standICT.eu 2026

ICT Standardisation Observatory and Support Facility in Europe

MPEG Technologies for CitiVerse

Marius PREDA,

MPEG 3D Graphics and Haptics Convenor

Funded by the European Union

What we would like to have

Realistic digital content

Natural visualization

Interactive and enriched digital content

Multi-user experiences

What we would like to have

Realistic real-to-virtual-to-real mapping

Natural visualization and interaction

High definition digital content

On-line and highly connected

What we really have

Where are we today?

- Is there a genuine demand for immersive applications?

- Is achieving realistic immersion technically feasible with current technologies?

Where are we today?

Immersive technologies occupied researchers since 1950, now, this goes beyond the research community!

Big and small companies, standardization organizations, public actors become all interested by Immersive Technologies

MPEG offer for Metaverse

- What is already known: experiences in metaverse (and its variations) requires a lot of data that must be “moved” through different networks

- MPEG “Coding of 3D Graphics and Haptics” WG
  - Continue the activity of the MPEG 3DG subgroup created in 1996
  - Focus on compression of 3D graphics data (objects, avatars, scenes)
  - Developed application formats for augmented reality (MPEG-ARAF), virtual worlds (MPEG-V), interaction between real and virtual (MPEG-U), immersive content (MPEG-I)

MPEG offer for Metaverse

1992/4 — MPEG-1/2 (AV content)

1997 — VRML

1998 — MPEG-4 v.1

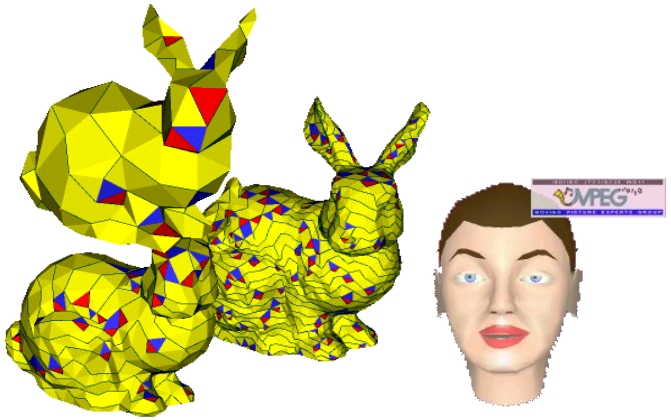
- Part 11 - BIFS:
  - -Binarisation of VRML
  - -Extensions for streaming
  - -Extensions for server command
  - -Extensions for 2D graphics
  - - ***Real time augmentation with audio & video***
- Part 2 - Visual:
  - - 3D Mesh compression
  - - Face animation

ISO/IEC 14496-2

1999 — MPEG-4 v.2

- Part 2 – Visual
  - - Body animation

First form of broadcast signal augmentation



MPEG offer for Metaverse

2003 2004 2005 2007 2009 2011

MPEG-4

- **Part 16 - AFX:**
  - **A rich set of 3D graphics tools**
  - **Compression of geometry, appearance, animation (including skinning)**

MPEG-4

- **AFX 2nd Edition:**
  - **Animation by morphing**
  - **Multi-texturing**

ISO/IEC 14496-2

MPEG-4

- **AFX 3rd Edition**
  - **WSS for terrain and cities**
  - **Frame based animation**

MPEG-4

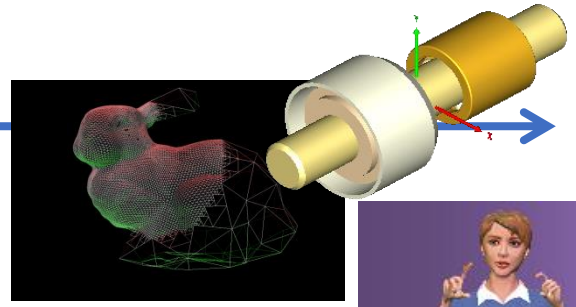
- **Part 16**
  - **X3D Interactive Profile**

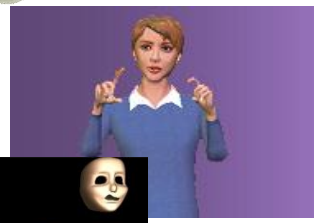
MPEG-4

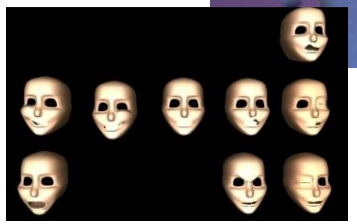
- **Part 25**
  - **Compression of third-party XML (X3D, COLLADA)**

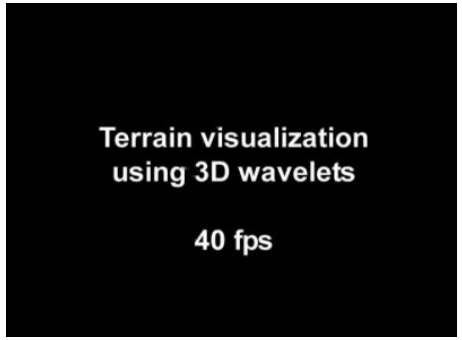
MPEG-4

- **AFX 4th Edition**
  - **Scalable complexity mesh coding (including TFAN)**









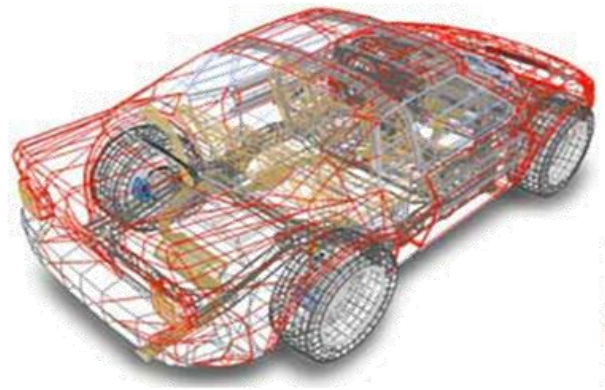
ISO/IEC 14496-16

MPEG offer for Metaverse

2011

MPEG-4

- **Part 16 - AFX:**
  - **AMD 1**
  - **Efficient representation of 3D meshes with multiple attributes**



ISO/IEC 14496-16

2014

MPEG-4

- **AFX AMD2:**
  - **Multi-resolution mesh coding**

2014

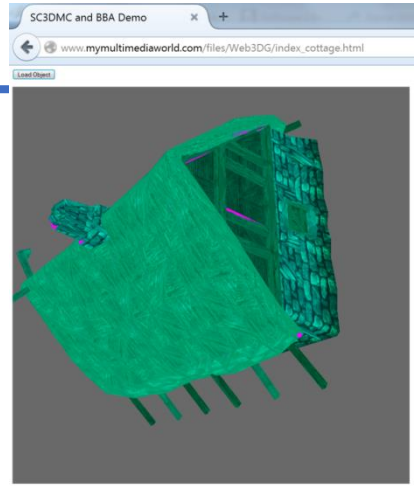
ISO/IEC 23002-4

- **Graphics Tool Library**

2016

MPEG-4

- **AFX AMD3**
  - **Printing material and 3D graphics coding for browsers**



MPEG offer for Metaverse

2020 2021 202x 202x 202x 202x

MPEG-I

- **Part 5 – V-PCC:**
  - **Video based point cloud coding**

realistic 3D humans

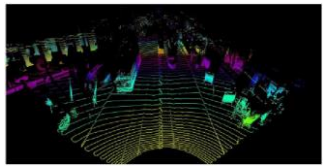
MPEG-I

- **Part 9 G-PCC:**
  - **Geometry based point cloud coding**

realistic environments

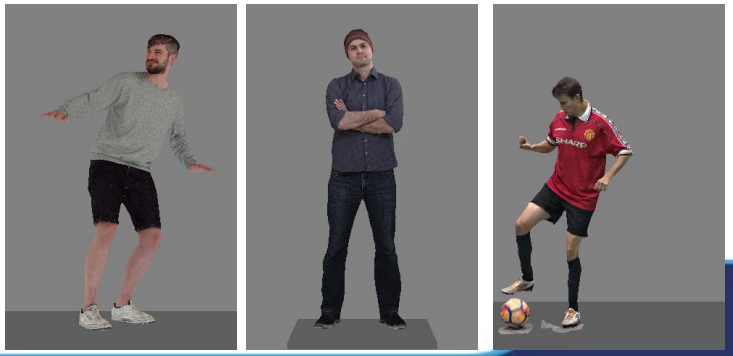
MPEG-I

- **Part 28: LiDAR data compression**



MPEG-I

- **Part 29: Video-based dynamic mesh compression**



MPEG-AI

- **AI-based graphics compression**

MPEG-I
Part 31: Haptics Coding

realistic interaction

ISO/IEC 23090-5, -9, -28, -29

MPEG offer for Metaverse

2011

MPEG-V - Media Context and Control
- 1st Edition
  - Sensors and actuators
  - Interoperability between Virtual Worlds

2012

MPEG-U – Advanced User Interface

2013

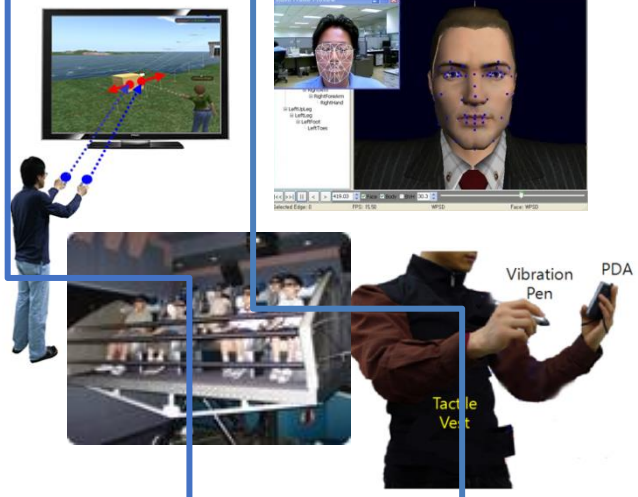
MPEG-V
- 2nd Edition:
  - GPS
  - Biosensors
  - 3D Camera

2016

MPEG-V
- 3rd edition:
  - additional sensors and actuators

2017

MPEG-ARAF
- Augmented Reality Application Format



2018

MPEG-V
- 4th edition:
  - Binarisation

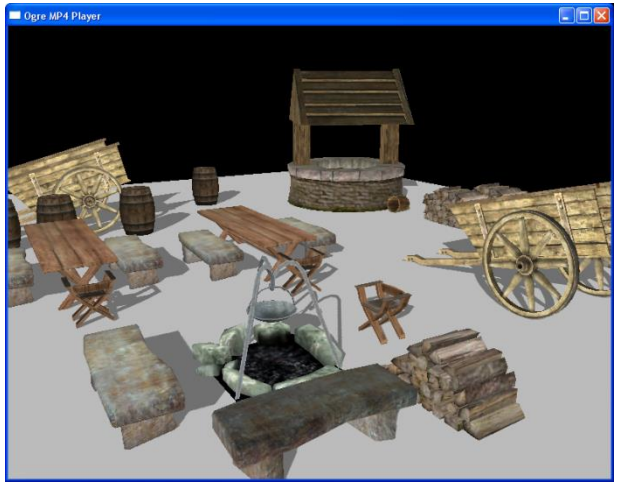
- A full set of Sensors and Actuators data formats to enrich multimedia experience
- API extension: MThings

ISO/IEC 23005

MPEG offer for Metaverse

MPEG-V: digital assets exchange btw virtual worlds

Generic Virtual Objects



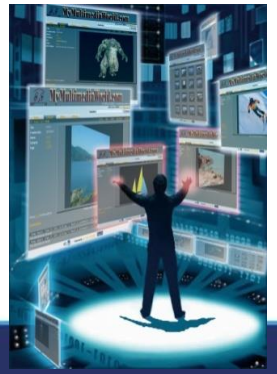
ISO/IEC 23005

Avatars

Container for personal data, personality, skills, …

Communication support between users

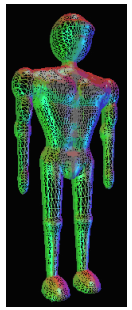
Interaction support between the user and the virtual environment

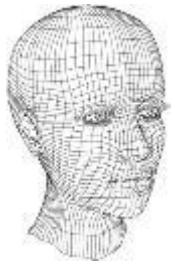


Conclusions

- MPEG 3DGH developed in the last 2 decades (and continues to do it) a rich set of technologies for representing, in a compressed form, various types of 3D assets (ready to be integrated in metaverse)
- MPEG 3DGH developed one of the first world standards – MPEG-V, that addressed interoperability between virtual worlds, and one of the first world standards – MPEG-ARAF, that allows to represent full AR experiences
- MPEG 3DGH is focused now on compressing data captured from real world(s) (when compression matters)
- MPEG 3DGH is looking forward to cooperate with other SDO groups to address the challenges of interoperability in Metaverse;
  - the digital television example from early 90' can be followed

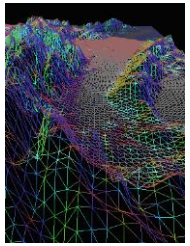
Thank you















- **MPEG 3DGH is**

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KDDI
KETI Korea Electronics Technology Institute
Canon
InterDigital
technicolor
LG
NOKIA
orange
Fraunhofer
SHARP
ByteDance

Usage of MPEG standards

1.Consumer Electronics: Most devices that play video or audio, such as TVs, DVD players, Blu-ray players, home theater systems, and digital radios, employ MPEG standards for decoding and playback.
2.Broadcasting: Many television broadcasters, both terrestrial and satellite, use MPEG standards to transmit digital video and audio to consumers.
3.Online Streaming: Websites like YouTube, Netflix, Amazon Prime Video, and Hulu use MPEG-derived codecs for streaming video content.
4.Software and Operating Systems: Media players like VLC, Windows Media Player, and others implement MPEG standards to play back media files. Operating systems like Windows, macOS, and Linux also have built-in support for MPEG media playback.
5.Mobile Devices: Smartphones and tablets use MPEG standards for video playback, recording, and streaming. This includes devices running on iOS, Android, and other mobile platforms.
6.Gaming Consoles: Platforms like the PlayStation, Xbox, and Nintendo Switch support MPEG standards for video playback, whether in games, movies, or other media applications.
7.Cameras and Camcorders: Many digital cameras and camcorders use MPEG standards, especially when recording video.
8.Video Conferencing: Platforms like Zoom, Microsoft Teams, and Skype might employ MPEG standards or derivatives for video and audio encoding and decoding during real-time communication.
9.Physical Media: DVDs, Blu-rays, and some older formats like Video CD (VCD) utilize MPEG codecs for video and audio storage.
10.Internet: Websites that host video or audio content, or software applications that play such content, usually support MPEG standards.
11.Content Creators: Professionals in the film, television, and music industries use MPEG standards when editing, storing, or distributing digital content.
12.Communication Providers: Companies that offer video-on-demand (VOD) or IPTV services often rely on MPEG standards.

MPEG has created various standards over the years (e.g., MPEG-1, MPEG-2, MPEG-4 Part 2, MPEG-4 Part 10 or H.264/AVC, MPEG-H Part 2 or H.265/HEVC, and more). Different applications might use different versions of these standards depending on the specific requirements.

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