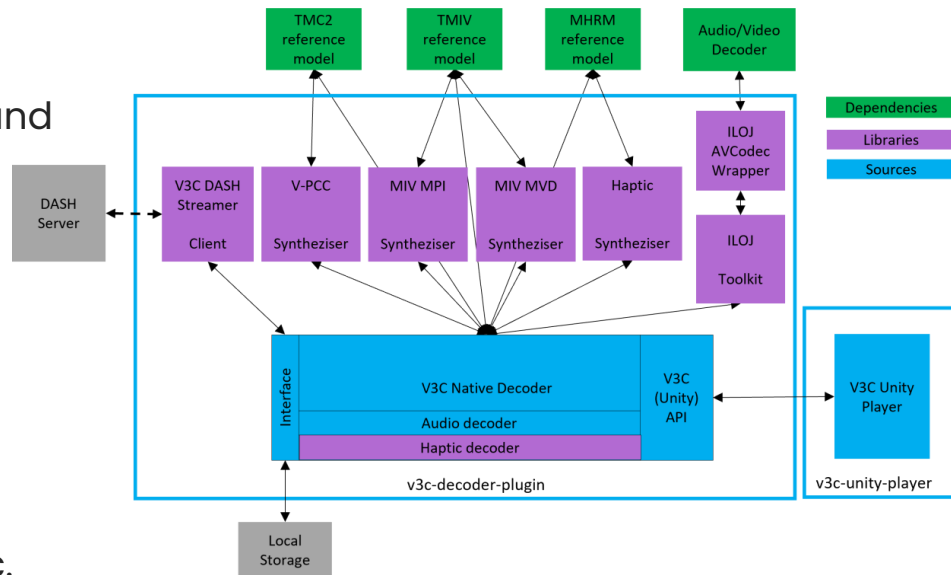# Volumetric Video Experiences with MPEG V3C
Reference Tools, what is being implemented?

V3C Decoder Plugin with support of ISO/IEC 23090-5

- V1.0:
- Add support for MPEG Haptics defined in ISO/IEC 23090-31 and Carriage of haptics data defined in ISO/IEC 23090-32:
  - Both .hjif and .hmpg file formats
  - Support for vibrations with time, duration and intensity.
  - Synchronized with the video.

- Modularization of the networking interface:
  - Plug-in for MPEG DASH
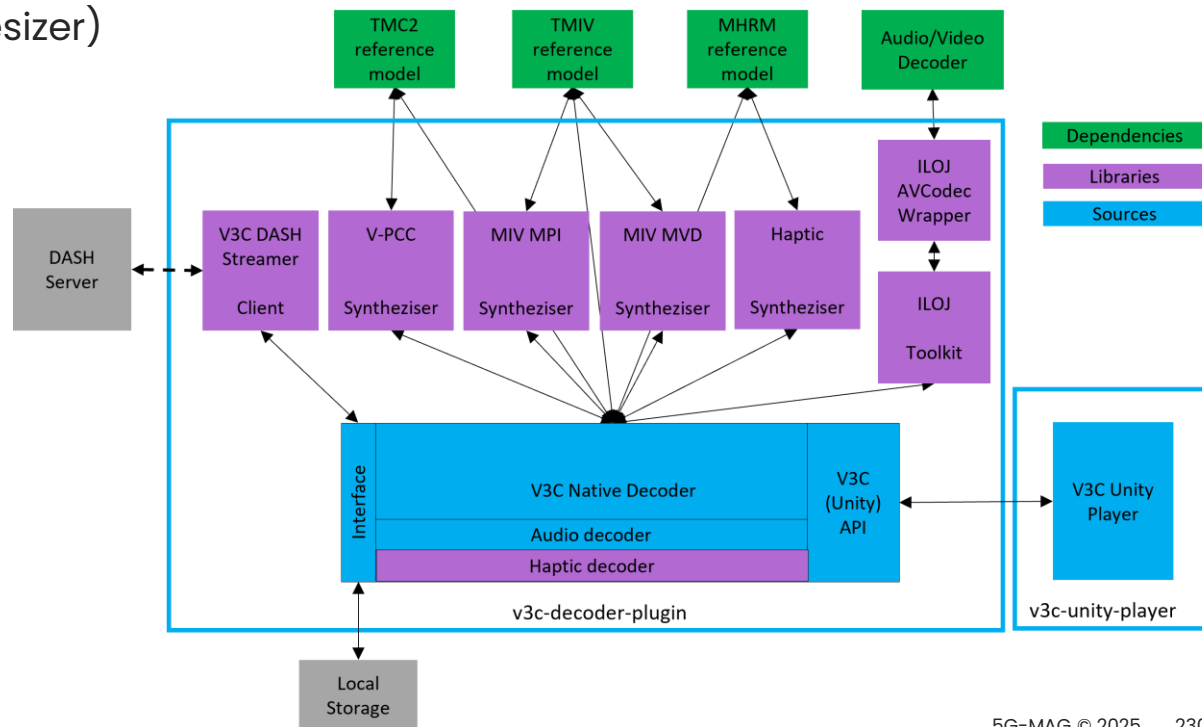 - Ability to add plug-ins for WebRTC, RTP, etc.

Volumetric Video Experiences with MPEG V3C
Reference Tools, what is being implemented?

V3C Decoder Plugin with support of ISO/IEC 23090-5

- V1.1:
- This release improves V-PCC rendering
- Adds source code for Haptic (decoder & synthesizer) and V-PCC (synthesizer)

Volumetric Video Experiences with MPEG V3C
Reference Tools, what is being implemented?

Under investigation

General improvements

- More, diverse, better content from multiple sources
- Better synthesizers

V3C Decoder Plugin

- Support for streaming of haptics data over DASH
- Support for real-time protocol, e.g. RTP, WebRTC
- Support for additional synthesizer, e.g. V-DMC

V3C Unity Player – advanced scene (VR/AR)

- Support for advanced use case, e.g. AR, XR
- Support for new devices, e.g stereoscopic Head Mounted Display (HMD)

5G-MAG RT Integration

- Link between XR and V3C?
- Link between 5GMS and V3C?
- Link with FS_Beyond2D evaluation framework

Volumetric Video Experiences with MPEG V3C
Reference Tools, what is being implemented?

Check our Tutorials and join the Developer Community
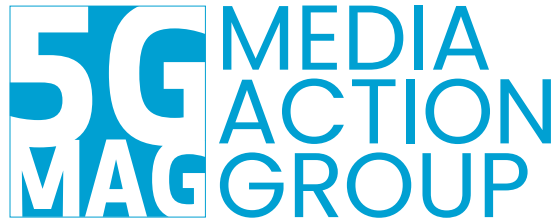How to use the tools? Check the GitHub Tutorials
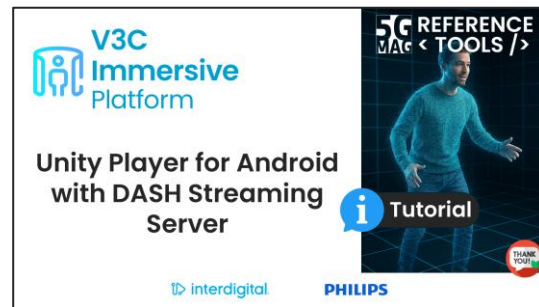
Volumetric Video Experiences with MPEG V3C
Reference Tools, what is being implemented?

5G-MAG Reference Tools in action

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