Performance Analysis of Multi-Source Wireless Multimedia Content Delivery

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Introduction

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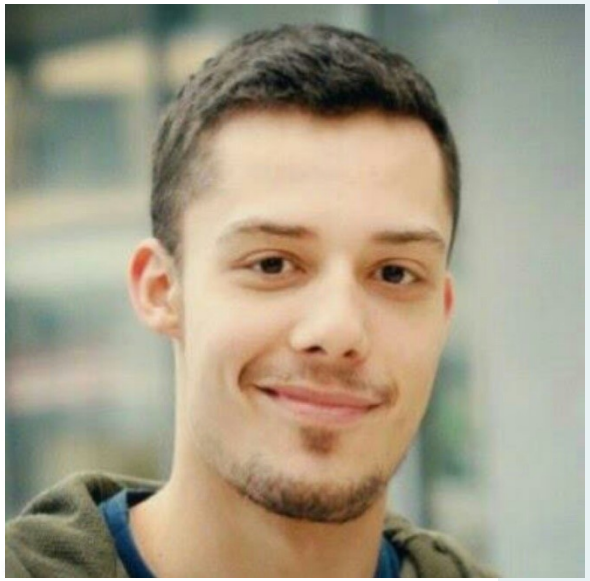

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TRACTION Partners

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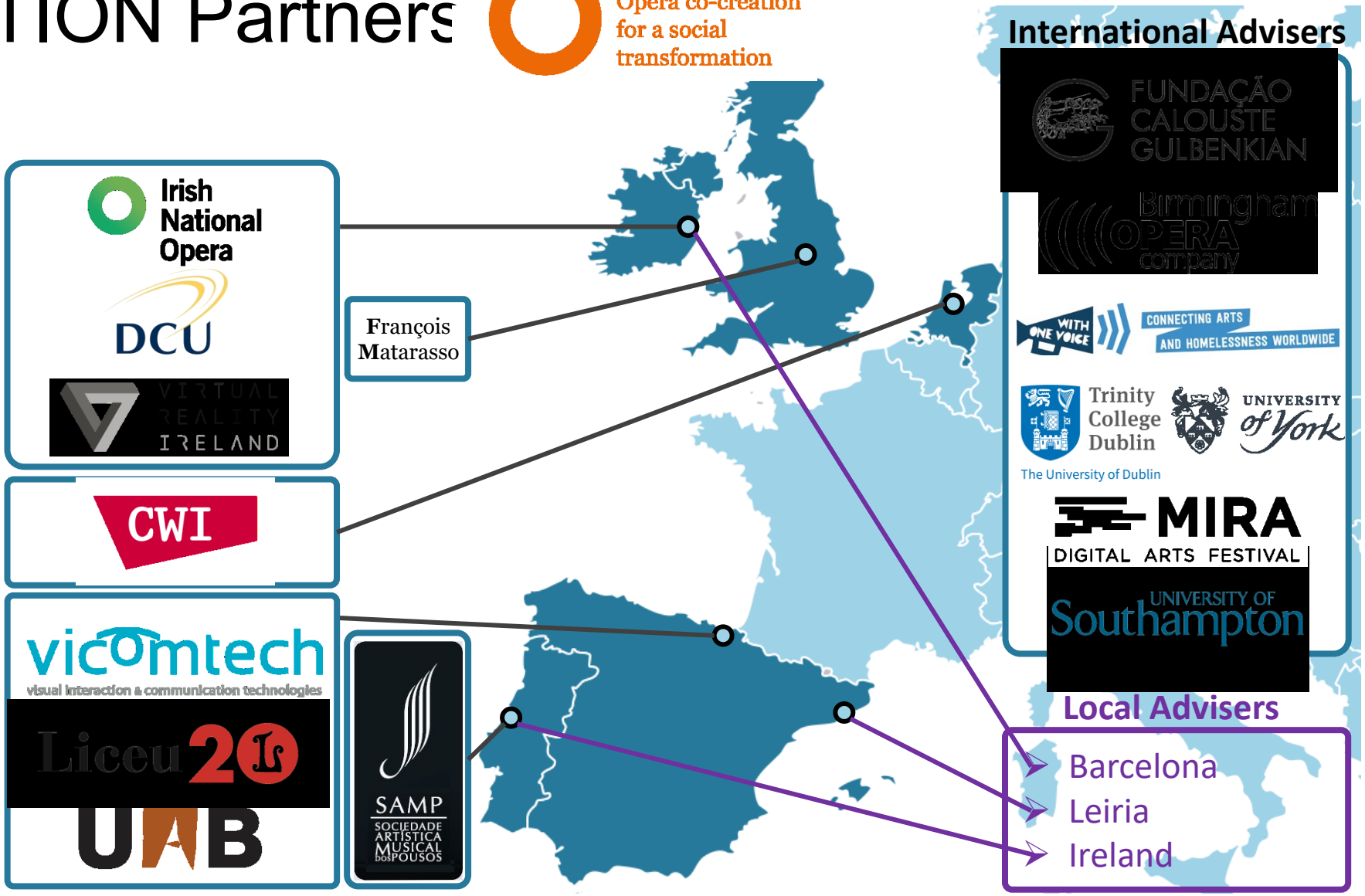


Motivation

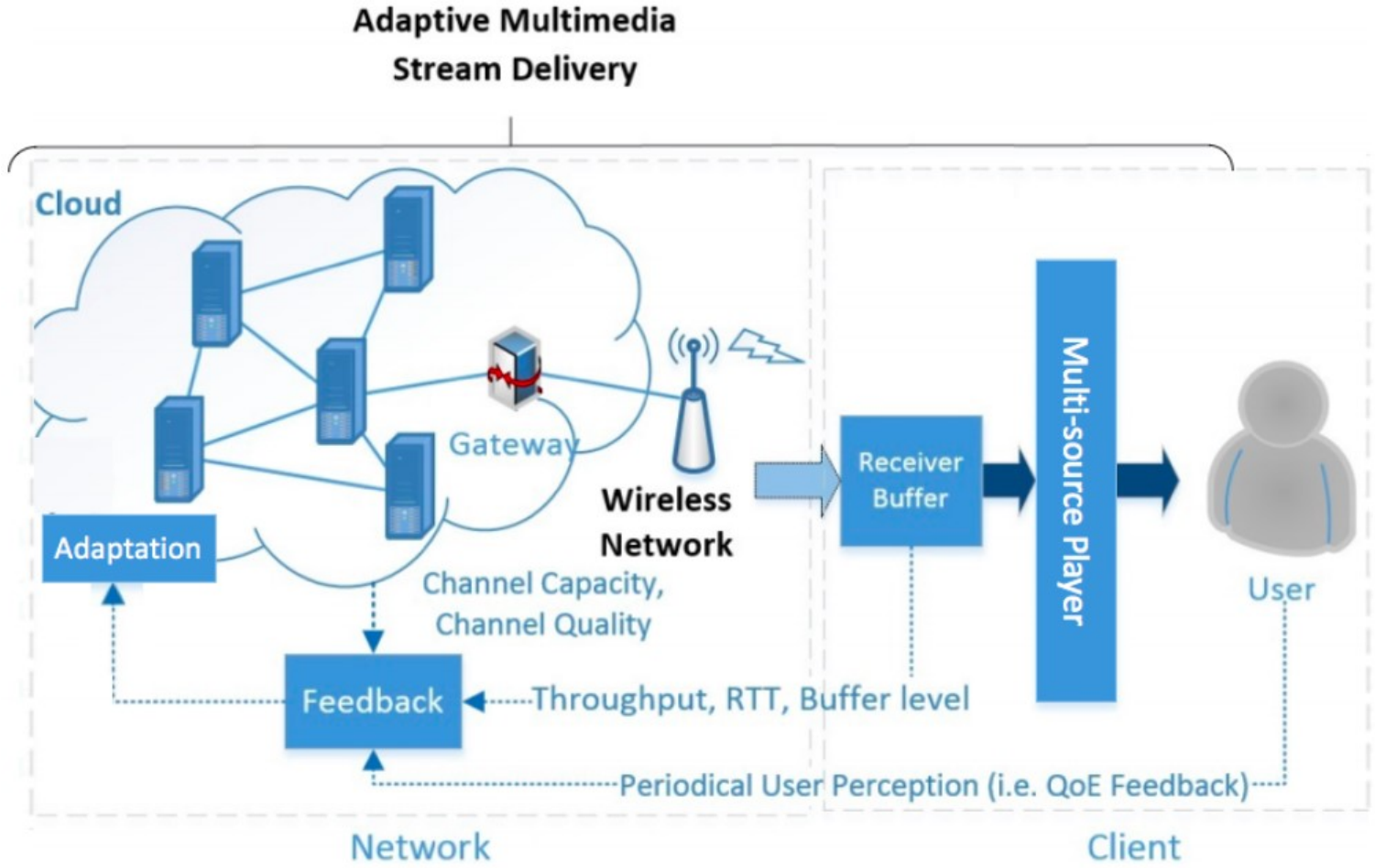
- The use of **multi-source streaming** can be useful for projects such as the European H2020 TRACTION project
- TRACTION aims to develop a **collaborative** and participatory production toolset, for the co-creation and co-design of operas, supporting:
  - community dialogue,
  - user-generated rich media capture,
  - immersive audiovisual and 360° content,
  - smart media editing,
  - narrative engines and
  - interactive adaptive media distribution.

Motivation

- Multi-source multimedia players must support, for instance, streaming of **multiple** pre-recorded recordings and live content from artists playing different instruments, merging the videos into one **single experience**, even when content is located in various locations.
- Other video elements that can be played **simultaneously** with a video stream include user feedback in video, commentators, and sign language interpreters.

Adaptive Multi-Source Delivery

- Some **metrics** can be used to adapt the content being delivered from multiple servers in the cloud.
- A receiver buffer helps the player **synchronise** the content, and the challenge is to present the content in similar quality.
- **Adaptation** can also be done at the servers, considering the feedback of the user, type of device consuming the data, and network conditions.



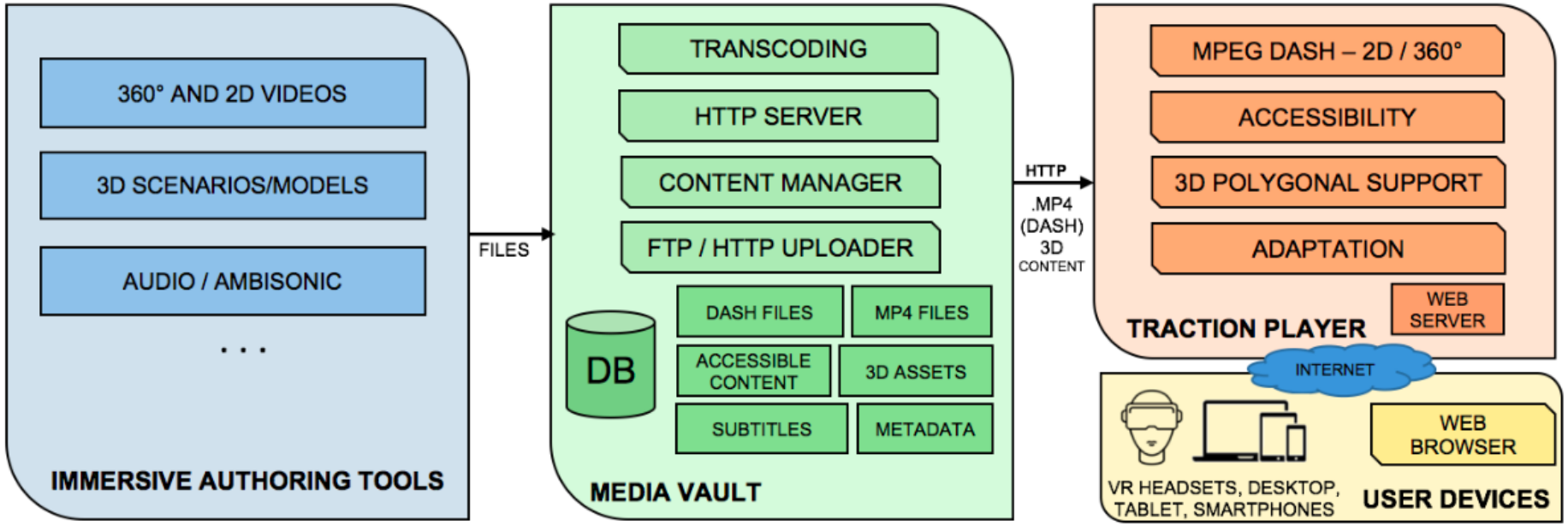
Challenges

- How devices can be analysed, in terms of **metrics**, when receiving multimedia content from multiple sources?
  - Networks and devices have constraints regarding **performance** and **video quality**.
  - This study is important for the development of novel algorithms and adaptation of video content.

The TRACTION Player

- The web-based **TRACTION player** is one of the technologies being developed in the TRACTION project to provide support to **immersive media from multiple sources** in a heterogeneous network with diverse types of devices.
- The player is aimed to support a number of types of media. E.g.:
  - Adaptive MPEG-DASH 2D and 360° 3D content;
  - Immersive polygonal content such as WebXR;
  - Ambisonics 360° audio;
  - Accessibility assets (e.g. sign language, subtitles)

The TRACTION Player



Assets are uploaded to the **Media Vault**, with multi-source capabilities and tools for the management of the content and its metadata as well as for download/upload of immersive applications and assets, storing of accessible content, streaming of 360° and 2D video (HTTP and FTP), transcoding of content into different resolutions and into MPEG-DASH.

Performance and Quality Metrics

- Player should support **novel adaptive algorithms** and schemes based on device, user and network requirements, allowing multiple concurrent users located in areas with limited Internet bandwidth and with a variety of devices to access and produce content at higher quality, even in constrained environments

- Assessment of Quality of Service (**QoS**) and Quality of Experience (**QoE**) metrics for content delivery at higher quality given network constraints.
  - QoS metrics are related to data transport and network parameters, such as packet loss, delay, jitter, round trip time, etc.
  - Peak Signal to Noise Ratio (PSNR), used to measure the quality of video reconstruction during video compression.
  - QoE metrics focus on the quality perceived by users.

Performance and Quality Metrics

- Content encoded in the **MPEG-DASH** standard can be adapted by the use of several **algorithms**. These algorithms make the use of metrics and schemes such as:
  - Stateful bitrates, bandwidth estimations, QoE models and Markov Decision Process (MDP).

- Adaptation based on **resolution** and **region of interest** can improve quality of the video. Based on user interest obtained from eye-tracking monitoring, quality of those regions from the multimedia frames the viewer is the least interested in is adjusted, if necessary, due to network conditions.

- 360° VR videos and the underlying 3D geometry can be also divided into spatially partitioned **segments/tiles** in the 3D space, and be adapted with more or less priority, according to the regions the user are more likely to look,

- **Colour** can also be improved. In certain areas (e.g. dark footage of the audience in a theatre), quality can be decreased as users are not interested in seeing it. On the other hand, colour quality of the stage can be improved with increased brightness and contrast.

Conclusion and Future Work

- The TRACTION player aims to support **content from multiple sources** and deliver it in a unified **web application** that supports immersive content, such as 360° videos and 3D environments.
- This web application is intended to be used in **several devices** with **different network and video requirements**, therefore, metrics for **adaptation** of content and performance analysis were presented.
- The TRACTION project is working to build a player that supports immersive media, includes **algorithms** for content adaptation and processes **3D models**.
- Other features to be considered include **intelligent annotation** of faces, images and audio, as well as inclusion of novel user experiences, such as the integration of **olfactory** and **gestural** technologies.

Thank you for your attention

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