

HCL

// CASE STUDY

ADVANCING AVIONICS VERIFICATION AND VALIDATION



HCL OneTest



HCL SOFTWARE

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INTRODUCTION

HCL Engineering and R&D Services (ERS) is one of the world's largest third-party service providers in aeronautics, working with more than 15 avionics customers worldwide on avionics and electro mechanical systems for Boeing, Airbus, Bombardier, Embraer, Gulfstream, COMAC and other major programs.

Avionics validation and verification requires significant engineering effort to comply with regulatory requirements DO-178B or DO-178C software standards, and teams are always looking for ways to reduce this effort through automation to achieve time-to-market goals.



CHALLENGE

Reducing delays in avionics software engineering projects is extremely difficult due to the risk of failure in the software – where an error could result in fatal loss. More than 90% of their software verification and validation projects are delivered late due to one or more of the following reasons:

- Project planning and tracking are inaccurate and incomplete
- Requirements are missing, unclear and changing
- Infrastructure delays in creating and configuring the development and test environments
- Third-party tool integrations cause delays due to unstable test frameworks
- Finding software issues late

Specific challenges addressed by OneTest Embedded include:

- Significant manual effort involved in low level testing, code review and hardware-software integration testing and analysis
- Manual errors and rework efforts and costs
- Availability of test environments for hardware-software integration testing during the early stages of testing strategy
- Control schedule and control variances while achieving time to market needs



STRATEGY

The HCL ERS avionics team had been using IBM Rational Test RealTime for 10 - 15 years and had deep expertise in that product, but Test RealTime lacked some features that would make their verification process more efficient and effective.

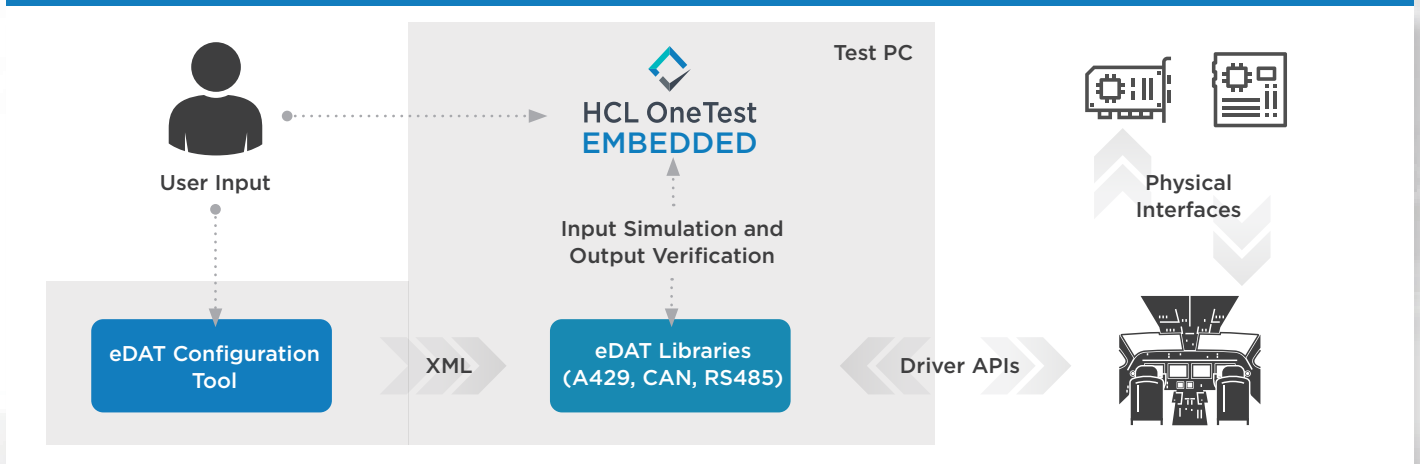
They partnered with the HCL OneTest Embedded engineering team to implement new capabilities that would allow them to use OneTest Embedded across all their testing phases.



SOLUTION

The solution (called eDAT) put in place by HCL ERS relies on a workbench that interfaces the system under test with a machine dedicated to the test through a C/C++ library (supporting discrete I/O, ARINC bus...), and targets the top five categories in avionics software testing / verification and validation (code review, low level testing, software-software integration testing, hardware-software integration testing, and analysis) based on the use of OneTest Embedded.

SOLUTION COMPONENTS SUPPORTING THE HARDWARE-SOFTWARE INTEGRATION TESTING:





SOLUTION CONTINUED

This solution offers the following advantages:

- For testers, the same tool is used independent of the testing phase
- For certification, the same kind of test report is produced
- Simplifies some testing phases as the coverage objective is global
- Provides a flexible solution regardless of the system under test (only the library should be updated)

OneTest Embedded primarily helped in automating the code review and analysis activities. Key features that benefited the team are:

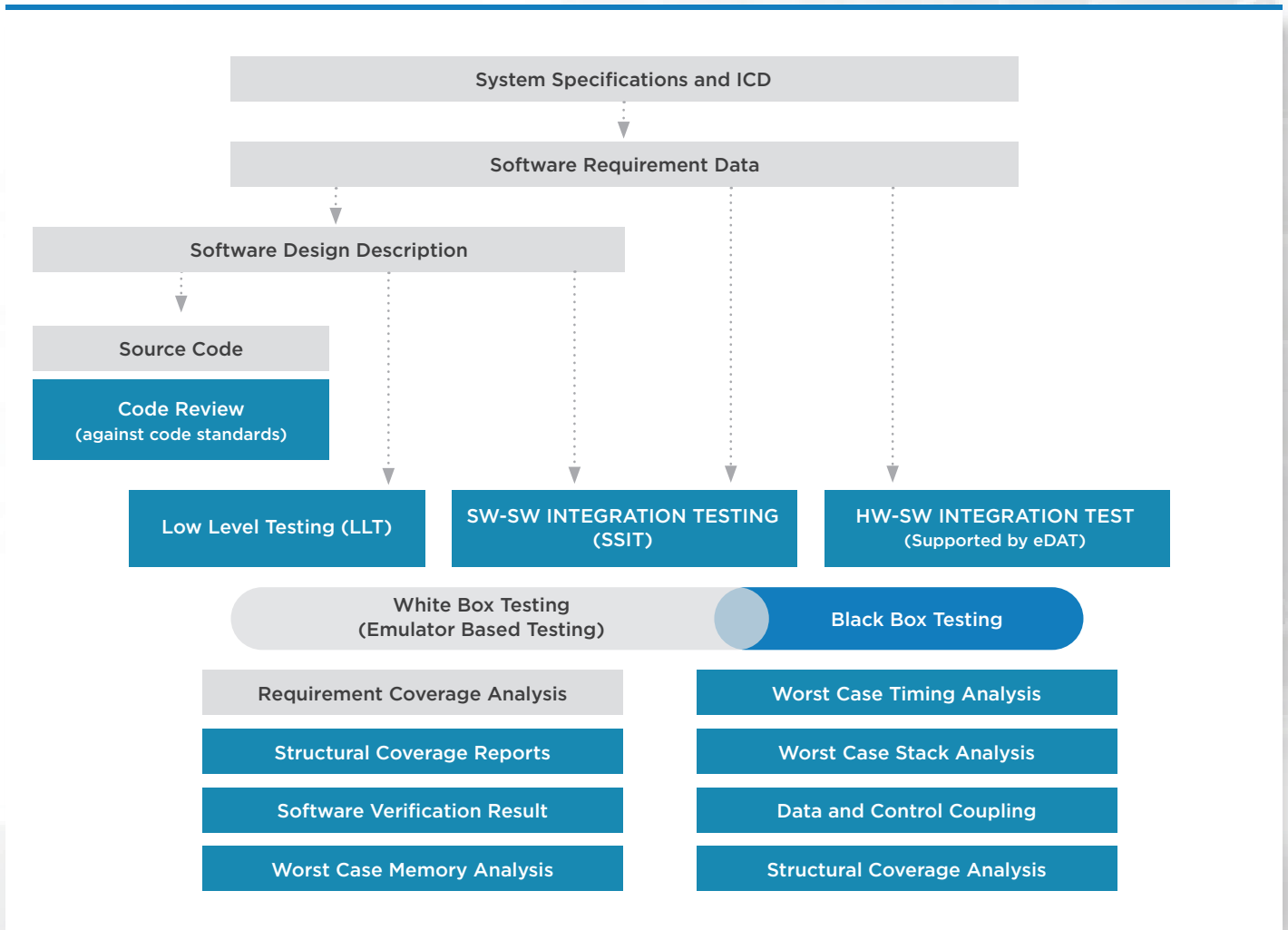
- Code review (specifically MISRA C 2012)
- Hardware-software integration testing (HSIT)
- Software-software integration testing (SSIT)
- Low level testing (LLT)
- Structural coverage in combinations or individual tests using HSIT, SSIT, and LLT, using the innovative framework
- Structural coverage analysis editor based on real time structural coverage
- Automation of data coupling and control coupling analysis
- Automation of memory and timing analysis
- Source to object analysis (for level A)
- Supporting tool qualification kits





SOLUTION CONTINUED

VERIFICATION ACTIVITIES SUPPORTED BY HCL ONETEST EMBEDDED





MEASURABLE RESULTS

Using OneTest Embedded, the team ensured software code accuracy and consistency, and reduced their test case generation effort by 20 - 25%. They also reduced their code coupling analysis effort by one-third with OneTest Embedded - saving more than 700 hours of effort. In addition, they achieved more than 14% savings with assisted test creation from call graphs and the scriptless visual test editor.





HCL ONETEST EMBEDDED FOR AVIONICS

HCL OneTest Embedded is a unique solution for component testing and runtime analysis (code coverage, performance, memory and stack analysis, control and data coupling) that works on targets thanks to its Target Deployment Port technology.

HCL OneTest Embedded supports the following DO-178C test objectives:

- Verification of output of software coding and integration process (Table A5 of DO-178C)
 - Software code is accurate and consistent (regarding stack, memory, and timing analysis).
 - Source code conforms to coding standards.
- Testing of output of integration process (Table A6 of DO-178C)
 - Executable object code complies with HLRs.
 - Executable object code is robust with HLRs.
 - Executable object code complies with LLRs.
 - Executable object code is robust with LLRs.
 - Executable object code is compatible with the target computer.

- Verification of verification process results (Table A7 of DO-178C)
 - Test results are correct and discrepancies explained (actual vs expected).
 - Test coverage of software structure (modified condition/decision coverage).
 - Test coverage of software structure (decision coverage).
 - Test coverage of software structure (statement coverage).
 - Test coverage of software structure (data coupling and control coupling).

OneTest Embedded also provides a qualification kit that verifies compliance against the DO-330 standard - at the most critical tool qualification level (TQL-5).





ABOUT THIS CASE STUDY

HCL OneTest belongs to the DevSecOps product domain of HCL Software which is a division of HCL Technologies (HCL) that operates its primary software business. It develops, markets, sells and supports more than 20 product families in the areas of DevSecOps, Automation, Digital Solutions, Data Management, Marketing and Commerce, and Mainframes.

For more information, visit hcltechsw.com/OneTestEmbedded.

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