Chapter 2.12

Developing Context Sensitive BIM Based Applications

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ABSTRACT

Current Building Information Model (BIM) based applications do not integrate well with the varying and frequently changing work processes of Architectural, Engineering, and Construction (AEC) professionals. One cause for this problem is that traditionally software developers apply software design methods that aim to design software that cater to a broad range of different users without accounting for the possibility of changing work processes. This chapter theoretically introduces a different method to design software - context sensitive software development – and theoretically argues that it is poised to enable application developers to adjust BIM based applications to the varying and frequently changing work processes of AEC professionals. As a first starting point for the practical applicability of the theoretical method, first user categories that BIM based application developers can use as a starting point for the analysis of different user contexts are provided. These categories were derived from the author's experience supporting more than ten projects with the implementation of BIM based applications and from what they learned on a number of industry BIM workshops. The chapter closes by mapping out future research directions to evaluate the practical value of the method and with a theoretical analysis of how researchers can apply state-of-the-art software development methods, software development technologies, and software dissemination models to support their research.

1 INTRODUCTION

The use of BIM based applications on AEC projects is still rudimentary and fragmented (Hartmann et al. 2008). One reason for this is that their devel-

opment is complicated by two characteristics of the AEC industry. For one, the AEC industry is a project based industry that organizes its workforce around projects. Companies form project teams that work detached from the formal hierarchy of the firm. Additionally, on projects different project teams from different companies work together.

Thus, projects are quasi-organizations (Eccles 1981) consisting of different project teams from different companies that need to work together to achieve project success (Dubois & Gadde 2002). To account for this project based structure of the AEC industry, BIM based software therefore, need to account for a large number of different and often conflicting groups of stakeholders. Moreover, AEC projects are mainly concerned with the construction of unique facilities and thus, operate in uncertain, complex, and frequently changing environments (Kreiner, 1995). Thus, information from and about the environment is also conflicting and changes frequently. This further causes needs and objectives of different project stakeholders to become ambiguous and ill-defined. It is often, not even easy to formally understand the requirements of a single stakeholder group never mind accounting for the multi stakeholder perspectives. Overall, due to the above reasons it is hard for software developers to develop general use software applications to meaningfully support AEC work processes.

In general, it is of utmost importance during the development of any software program to account for the different perspectives and roles of the intended users (Checkland & Scholes 1990). This is important to ensure that these software solutions become meaningful to improve the users' work practice (Carroll 2000: 45-47). Technology developers need to focus on users and their actions instead of focusing on the technical possibilities (Carroll 57). Additionally, developers need to focus on supporting interactions between different user groups (Sato 2004; Lim & Sato 2006; Haymaker et al. 2004). It is obvious that due to the above characteristics of the AEC industry this should hold especially true for technology developers that work on BIM based applications.

Unfortunately today, many BIM development efforts do not account for specific users and their viewpoints. Instead, currently many BIM development efforts focus on establishing standardized databases to store building related models – so called building information models (Fox & Hietanen 2007;

Vanlande et al. 2008) – or they focus on how AEC practitioners can model a building to store in such a database – so called building information modeling (Eastman et al. 2008). Contrary to these efforts, this chapter focuses on the development of applications that support the work processes of AEC practitioners for which the chapter uses the term BIM based applications. The chapter defines a building information model as exactly what its name states: a model to describe information related to a building. In this way, BIMs allow storing information that is related to a building in electronic databases. Such BIM information can describe the physical shape of the building, so called product information, and the management processes to build or manage the building, so called process data. Simple storage of information alone however, cannot in itself, improve work practices. Software applications need to meaningfully access, visualize, and offer the possibility to alter the electronically stored product and process information. To account for this difference between BIM databases and applications that use such databases, the chapter therefore uses the term BIM based applications. BIM based applications allow users to understand information stored in BIMs better, by for example providing possibilities to easily access and visualize information. Further, BIM based applications enable users to generate new knowledge with respect to a building's design or related management process and to again store this data within a BIM database.

To help BIM based application developers with their efforts to purposely support the decision making of AEC professionals, this chapter introduces context sensitive software design as a method of how developers can explore and describe the context of stakeholders and theoretically argues that the method enables software designers and developers to adjust BIM based applications to specific user and project contexts. The chapter begins with a theoretical overview about context sensitive software development. In particular, the chapter summarizes latest research efforts that are related to context sensitive software develop-

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