



A Dynamic Framework for Construction Scheduling based on BIM using IFC

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Summary

Construction scheduling is one of the key processes during the development of construction projects. As Building Information Models (BIM) gain more and more in importance for the design process, the scheduling process also has to be integrated into the collaborative model based working environment. For this purpose a Business Process Re-engineering approach (BPR) was applied to identify potential areas of improvement within the current scheduling and 4D simulation practice. This paper highlights the main findings and describes a novel solution approach consisting of a dynamic collaboration framework tailored for construction scheduling. Several tools were implemented to prove the new concept. The Industry Foundation Classes (IFC) are deployed to ensure open communication within the project team. Further research is ongoing within the European R&D project InPro.

Keywords: construction scheduling; building information model; IFC; object versioning; object splitting; object linking; 4D simulation; CAD.

1. Introduction

Large construction projects typically involve many stakeholders during the design phase. Each of them brings in his expertise in a specific design domain. A project scheduler estimates the overall project duration as well as major cost factors for labour and equipment. He takes input from several other domains. The resulting construction schedule is used later on by other stakeholders as a means for project management, as well as triggering procurement and logistic processes.

The design process already benefits from new software technology which allows collaborative, model based working where stakeholders of a project team interact through a BIM. Construction scheduling is not yet integrated in such a collaborative environment. The aim of this research is to close this gap.

2. Problem analysis

BPR was applied to investigate the current situation in a major European construction company. The aim was to identify information needs and communication patterns between involved stakeholders of the scheduling process and to suggest a solution approach.

Depending on the project stage and the related detail level of available design data up to six different stakeholders where found to be involved in the scheduling process (Figure 1). With the increasing detail level the data exchange also grows and thus the possible advantage of BIM based collaboration; especially if it is considered that the scheduling process is iterated several times to further refine time and costs estimations.

3D CAD, quantities, costs, schedules, resources and 4D information have to be handled by the project engineer, but today's software packages dedicated for scheduling aren't adopted to such a model based, collaborative working environment. They lack integrated, easy to use 3D editors with access to all the different information needed as well as appropriate change management support. Especially for large projects it is crucial for the project scheduler to identify activities in the

schedule which are affected by changes in the underlying design data. Furthermore several schedule alternatives have to be managed and examined to optimise the project execution. Available 4D simulation software on the other hand requires too much effort and needs a specific object granularity for the 3D CAD model which isn't automatically provided by the design team. In addition the 4D technique is only applied after the construction schedule has been completed. Thus it does not really support the project scheduler during his work.

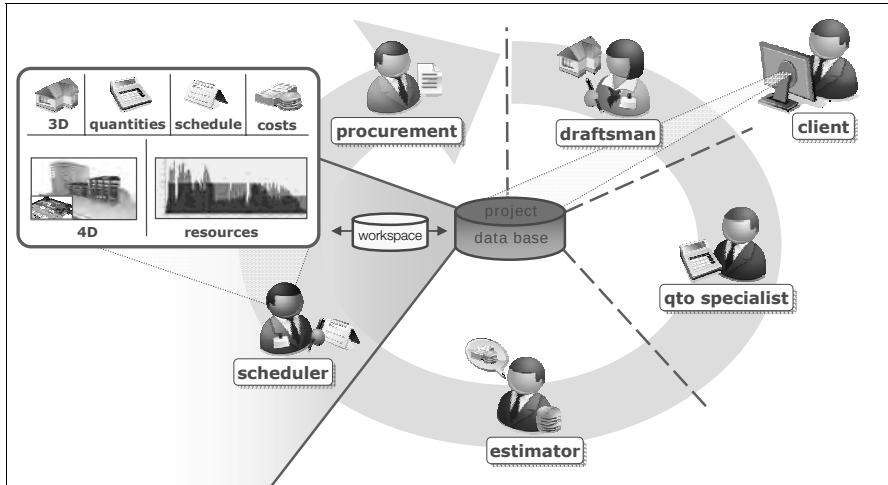


Figure 1: Working environment of the collaborative BIM based scheduling process

3. Solution approach

To significantly improve the current situation and to support informed decision making an efficient, visual and dynamic framework is suggested which focuses on the following aspects:

1. The use of a Building Information Model as a central repository for project data
2. Introducing model based quantity take-off as a central process
3. Establishing a workspace for the scheduling process which is capable of exchanging scheduling data in IFC/STEP ISO 10303-P21 format.
4. Object versioning as a technology for change management.
5. An easy to use 3D editor tailored to suite the needs of the project scheduler

With the suggested solution approach the following improvements are provided:

- Improved communication between stakeholders
- Reuse of information across processes
- Scalability regarding project stage and related data maturity
- Allowance for a fixed software infrastructure per stakeholder even across projects
- External data exchange based on a neutral data structure
- More efficient and powerful linking between CAD, quantities and schedule
- Adaptability of CAD object granularity through an object splitting functionality
- Change management and versioning capability