Visit at Volvo Car Corporation

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Introduction
During the first two weeks of June 2004, I visited the Systems Architecture group 94 221 (simply called 94 221), a group within the Electrical Architecture 94 200 section that is one of five sections within the Electrical and Electronic System (EESE) department at Volvo Car Corporation (VCC). The 94 221 group is located in the building Navet, at the beautiful sea shore area of Lindholmen Science Park in Göteborg, Sweden. I followed Ulrik Eklund, one of the members of 94221 during his working days, attending both internal meetings within the 94 221 group and the EESE department but also cross-corporation meetings within Ford Motor Company (FMC).

Ford Motor Company
In 1999, FMC bought Volvo Car Corporation and later on, in 2001 also Jaguar Land Rover (JLR) to create the second largest car company in the world (only General Motors is larger). FMC is currently the owner of a great fleet of cars including Ford, Lincoln, Mercury, Mazda, Volvo, Jaguar, Land Rover and Aston Martin.

94 221
The Electrical department 94 200 has total responsibility for the complete electrical systems in the cars. The group I visited, 94 221, consists of approximately 15 employees and their main responsibility is functional modeling and design of the electrical architecture.

At their internal website, the 94 221 describe themselves as:

> *"We are the 'Center of excellence' at electrical architectures at Ford. We are associated with a world leading modern architectural thinking and we are the group that one should naturally contact with questions concerning architectures. We develop electrical architectures and apply methods and methodologies that in an effective way strengthen the quality in the electrical system of the car."*

As mentioned, their work mainly consists of modeling functional behavior of components in the electrical system of the cars. They work primarily with the UML-based tool Rational Rose but also the tool Statemate is used in some parts of the systems. Their models are the sent to subcontractors or other parts of VCC which develop the actual components according to the specifications.

In parallel with their modeling work, some members of the group (one being Ulrik) are a part of different projects within VCC. One of the projects are to develop a new strategy for structuring the architecture so it will facilitate reuse, flexibility and become more cost-efficient in the long run.

Experience
The visit at VCC was very rewarding, especially attending the internal meetings with Ulrik. These meetings where practical and technical, and I was enlightened with the different challenges that the people at Volvo are confronted with. For example, one challenge is the new distributed architecture that was developed for Volvo S80. Instead of individual electronic control modules, the Volvo S80 is based on a number of microprocessors interconnected by networks [1]. This puts of course new demands on the electrical architecture and the software development methods [2] and these were one of the challenges that the group were working with. Another challenge is the integration and prioritizing of different applications that are distributed inside the car. Here, the need for a standard architecture is identified. However, the development if a

standard architecture is not trivial, it needs the expertise from several departments and it is very costly. Hence, one challenge alone is to convince the heads that it is money worth spending to invest in the development of a standard architecture.

During my visit, apart from attending internal project meetings within 94221, I also had the opportunity to accompany Ulrik to meetings with representatives from Jaguar and other departments of Volvo, such as the Chassis Department, and also a workshop with members from both JLR and Ford North America (FNA) and Ford of Europe (FoE). I also had the opportunity to attend an AUTOSAR [3] meeting held by VCC. These meetings were very interesting and gave me a small insight in the business environment inside a global company and it was interesting to see how they tried to combine their experiences into something useful for the whole company. One of the challenges discussed at these meetings was the need for standardization within FMC (e.g. a common electrical architecture for all cars within the company). Some of the lessons learned through these meetings are the practical difficulties of introducing technology steps (e.g. how to get money for savings in the long run) and the time-consuming work within a large partnership as AUTOSAR (e.g. uniting a majority of the world's car companies and subcontractors).

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References

[1] K. Melin. *Volvo S80: Electrical System of the Future.* Volvo Technology Report, 1. 1998

[2] M. Rohdin, L. Ljungberg, U. Eklund. *A Method for Model Based Automotive Software Development,* Proc. Work in Progress and Industrial Experience Sessions, pp. 15-18, 12th Euromicro Conference on Real-Time Systems, Stockholm 2002.

[3] AUTOSAR – Automotive Open System Architecture. http://www.autosar.org. URL. 2004