

Comments

Date	Author	Description	Classification	Action	DiVa
15.04.2013 15:11:17	VECTOR	The DID is not implemented yet	ECU Issue	To Do	delete edit

Test Case begin: 2013-04-15 14:36:39 (logging timestamp [4.882240](#))
 Test Case end: 2013-04-15 14:36:55 (logging timestamp [5.092240](#))

Test Case Sequence

[Show All](#) [Hide All](#)

Timestamp	Test Step	Result
4.885240	Read1	+
4.912232	Read1	+
4.914230	Write1	+
4.942232	Write1	+

3D car model with network diagram overlay.

CANoe.DiVa

Diagnostic Integration and Validation Assistant

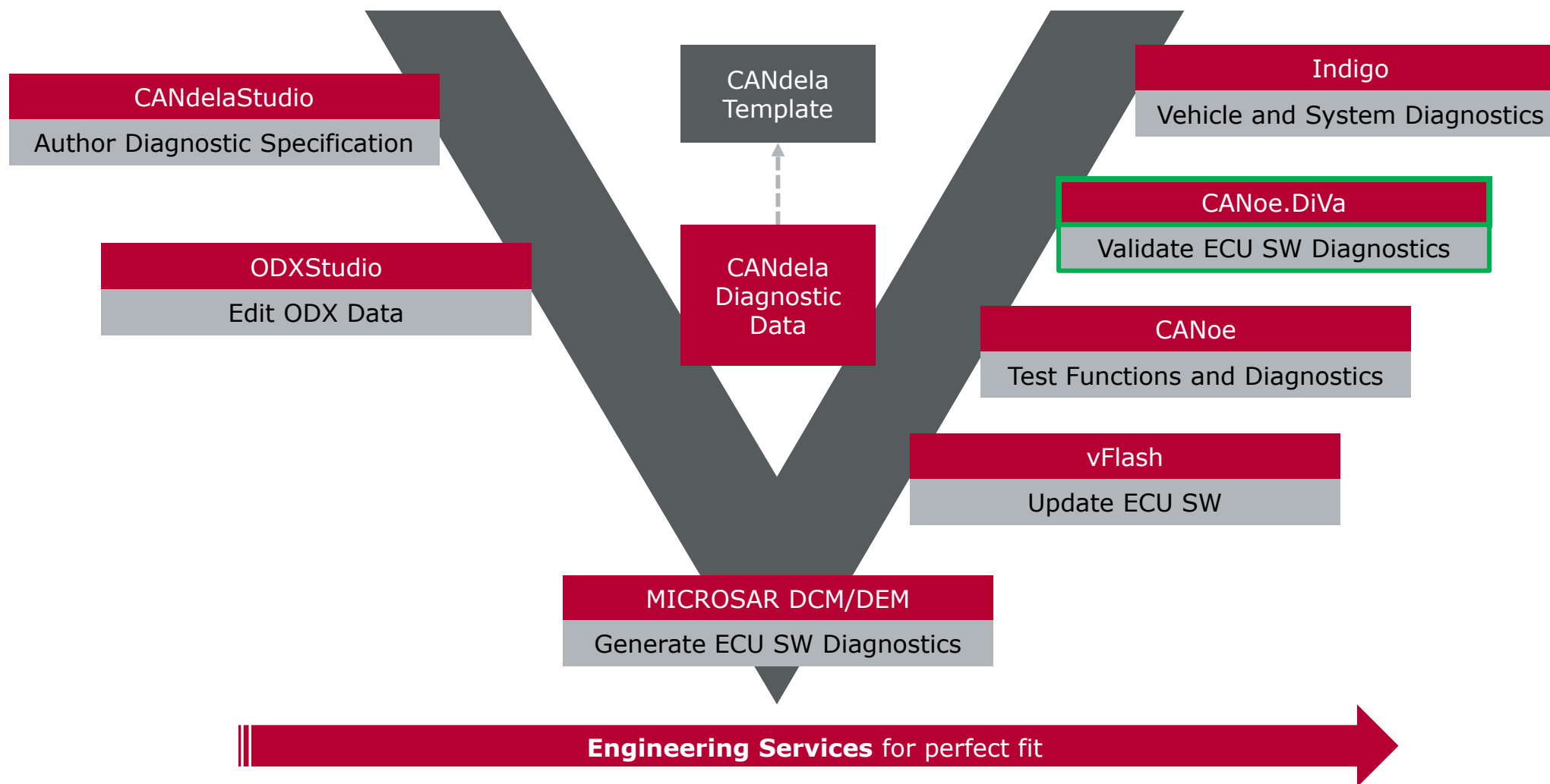
Agenda

► **Overview**

Features

Summary

CANoe.DiVa in Diagnostics Development Process



The Mission

automated

test run

test generation

CANoe.DiVa

documented

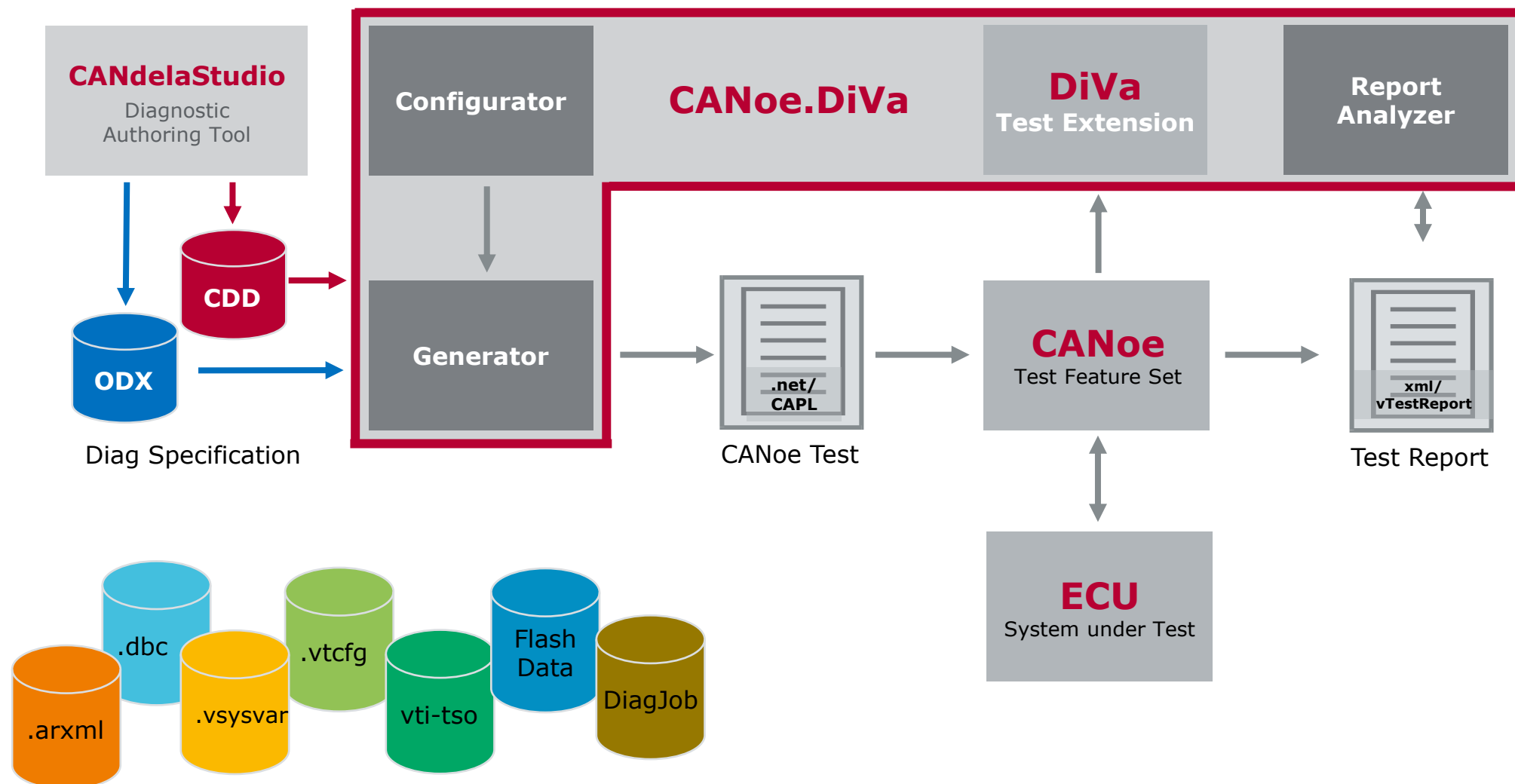
broad and detailed

reproducible

data driven

diagnostic tests

CANoe.DiVa



Supported Protocols

- ▶ ISO 14229 Unified Diagnostic Services (UDS)
- ▶ ISO 14230 Keyword Protocol 2000 (KWP)
- ▶ ISO 27145 World-wide harmonized OBD (WWH-OBD)
- ▶ ISO 15031/J1979 On Board Diagnostics: OBD II, OBDOnUDS and ZEVonUDs
 - > Including Production Vehicle Evaluation (PVE)
 - > Including automation for J1699-3/-5

- ▶ Various manufacturer specific test extensions
e.g. for DTAG, FCA, GM, HMC, Mercedes, TMC,...

Comprehensive Diagnostic Testing Solution

Diagnostic Application

Fault memory,
parameter contents,
environment
conditions,...

SW Update

Valid SW update &
error conditions (power
loss, under-voltage,...)
Test ability to recover
from errors

Diagnostic Sequences

Testing of diagnostic
scripts e.g. for
Production, After-Sales
or OTA use cases

Diagnostic Protocol

Timing, Format, Data type definitions, Sessions,
Authentication/Security,... on all diagnostic busses:

CAN, LIN, FlexRay, DoIP, K-Line,...

Process Integration

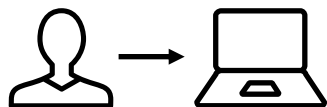
Development

- ▶ Control and automate test execution to support CI/CT use cases via CANoe Server Edition or Command Line

Quality

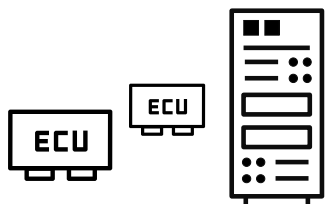
- ▶ Requirement Traceability for the major TDM/RQM systems (via the Connection Utilities)
- ▶ Open interfaces to integrate with others/proprietary solutions (xml or .net API)

CANoe.DiVa Product Editions



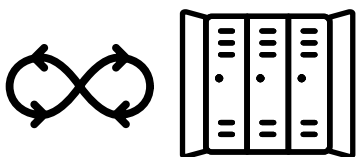
Desktop

Workplace tool for diagnostic test engineers
Test of HW and SW based HPCs and ECUs (real-time and above)



Test Bench

Shared tool usage on a test bench for diagnostic test engineers
Remote and anonymous access
Test of HW and SW based HPCs and ECUs in real-time



Server

Script-based headless test generation and execution
to support DevOps, CI/CT applications (GitLab, Jenkins etc.)
Test of HW and SW based HPCs and ECUs (real-time and above)

Agenda

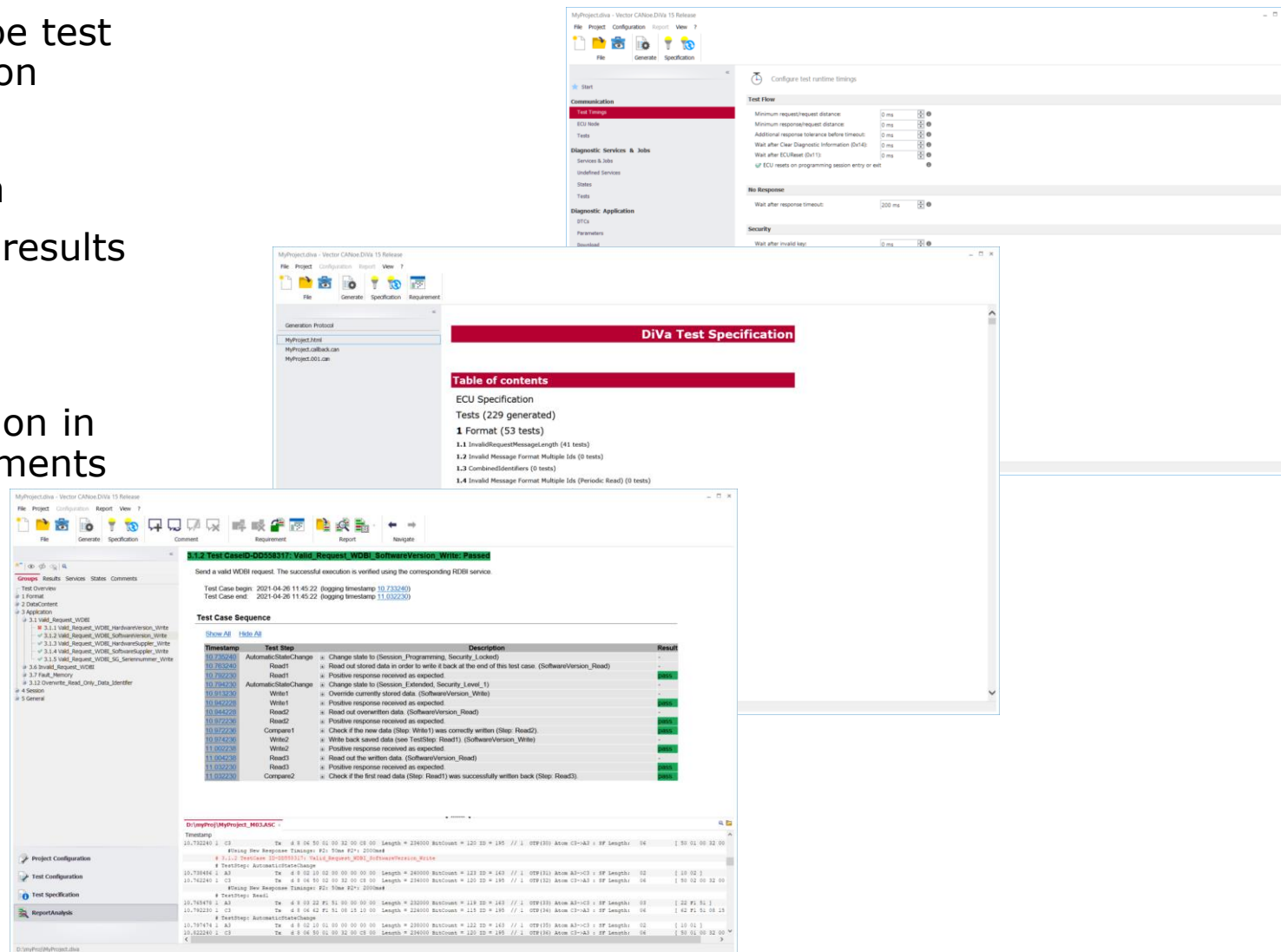
Overview

► **Features**

Summary

Overview

- ▶ Automated generation of a CANoe test based on a diagnostic specification
- ▶ User interface to configure tests
- ▶ Generation of a test specification
- ▶ Clear and detailed report of test results
- ▶ Support of test report analysis
- ▶ Requirement traceability
- ▶ Automatable control for integration in build- or regression test environments (e.g. Jenkins)
- ▶ Extensible test functionality



The image displays three overlapping screenshots of the MyProjectLab - Vector CANoe DiVA 15 Release software interface.

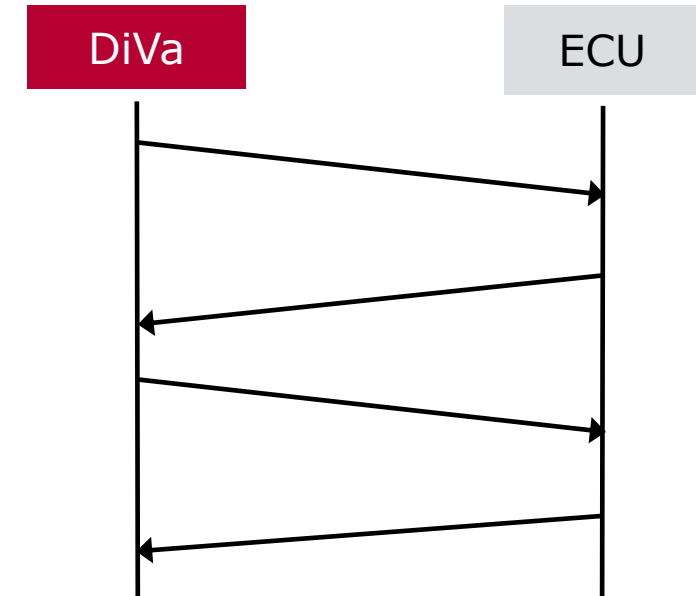
The top-right screenshot shows the "Configure test runtime settings" dialog, with tabs for "Test Flow", "Test Parameters", and "Security". The "Test Flow" tab is active, showing settings for "Minimum request/request distance" (0 ms), "Minimum response/request distance" (0 ms), "Additional response timeout before timeout" (0 ms), "Wait after Clear Diagnostic Information (Dx14)" (0 ms), "Wait after ECU Reset (Dx11)" (0 ms), "Wait after ECU Reset on programming session entry or exit" (0 ms), "Wait after response timeout" (200 ms), and "Wait after invalid key" (0 ms).

The middle-right screenshot shows the "DiVA Test Specification" window, which includes a "Table of contents" listing the ECU Specification, Tests (229 generated), and a list of test cases including "1.1 InvalidRequestMessageLength (41 tests)", "1.2 Invalid Message Format Multiple Ids (0 tests)", "1.3 CorruptedData (0 tests)", and "1.4 Invalid Message Format Multiple Ids (Periodic Read) (0 tests)".

The bottom-left screenshot shows the "Test Case Sequence" window, displaying a list of test steps with their timestamps, descriptions, and results. The test case is "3.1.2 Test Case ID-00505217: Valid_Request_WDID_SoftwareVersion_Write_Passive". The test case sequence includes steps like "AutomaticStateChange", "Read1", "Write1", "Read2", "Write2", "Read3", and "Compare2". The results for all steps are "PASS".

Protocol Testing

- ▶ Diagnostic Message Flow
 - ▶ Physical, functional addressing and timing
- ▶ Diagnostic Protocol Format
 - ▶ Valid, Combined and Invalid Requests
 - ▶ Response (single, none, multiple)
- ▶ Data Type Checks
- ▶ Sessions and Security Levels
 - ▶ Service execution in the different sessions and security levels
 - ▶ Session and security state transitions



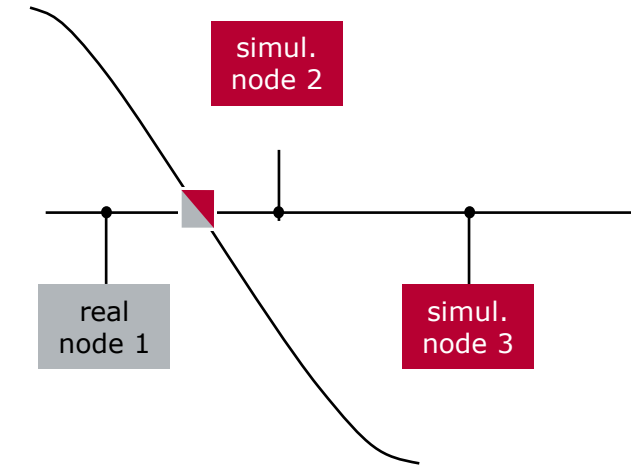
Application Testing: Diagnostic Parameter

- ▶ Passive parameter validation against
 - ▶ Diagnostic values (e.g. read/write)
 - ▶ Configured data ranges
 - ▶ Expectation values
 - ▶ CCP/XCP values
 - ▶ CANoe System Variables

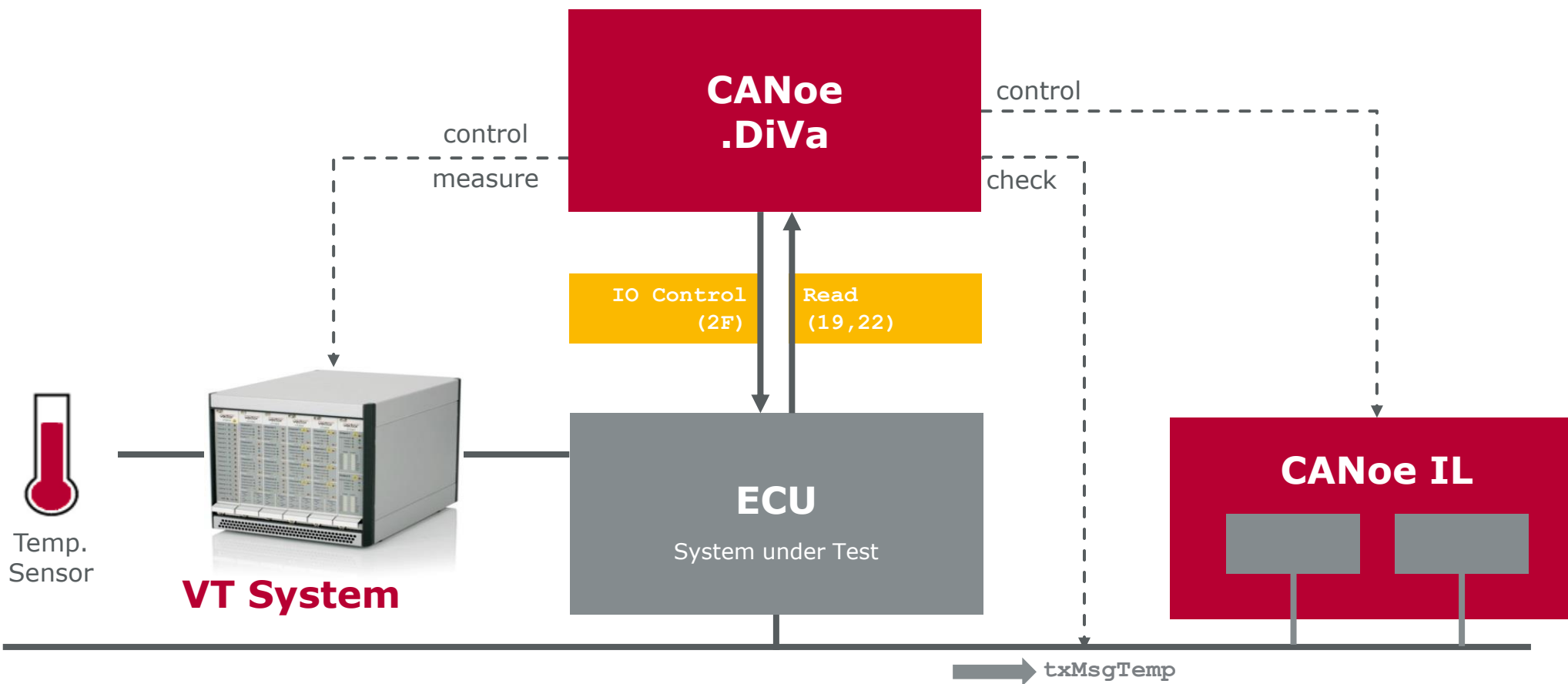
- ▶ Active control of I/Os to validate diagnostic parameter content
 - ▶ CAN messages using CANoe rest bus simulation
 - ▶ HW I/Os via VT System channels
 - ▶ Any I/O using CANoe system variables

Application Testing: Fault Memory

- ▶ Provoke network signal failures
 - ▶ Communication timeouts
 - ▶ Data consistency failures
- ▶ Provoke hardware failures using the VT System:
 - ▶ Short-circuits (Ground, UBatt, Pins)
 - ▶ I/O failures (interruption, resistance, voltage)
 - ▶ Individual error settings
- ▶ Any other failures using user scripts



Application Testing



Diagnostic Job Testing using Vector Diagnostic Scripting

► **Motivation** *Test ECU-individual diagnostic sequences*

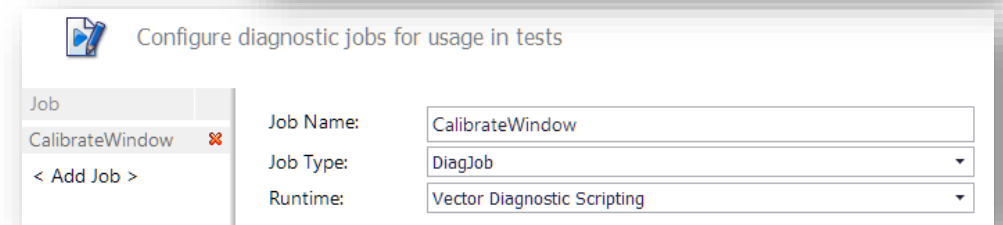
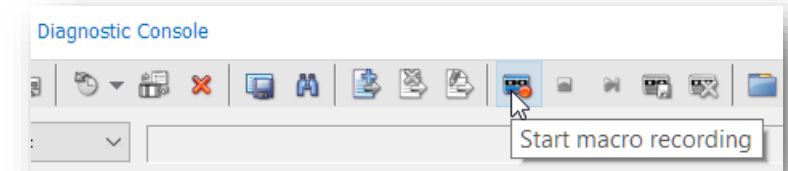
- > Prove that a required diagnostic sequence/feature is correctly supported

► **Fast & easy setup**

- > Use the CANoe macro recorder to record ECU-specific diagnostic sequences (e.g. "Calibration of roof window")
- > Configure the recorded VDS macro in DiVa and run it in a Test
- > Flexible: Use Vector Diagnostic Scripting (VDS) to implement test sequences in C#/.net

Benefits

- CANoe.DiVa standard checks (format, data, timing etc.) are automatically applied
- Automated and reproducible diagnostic sequence/feature test
- Use of CANoe's testing, reporting and post-processing features
- Allows pure virtual SW based testing of diagnostic jobs in combination with vVirtualTarget ECU
- Can be used to emulate not yet available diagnostic tester systems: e.g. On-Board Tester



Test Case Sequence			
Show All Hide All			
Timestamp	Test Step	Description	Result
42.675240	TesterPresent	Send Tester Present (Tester_Present_Process)	-
42.727486	TesterPresent	Response suppressed.	pass
42.928486	Setup	Start external third party tool.	-
42.929486	Run Diag Job	Execute diagnostic job. Check diagnostic communication e.g. for timing, service format and parameter contents.	pass
		Send request Default Start in state Session_Default, Security_Locked	
	Parameter	Value Raw	
	SID-RQ	0x10 10	
	DiagnosticSessionType	0x01 01	
		Request format correct and data for service in defined range.	pass
45.392240		Positive response received as expected.	-
		Default Start	

Software Download Test

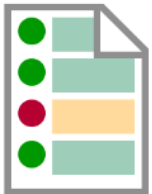


Test Setup

- ▶ SW download tool to bring the SW download sequence and flash data
- ▶ Supported tools: Vector vFlash & D-PDU API based tools

Test Coverage

- ▶ Valid Flashing under different conditions
 - > Validation of timing and format
- ▶ Test of various fault conditions: validate that the ECU can recover
 - > Over- and under voltage tests
 - > Cancel data transfer: stop transmission or power loss
 - > Cancel after or during erase memory (clamp reset) or skip erase memory routine
 - > Write inconsistent data (signature/checksum fails)
- ▶ Endurance test of the ECU's update capability
 - > Flash x times in a row
- ▶ Additional SW Download tests available for various OEMs



CI/CT: CANoe.DiVa Server Edition

- ▶ Test early and continuously!
- ▶ Automated test generation and execution on a server
 - > CANoe SE .DiVa: testing real/HW and virtual/SW components in a CI
 - > CANoe4SW SE .DiVa: testing virtual/SW components in a CI
- ▶ Easy and fast test setup via .yaml files
 - > "from the scratch" just using a diagnostic file (CDD, PDX)
 - > via a DiVa configuration template or
 - > using an existing project



```
1 $canoe4sw_se_install_dir = "C:\Program Files\Vector CANoe Server Edition 18\Exec64"
2 $diva_se_install_dir = "C:\Program Files\Vector CANoe Server Edition .DiVa 18\Bin"
3
4 $ErrorActionPreference = "Stop"
5 Set-StrictMode -Version 3
6
7 #create environment
8 & $canoe4sw_se_install_dir/environment-make.exe "$PSScriptRoot/venvirement.yaml" -o "$PSScriptRoot" -A Win32
9
10 #create DiVa Test...
11 # ... from the scratch
12 & $diva_se_install_dir/diva-make.exe "$PSScriptRoot/abs.diva.yaml" -o "$PSScriptRoot/DiVa"
13
14 #create & compile the CANoe.DiVa test for the test environment
15 & $canoe4sw_se_install_dir/test-unit-make.exe "$PSScriptRoot/DiVa/abs.vtuexe" -e "$PSScriptRoot/Default.venvirement" -o "$PSScriptRoot"
16
17 #run tests
18 #for test results check cli or $PSScriptRoot/working-dir/TestReports
19 & $canoe4sw_se_install_dir/canoe4sw-se.exe "$PSScriptRoot/Default.venvirement" -d "$PSScriptRoot/working-dir" --test-unit "$PSScriptRoot/abs.vtestunit" --show-progress "test-case" -t 60
```

```
1 version: 1
2 diag-description:
3   file-path: SUT\ABS.cdd
4 sut:
5   ecu: ABS
6   variant: CommonDiagnostics
```

Agenda

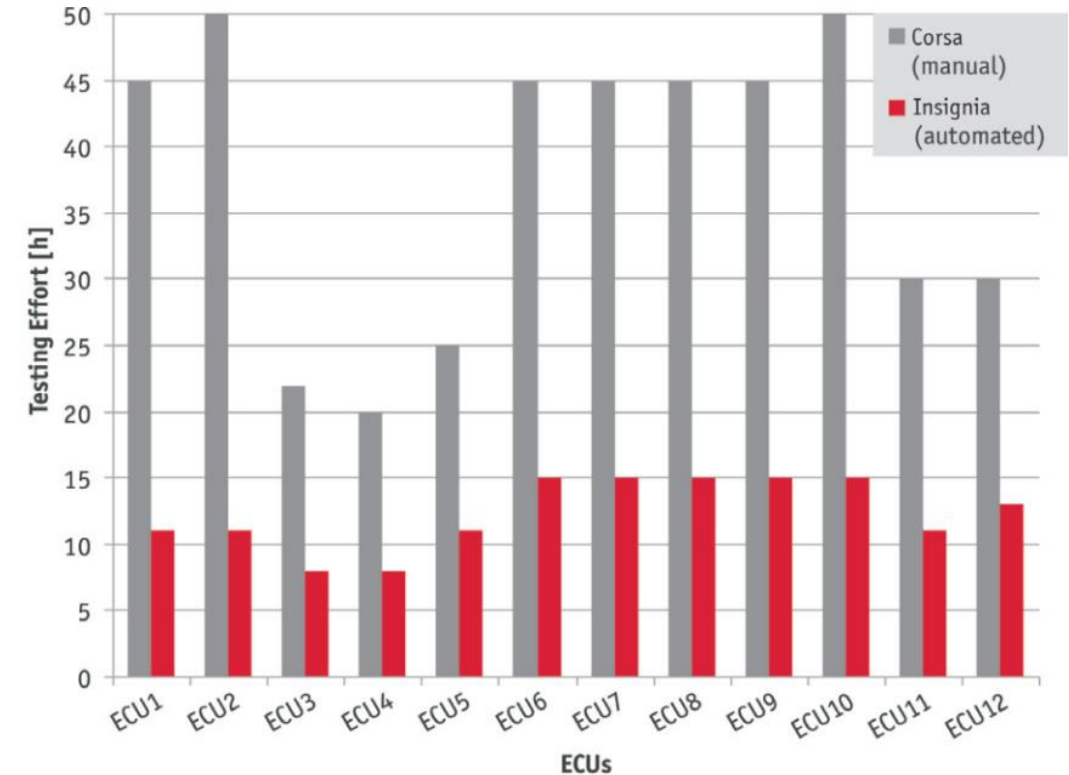
Overview

Features

► **Summary**

Benefits

- ▶ Significant savings of time and effort
- ▶ Further quality improvement of the ECU Software
- ▶ All development stages supported
- ▶ Excellent test coverage
- ▶ Efficient, generation-based approach
- ▶ Automated tests without user interaction
- ▶ User-defined tests allow tailoring
- ▶ Widely used by OEMs and suppliers already with a proven record of success
- ▶ Continuously enhanced features through implementation of customers' requirements



For more information about diagnostics and flashing at Vector please visit:



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www.vector.com/diagnostic-videos

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