360° VIDEO CLOUD STREAMING & HTMLVIDEOELEMENT EXTENSIONS

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360° video cloud streaming

https://www.fokus.fraunhofer.de/go/360
360° STREAMING AND VIDEO PROCESSING OPTIONS

Option 1

Server

Streaming

360° Processing

Video Playback

Client

Option 2

Server

360° Processing

Streaming

Video Playback

Client

Option 3a

Server

360° Pre-Processing

Prepare Video

Streaming

Video Playback

Client
360° STREAMING AND VIDEO PROCESSING OPTIONS

Option 1
- Server: Streaming
- Client: 360° Processing
- Video Playback

Option 2
- Server: Streaming
- Client: 360° Processing
- Video Playback

Option 3b
- Server: Streaming
- Client: 360° Pre-Processing
- Prepare Stream
- Video Playback
## ADVANTAGES AND DISADVANTAGES

<table>
<thead>
<tr>
<th>Option1</th>
<th>Option2</th>
<th>Option3a</th>
<th>Option3b</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Additional Storage</strong></td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>360° Video Processing on Client</strong></td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td><strong>360° Video Processing on Server</strong></td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>Bandwidth</strong></td>
<td>High</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td><strong>Motion-to-Photon Delay</strong></td>
<td>Low</td>
<td>Medium³</td>
<td>Medium³</td>
</tr>
<tr>
<td><strong>CDN usage</strong></td>
<td>Yes</td>
<td>No⁵</td>
<td>No⁵</td>
</tr>
<tr>
<td><strong>Example Target Devices</strong></td>
<td>Head Mounted Displays</td>
<td>Low Capability Devices e.g. HbbTV</td>
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<tr>
<td><strong>Interaction Types</strong></td>
<td>- Motion Sensors</td>
<td>- TV RC</td>
<td>- TV RC</td>
</tr>
<tr>
<td></td>
<td>- Touch/Mouse</td>
<td>- Keyboard</td>
<td>- Keyboard</td>
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<tr>
<td></td>
<td></td>
<td>- (Touch/Mouse)</td>
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</tbody>
</table>

1. Medium³ represents a medium capability level.
2. Low² indicates low capability.
3. No⁵ denotes no capability.
5. Yes indicates the availability of the option.
1) The original 360° video will be pre-processed and FOVs are stored in separate files. There will be an overlap between the FOVs this is why there is a need for more storage but on the other side no video processing is needed.

2) since only one FOV is streamed to the client, no additional bandwidth is needed comparing to traditional video streaming. But it is still possible to pre-cache neighboring FOVs e.g. in lower quality to enable fast switch between FOVs in this case additional bandwidth is needed.

3) Motion to Photon delay depends on network latency and protocol used to stream a single FOV (and Buffering on the Player).

4) Motion to Photon Delay depends on the caching strategy of the player.

5) it is difficult to use CDN since a persistent connection between client and server is needed (there is a session for each client)
DEMONSTRATION (Option 3b)

4k origin 360° Video, 30fps, bitrate 40053 kb/s

HD view port, 30fps, bitrate 2435 kb/s, segment=333ms

- HTML5 Video Element (MSE)
- Intelligent/Efficient Buffering (two dimensions: time and space)
- No Canvas, WebGL or any other APIs are required

360° Pre-Processing

Prepare Stream (Caching)
Demo video
Two types of players:
- Native 360° Video Player
- Using MSE → do we need extensions for the MSE API?

Native 360° Video Player:
- The HTMLVideoElement plays 360° video natively. Set video.src={360_video_url} (or use <source element>)
- The HTMLVideoElement needs to get all the metadata in order to render the view correctly.
- New functions to set and get the FOV are needed
- New events on start, during and after changing the FOV are needed
- (Maybe also functions and events for Zoom in/out.)
- Example:
  - video.setFOV(phi, theta, width, height)
  - video.onfovstart, video.onfovend, ...
MSE 360° Player
- Allows to implement different player algorithms similar for DASH on top of MSE
- Available viewports can be described in a manifest (e.g. DASH SRD fields)
- At the start of the playback the currently selected viewport is buffered. When the user triggers a switch request for a different viewport, already buffered segments are removed/replaced by segments of the new viewport.

Challenge:
- How to reduce delay by switching between two viewports?