FACULTY OF ENGINEERING
AND ARCHITECTURE

Augmented Reality visualisation on site: BIM semantics and communication

Linked Data

Master's dissertation submitted in order to obtain the academic degree of
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Short abstract

This is my short abstract.

Abstract

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Chapter 1

Introduction

1.1 Context

1.1.1 3D viewers

-> Applications?

-> Who uses them?

-> What for?

1.1.2 BIM geometry

The 3D model of a building consists of a multitude of sub-models, describing objects for all the different stakeholders participating to the porject. Some describe very large objects, and some very small parts. Both can be defined in there most simple and abstract form or have an intricate and complex geometry. As a basic example, can a door simply be defined as a box, or up to the level of the screw-thread for the hinge system. The level of abstraction is here described as the LOD and is most of the time pre-selected for the needs of a Building Information Modeling (BIM) model, and is applied throughout a single model.

As shown in figure 1.1, a standard BIM workflow goes through multiple fases each with there assosiated model and LOD. The LOD is a very important concept in the Architecture, Engineering and Construction (AEC) industry, as it allows for a very efficient workflow. Approaching the modeling step from a top-down perspective, starting with rougher geometries descriving the rougher ideas of a concept model and evoluting to a more refined model for the construction fase. As last and longest standing model, can a higher LOD be used to describe suttle changes in the evolution of a building.

This amount of data, both accounting for the

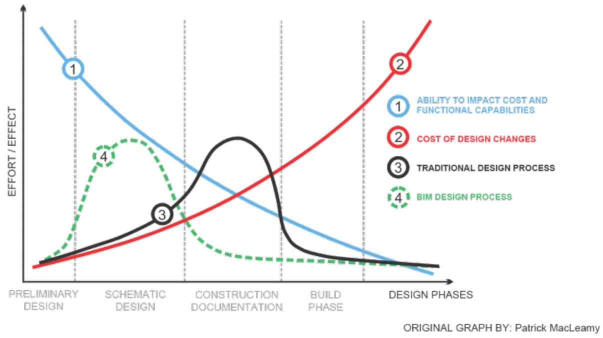

Figure 1.1: Evolution of LOD during the life-cycle of a building.

-> Some data BB models

1.1.3 LDBIM

-> Own definition of Linked Data BIM (LDBIM)

The interconnectivity of semantics can also be applied to geometry descriptions. Which could allow the co-existance of multiple LOD's in a single model. Besides storing the evolution of an single element's geometry, it allows the linking of the different LOD's to each other. In contrary to a standard BIM models, as explained in 1.1.2.

1.1.4 Computing power dilemma

The enrichment of the LDBIM-graph also comes with a cost. The amount of data that needs to be stored and processed is much larger than a standard BIM model. Viewers greatly suffer from enrichment as most standard applications require the full model to be loaded in memory.

-> What is the hardware problem?

-> Why is it that important for the AEC industry?

1.2 Research questions

-> Why the need for this thesis? (why a LDBIM viewer?)

-> What is the possible solution? (Culling algorithms)

-> Why the need for research questions? (culling algorithms are not new, always progress, see later)

1.2.1 To which extent can LDBIM geometry be culled to be streamed to lightweight viewers?

-> What can be culled exactly?

-> What needs to be streamed?

-> What is the impact of culling on the viewing experience?

1.2.2 Can existing semantic and ontologies be used to feed possible culling algorithms?

-> What are ontologies?

-> Can GIS ontologies be used too?

-> What are the advantages of using ontologies?

1.3 Research objectives

1.3.1 Bring forward the advantages of LDBIM for visualization of big 3D models

-> Showcase that existing models are already mature enough for these usecases.

->

1.3.2 Showcase the fisability of LDBIM for visualization of big 3D models

->

Chapter 2

State of the art

2.1 Software and hardware

-> Both explanation as highlighting the problems

-> About the CPU problem (explanation in following two examples)

-> Overview of on the market software and hardware solutions

-> Why lightweight viewers

2.1.1 Autodesk Atom headset

-> Explanation of the hardware

-> Highlighting the visible problems / limitations

-> Presenting HHD as the solution / alternative

2.1.2 Unreal Engine

-> Explanation of the software

-> Highlighting the RAM problem and how it's related to the aec industry

-> Use cases (model type and size)

2.2 Viewers

2.2.1 File based viewers

-> What I mean by file based viewers

-> Present it as some examples of cutting edge viewers, both from there intensive use in the industry as the quality of the results / technologies

2.2.1.1 BIM360 Autodesk

-> Why I chose this one (why special)

-> Overview of the features / capabilities

-> Probably present it as a goal but in the older framework (for interactivity)

2.2.1.2 Qonic

-> Why I chose this one (why special)

-> LOD streaming principle

-> Probably present it as a goal but in the older framework (for effectiveness(esthetics and performance))

2.2.2 Linked data based viewers

-> What I mean by linked data based viewers

2.2.2.1 ld-bim.web.app

-> Where does it come from

-> Detailed explanation of the features / capabilities

-> Detailed fragmentation of missed opportunities / how this thesis positions itself to it

Chapter 3

Culling approaches

3.1 AEC related ontologies

3.1.1 BOT

3.1.2 FOG and OMG

3.2 GIS related ontologies

3.2.1 geoSPARQL

Chapter 4

Setup

4.1 Participants

This is a diagram:

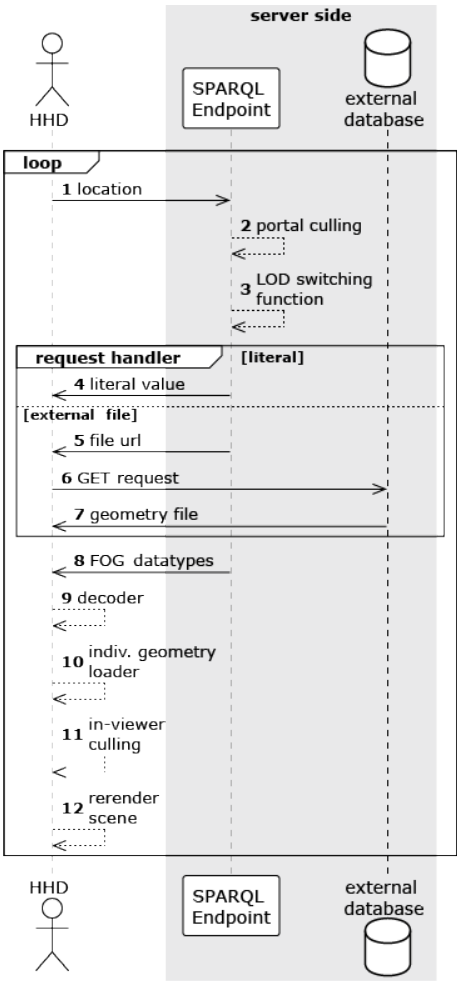

Figure 4.1: Sequence diagram

4.2 Framework

4.2.1 Nextjs

4.3 Querying

4.3.1 Front-end

4.3.2 Back-end

4.4 Rendering

4.4.1 Xeokit SDK

List of Acronyms