

Reducing Time-to-Market

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Optimizing rapid prototyping for AUTOSAR software components

Rapid prototyping in automotive software development is a complex matter. The tried and tested tools provided by ETAS pave the way to develop a truly customized solution for each customer's specific use case. With the ETAS solution, PSA Peugeot Citroën was able to speed up the engine control development to master EURO 6.2.



In **prototyping**, models from ETAS ASCET and MATLAB®/Simulink®, or C code are traditionally integrated into the prototyping target. However, with the introduction of EURO 6.2, the approach for designing future diesel and gasoline engines as well as hybrid drivetrains has changed, at least for PSA. Now, under its newly established software development cycle, a functional validation in the form of rapid prototyping of AUTOSAR software components (SWCs) is essential. By inte-

grating the AUTOSAR C code generated by the function model, the internal (arithmetical) functions of the AUTOSAR SWCs are validated.

Customization enhances available rapid prototyping solution

In PSA's case, the typical configuration for a rapid prototyping system with ETAS software and hardware products needed some additional features, such as:

- Free mapping of the runnables managed by the AUTOSAR Run-

time Environment (RTE) to any task in the bypass raster

- A way to measure and calibrate the components' internal variables
- Handling of client/server calls

The AUTOSAR and rapid prototyping experts of ETAS and PSA teamed up to develop these customized extensions. Together, they designed the conversion tool AR2SIX, which makes the AUTOSAR SWCs compatible with ETAS INTECRIO.

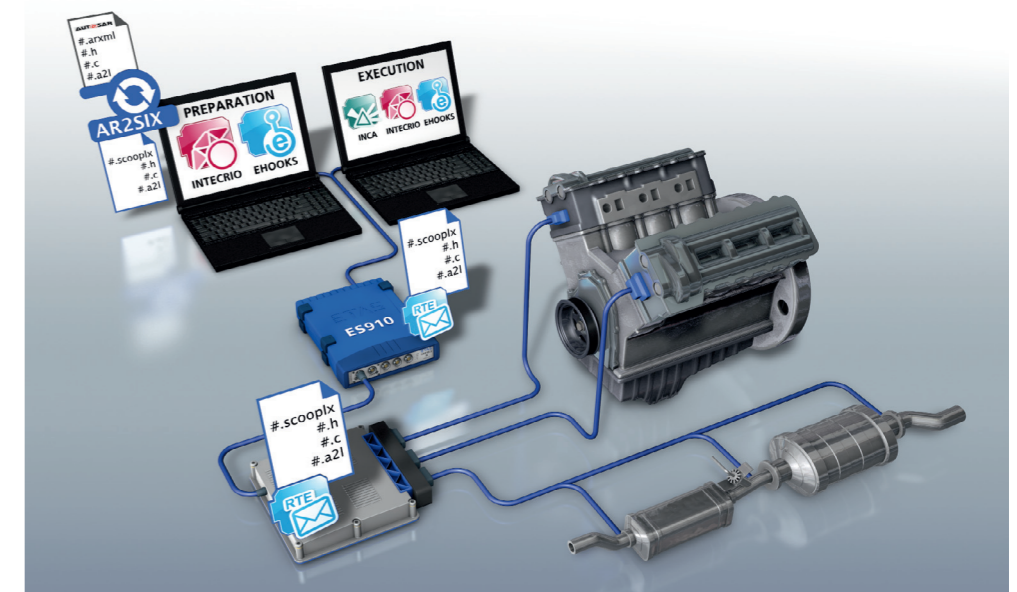
It takes original arxml, C, H, and A2L input files and converts them into Scoop-IX – a format that can be understood by INTECRIO. How the new extension complements the typical configuration of a rapid prototyping system with ETAS software and hardware products is shown in figure 1.

The conversion takes place in four major steps. First, the AUTOSAR SWCs under test contain calls to the RTE and other AUTOSAR SWCs that are not available on the INTECRIO rapid prototyping platform. These AUTOSAR SWCs are stubbed by generating C code adapters. Second, the internal SWC variables not included in the component's A2L file such as Inter-Runnable Variables (IRV) need to be visible during rapid prototyping. In order to find and visualize these internal variables, AR2SIX parses the arxml files and adds them to the SCOOP-IX interface. Third, the SCOOP-IX file defining the sources, variables, data types, etc. of a C code to be integrated is automatically generated based on its arxml definition, its A2L file, and its C code. The INTECRIO rapid prototyping platform uses the SCOOP-IX format described in xml for integrating C Code. Finally, the previously described steps can be carried out for each SWC in a composition. The effort needed to create a workspace is minimized by the automatic creation of an INTECRIO workspace with interconnecting modules.

New tool proves its worth every day

Through the AR2SIX conversion tool, the PSA coding teams can now prototype, simulate, and debug most of PSA's AUTOSAR modules in addition to their unitary validation be-

Figure 1: The new conversion tool AR2SIX (see laptop on the left) enhances the typical rapid prototyping system with bypass.



“The AR2SIX project with ETAS demonstrated the high agility of ETAS Engineering that made it possible to develop a tool serving EURO 6.2 developments of an automotive group such as PSA Peugeot Citroën in less than six months.”

El Mahdi Abghour, PSA Peugeot Citroën

fore integrating them into the engine or hybrid supervision software. The process proposed by ETAS comes with a double advantage for PSA: it's compatible both with real-time targets such as the ES910 prototyping and interface module and with the offline simulation offered by INTECRIO Virtual Prototyping.

PSA has been working with its own customized solution for two years now and reaps its benefits on a daily basis. Their SWCs are functionally tested on the vehicle designed for their needs, using the installed prototyping hardware. Additional validations – often regression tests – are made via offline simulation on the basis of real recording data using INTECRIO-RLINK. SWC compositions covering several functional areas such as pollution and combustion

functions, ADAS or hybrid functions are validated in vehicles and simulations. But most of all, PSA uses AR2SIX for a particular use case: several software and functional bugs have been detected and fixed even before they could propagate into different software projects.

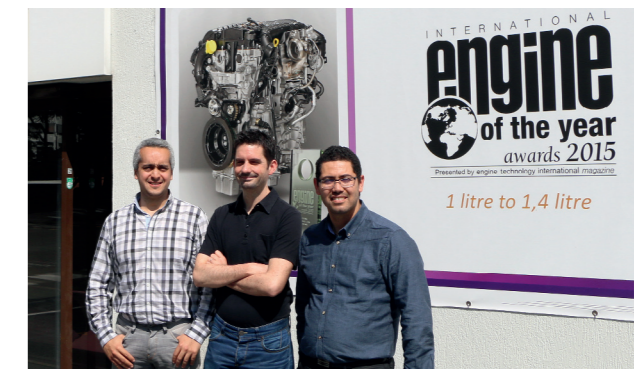


Figure 2: The PSA project team members were Mohammed Dahhani, Julien Allard, and El Mahdi Abghour (left to right).