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INTEROPERABILITY CHALLENGES IN BIM MODELS

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ABSTRACT

This paper analyses the interoperability challenges within the Architecture, Engineering, Construction and Operation (AECO) sector. The main focus is how the existing national information systems can be integrated with BIM (Building Information Modelling) models for a collaborative environment using IFC. Given the heterogeneity of data, the available tools and the stakeholders, it is necessary to take advantage of syntactic and semantic interoperability techniques, using standardization efforts, but also data transformation, migration and integration techniques, usually applied in the area of information systems.

Keywords: ISO 16739, interoperability, IFC, BIM models, AECO sector.

INTRODUCTION

As regards BIM models, the buildings life-cycle have an evolution where specific phases and engineering projects must share models and contribute with their results to increase the overall model. Challenges and needs for an adequate interoperability between all stakeholders emerge. In fact, they would benefit from a collaborative environment, in which, interoperability is the key factor in order to avoid inefficiencies through the exchange of information between the several phases of the building life cycle (Minho et al., 2015).

Interoperability, sharing and collaboration are common and recognized challenges in the field of information systems, where normalization techniques, such as the use of standardized formats, are important factors to address these challenges. buildingSMART International (bSI) is working on the development and use of open standards for BIM to improve interoperability, sharing and collaboration throughout the buildings life-cycle (bSI, 2016). As a result of the effort developed and maintained by bSI, the Industry Foundation Classes (IFC) (Regateiro et al., 2013), which correspond to the ISO 16739, is a neutral and open format specification of a recommended model to describe AECO data (IFC4, 2016).

RESULTS AND CONCLUSIONS

Interoperability is defined as the ability of two or more systems, products or components to exchange and use information without significant human effort (IEEE, 1990). In ISO 16739 the IFC are specified as well as the conceptual data schema and file representation format for BIM models. Although not used directly by commercial BIM tools, IFC can be used as a data transport format to promote interoperability across multiple systems, applications, and stakeholders. Different stakeholders in a building project require different levels of detail and

can produce and modify different parts of the model. The ability to manage the same model in multiple ways across multiple parties is a challenge for the AECO sector.

Interoperability requirements become more challenging when considering scenarios where relevant information (especially alphanumeric data) is managed by external data sources (material catalogues) and must be integrated to extend and enrich BIM models. Interoperability is possible, or at least simplified for the AECO sector, by implementing and adopting standards, such as the IFC data model. The adoption of standardized formats contributes to the syntactic interoperability between various systems. Syntactic interoperability can be solved by Extraction-Transformation-Loading (ETL) processes, where heterogeneous data sources are extracted and transformed in order to produce a homogeneous and coherent set of data. The buildings life cycle can be seen as a continuous process in which new data are integrated into a homogeneous model through multiple successive ETL steps (Falcão Silva, et al., 2016). Migration is one of the most common types of transformations required in interoperability ETL processes. According to ISO 42010 the loss of data in the migration processes may imply the loss of important information.

The process of transformation and valuation within the building life-cycle is executed continuously and incrementally, involving multiple stakeholders, different tools and data representations. This can be seen as a sequence of transformations, in which the result of each step will be used as the source of the transformation in the next step. At the end it is possible to obtain a BIM model enriched with all the information that has been produced during the building life-cycle.

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