



Integration Testing for AUTOSAR Software Components

CUSTOMER SUCCESS STORY

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The Customer

Magneti Marelli, a subsidiary of Fiat Chrysler Automobiles, is an automotive supplier for a range of products, including lighting, powertrain, electronic systems, suspensions and exhausts. Their embedded software team for the body control module development is comprised of members from three continents.



The Challenge

Having switched their code development to an AUTOSAR-based application, the Body Control Module team wanted to automate testing of the software. They preferred an off-the-shelf solution that could easily achieve their basic goal with the possibility of expansion.

To develop Body Control Module software applying AUTOSAR standards and implementing an off-the-shelf solution that could achieve their basic goal of software component testing and also be extended to include integration and system level testing.

AUTOSAR Software Component Testing

To implement software-in-the-loop (SiL) unit testing for their AUTOSAR Software Components (SWCs) Magneti Marelli selected Danlaw's Mx-Suite Embedded Systems Test Automation software. Mx-Suite's Virtual Microcontroller component (Mx-VMC) and PC executable component (MxVDev) reads AUTOSAR XML files (.ARXML) containing details of the application interfaces and automatically creates its own runtime environment (RTE). This allows testing of the SWCs in a PC environment without the AUTOSAR basic software (BSW) layer. After the short and straightforward authoring tool.

Results

The software component testing provided immediate improvements to Magneti Marelli's test process, which included:

- Defects were found before the formal validation phase with an actual ECU resulting in large savings of development time and cost
- Deeper analysis of the software was possible by providing a PC-based debugging environment, providing a higher quality deliverable
- An automated, repeatable process was reused throughout the organization

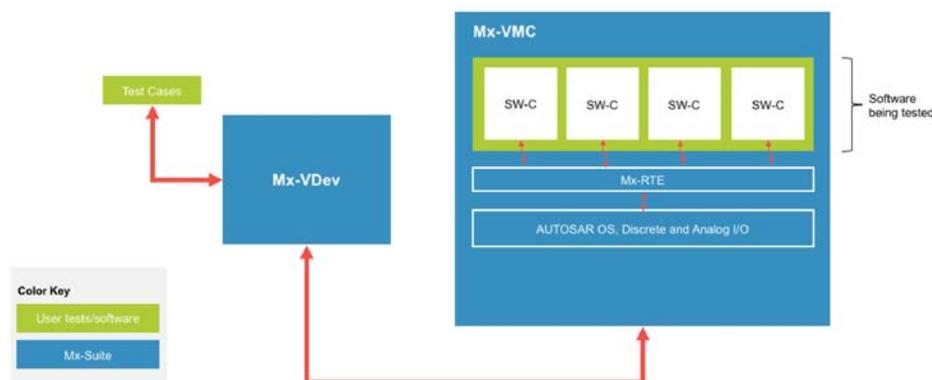


Figure 1 - Initial ECU Architecture for SiL Testing



Extending to Integration/System Testing

After the ease and success of the first implementation, the team decided to expand their testing to include integration and system testing of its full AUTOSAR implementation, not just the SWCs. They utilized Mx-Suite's ability to simulate CAN, EEPROM, Serial I/O and GPIO. It has also allowed them to reuse the SiL SWC tests.

Implementation

Magneti Marelli developed a second test harness that allowed testing of its RTE, a large portion of its Basic Software, and Complex Device Drivers. To handle the physical signals from the ECU, relevant BSW modules were modified for the target PC and mapped to the necessary Mx-Suite services. For CAN and LIN signals, a COM stack consisting of AUTOSAR COM, PDU Router, CAN/LIN Transport Layer, CAN/LIN user interface, CAN/LIN State Manager, CAN/LIN Network Manager, and CAN/LIN driver were inserted into the environment. The MCAL was discarded.

The CAN and LIN interface modules were mapped to the Mx-Suite library components by importing the project's CAN database files (.dbc) and LIN database files (.ldf). This allowed the communication stimulus and response signals to be available for testing.

Mx-Suite can import the AUTOSAR OS OIL configuration which automatically maps the task artifacts to the PC OS.

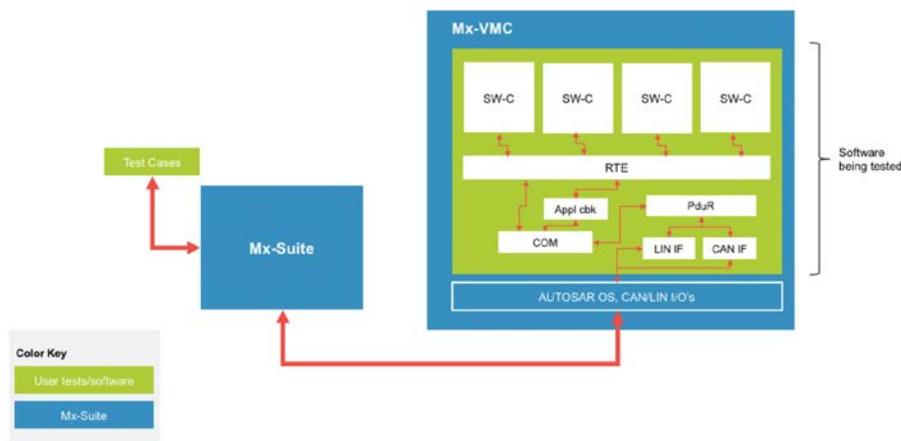


Figure 2. Final ECU Architecture for SiL Testing

Injecting Faults

For robust testing, the team wanted to inject erroneous messages (such wrong message length or timing) into the system. This was achieved by creating a second VMC in the test harness to simulate additional ECUs with those attributes.

Results

The Magneti Marelli team reported that additional setup – stubbing and the SiL configuration - took less than one business week to complete. The mapping of the MxVDev services supporting CAN and LIN messaging was also straightforward.

Contact Us

If you would like to learn more about Danlaw's integration testing of AUTOSAR software components, please contact our team at mxsales@danlawinc.com.