SWIMing: Supporting Use Case Data Requirements Modelling for Managing Data Across the Building Life Cycle

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Abstract. Data exchange and data sharing is still one of the big challenges in the AEC industry. BIM and open standards like IFC, SAREF or CityGML and lately the use of Semantic Web technologies provide a sound basis to implement exchange requirements derived from typical AEC use cases. Meanwhile many solutions are available that may already solve the problem in question. However, it is very challenging to find out what is available and how to align it with specific requirements.

Keywords: Exchange requirements · Use case management · BIM · MVD

1 Introduction

SWIMing is a Coordination and Support Action (CSA) with the goal of supporting EU-funded projects working in the area of improving energy efficiency of buildings and districts, to increase their impact through the adoption of open BIM standards. It is focusing on use case specifications and is following the IDM/MVD methodology developed by buildingSMART. The first step in this methodology is to identify use cases and to extract meta-data such as involved stakeholders, covered building life-cycle stages or data domains. While this information helps to classify use cases it does not give detailed insights into the exchange requirements and how these fit together and integrate into the BIM-based design process. In order to do so, SWIMing is proposing to build-up a shared use case repository that collects detailed Exchange Requirements as well as its implementation in data structures. We will show the current state of this repository and how it can support other projects to identify data structures and links to existing standards so that they can better manage the data requirements of their project. We will explain available features of the repository and will discuss potential extensions that help to better analyze and compare requirements.

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2 Short Presentation of Work

Taking into account the whole Building Lifecycle (BLC), which defines the life of a building from design, construction, operation and maintenance, refurbishment/ renovation and on to eventual demolition/recycling [2, 3], buildings are responsible for around 40 % of total EU energy consumption [4]. The EU has established the Energy Performance of Buildings Directive (EPBD) which aims to reduce energy consumption across the BLC as part of its overall goal of cutting EU energy consumption by 20 % by 2020 [5].

Reducing building energy consumption across the BLC requires the exploration of new and novel use cases for monitoring and predicting energy consumption and also the re-evaluation of existing use cases to determine if existing building processes may be refined and made more efficient. One enabler for this is Building Information Modelling (BIM) [3]. BIM is a concept which has arisen to address the management and interoperability of the data exchanged between different computer aided tools employed at different stages of the BLC [6]. Access to reliable structured data plays a key role in all aspects of energy management across the BLC, as ICT solutions ranging from energy and performance modelling tools to operational decision support tools, rely on this for their correct operation.

The leading standard developed around the concept of BIM is Industry Foundation Classes (IFC) [7], which is also the only BIM ISO standard [8]. IFC is a non-proprietary exchange format for describing buildings in terms of the semantics of constituent building elements. It enables the passing of information between different stakeholders involved in different stages of the BLC and addresses several core data domains required for building architecture, engineering and construction processes. Many commercially available tools support exporting their models in IFC, e.g. REVIT, Autodesk, ArchiCAD, MagiCAD and IES.

However, in practice, barriers exist to the use of IFC. For instance, the conversion of IFC data to and from tool specific data models often result in data loss [9, 10]. Nonetheless, IFC is a well-established standard, which supports many use cases relevant to the BLC, and while it may not currently meet all building data requirements. Making building processes open and interoperable using IFC is viewed as a better alternative than closed vendor specific proprietary models and has significantly increase its use over the past decade in the design stage and also in the construction domain [11].

To make the process of using IFC simpler, so that data exchanges can be identified and tools can support those data requirements while still being interoperable with the IFC schema, the Information Delivery Manual (IDM) and Model View Definitions (MVD) have been developed by the non-profit organization buildingSMART. IDM can help identify and capture the exact information exchange requirements to meet a business use case.

As the IDM methodology is agnostic about the particular data schema used to meet data exchange requirements, it is also possible to map data requirements to data structures other than IFC if they are not yet covered, or fall outside its scope. The issue remains though about how to link these models and maintain interoperability. Linked

Data (LD), which is used by the W3C Data Activity, provides a possible solution to this problem. LD is a structured form of data storage, distributed across the web, and which is supported by tools to easily query that data. By integrating BIM into the wider web of data, building information can be queried alongside all other Linked Open Data (LOD) sources, which include data on materials and systems (e.g. sensor and state of building devices data) which make up the building, profiles of occupants, and information about weather patterns and regional and global energy prices. Together this information can make for more meaningful analysis of energy consumption and its relation to the localized costs of materials, systems and personnel in existing and future buildings.

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