Study of 3D Web Technologies for Industrial Applications

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1 Introduction

This work presents the first steps of an active applied research project whose objective is to use 3D Web technologies in order to support the stages of the on-demand industrial products life-cycle (product customization, processes setup, and training). These applications presents two main requirements:

- High quality. The 3D render has to have a high quality in order to show faithfully industrial models, having also a good performance since these models are usually quite complex.
- Complex animations. The final application has to be able to execute complex animations that allow the representation of interactions between objects and materials.

Considering these requirements, this work analyses two of the most extended web3D platforms, O3D [O3D] and X3DOM [X3DOM].

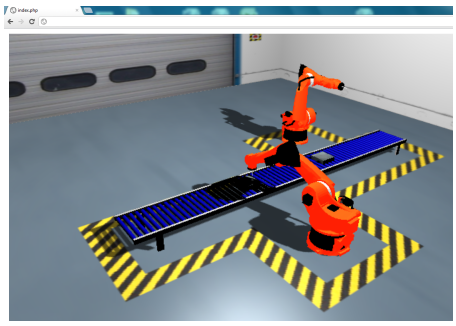


Figure 1: *Web3D industrial application.*

2 Evaluation of the Technologies

For the evaluation, two sets of benchark have been carried out.

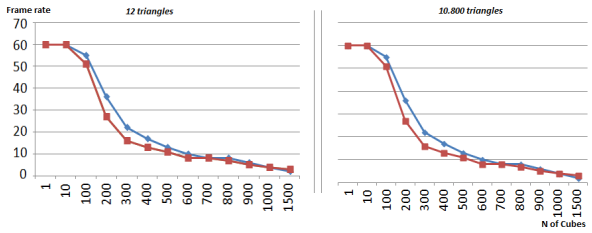
The first benchmark implies a complex scene with 15.000 geometrical nodes and their corresponding material nodes. Two cases have been defined: the worst case and the regular case.

The worst case is when all the scene is visible from the virtual camera and, therefore, frustum culling optimization can not be applied. The regular case is the 'usual' view, where only part of the scene is into the field of view. Results are shown in Table 1:

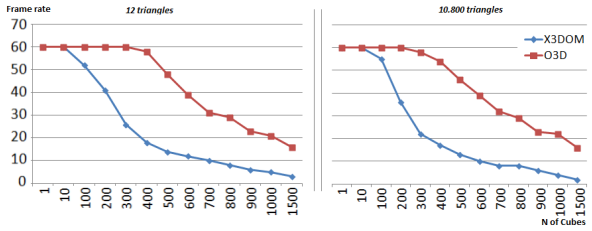
Table 1: *Results of the first benchmark.*

Case	X3DOM	O3D
Worst	2 fps.	2 fps.
Regular	2 fps.	28 fps.

The second benchmark consists on the creation of aleatory distributed cubes in the scene using transform nodes. Cubes include not only the geometry, but also textures and lighting. Two types of scenes were created: using cubes composed by 12 triangles, and using cubes composed by 10.800 triangles.



(a) *Worst case*



(b) *Regular case*

Figure 2: *Results of the second benchmark.*

As shown in Figure 2, the complexity of the geometry of the cube does not affect heavily to the application performance. The actual bottleneck is the number of nodes in the scene.

3 Conclusions

As general conclusion, it can be said that the declarative approach of X3DOM makes easier the generation of a scene. However, regarding to the requirements analised it can be concluded that:

- Performance. When there is possibility to apply frustum culling, O3D provides better frame rates.
- Animations. Crating simple animations is really easy with X3DOM. However, when complex animations have to be created, O3D offers a easier way of implementation, and also, due to the DOM structure of X3DOM, a better performance.

Regarding to WebGL, it has been demonstrated that the main bottleneck is placed in the JavaScript side. The low floating point performance combined with high memory latencies derive in an important frame rate drop when working with complex scenes. This fact is particularly important in industrial applications, since CAD models are usually composed by a lot of geometry nodes.

References

O3D. Webgl implementation of o3d - google project hosting. http://code.google.com/p/o3d/. Retrieved in June 2012.

X3DOM. http://www.x3dom.org/. Retrieved in June 2012.

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