Chapter 10
Customized Data Capture for BIM:
Using APIs and Visual Programming

Kjartan Gudmundsson
KTH Royal Institute of Technology, Sweden

Giuseppe Digregorio
KTH Royal Institute of Technology, Sweden

Jiayu Cui
KTH Royal Institute of Technology, Sweden

ABSTRACT

Building information models (BIMs) make it possible to share structured data in the planning and building process and during the live cycle of the building. The models can be enrichened with information in all stages from planning to end-of-life. Predefined information requirements, data structures, and file formats allow the model to be used for design, cost planning, and time scheduling as well as analysis of building performance, and ideally also for facilities management. This chapter describes the possibilities of using application programming interfaces (APIs) to enhance the usefulness of BIM models. This provides the user with the possibility of creating own applications with real time bidirectional data exchange. Of particular interest is the exchange of data with web-based data sources. The applicability is illustrated with examples of environmental analysis based on web-based data and the use of web-based forms to enrichen BIM models with data input from building users.

INTRODUCTION

The usefulness of sharing structured building data in accessible format and the applicability of that data in a well-defined context is undeniable. Ideally, the different actors in the domains of architecture, engineering and construction (AEC) can collaborate and share data without loss of information and without

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the need for the manual repetition of data input. Consequently, much effort has been put into defining effective means of structuring and sharing data in BIM models as well as platforms for sharing documentation in building projects. This chapter focuses on the need of practitioners in the AEC domain to be able to develop custom-made tools that can be used together with design authoring software for BIM models. It is explained how APIs can be used to develop custom-made tools with real time bidirectional data exchange between BIM models and existing applications. It will also be explained how this can make useful the vast amount of existing program code and resources. Furthermore, it is described how APIs can be used to access and navigate in the data structure of BIM models and the most common formats used for web based data exchange. It is also explained how automated data capture can be used to enrichen BIM models with information. It is shown by examples how this can be used to capture data for the calculation of environmental mid-point impact as well as well as by using web-based forms for the gathering of real-time data from building users. This is carried out with the Dynamo visual programming plug-in for Autodesk Revit design authoring software. In a broader context, the authors hope to contribute with processes that can be of use for the linking of a physical asset with its digital representation or digital twin.

Background

According to BIM Alliance Sweden (2020), BIM is about creating and using digital models of construction work in the building process. The digital models that are created are called Building information models and the working process is called Building information modelling. Building information management is the handling and administration of the models and the process of creating them. All three concepts are abbreviated BIM.

The core of BIM is the individual object. The object carries information about the geometry, attributes, classification and relations to other objects. Together the elements constitute a BIM model. The information associated with the object is what separates BIM from CAD drawings, CAD models and 3D models. Thus, a wall is not merely a geometrical volume but it can also contain information about properties such as materials, width, height and type as well as the relationships to other elements in the model.

One outspoken aim of digitalization in the building sector has been to create continuous flows of information between all actors involved in planning and building. Data deliveries can be defined at different points from planning and further through the whole life cycle of a building. The definitions can include a definition of the data set, the reliability of the data, the structure of the data and the file format that should be used.

Ongoing efforts include the establishing of classification systems that include infrastructure and the possibilities to share data between BIM and GIS (Smart Built Environment, 2020) as well as the implementation of CIM or City Information Modelling. The classification of objects in BIM models means that the objects are sorted according to a structure that makes it possible for different actors to find the information needed. The classification system commonly agreed upon by the building industry is IFC or Industry Foundation Classes that is a platform neutral open file format and an official ISO Standard that architects and engineers can use to share data and use data in their areas of expertise. A large number of commercial tools use IFC files for the viewing BIM models and the sorting of BIM data. In addition, there is a vast number of regional classification systems.

Current research efforts are also concerned with processes and platforms for sharing project information through single sources of information in a common data environment (CDE) that can store BIM