

Data Managment for Engineering Applications

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Abstract. Current database technology has proven to fulfill the requirements of business applications, i.e., processing a high number of short transactions on more or less simple-structured data. Unfortunately, the requirements of engineering applications are quite different. A car's bill of material, for example, is a deep tree with many branches at every level. Data objects become even more complex if we consider the engineered design objects themselves, as for example a gear box with its parts and how they are related to each other. Supporting complex data objects has many implications for the underlying data management system. It needs to be reflected at nearly any layer, from the API down to the storage system. Besides complex objects, the way design objects are processed in engineering applications differs from business applications. Because engineering is an explorative task, the concept of short transactions does not fit here. Working with design objects is a task of days, which leads to a different programming model for engineering applications. In addition, the data management system needs to support versioning of objects and configuration management. Furthermore, engineering is done in a collaborative team. Hence, sharing of design objects in a team is necessary while, at the same time, their collaborative work has to be synchronized. All those special requirements have to be considered in data management systems for engineering applications. In this contribution, the special requirements, as sketched above, are characterized. Also the approaches developed to cope with these requirements will be described.

1 Introduction

Business applications have been always the main focus of data management systems. Hence, current data management technology is able to serve most of the demands of this domain very well. Other domains with differing requirements have to cope with less support, for example, the engineering domain. Although engineering databases have been well researched [2, 10, 18, 23], support for engineering applications in current database or middleware technology is still marginal. Therefore, existing technology still requires adoption to the needs of the engineering applications.

The most demanding challenge today is not data management itself but to support a seamless flow of data through all tools used in the product creation process, i.e., construction tasks as well as production-related activities. Of course, this has a lot of different aspects and discussing all of them is beyond the scope of this paper. Therefore, we will focus on a selection of topics which are of special interest because of new trends:

- Building up an IT infrastructure never starts at the open field. Instead it is always the result of an evolutionary process. This is the first reason, why the IT landscape of any larger company will always be heterogeneous. The second reason for heterogeneity is that engineering processes need to be supported by many highly specialized engineering applications. Therefore, the all-in-one engineering tool is more utopia than reality. Each of these tools is optimized for a given task and so are the data structures: CAD applications may work with data structures that support free-form surfaces. Tools for crash simulation require, for example, finite-element meshes. The bill of material may be implemented as a graph with simple-structured nodes which contain links to large chunks of external information. The challenge for data management is to support each tools with its appropriate data format, ensure the seamless flow between tools and enable an integrated view upon all relevant data, if required. In section 2 we will discuss the utilization of current integration technology within engineering processes.
- Another important aspect in engineering processes is agility. Because such processes cover long running activities, there is always a need to adapt to new requirements. On the other hand, application integration creates dependencies between applications and those are an inherent risk for agility, because changes within one application or within the process need to consider all dependent applications. That is why we need to take countermeasures to ensure that changes can still be applied. In section 3 we will describe an approach for development and maintenance of integration solutions which does reflect this need.
- Engineering processes involve many parties inside and outside a company. Especially, integration of suppliers has become more and more important during the last years. This results in a need to manage the flow of engineering data in the product creation process as it leaves the company and comes back again. In such a scenario, the task of providing the required data in the right format at the right time is a demanding challenge. In section 4 we will describe first steps done towards managed cross-company data flows.

In the next paragraphs, we will discuss these three challenges of engineering data management.

2 Applying Integration Technology in Engineering Domains

Application integration is a crucial point in order to support faster engineering processes. The advantages of application integration have already been discussed [11, 22]. Sev-