

# A Method for Encoding and Decoding Multi-Sensory Media Streams

Encoding multi-sensory media streams using dynamic adaptive streaming over HTTP

Reference: Multi-Sensory



*Image provided by university*

## IP Status

Patent application submitted

## Seeking

Development partner, Commercial partner, Licensing, University spin out

## About **Dublin City University**

Dublin City University (DCU) aims to transform lives and societies through education, research and innovation. Research and Innovation at DCU stems from the academic excellence of its four faculties coupled with a passion for translating knowledge into innovations for economic or societal benefit.

# Background

This invention demonstrates the feasibility of adaptive rich media streaming, to create an immersive multimedia environment that stimulates user experience with multiple media elements engaging three or more human senses (sight, sound, touch and smell) and allows content adjustment in existing delivery networks.

Multimedia is mostly composed of audio and video, and very seldom text, targeting two human senses only. Multi-sensory Media (mulsemedia) refers to the combination of multimedia objects (video and audio) and components targeting other human senses such as touch, smell, and taste.

Current mulsemedia applications may use two standards designed by the Moving Picture Experts Group (MPEG): MPEG-7 (ISO/IEC 15938) and MPEG-V (ISO/IEC 23005). MPEG-7 is designed to describe multimedia content data, whereas MPEG-V is designed to interface with virtual worlds. Current mulsemedia distribution is performed mostly locally. The few networked-enabled solutions proposed employ a one-solution-fits-all approach or require specific protocols for content delivery and do not support the widely used HTTP protocol.

The state of the art focuses on the emerging communication technologies which enrich user perceived QoE by involving media stimuli which target vision, auditory, tactile, olfaction, gustatory and other human senses. Therefore state of the art research and development is focused on finding ways to overcome many existing challenges in acquiring, storing, displaying and exchanging mulsemedia content and propose solutions to address them.

However, there are still challenges related to using mulsemedia, including synchronization with the traditional multimedia content and delivery over diverse network environments.

Hence there is an unresolved and unfulfilled need for a method and system which provides multiple media elements to mulsemedia content in order to engage three or more human senses (i.e. sight, sound, touch and smell), performing adaptive delivery of mulsemedia, adjusting its transmission to existing network conditions and synchronizing the presentation of its diverse components in order to create an immersive mulsemedia environment that increases quality of user experience (QoE).

## Tech Overview

The present invention encodes Multi-sensory Media or mulsemedia streams using dynamic adaptive streaming over hypertext transfer protocol (DASH)-based adaptive rich media delivery solution (DASH-ARM).

The system for encoding/decoding a mulsemedia steam comprises a web server 301 and a plurality of devices capable of rendering mulsemedia content e.g. the device 302.

In one embodiment the web server 301 comprises a processor 301a, a memory and or databases(s) 301b operatively coupled to the processor 301a and a transceiver 301c operatively coupled to said processor 301a. The

transceiver 301c receives a hypertext transfer protocol (HTTP) request from the device 302, said HTTP request comprising one or more of a segment information, the device capabilities, and/or user experience feedback from a user of the device. Based on the HTTP request received from the device 302 the processor 301a encodes the multi-sensory media presentation description (Mulse-MPD) data stream. The Mulse-MPD data stream comprises a plurality of period structure segments 102. Each of the plurality of period structure segments 102 comprises a start time in reference to the beginning of the mulsemedia stream and the duration of the mulsemedia stream. Further each of the plurality of period structure segments 102 comprises a plurality of mulse-adaptation segments 103. Each mulse-adaptation segment 103 comprises a type of the mulse-adaptation segment, a universal resource locator identifying the base location of mulsemedia data, and a plurality of representation segments 104. Each representation segment 104 comprises an intensity level of the multi-sensory effect to be caused by the device 302 and a plurality of mulsemedia segments 105. Each mulsemedia segment 105 comprises a flag indicating whether said mulsemedia segment 105 is full or empty, an offset time in reference to the beginning of the mulsemedia segment 105 and a relative universal resource locator with reference to the base location identifying the mulsemedia content.

Further the processor transmits the encoded multi-sensory media presentation description (Mulse-MPD) data stream to the device 302 using the transceiver.

In one embodiment the client or device 302 comprises a processor 302a, a memory and or databases(s) 302b operatively coupled to the processor 302a, a transceiver 302c operatively coupled to said processor 302a and a plurality of output devices 302d operatively coupled to the processor 302a. The transceiver 302c of the device 302 is configured to transmit a hypertext transfer protocol (HTTP) request to the web server 301, said HTTP request comprising one or more of a segment information, the device 302 capabilities, and/or user experience feedback from a user of the device 302. Further, the transceiver 302c of the device 302 is configured to receive a multi-sensory media presentation description (Mulse-MPD) data stream from the web server 301 in response to the request.

The processor 302a of the device decodes the multi-sensory media presentation description (Mulse-MPD) data stream. Further, the processor 302a is configured to cause said one or more output devices 302d to provide sensory stimulus to the user of the device based on the decoded multi-sensory media presentation description (Mulse-MPD) data stream.

Thereby, the present invention provides a method and system for performing adaptive delivery of mulsemedia, adjusting its transmission to existing network conditions and synchronizing the presentation of its diverse components in order to create an immersive mulsemedia environment that increases quality of user experience (QoE).

## Benefits

The solution introduces some important and novel concepts such as the decomposition of effects in segments of different types, “Mulsemedia Representation” and the most important one: the “Mulsemedia MPD”.

Mulsemedia MPD inspired by MPEG-DASH inherits the XML-based hierarchical architecture which provides the flexible and reliable content organization for different sensory effects, quality/intensity levels, adaptation sets and play periods. However, different from the XML-based description formatting of sensory information in MPEG-V and MPEG-7 media segment, the JSON-based encapsulation is exploited for the mulsemedia segments associated with the Mulsemedia MPD. JSON's speed outperforms XML's speed when a large number of objects encoded in JSON/XML are transmitted during the same duration.

Otherwise, DASH-based Adaptive Rich Media Delivery Solution solved the synchronization problem between multi-sensory effect and multimedia information and make the synchronization delays rarely exceed  $\pm 0.07$  seconds.

## Applications

Potential Commercial Applications - 4D Cinema, Enhanced Gaming/VR/Education, Museums

This invention provides a method and system for performing adaptive delivery of mulsemedia, adjusting its transmission to existing network conditions and synchronizing the presentation of its diverse components in order to create an immersive mulsemedia environment that increases quality of user experience (QoE).

## Opportunity

This invention demonstrates the feasibility of adaptive rich media streaming, to create an immersive multimedia environment that stimulates user experience with multiple media elements engaging three or more human senses(sight, sound, touch and smell) and allows content adjustment in existing delivery networks.

## Patents

- GB1909157.8 filed on the 26/July/19

For Further Information please contact

Paddy O'Boyle  
ICT Business Development Director - DCU Invent  
paddy.oboyle@dcu.ie