Compare notes

BERNER & MATTNER'S POWERDIFF SYSTEM PROVIDES EADS DEFENCE & SECURITY WITH AN AUTOMATED CHANGE MANAGEMENT PROGRAM FOR STATEMATE MODELS

BY DR MICHAEL STURM

The Eurofighter from EADS Division Defence & Security (DS) is one of the most effective tactical aircraft in the world. From its conception plan drawn from pilot surveys in the 1970s, its rapid technological progress has posed constant challenges regarding requirements and specifications for the development teams using complex embedded systems.

The graphical design tool IBM Rational Statemate has facilitated the development of the Attack computer. In order to solve typical change management tasks, the department in charge at DS, Military Air Systems (MAS), works closely with Berner & Mattner Systemtechnik GmbH. The configuration management tool PowerDiff, which was jointly developed by both organizations, reliably identifies, visualizes and documents any changes made in Statemate charts.

More than three dozen highly complex computer systems ensure the Eurofighter's systems are fully capable. The Attack computer and the Attack & Identification Subsystem execute elementary identification, friend or foe (IFF) within a split second. The long-term partnership of MAS and Berner & Mattner ensures the functional capability of these embedded systems work. To verify the constantly improving technologies with the aircraft's weapons systems, the EADS department, Avionics and Mission Systems introduced the graphic design tool Statemate (now distributed by IBM) at an early stage.

"In doing so, we kept reaching the limits of Statemate, which at first could hardly manage our complex and extensive models," recalls Dr Michael Randolph from EADS, who took a lead role in the system development process of the Eurofighter. The system is being developed by MAS and its partners, with teams of engineers spread throughout Europe.

"In cooperation with the manufacturer," continues Randolph, "we have therefore systematically enhanced Statemate in order to efficiently apply the tool in our development process."

Fresh challenges

Trying to master the complex Statemate models revealed another obstacle. This was the ability to compare Statemate charts in order to retrace, document, and specify changes according to each client. For example, changes can be triggered by a Eurofighter customer requesting a new weapons system to be integrated into the tactical aircraft.

This puts into operation a complex process chain, as the corresponding requirements have to be implemented in the model and possible effects on the complete system have to be considered. By the time of system delivery, any changes have to be specified exactly by means of very detailed simulations and model process reviews.

This process does require the comparison between individual charts. "With no such function or tool being available for Statemate, the employees used to print the corresponding documentation before and after any change so they could manually highlight the differences," Randolph explains.

"At first this meant just a couple of prints, but in the course of the Eurofighter's development progress, it eventually added up to thousands of pages."

Due to the enormous effort involved, MAS entrusted Berner & Mattner (then Statemate systems partner for Germany) with the development of an appropriate comparison tool. This tool would be able to automatically detect any changes between two model versions as well as to visualize and document them in detail.

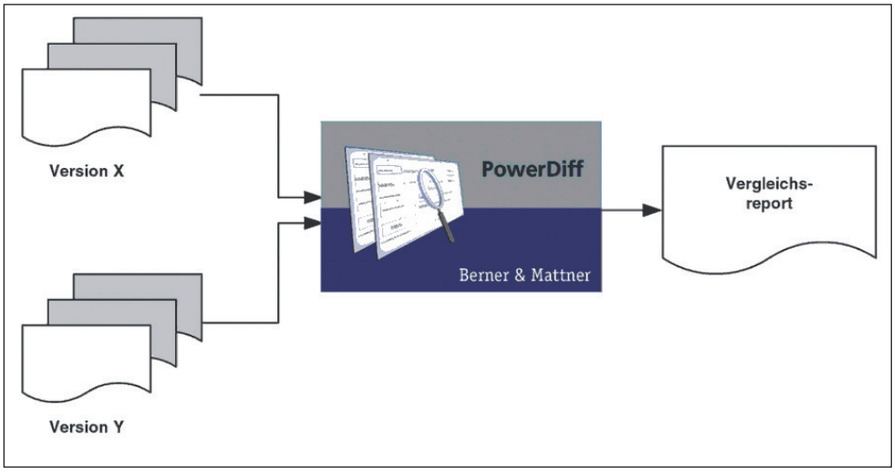
The Eurofighter has been in service at Deutsche Luftwaffe since April 2004

Comparison-to-configuration

The prototype of PowerDiff meant that two Statemate charts could be directly compared so changes could be visualized and it would be easier for employees to retrace previous work. Due to the embedded systems' complexity, the number of comparisons quickly rose to a triple-digit number of objects.

"Once the supplier and ourselves had constantly extended the functionality of Statemate, the requirements for PowerDiff and their design and documentation also increased," says Randolph. "We are currently using Statemate models with a capacity of several thousand charts and a documentation of up to 100,000 printed pages." This rise in volume turned PowerDiff from the original comparison into a complete and total configuration management tool.

Dr Michael Randolph (left) and Dr Michael Sturm collaborated on the software development



PowerDiff comparison of versions

PowerDiff in the field

PowerDiff can now highlight any changes made in a Statemate model consisting of up to 6,000 charts at the push of a single button. PowerDiff goes far beyond a mere graphical-visual display and even compares context and algorithms of the models. The development engineers can precisely adjust the type of changes to be compared. This includes a logical comparison of the chart elements as well as a detailed, type-specific display of the element's types of arrays.

A hierarchical diagram showing the differences in the form of a tree and an easily operated synchronized zoom and scroll function in the graphical displays can save employees a lot of time. The index assigns the altered Statemate objects to the charts defining them. Each object listed is connected with a detailed description of its changes.

A summary function listing all altered objects according to type in alphabetical order ensures high operating comfort. It even includes a link with detailed change descriptions. Modifications can therefore be easily detected and analyzed.

Comprehensive PDF reports

The growing complexity of the Statemate models has also increased the importance of an efficient report function, as the documentation may easily comprise thousands to tens of thousands of pages. PowerDiff automatically generates PDF documentations of various types. These include displays of changes, graphical comparisons of charts, and comparisons of elementary attributes in table form.

A high level of operating comfort is achieved through the flexible layout of headers and footers, the selection of individual or several charts, as well as entire models and the clearly represented, color-coded marking of differences. PowerDiff also offers specific context information for emphasizing differences in the detailed change descriptions. In addition to the highlighted differences between 'before case' and 'after case', the comparison tool displays unmodified object attributes as context information.

"Developed in long-term close cooperation with Berner & Mattner, PowerDiff facilitates the specification of Statemate models and has brought about a quality leap in systems engineering," explains Randolph. "Together we have developed a standard tool for comparing the Statemate models, as inquiries from other industries using Statemate clearly demonstrate."

Today the engineers of the Avionics & Mission Systems department benefit from a fully automated change management and can therefore focus on engineering. PowerDiff reliably takes over the analysis of model changes, supports the transition from model to realization and documents object changes. MAS's project teams in Germany, the UK, Italy, and Spain can now analyze and retrace model changes much better. PowerDiff plays an important role in the quick and efficient development of complex systems. ▮

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