

Using 3D Bookmarks for Desktop and Mobile DASH-3D Clients

Thomas Forgione
thomas.forgione@enseeiht.fr
Université de Toulouse – IRIT
Toulouse, France

Axel Carlier
axel.carlier@enseeiht.fr
Université de Toulouse – IRIT
Toulouse, France

Géraldine Morin
morin@enseeiht.fr
Université de Toulouse – IRIT
Toulouse, France

Wei Tsang Ooi
weitsang@nus.edu.sg
National University of Singapore
Singapore, Singapore

Vincent Charvillat
charvi@enseeiht.fr
Université de Toulouse – IRIT
Toulouse, France

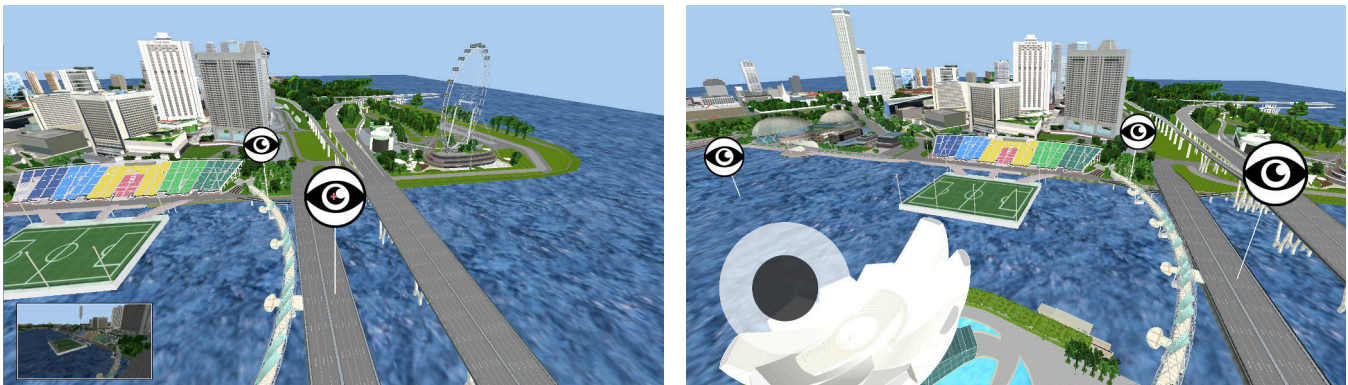


Figure 1: The interfaces that will be presented during the demonstration. On the left, a screenshot of the desktop version of the interface with a bookmark and its thumbnail, on the right, a screenshot of the mobile version with its virtual joystick.

ABSTRACT

Navigating in a 3D networked virtual environment with a six-degree of freedom on a mobile device can be disorientating and challenging to users. In this technical demonstration, we show how 3D bookmarks can be used to simplify such interactions. Our system integrates the 3D bookmarks into a DASH-based network virtual environment in a DASH-compliant manner and is available on both the desktop and mobile.

CCS CONCEPTS

• Information systems → Multimedia streaming; • Human-centered computing → Virtual reality.

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1 INTRODUCTION

Controlling a free camera in a virtual environment requires users to handle six degrees of freedom, leading to cumbersome interaction, especially when using a touch-based mobile device. We have previously demonstrated that 3D bookmarks can provide a decisive aid in navigating in a scene [1].

Recently, 3D models and scenes transmission has received a lot of attention. The Khronos Group has developed the glTF format (<https://www.khronos.org/glTF/>), in order to build a standard format for 3D compression and transmission. Cesium (<https://cesium.com/>) has developed Tiles 3D (<https://cesium.com/blog/2015/08/10/introducing-3d-tiles/>), another format built upon glTF to stream and visualize 3D cities. In a recent work, we have also showed that Dynamic Adaptive Streaming over HTTP (DASH, or MPEG-DASH), which is a widely used video streaming standard, can be efficiently used for streaming 3D content [2], in a format called DASH-3D.

In this technical demonstration, we will demonstrate an interactive networked virtual environment application that is based on DASH-3D and integrates 3D bookmarks in a DASH-compliant manner. In the next section, we briefly review the basic concepts of DASH and how we embed 3D bookmarks in DASH. In Section 3, we explain the challenges of the interaction for desktop and mobile devices and describe our interfaces. Finally, in Section 4, we present the setup of our demonstration.

```

1 <AdaptationSet>
2   <SupplementalProperty value="156.4909,1.6267,-146.2062,
3     157.43106,1.5476,-146.5379" />
4   <BaseURL>b1/</BaseURL>
5   <Representation>
6     <BaseURL>repr1/</BaseURL>
7     <SegmentList>
8       <SegmentURL media="thumbnail.jpg" />
9     </SegmentList>
10  </Representation>
11 </AdaptationSet>

```

Listing 1: The bookmark metadata in the MPD

2 BOOKMARKS IN DASH-3D

The client needs to be aware of the information contained in the bookmarks to display a 3D bookmark and correctly manage the interactions with the user. Since DASH [4] and DASH-3D [2] use a metadata file named Media Presentation Description (MPD) in order to give the user information about the content structure, it is the right place to add extra information about each bookmark. The MPD file stores this extra information as a supplemental property that gives 6 floating point numbers, which are the coordinates of the center and the target of the camera, as shown in the Listing 1. There is also a segment consisting of an image that represents a thumbnail of the scene from the bookmark point of view. We generate it during the precomputations for encoding the scene in a DASH-3D format.

3 3D INTERACTIONS

We implement the client in JavaScript and use THREE.js for rendering. This enables the full functionality of the client on almost any desktop devices and Android mobile devices. However, desktop and mobile devices have different input types: desktop interfaces mostly use keyboard and mouse, whereas mobile devices use the touchscreen, along with sensors such as the gyroscope [5]. For this reason, our interactive application behaves differently depending on whether the user is using a desktop or a mobile device.

3.1 Desktop interactions

Orbit controls are often used to visualize a single object [3]. However, these types of interaction fail to allow a user to navigate in a vast 3D scene. We handle the situation for our desktop interaction using a modified version of the traditional controls for first-person games, namely:

- W, A, S and D keys to translate the camera.
- mouse movements to change the orientation of the camera.
- mouse wheel to translate the camera in the vertical direction.

Furthermore, we add a small cross in the middle of the screen, which allows users to target bookmarks. When the cursor hovers over a bookmark, it becomes red to indicate to the user that he can click to trigger an interaction. The preview described in Section ?? appears in the bottom left corner of the screen. When the user clicks on a bookmark, the controls freeze temporarily, and the camera moves towards the point of view corresponding to the bookmark. We use linear interpolation for both the position and the angles of the camera.

3.2 Mobile interactions

We use the gyroscope to enable a user to turn his device to turn the virtual camera. We also add the possibility to turn the camera by drag 'n' dropping the scene. This way, the user is not forced to perform a real-world half-turn to be able to look behind or to keep its device pointing to the sky (which can quickly become tiring) to look up. These interaction do not allow the user to translate the camera. A small virtual joystick appears on the bottom left corner of the screen that the user can touch to translate the camera.

When the user touches a bookmark, the same behavior as the one described in the desktop section occurs. However, since the user cannot "hover" a bookmark, the thumbnails are neither displayed nor downloaded by the client.

4 DEMONSTRATION

During the demonstration session, the audience will be able to experience both desktop and mobile interfaces. We will bring a desktop with a mouse and a Galaxy S 5 device to let the public play with the interfaces. The server will be hosted on the computer, and both the desktop client and the mobile client will request the files from the computer. The computer will voluntarily limit its bandwidth to be able to see how interactions impact the streaming.

Also, the demo is available online for users to access it directly at <https://storage.tforgione.fr/dash-3.0.0/>. It automatically detects whether the device is a desktop or a mobile device and sets the interaction accordingly. This demo targets desktop devices (with Google Chrome / Chromium) and Android devices (with a recent version of Google Chrome). A video presenting this demonstration can be seen at the following address: <https://youtu.be/7HCggMA7Y9o>.

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