A Framework for Real-Time Collaborative Engineering in the Automotive Industries

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Abstract. Today, many different companies are involved in the automotive engineering process. The OEM, subcontractors and suppliers all need to collaborate and access the same data. Specialized applications are used in the process of designing vehicle electrical systems. These applications use proprietary data formats and do not support collaborative engineering. Thus collaboration methods are limited to turn-taking, split-combine and copy-merge. To become application independent and stay future-proof, a new trend is the transformation of data from the proprietary data formats to the Extensible Markup Language[1] (XML). This will allow new ways of viewing, editing and analyzing the data using new and existing applications and tools that use XML as a data model. This paper presents a novel software framework that allows easy enhancement of any such applications with the ability of collaborative real-time editing. Support for heterogeneous applications, a new flexible plug-in architecture and easy application integration are some of its key features.

Keywords: XML, Collaborative Engineering, Real-time Collaboration, Software Engineering, Groupware, CSCW, Vehicle Electrical System.

1 Introduction

The development of vehicle electrical systems is a complex and tedious process. Many different companies such as subcontractors and suppliers are involved in designing and building the cable loom of a car. In order to support the engineers, a number of applications such as Logical Cable[2], Catia[3] and LDorado[4] are used to design circuit diagrams and electrical components. The electrical components and component symbols that are used in the design are administered in a so called Cable Library System (CLS). The cable loom design is split into different modules where each module design contains one or more diagram sheets. A number of companies such as the supplier or manufacturer of the cable loom, different subcontractors and

[1] Extensible Markup Language (XML) 1.0 (Third Edition) W3C Recommendation, http://www.w3.org/XML/, 4th February 2004
[2] Logical Cable (LCable), http://www.mentor.com/products/cabling_harness/index.cfm
[3] Catia 3D, http://www.3ds.com/home
[4] LDorado, http://www.ldorado.harnesslab.de

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the OEM (e.g. Volkswagen) are involved in the cable loom design. Thus a tight collaboration between the involved companies and the OEM is required. For the exchange of data between the OEM and the subcontractors today a so called construction data management system (CDMS) is used. Such systems are used for storing and retrieving development artifacts. For example, a copy of the CLS library (containing all electrical components that are required for designing a circuit diagram) is retrieved by the subcontractor via the CDMS. The subcontractor then uses this library to design the wiring diagrams. Problems occur here for example, when one subcontractor works with an older version of the CLS than other involved parties. When exchanging the wiring diagrams, conflicts can occur that need to be resolved manually. The process of integrating changes made by subcontractors into the overall design, the management of the design data in CDMS and an error checking procedure are time consuming and expensive. These and other problems reduce the productivity of the engineering process. To overcome these problems a synchronization mechanism would be helpful, which ensures that all companies involved in the design process, work with up to date data. In the design process a system that supports real-time collaborative engineering would allow all parties to work on a single source. Additionally the OEM would always be able to see the current status of work and check the design for errors at all times. This could lead to a better quality and higher productivity.

The development of complex applications such as a symbol editor or a wiring diagram editor is a difficult and time consuming task. Since already various single-user applications exist it would be much simpler and user friendly to enhance the existing applications with real-time collaboration functionality, instead of developing new collaborative applications. One of the advantages is, that users do not have to learn and adapt to a new application but can use their familiar application with enhanced functionality. The goal of our research is to develop a software framework that allows the enhancement of any type of single user editing system or application, using XML as a data format, with the ability of collaborative real time editing. The trend is set by the Verband der Automobilindustrie VDA (Automotive Industry Association) to use XML as the new data format for the design and exchange of vehicle electrical systems. In the automotive industry the Scalable Vector Graphics[5] (SVG) format is used to visualize and exchange wiring diagrams. Other XML based languages exist or are in development to model the logic and other data that is needed in the vehicle electrical system design. These are for example KBL[6] and Elog[7]. The KBL (Harness Description List) XML format (VDA recommendation 4964) is a subset of the AP212 ISO Specification[8] for vehicle electrical systems. It defines a data model and an XML schema for the exchange of harness design data between the OEM and the suppliers. Elog is a XML format currently under development by the VDA and will be used to represent the electro-logical model of a vehicle electrical system including views (sheets), electrical components, wires and connectors. As

[5] Scalable Vector Graphics 1.0 Specification. W3C Recommendation, http://www.w3.org/TR/SVG/, 2001

[6] KBL, Kabelbaumliste (Harness Description List), VDA recommendation 4964, http://www.ecad-if.de/kbl.html

[7] Electrological Model, ELOG, VDA, http://www.ecad-if.de/elog.html

[8] AP212, Electrotechnical Design and Installation, ISO Standard 10303-212.