SHERPA ENGINEERING BUSINESS
EMPOWERED BY PAPYRUS

[Aeronautic, Automotive, Energy, Space ...]

« Designing Cyber-Physical Systems »

The Business
Sherpa Engineering is a world-class provider of expertise in model-based system engineering for a broad range of industries. They cover the full product lifecycle including modeling, simulation, and control design.

The Challenge
In the early 2010s, Sherpa Engineering decided to provide a comprehensive tool-based methodology for design and analysis of cyber-physical systems. For this new challenge, it was necessary to develop expertise in system modeling based on the SysML industry-standard modeling language as well as a corresponding tool.

The Solution
Sherpa Engineering selected Papyrus as the underlying MDE platform for PhiSystem, their multi-viewpoint modeling tool for complex systems design. This tool supports working with all facets of development: requirements capture, data flow design, architecture, component behaviour, and testing.

The Benefit
Sherpa Engineering successfully deployed their PhiSystem to their principal customers. The resulting quality and product improvements have directly led to increased revenue. This was accomplished in less than three years from the start of development. Such a rapid turnaround was to a great extent due to the use of an existing open-source editing tool for SysML.

list cea tech

SHERPA ENGINEERING

Phi System

papyrus

[Sherpa works on electric cars with PSA.] © Michael Flippo / Fotolia

« A more concrete and formal method »

The Business

From 1997 onwards, Sherpa has consistently invested over 12 % of its revenue into developing and refining its methodology and associated tools, in order to enable their customers to enhance the quality and performance of their products.

Sherpa's mission is to support their customers in deploying a methodology based on models and on specialized Sherpa tools, which capitalize on their experience from literally hundreds of projects. Thanks to these tools they are in a unique position to support customers with highly customized solutions.

Sherpa Engineering participated in several advanced research projects and have developed key technological partnerships with a number of renowned French research labs (CEA-List, IRT SystemX, and others). Thanks to this major investment in research, they are at the forefront of technological and methodological innovation.

Sherpa Engineering is not only an engineering services company, but also a specialized tool developer. Their tools are based on models and libraries developed over a period of 15 years of working with customers and partners.

The Challenge

In 2012, Sherpa Engineering decided to complement their multi-physics and control system design tools to offer a highly integrated tool-based methodology for the design and analysis of cyber-physical systems. Prior to that, Sherpa Engineering was already using a system engineering method based on well-understood and generally established system engineering principles, including the use of viewpoints, system architectures, system refinements, and requirements traceability. These were supplemented by some Sherpa-specific refinements developed as a result of their extensive background and experience with simulation. One objective of their method is to produce system models that are sufficiently formal to be evaluated by simulation at very early stages in the development lifecycle.

Although this method was applied successfully by Sherpa engineers in the past, it remained largely under-specified, allowing for different and divergent interpretations by different individuals. Moreover, the application of the method was completely manual, which contributed to further misinterpretation and which required extensive training prior to application in practice.

Consequently, the challenge was to make the method more concrete and more formal, by replacing its informal and sometimes ambiguous documentation with a computer-based engineering tool that directly supports the SysML standard. Furthermore, such a tool had to be easily and seamlessly integrated into existing customer toolchains.

The Solution

« Sophisticated Modeling »

["We chose Papyrus as a development platform for PhiSystem. There was a need for expertise and for an efficient tool that supports the SysML standard."]

PHILIPPE FIANI - R&D MANAGER - SHERPA ENGINEERING

Sherpa Engineering selected Papyrus as its underlying tool platform because of its full coverage of SysML concepts and because Papyrus is open-source software that is maintained by an extensive scientific and industrial community.

As a first step, a SysML profile (i.e., customization) was defined using Papyrus, to support Sherpa's system engineering methodology. This profile was limited to just the primary methodological features, such as concern-specific viewpoints,

architectural views, types of requirement, and cyber-physical structure. This facilitated the integration of Sherpa's PhiSystem within an end-user toolchain.

In addition, some specialized model libraries were developed to help users in constructing their models. These libraries included specifications of functional, physical and control flows, as well as templates for control architectures and functional transformations.

The main contributions of PhiSystem

are the tools developed for constructing a system-level model, for verifying modeling rules, and for extracting custom views.

Views can be used to automatically generate simulation models, control architectures, and documentation, thanks to the model-to-text and model-to-model transformations capabilities of Papyrus.

PhiSystem is deployed as a Rich Client Platform (RCP) that includes Eclipse Papyrus-SysML, the PhiSystem profile, model libraries, and other tooling.

[Sherpa's team at work, using Papyrus solution.] © Philippe Fiani / Sherpa Engineering
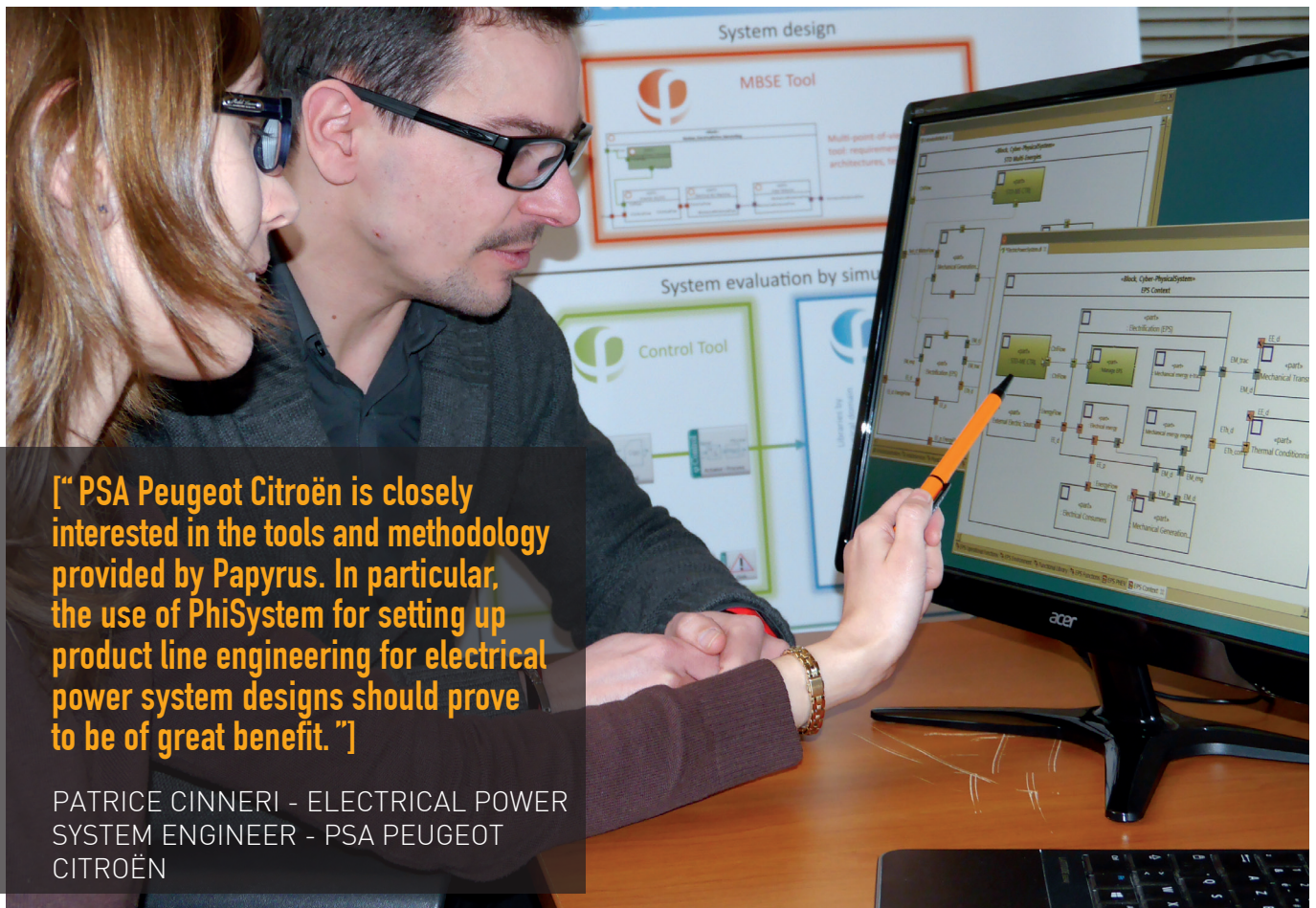
["PSA Peugeot Citroën is closely interested in the tools and methodology provided by Papyrus. In particular, the use of PhiSystem for setting up product line engineering for electrical power system designs should prove to be of great benefit."]

PATRICE CINNERI - ELECTRICAL POWER SYSTEM ENGINEER - PSA PEUGEOT CITROËN

The Benefits

« Success was achieved in less than three years »

© Vasilki / Fotolia

Thanks to Papyrus, Sherpa now has an effective tool that supports their specific system engineering methodology by helping guide engineers in applying it in a consistent and systematic manner. In the software market for model-based system engineering, PhiSystem is one of the most specialized and most powerful tools for designing cyber-physical systems.

In addition, since the language semantics are explicit and precisely defined, the link with simulation tools is direct, making the design-evaluation iteration seamless and continuous.

Relying on computer-based tooling also allowed straightforward development of a specific modeling and optimization methodology for energy and resource management.

PhiSystem is now deployed on all Sherpa R&D projects, which has enabled them to improve their knowledge management and to facilitate communication with partners.

Furthermore, since PhiSystem supports formal design, a system engineer is less dependent on simulation tools and their idiosyncrasies. As a result, the simulation tools are mainly used for product instance configuration and execution.

In industrial application with PSA Peugeot Citroën, Sherpa Engineering developed a system model for the electric power system of a hybrid vehicle.

This specific use case confirmed two key points: first, the ability of the PhiSystem to be readily integrated in a customer's development workflow and toolchain, and, second, the effectiveness of the approach for designing functional architectures by supporting formal analyses.

About Sherpa Engineering

Web site : www.sherpa-eng.com

Activity : Automotive and Energy

Domain : Automotive (60 %) → PSA, Renault, Valeo, Volvo ; Aeronautic (25 %) → Safran/Snecma ; Energy (5 %), Industry (7 %), Space (3 %)

Expertise : System Engineering, Modeling and Control System Design

Employees : 75

Consequently, Sherpa Engineering can offer a credible and competitive product in the cyber-physical systems market: a powerful tool and associated services, using their proven model-based approach supported by Papyrus and the PhiSystem toolchain.

PAPYRUS CASE STUDY SERIES

About List (www-list.cea.fr) : One of three institutes which comprise CEA Tech (CEA Technological Research Division), the List institute is committed to technological innovation in digital systems. Its R&D activities - driven by major economic, societal and industrial challenges - encompass four main themes : advanced manufacturing ; embedded systems ; ambient intelligence ; and healthcare, including radiotherapy and imaging technologies.

About Papyrus (www.eclipse.org/papyrus) : Papyrus is an Eclipse project led by List (contact : Sébastien Gérard at sebastien.gerard@cea.fr). Papyrus is also labelled as a solution of the Eclipse industrial working group Polarsys (https://www.polarsys.org/solutions/papyrus). Papyrus supports model-driven approaches by providing a standards-based modeling tool that supports, out of the box, both the UML and the SysML international industry standards from the OMG. In addition, Papyrus provides very advanced support for custom UML profiles that specialize UML, which enables users to define and implement their own domain- and project-specific modeling tools and languages (DSMLs). The user interface of Papyrus is highly configurable to support a broad spectrum of user-specific domains and concerns.