



AURIX™ Knowledge Lab 2021

miniHIL Overview – HIL Tests on developers desktop

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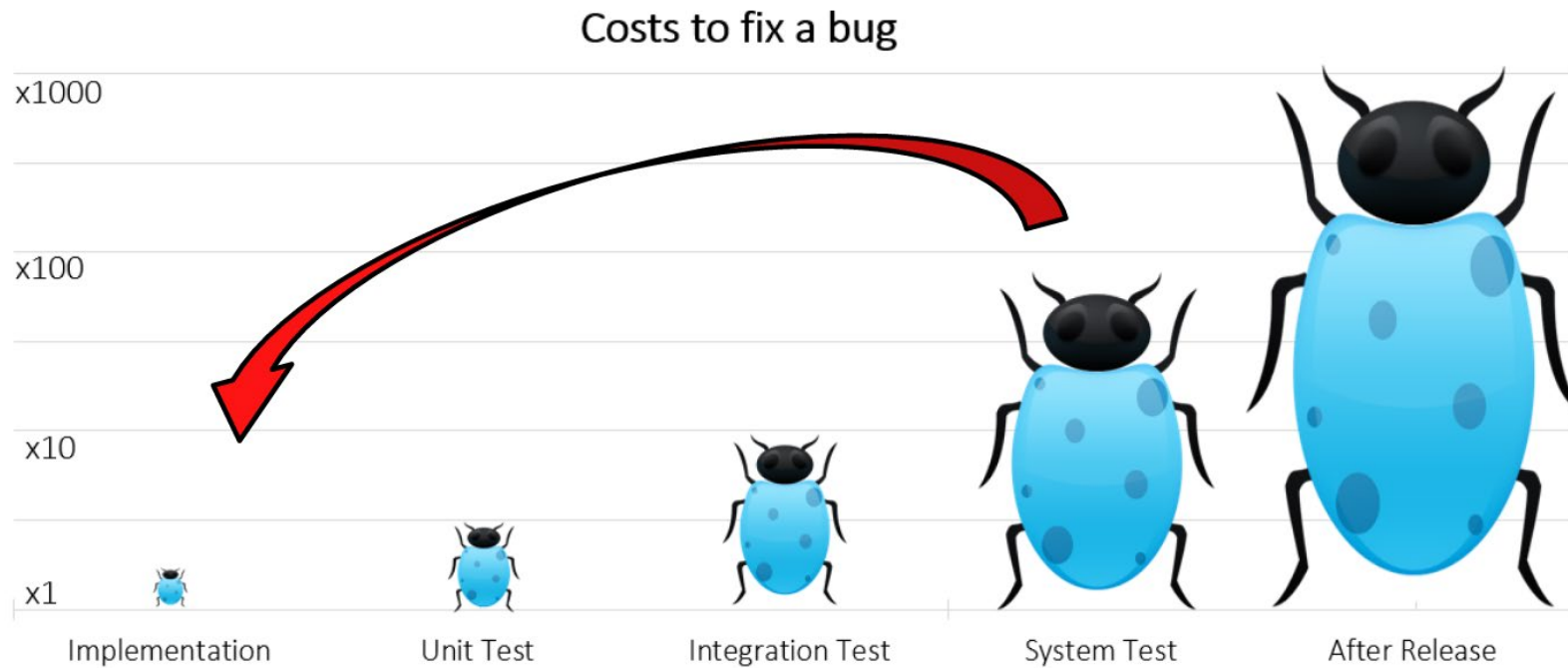
miniHIL Overview - HIL Tests on developers desktop



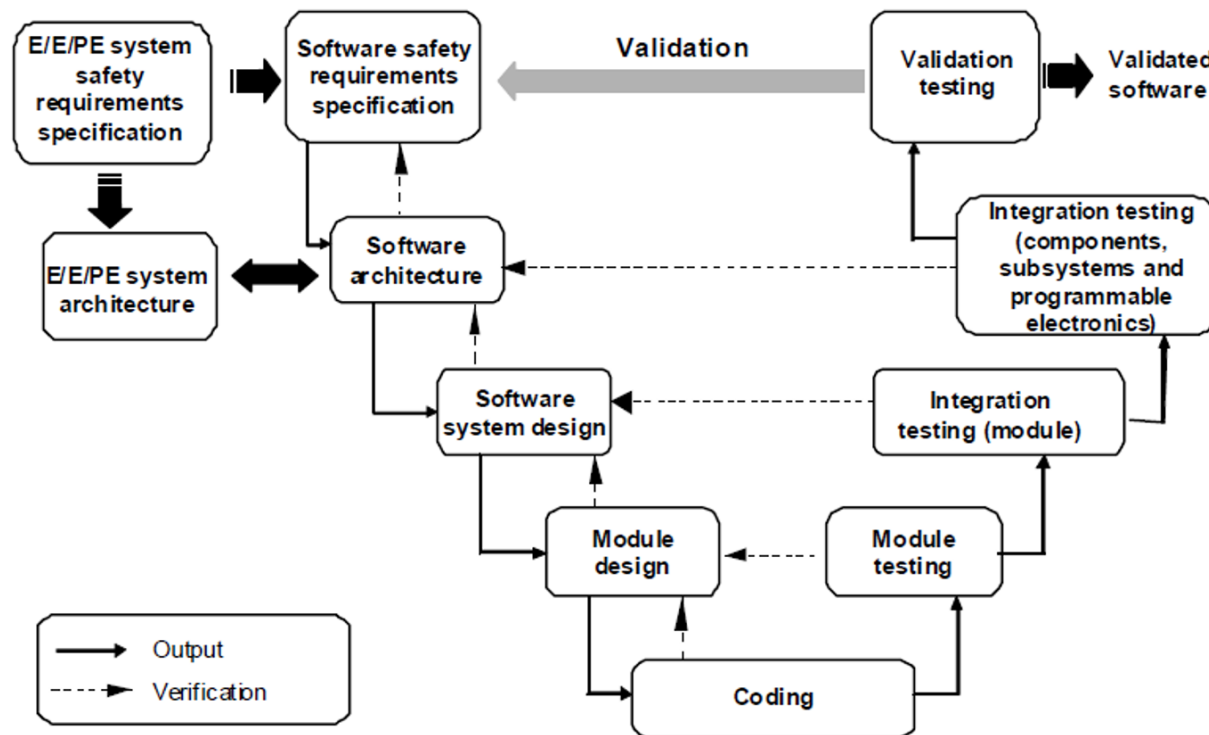
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Why is (early) testing so important?

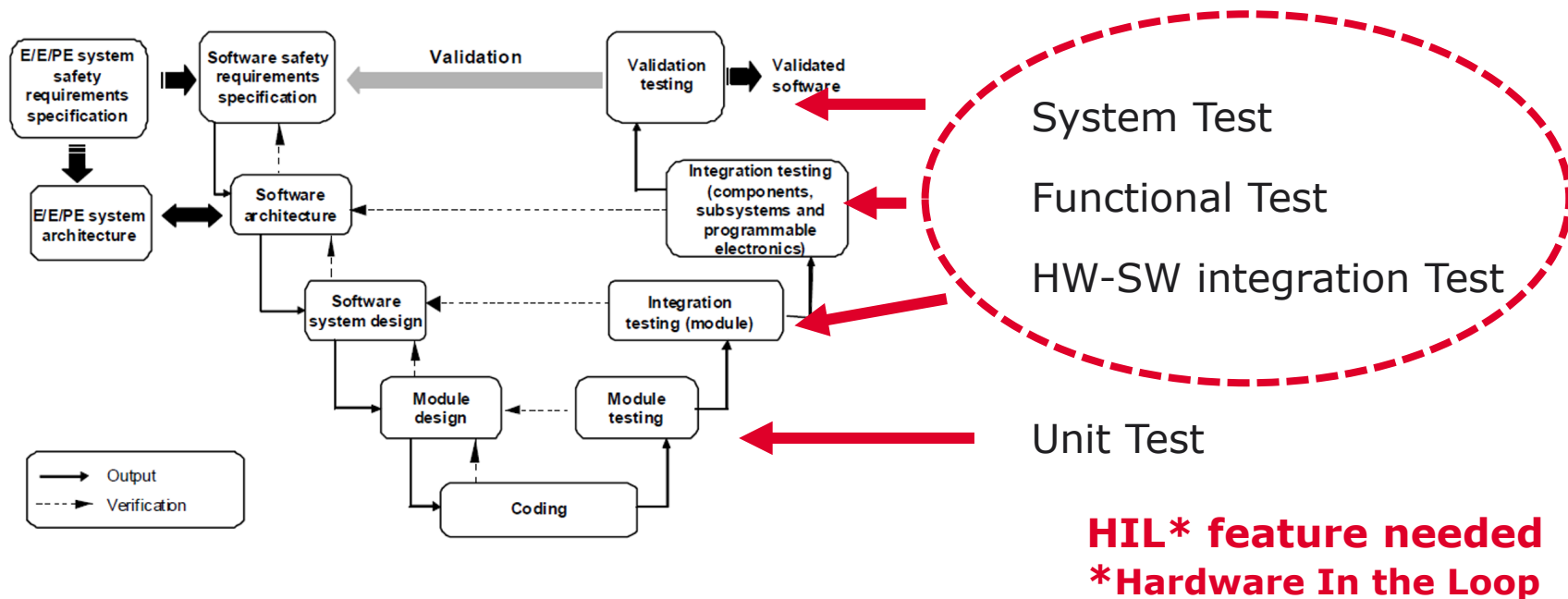


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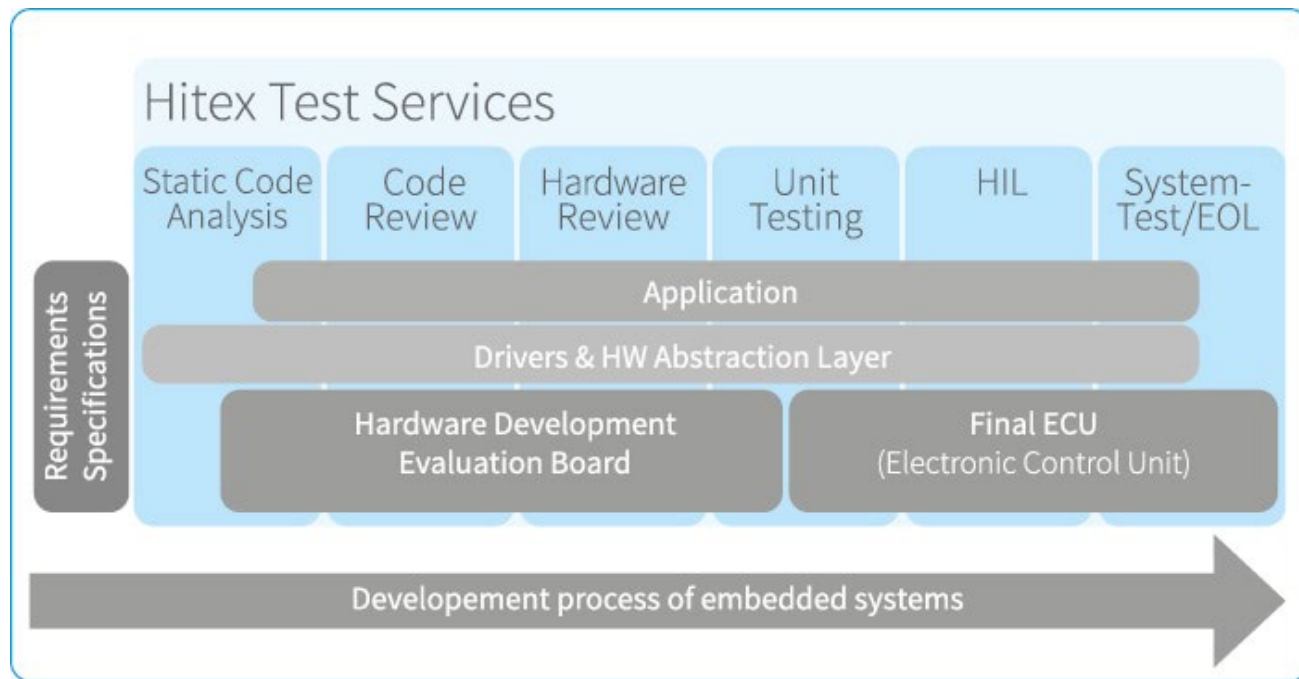


Why is (early) testing so important?

Quality SW development and safety standards are demanding test & validation on the right side of the V-Model



Testing is essential ... but often done to late



- Tests are mandatory according to FuSa-standards:

- ☐ ISO 26262
- ☐ IEC 61508
- ☐ ISO 13849
- ☐ EN 5012x
- ☐ IEC 60335
- ☐ IEC 60730

➡ 95 % of the Embedded Projects are not tested in the early phases

Challenges with conventional HIL solution

- Tool costs are high
- Complexity of tool
- Simulation of complex or dangerous hardware
- Expensive HIL hardware necessary
- Early test without final ECU not easy
- No test on developers desktop

Today's challenge ...

➔ No HIL tests at home possible ... but project timeline will not change

What is needed to master these challenges ?

- Real time HW stimulation and measuring
- Support of used interfaces (IO, analog, UART, SPI, I2C, CAN, LIN,...)
- Support of complex protocols (e.g. CAN, LIN, XCP, TCP/IP...)
- Simulation of complex real time hardware (Sensors, Batteries, Components like RAM, Flash,...)
- Test of Motor Control Software (e.g. BLDC motors, sensorless, with sensors)
- Hardware Abstraction Layer (HAL) Test
- Definition of test cases
- Automatic execution of test cases
- Protocolling of test results
- Continuous Integration (CI) possibility
- Achievable prices
- Last but not least ...

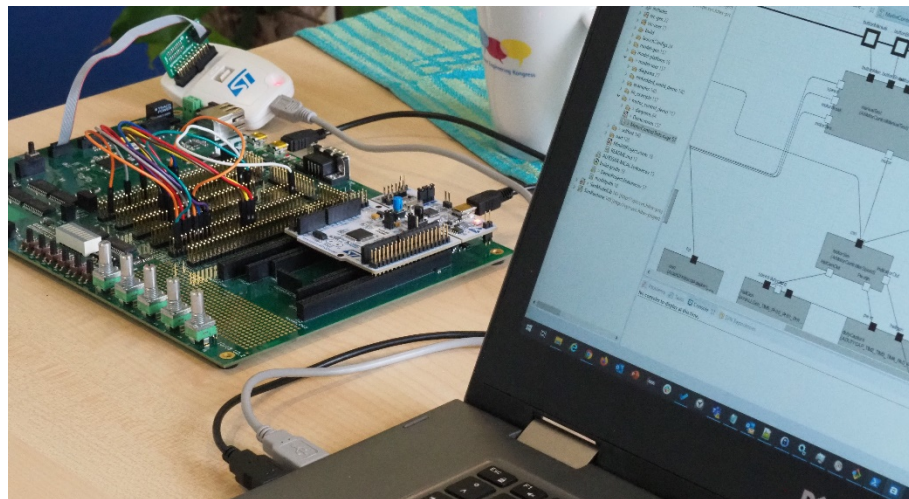
→ We need a portable and budget friendly solution !

The solution: The PROTOS miniHIL

- No safety or hardware problems:
 - Low voltage
 - No additional hardware, only simulations
- Simple development and test on evaluation boards
- Small enough for desktop
- Inexpensive hardware for every desktop

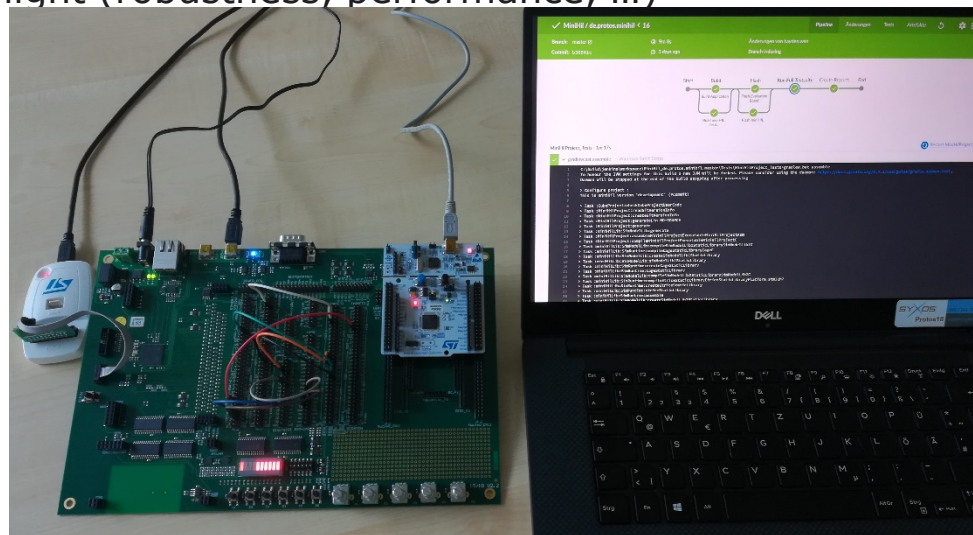
Additional Benefits:

- Full test automation from desktop to continuous integration
- Failure injection, not only “happy path tests”
- Full regression testing after every change
- Simulation based integration- and system-test
- No ECU or final hardware necessary



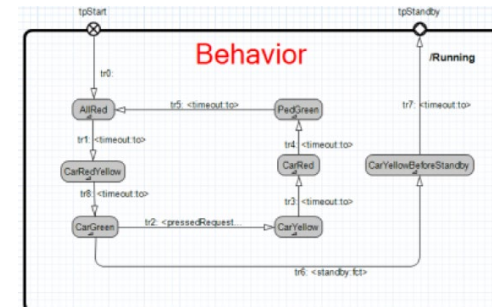
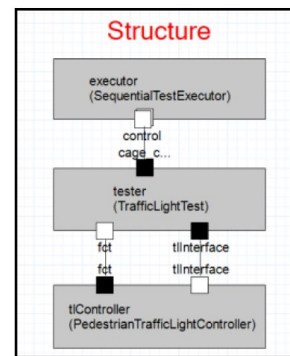
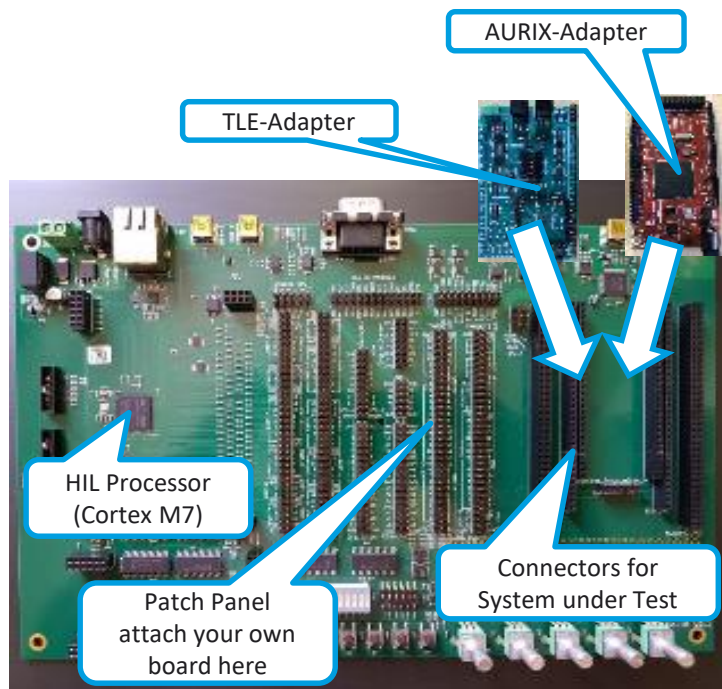
Continuous Integration for HIL Tests

- Full Hardware in the Loop test automation with continuous integration (CI)
- Every commit for application or test cases triggers test run
- Fail fast: First test results for commit after 5-15 minutes
- Deeper tests can run automated over night (robustness, performance, ...)
- Automated test reporting
- Inexpensive, small hardware enables CI setup for every project
- Every application or test developer can use the test setup, **also from home office**



The solution:

miniHIL Environment Simulation and Tests



Feature Coverage Report Overview

Result: FAIL

Project: **Project1**

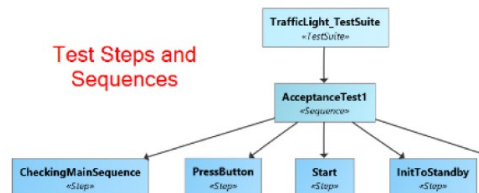
Date: **23-08-2017**

Rev. Info:

PASS Total Coverage
Features: 11 43 25.5 %

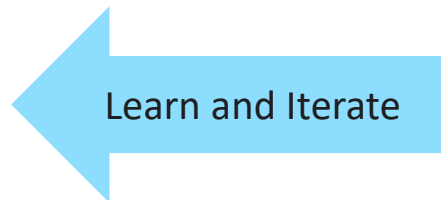
Testcases: 2652 2653 99.9 %

Legend: failing missing issues passing



Feature	Testcases		
Feature 1	100 %	8 / 8	
Feature 2	89.4 %	17 / 19	
Feature 3	79.3 %	23 / 29	
Feature 4	90.9 %	20 / 22	
Feature 5	100 %	8 / 8	
Feature 6	65.6 %	21 / 32	
Feature 7	92.8 %	13 / 14	
Feature 8	90 %	18 / 20	
Feature 9	85.7 %	6 / 7	
Feature 10	80 %	12 / 15	
Feature 11	68.4 %	13 / 19	
Feature 12	90.6 %	29 / 32	
Feature 13	83.3 %	5 / 6	
Feature 14	75 %	3 / 4	
Feature 15	100 %	9 / 9	
Feature 16	82.7 %	24 / 29	

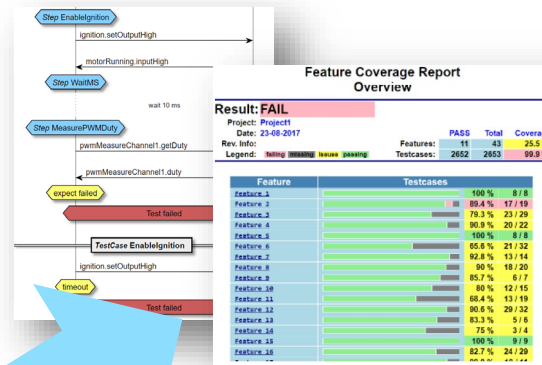
3. Analyse Test Reports and Traces



Generate,
Compile, Flash



Log



2. Execute Simulation and Tests on miniHIL

hitex
EMBEDDED TOOLS & SOLUTIONS



Feature Coverage Report Overview

Result: FAIL

Project: Project1

Date: 23-08-2017

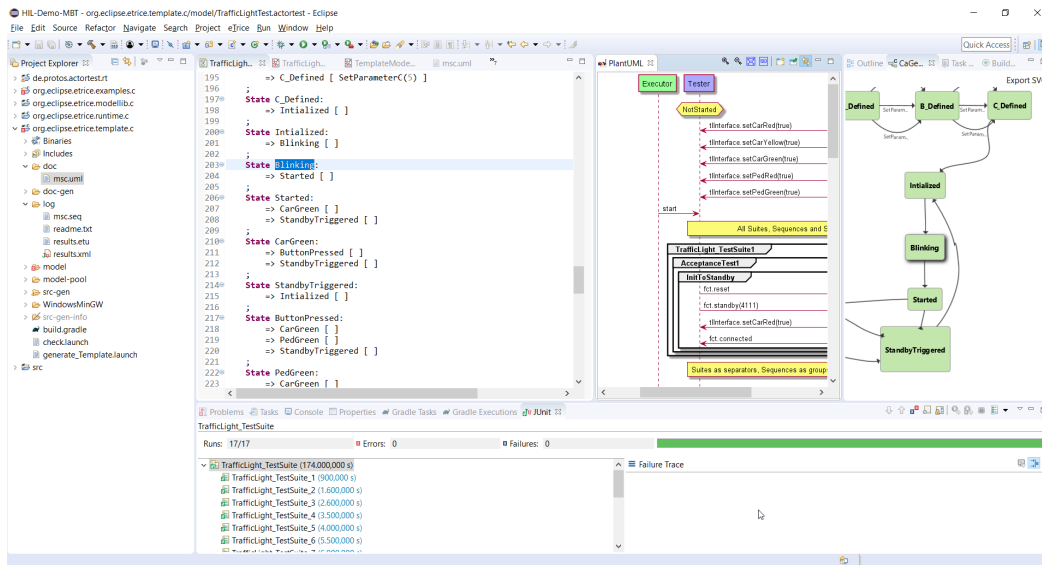
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No time for miniHIL Demo here ... contact us ☺



Price Indication (10.2021)

miniHIL Software Licenses and Features				
miniHIL Features	Developer License (Node Locked)	User License (Node Locked)	Continuous Integration Server License (Node Locked, max. 4 Cores)	Target License (per miniHIL Board)
CaGe - Test Modeling and Test Generator	X			
miniHIL GUI	X	X		
Test Reporting and Traceability	X	X	X	
Build and Test Automation	X	X	X	
eTrice (Open Source) - Modeling for Simulation and Monitoring	X			
miniHIL Target Framework				X
Software Price				
License Price	12.000 €	4.000 €	10.000 €	1.000 €
Maintenance Price (20% of License Price per year)	2.400 €	800 €	2.000 €	200 €

miniHIL Hardware	Price
miniHIL Board 2.1 (requires one Target License per Board)	2.000 €
miniHIL Target Adapter Boards for specific Microcontrollers	price on request
miniHIL FPGA Extension Board	price on request

Starting a miniHIL project

- We support you throughout the entire miniHIL implementation process
- Detailed consulting based on your use cases
- Initial workshop with concrete benefits for you based on your requirements
- Implementation of pilot project(s)
- Project accompanying test services

■ Agenda

- Introduction into miniHIL based on customers test requirements (e.g. current system/software architecture, current test methods, test objectives, gaps, ...)
- Overview of test possibilities with miniHIL on the basis of a concrete demo project.
- Development of test objectives and boundary conditions
- Definition of system boundaries, interfaces and performance characteristics
- Definition of next steps

■ Results of the workshop

- Test objectives and boundary conditions
- Conceptual design for a pilot project (specification)
- Definition of acceptance tests
- List of next steps and priorities
- Clear insight into the advantages and values of using miniHIL

■ Time Invest

- 1-2 days onsite or WebEx

■ Pilot Project Definitions

- The type and scope of the pilot project will be defined during the initial workshop.
- The scope of the pilot project includes
 - Implementation of test cases on a jointly defined customer project
 - Installation of hardware and software incl. electrical wiring for device-under-test (DUT)

■ Procedure

- During the pilot project, a test setup relevant to you will be developed, which will already be of use to you and will enable you to assess the further use of miniHIL technology.
- During the workshop, training on the basics of miniHIL hardware and software will be conducted on your test setup.
- You will be able to work with the test system during the pilot project and receive remote support from Hitex.
- At the end of the pilot project, the test setup is handed over in the form of a two-day workshop.

■ Invest: on request / based on outcome of Initial miniHIL Workshop

- Test-Consulting
 - Based on standards (e.g. IEC 61508, ISO 26262, ISO 13849 ...)
 - Test strategies for static and dynamic testing and system integration
 - Test strategies during development
 - Writing testable code
 - ... and much more
- Implementation of miniHIL tests based on your specification
- Project accompanying consulting
 - Direct access to miniHIL experts during your project
- Training

The miniHIL enables early Tests:

- Microcontroller Systems Tests
- Driver Development Tests (HAL / AUTOSAR-MCAL)
- Component Tests for Motor, Battery, Protocols and other Elements
- Integration Tests for Drivers, Components and Application on Target CPU with IO-Signals
- Test for complete Microcontroller Applications (HIL System Tests) without additional HW

Features:

- Model Based Development for Environment Simulation and Test Cases
- Code Generators for Simulation and Test Cases
- Hard Realtime
- Support for a big variety of Microcontrollers
- Automatic execution of test cases on Desktop and Continuous Integration

- ➡ **Test your Microcontroller Applications early and automated !**
- ➡ **You can perform HIL tests on your desktop and at home as well ☺**

Compatible with HomeOffice ! ☺



Any questions?

Thank you
for your attention!
Please contact me ...



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Embedded Solutions

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