



AUTOSAR Conformance Testing: an overview

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Milano, 17/02/2011



- Definition
- Applicability and availability
- Conformance Test System
- Conformance Test Process
- Conformance Test Agencies
- Actors involved in AUTOSAR Conformance Testing
- Available paths for the Conformance Test Process
- Conformance Test Agencies Accreditation
- Intecs and Autosar Conformance Testing



DEFINITION



- **Definition:** verify that the test object (a software module) adheres to the relevant AUTOSAR specifications (i.e. it is “conformant”).
- **Nature:** Black box functional tests, focus on behaviour, interfaces and configuration of software modules
- **Object:** the Product Under Test (PUT) is a software item developed by a Product Supplier (PS)
- **Purpose:**
 - interoperability and re-use
 - obtain right to use AUTOSAR trademark



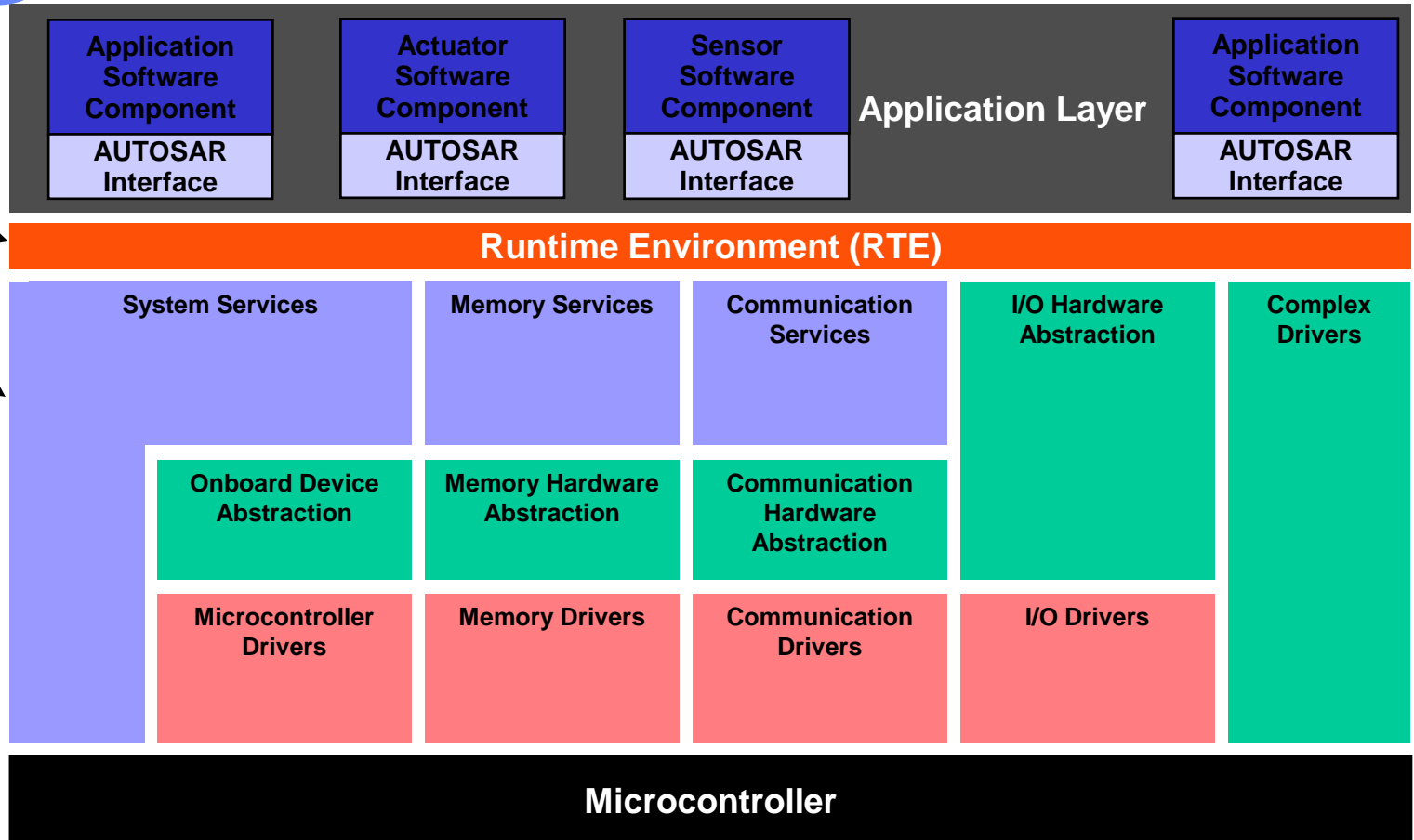
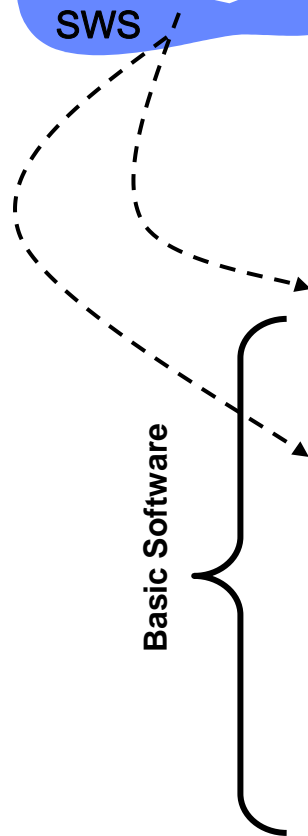
APPLICABILITY AND AVAILABILITY



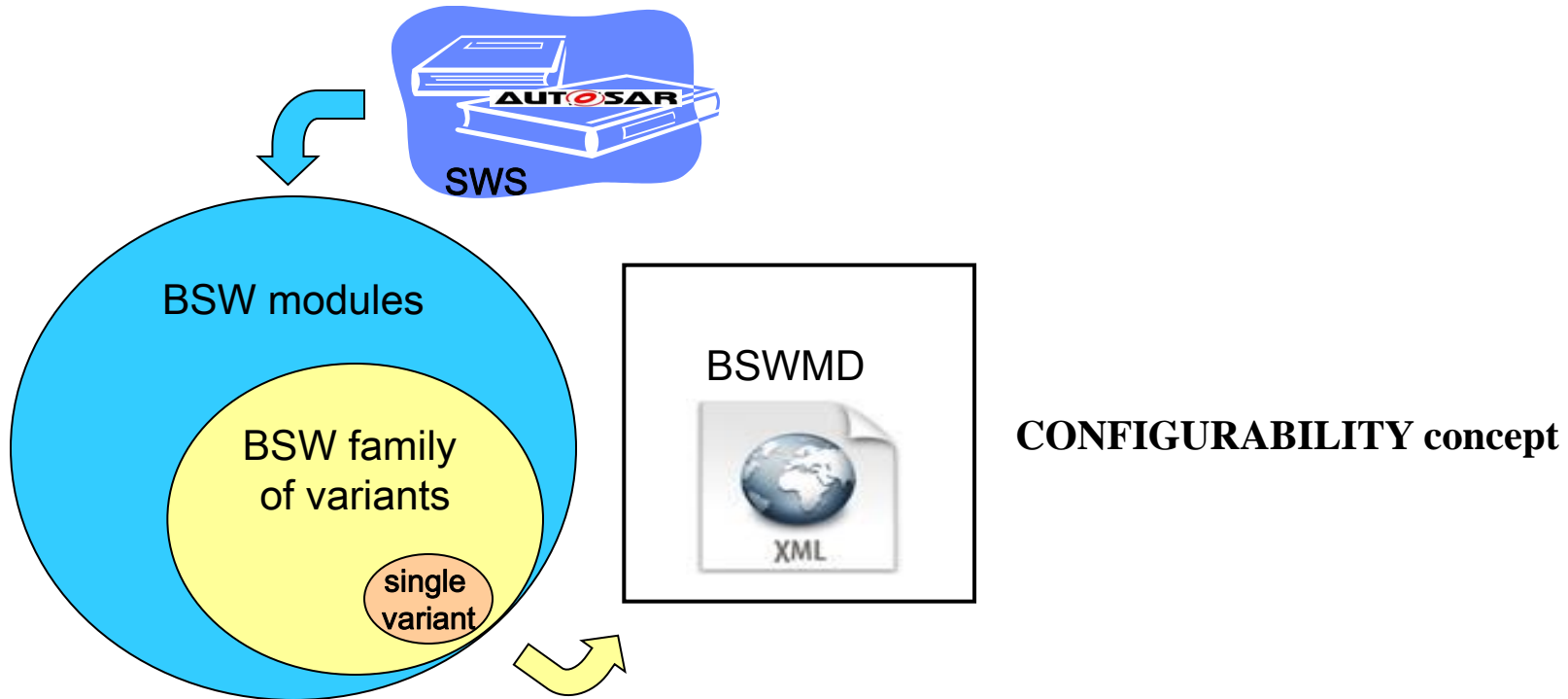
- **Applicability:** the PUT can fall under one of the categories:
 - Basic Software Modules (BSW)
 - Runtime Environment (RTE)

- **Availability:**
 - Conformance test specifications for BSW and the RTE will be released as part of Release 4.0. These conformance test specifications will become part of the AUTOSAR standard and are currently scheduled for March 2011.
 - Available for exploitation to all AUTOSAR licensees.

AUTOSAR BSW Specifications



What is to be tested



- BSW module: what is specified by Autosar through a SWS document specific for each module
- BSW variant: a single (testable) instantiation of a module.
- BSW family of variants: in general what PS wants tested



CONFORMANCE TEST SYSTEM



- Conformance Test Specifications (CTSspecs);
- Conformance Test Suite (CTS);
- Conformance Test Process;
- Accredited Conformance Test Agencies (CTAs)

Conformance
Test System





CTSpecs contain:

Dynamic test cases: to show the correct functionality of BSW modules in terms of their public input/output behaviour. They intend to check also whether the module correctly uses collaborating modules.

Static test cases: to check the configurability of modules (presence, multiplicity and value range) and check for the presence and content of interface files (header files)

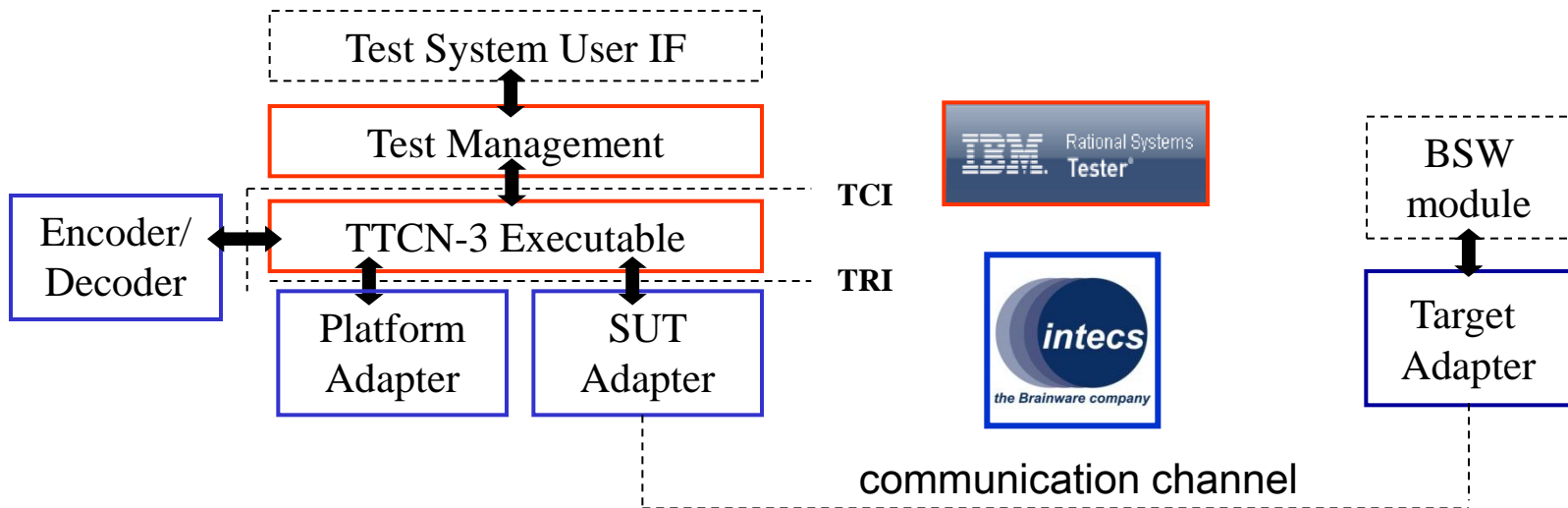
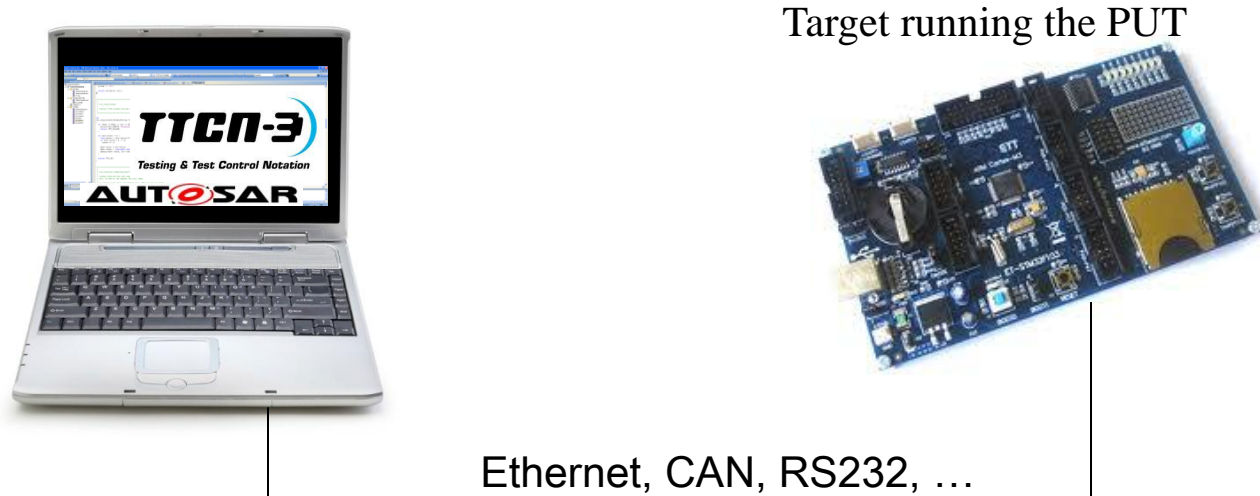




- Includes:
 - one or several test tools
 - the necessary service to install, configure and run the tests
 - the identification of the test environment:
 - Build environment
 - Test board/ PC emulation
 - Required software configuration
- Must allow performing a collection of test cases on the PUT obtaining a list of reproducible results.



An example of a CT Suite





CONFORMANCE TEST PROCESS

Conformance Test Process : from Test Report to AUTOSAR label



Test Report

AUTOSAR Conformance Test Process Definition Path A-C V2.0.0 R4.0 Rev 1

Annex C Conformance test report template

1. Test Body	
Test report no.	Responsible Test Engineer
Name of company	Department
Address of company	Telephone
Address of test facilities	Mail
	Date of the test (YYYY-MM-DD)
2. Product developer	
Name of company	
Address of company	
Responsible inside company	
3. Product	
Name of product	
Version of product (Identification of product version number)	
Configuration (Configuration includes checksum)	
4. Conformance Test Suite (CTS)	
Name of CTS	
CTS version number (Identification of CTS with version number)	
Configuration	
5. Test environment	
Description of test environment	
6. AUTOSAR	
AUTOSAR module/module cluster name	(AUTOSAR technical area / specific module / specific module cluster)
AUTOSAR module/module cluster version	(AUTOSAR version number (X, Y, Z))
AUTOSAR release number	(AUTOSAR release number (x, y))

17 of 35 Document ID: AUTOSAR_IP_CTTProcessDefinitionPathC - AUTOSAR Confidential

Conformance Attestation

AUTOSAR Conformance Test Process Definition Path A-C V2.0.0 R4.0 Rev 1

Annex D Conformance attestation template

Attestation Body (Third party CTA)		
Name of company (issuer of attestation)	Responsible Engineer	Name of responsible individual (Name, company, department)
Address of company (issuer of attestation)	Department	
	Date of attestation (YYYY-MM-DD)	
Product Developer		
Name of company (developer of product)	Address of company (developer of product)	
Responsible under test (Name of product under test)	Version of product (Identification of product version number)	
Product version number	Date (YYYY-MM-DD)	
ATTESTATION		
AUTOSAR module/module cluster name	(AUTOSAR technical area / specific module / specific module cluster)	
AUTOSAR module/module cluster version	(AUTOSAR version number (X, Y, Z))	
AUTOSAR release number	(AUTOSAR release number (x, y))	
The product described above conforms to the AUTOSAR Release x.y specifications.		
Responsible's signature		

18 of 35 Document ID: AUTOSAR_IP_CTTProcessDefinitionPathC - AUTOSAR Confidential

AUTOSAR Label



Products which have successfully gone through this process are allowed to be marketed as AUTOSAR Release x.y



- The Conformance attestation is considered valid, independent of
 - Defects in CT specifications (documented in errata sheet)
 - Adaptations of the product for further hardware platforms
 - Changes in used tooling, e.g. compiler, linker, etc.
 - Minor updates of product

- Each attestation of a product is valid worldwide and permanent





CONFORMANCE TEST AGENCIES (CTA)



- Role of CTAs in the Conformance Test Process is to execute (or witness the test execution) conformance test, to approve test results and to deliver/reject Conformance Attestations.
- CTAs can be independent bodies or delivering a third party attestation or can be product suppliers accredited as CTA delivering self attestation for their products.





1. AUTOSAR objectives	Scope of AUTOSAR standardization
2. Main requirements	
3. detailed requirements	
4. detailed specifications	
5. Conformance test specifications ¹⁾	
6. Test implementations (CTS)	Scope of CTA tasks or responsibility
7. Conformance Test execution	
8. Test report / conformance attestation	

¹⁾ Including the conformance test methodology

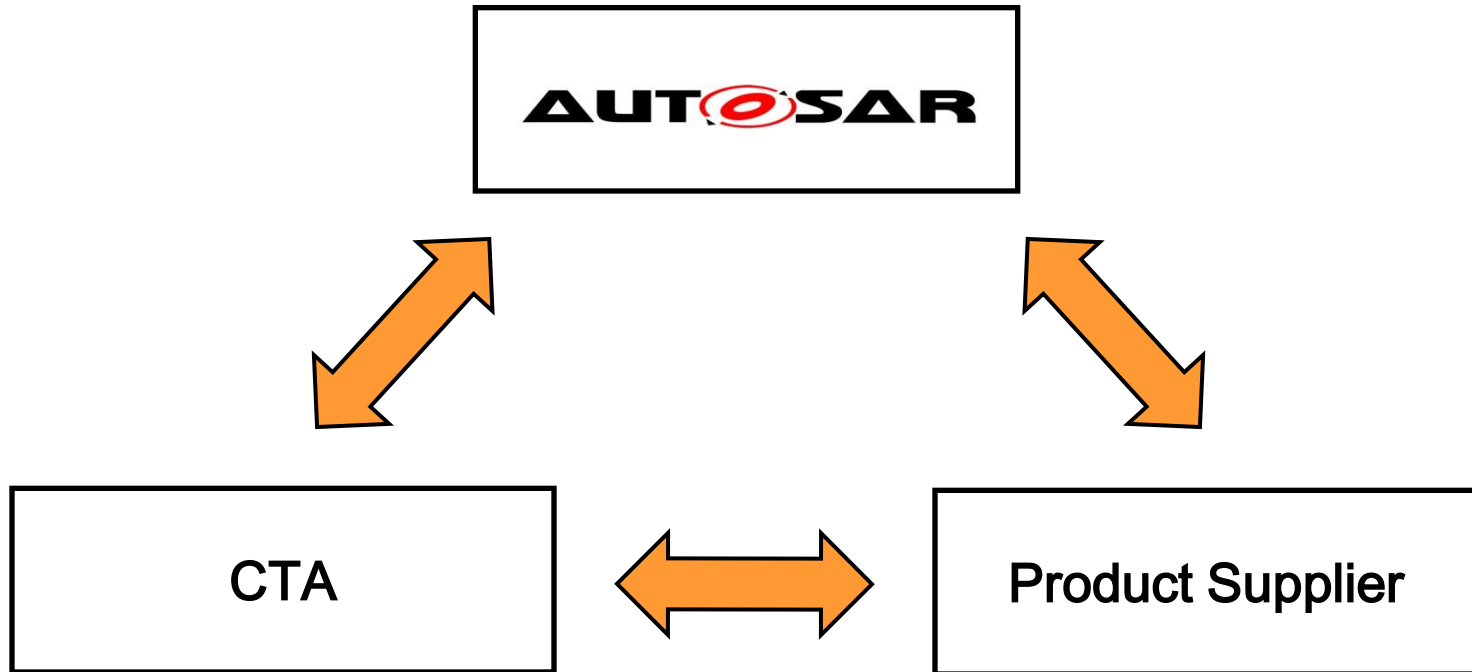
➤ CTA responsibilities:

- CTS setup: must faithfully implement the CTSspecs of a PUT such that tests can be executed in a reliable, reproducible manner
- CTS definition: attributes of the test environment must be identified
- CTS maintenance: new standard releases, bugs in the CTS
- Conformance Test Execution
- Test Report
- Conformance Attestation



ACTORS INVOLVED IN AUTOSAR CONFORMANCE TESTING

Actors involved in AUTOSAR Conformance Testing



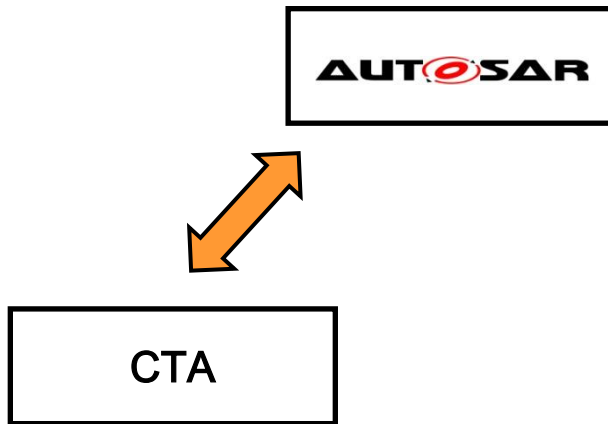


AUTOSAR:

- DEFINITION AND MAINTENANCE OF CTSPECS: defines, maintains and makes available conformance test specifications to CTA; informs CTA about changes in the standard (upcoming releases or errata sheet)
- DEFINITION OF TEST REPORT TEMPLATE

CTA:

- RECEPTION OF CTSPECS: gets conformance test specifications and updates from AUTOSAR
- CONFORMANCE ATTESTATION/REJECT REPORTS: on a quarterly basis report to AUTOSAR, (number of test reports for each module, number of test results rejected, number of attestations i.e. results accepted), data shall be anonymous
- FEEDBACK: raises RFC in case of inconclusive tests or bugs in the conformance test specifications in order to improve the standard continuously





- AUTOSAR:
 - PRODUCT SPECIFICATIONS: defines and makes product specifications available to the PS
 - PRODUCT REPORT TEMPLATE: information about the PUT

Product Report template

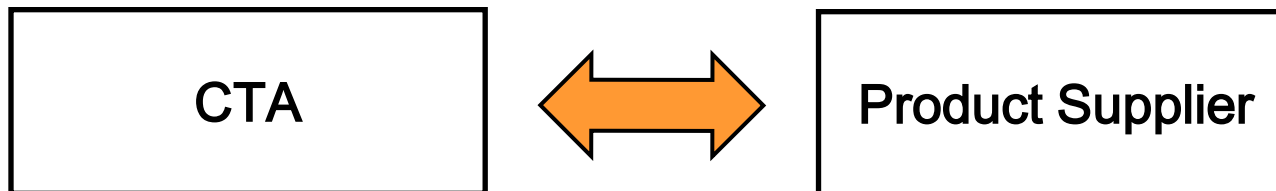
1. Product developer			
Product report no.		Responsible Product Manager	
Name of Company		Department	
Address of Company		Telephone	
		Mail	
		Date of the report (yyyy/MM)	
2. Product under test			
Name of product under test	(Name of product)		
Product version number	(Identification number)		
Configuration	(Configuration identifier)		
3. AUTOSAR			
AUTOSAR module/module cluster name	(AUTOSAR technical area / specific module / specific module cluster)		
AUTOSAR module/module cluster version	(AUTOSAR version number (X. Y. Z))		
AUTOSAR release number	(AUTOSAR release number (x. y))		
4. Observations and comments (product variants and etc.)			
Responsible's signature			



Product Supplier



- **CTA:**
 - **CTS SETUP AND MAINTENANCE:** checks the applicability of the CTS for conformance testing, assures the reproducibility of the CTS results, identifies the attributes of the test environment; maintains CTS up-to-date.
 - **CT EXECUTION:** under its own quality control or eyewitness onsite
 - **SUPPORT:** provides assistance to PS with process, gathers questions from PS and reports to AUTOSAR if required (single interface to the customer)
 - **ATTESTATION OF CONFORMANCE:** attestate or reject conformance according to the test results, within 2 weeks after receiving the product and its documentation
- **PS:**
 - **PRODUCT DELIVERY:** send the product to the CTA
 - **PRODUCT REPORT REDACTION:** fill the report and send it to the CTA



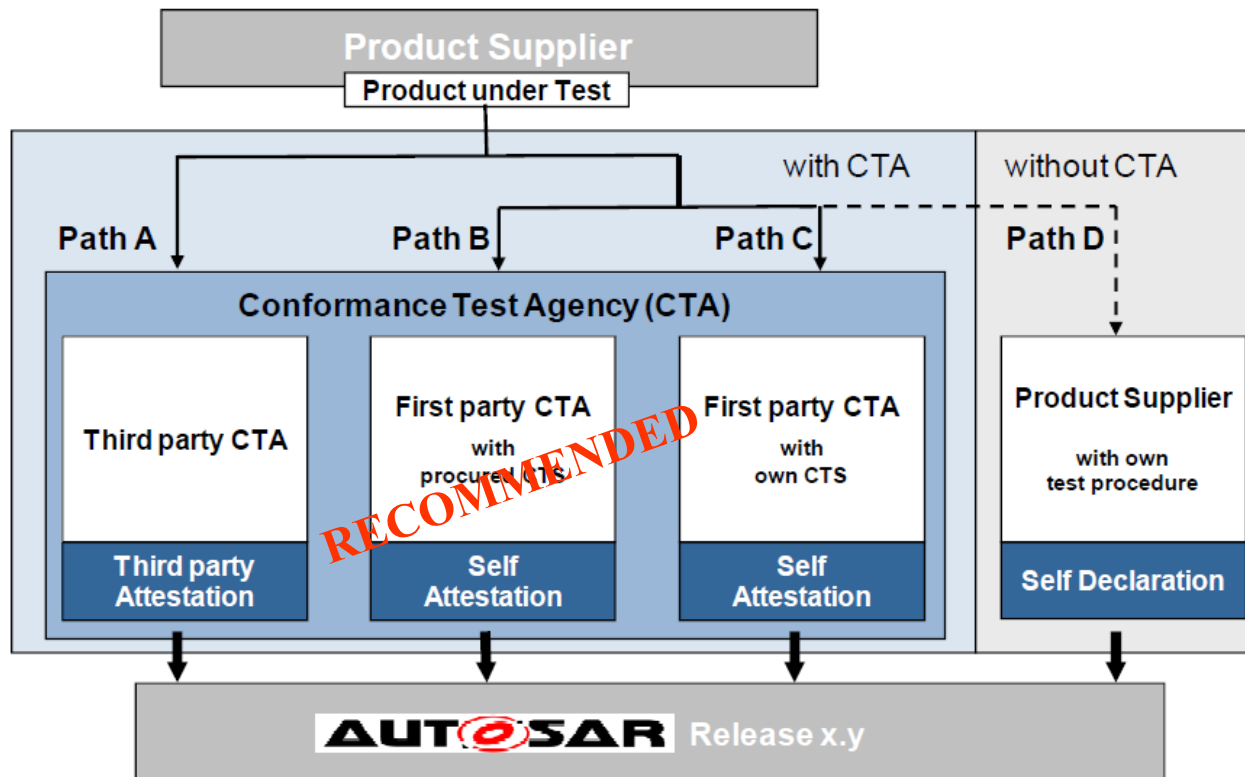


AVAILABLE PATHS FOR THE CONFORMANCE TEST PROCESS

Available paths for the conformance test process



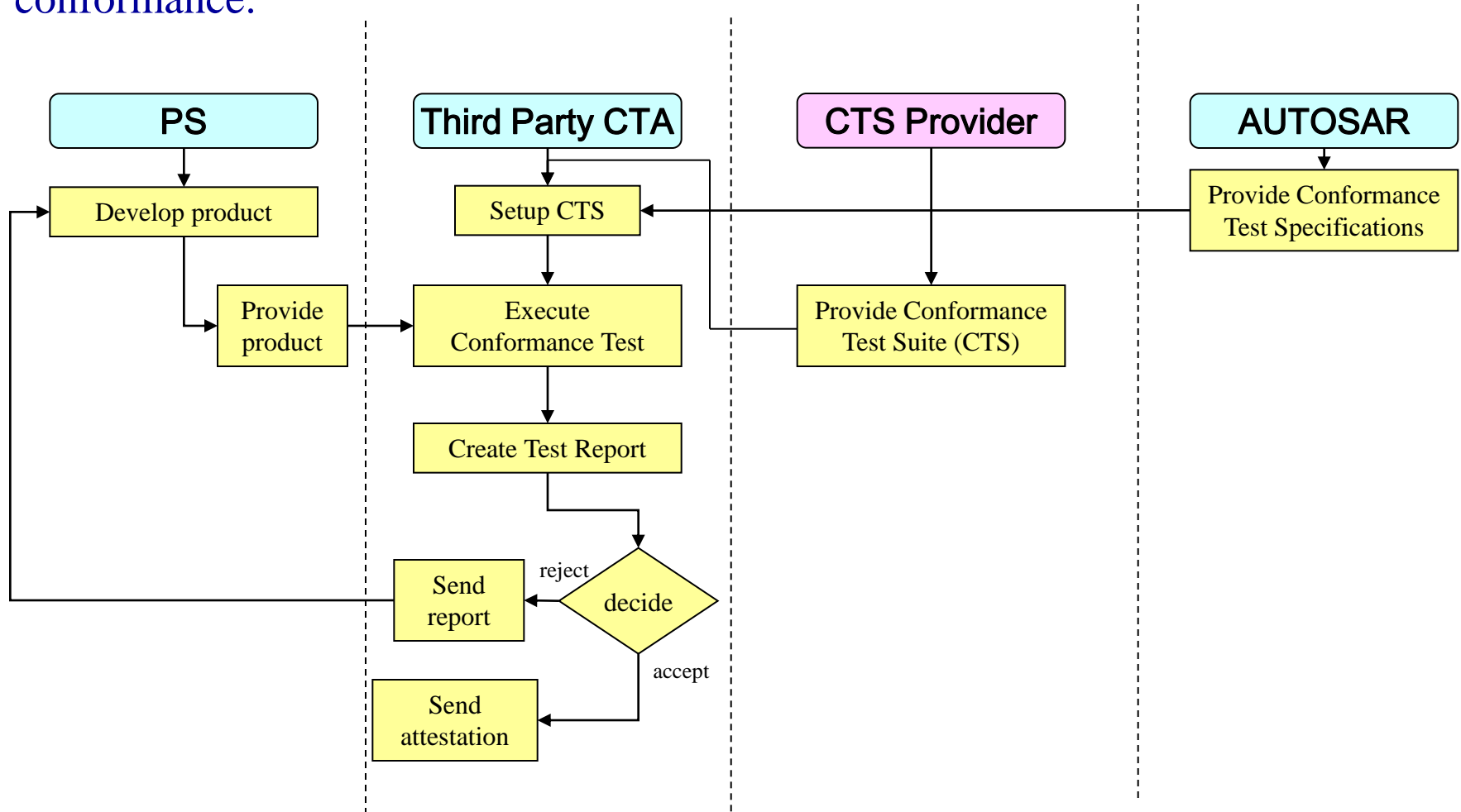
Conformance test process can follow one of paths A to D



CT Process: path A



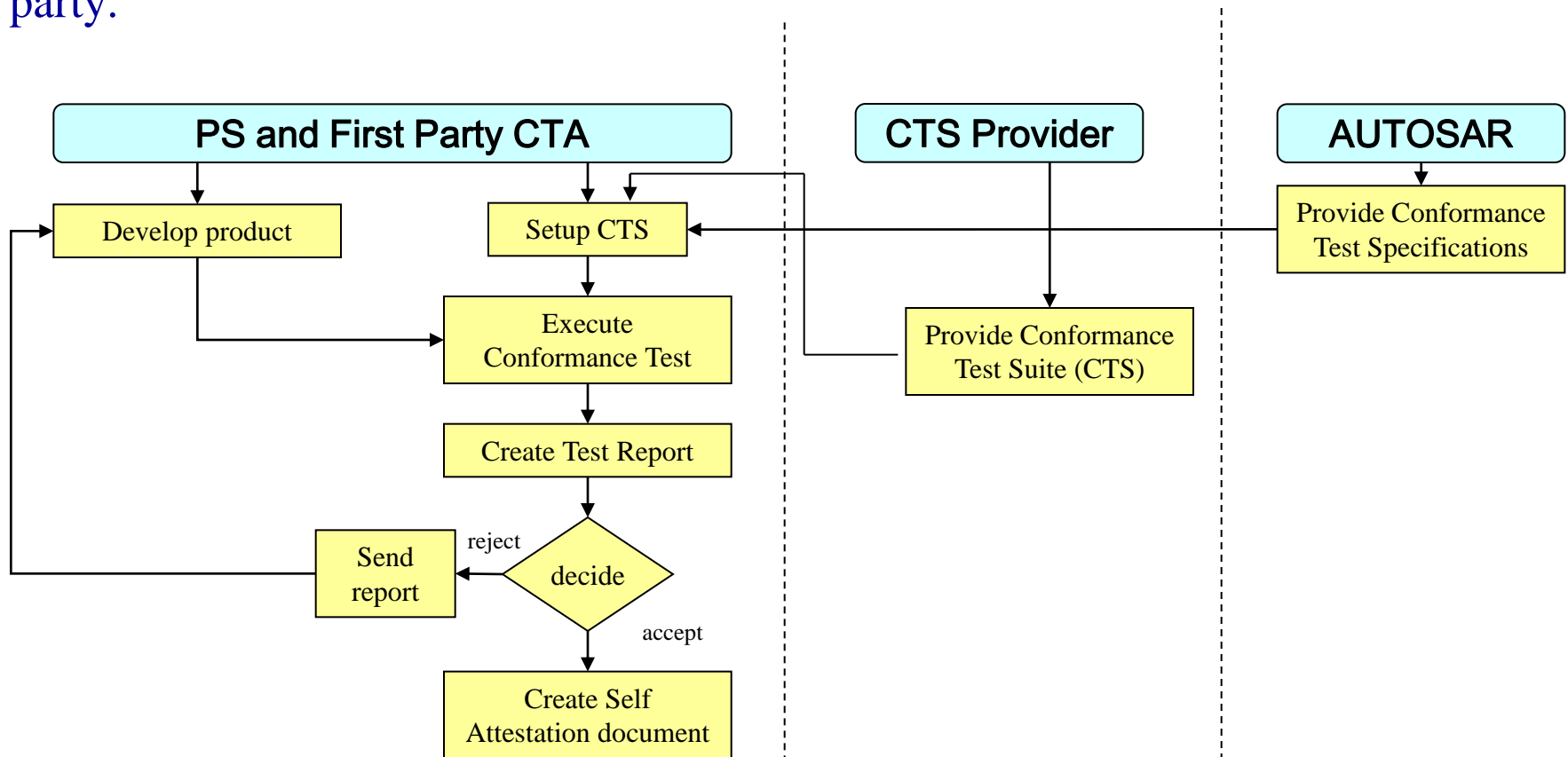
In this case CTAs are independent bodies delivering a third party attestation of conformance.



CT Process: path B



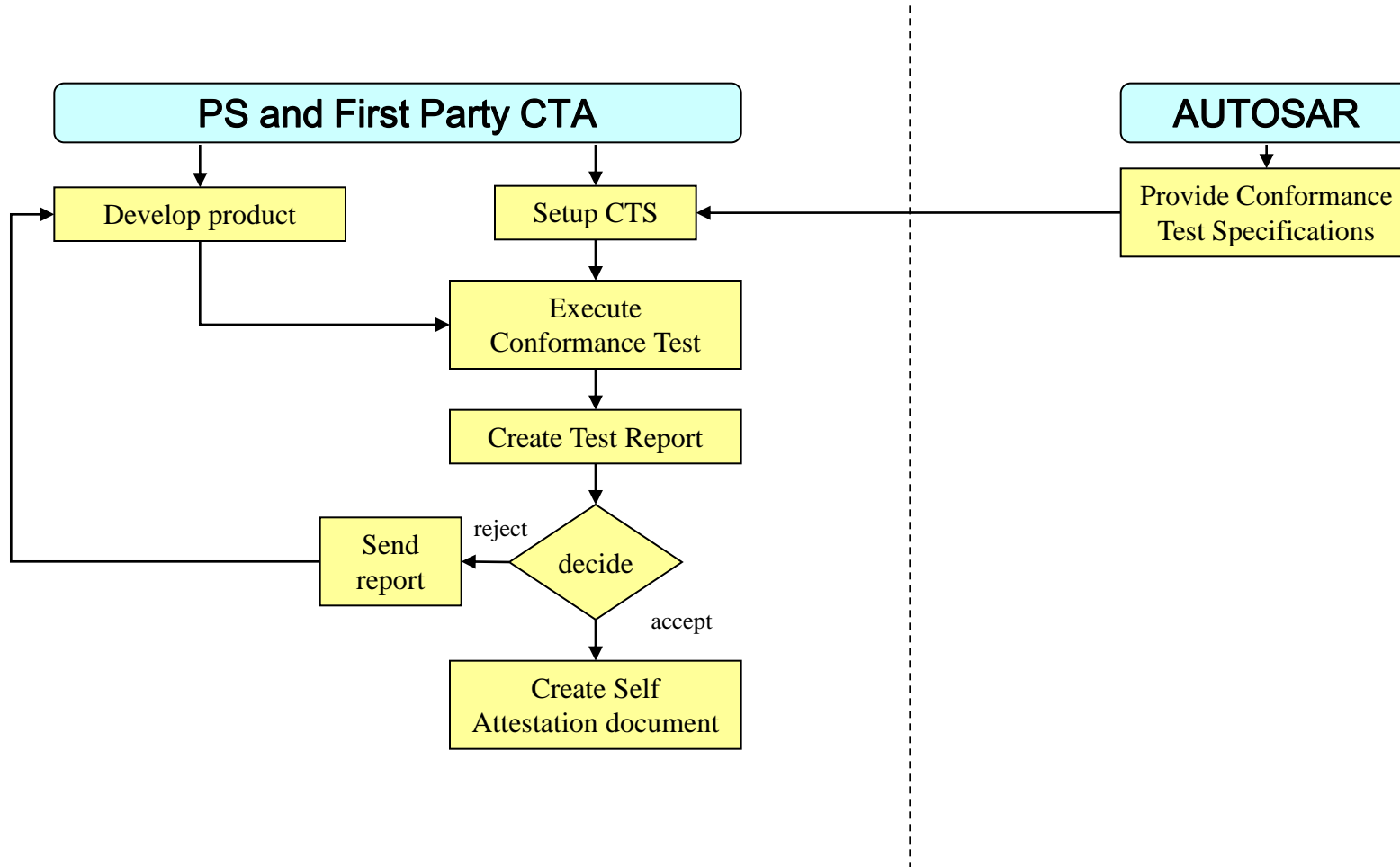
In this case CTAs are product suppliers accredited as CTAs and delivering self attestation of conformance for their products, CTS is provided by an external party.



CT Process: path C



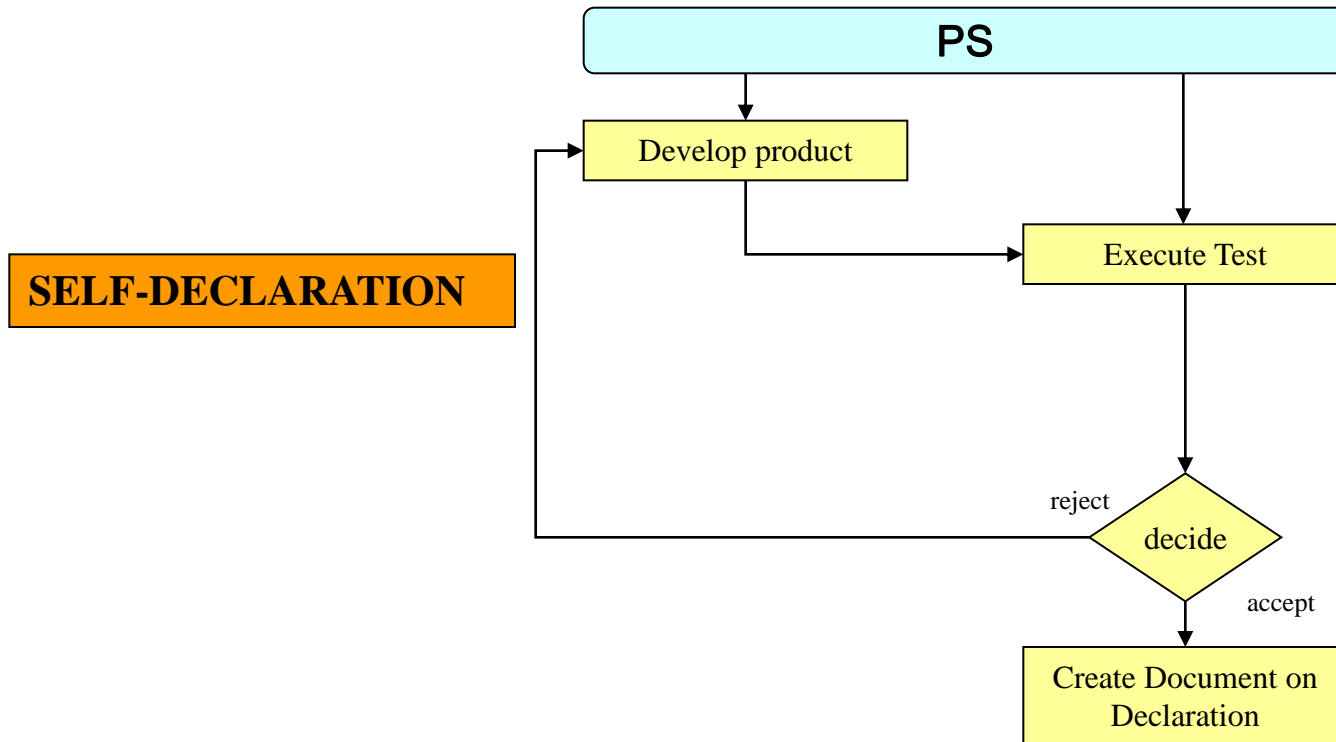
Same case as path B, but CTS is directly developed by the first party CTA.



CT Process: path D



A conformance test system for a specific AUTOSAR Release is not available (conformance test specs or CT process or CTA are not available).



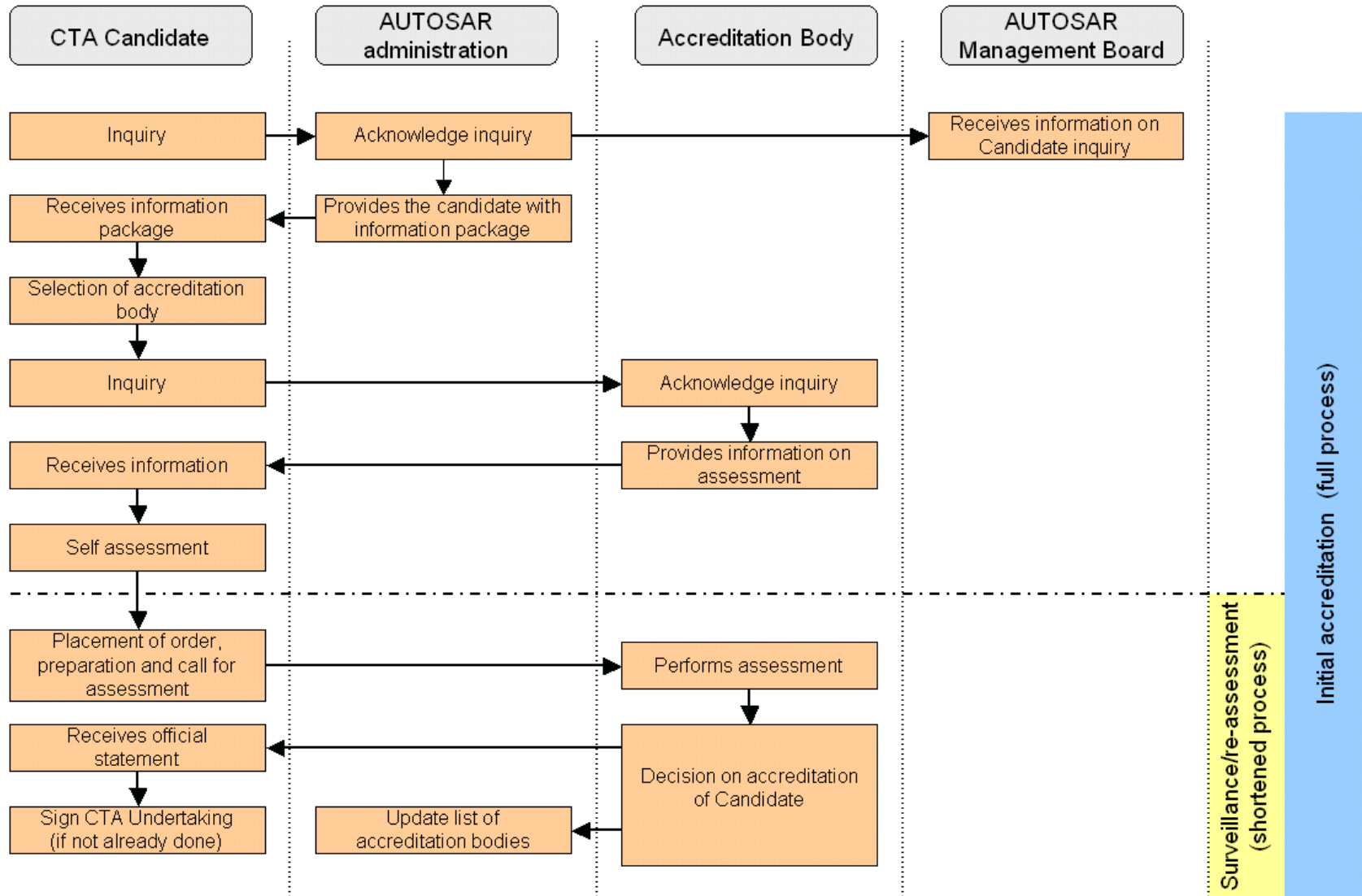


CTA ACCREDITATION



- Is the process by which first or third party CTA are assessed
- There are no limitations to the number of CTAs that may achieve accreditation
- AUTOSAR seeks to secure the capability of an accredited party

CTA Accreditation



CTA candidate assessment criteria

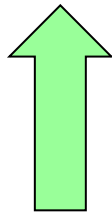


AUTOSAR		AUTOSAR CTA Accreditation - application rules for ISO/IEC 17025 V1.1.0 R4.0 Rev 1	
Document Title	AUTOSAR CTA Accreditation - application rules for ISO/IEC 17025	INTERNATIONAL STANDARD	ISO/IEC 17025
Document Owner	AUTOSAR		Second edition 2005-05-15
Document Responsibility	AUTOSAR		
Document Identification No.	244		
Document Classification	Standard		
Document Version	1.1.0		
Document Status	Final		
Part of Release	4.0		
Revision	1		
Document Change History			
Date	Version	Changed by	Change Description
10.12.2005	1.1.0	AUTOSAR Administration	<ul style="list-style-type: none"> • applicable to 1st and 3rd party CTA without reference • CTS development is out of scope • 1st party CTA affects the conformity of a product • Sampling is required • Legal disclaimer revised
23.06.2008	1.0.1	AUTOSAR Administration	Legal disclaimer revised
05.12.2007	1.0.0	AUTOSAR Administration	Initial Release

General requirements for the competence of testing and calibration laboratories

Exigences générales concernant la compétence des laboratoires d'étalonnage et d'essais

ISO-IEC 17025:2005
guidelines for test laboratories

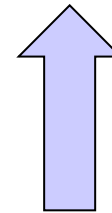


First party and third party CTAs accreditation

AUTOSAR		AUTOSAR CTA Accreditation - application rules for ISO/IEC Guide 65 V1.1.0 R4.0 Rev 1	
Document Title	AUTOSAR CTA Accreditation - application rules for ISO/IEC Guide 65	GUIDE 65	
Document Owner	AUTOSAR		
Document Responsibility	AUTOSAR		
Document Identification No.	245		
Document Classification	Standard		
Document Version	1.1.0		
Document Status	Final		
Part of Release	4.0		
Revision	1		
Document Change History			
Date	Version	Changed by	Change Description
10.12.2005	1.1.0	AUTOSAR Administration	<ul style="list-style-type: none"> • Surveillance is applicable • Use of labels, certificates and marks of conformity is applicable • Complaints to suppliers are applicable • Legal disclaimer revised
23.06.2008	1.0.1	AUTOSAR Administration	Legal disclaimer revised
05.12.2007	1.0.0	AUTOSAR Administration	Initial Release

ISO/IEC

ISO-IEC GUIDE 65:1996
recommendations for the certification agencies



Only third party CTAs accreditation



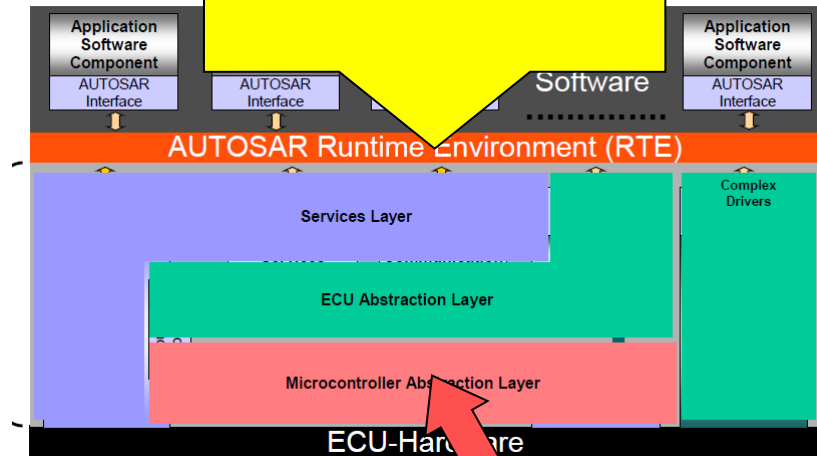
INTECS AND AUTOSAR CONFORMANCE TESTING



TOMORROW

- ✓ INTECS is going to extend the conformance test platform to all MCAL modules and to upper layer BSW modules.
- ✓ INTECS plans to add CAN and LIN as a support to communicate with the target where BSW modules are to be tested.

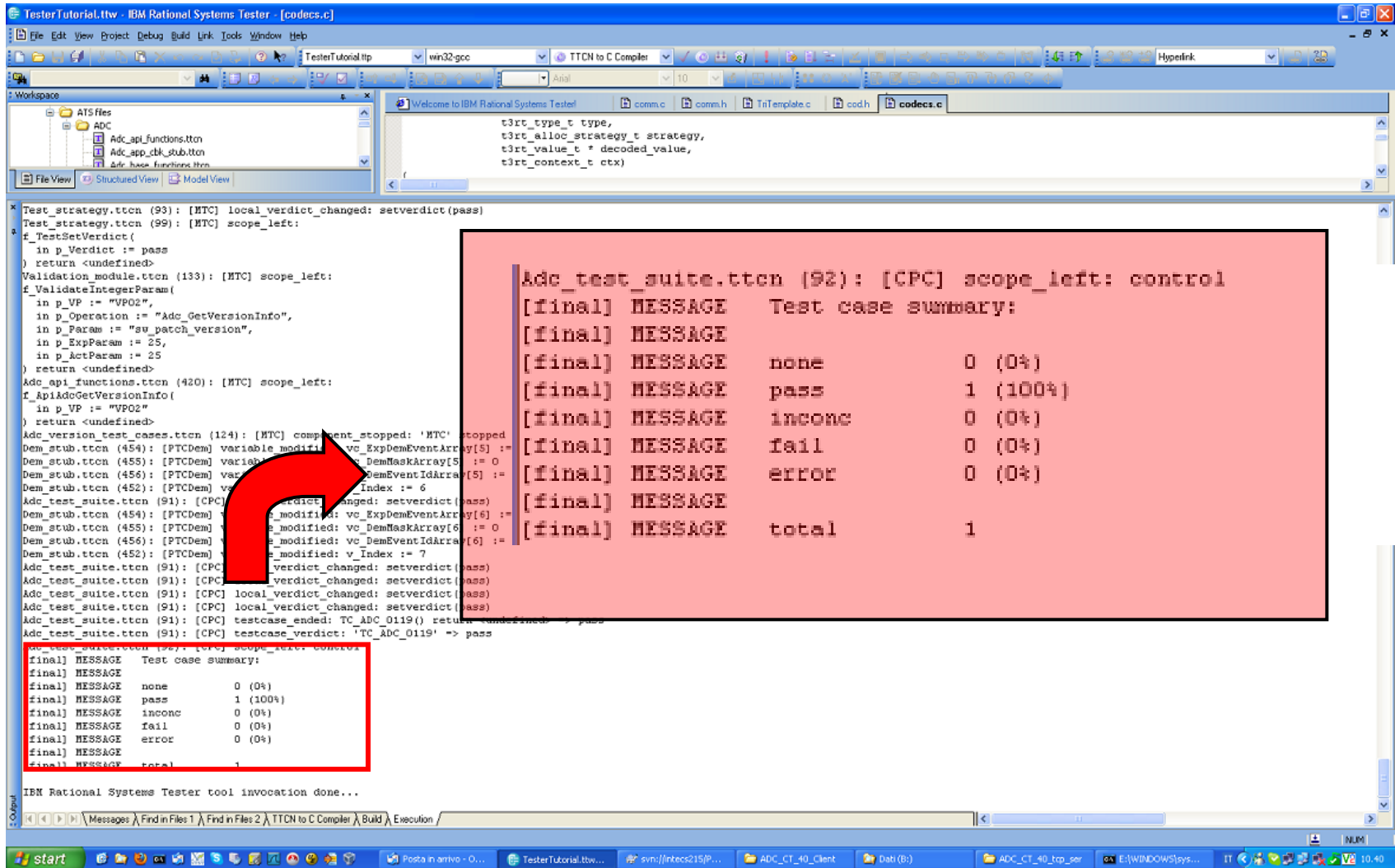
INTECS is developing a CTS for AUTOSAR Conformance Testing



NOW

- ✓ testing MCAL ADC module
- ✓ testing through RS232 and Ethernet

An example of an ADC test output

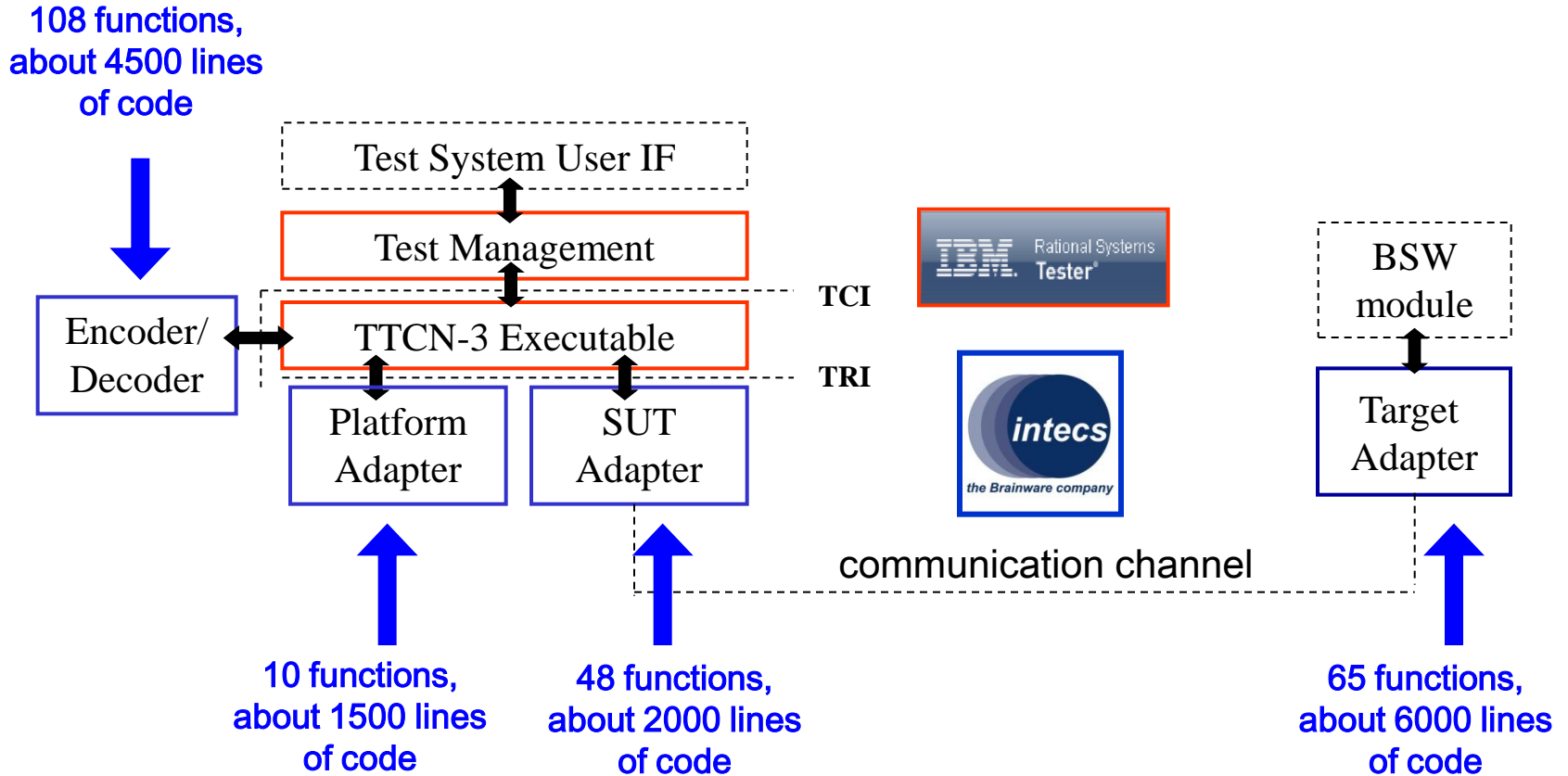
The screenshot shows the IBM Rational Systems Tester interface. The main window displays test results for the 'ADC' test suite. A red arrow points to a summary table within the output.

```

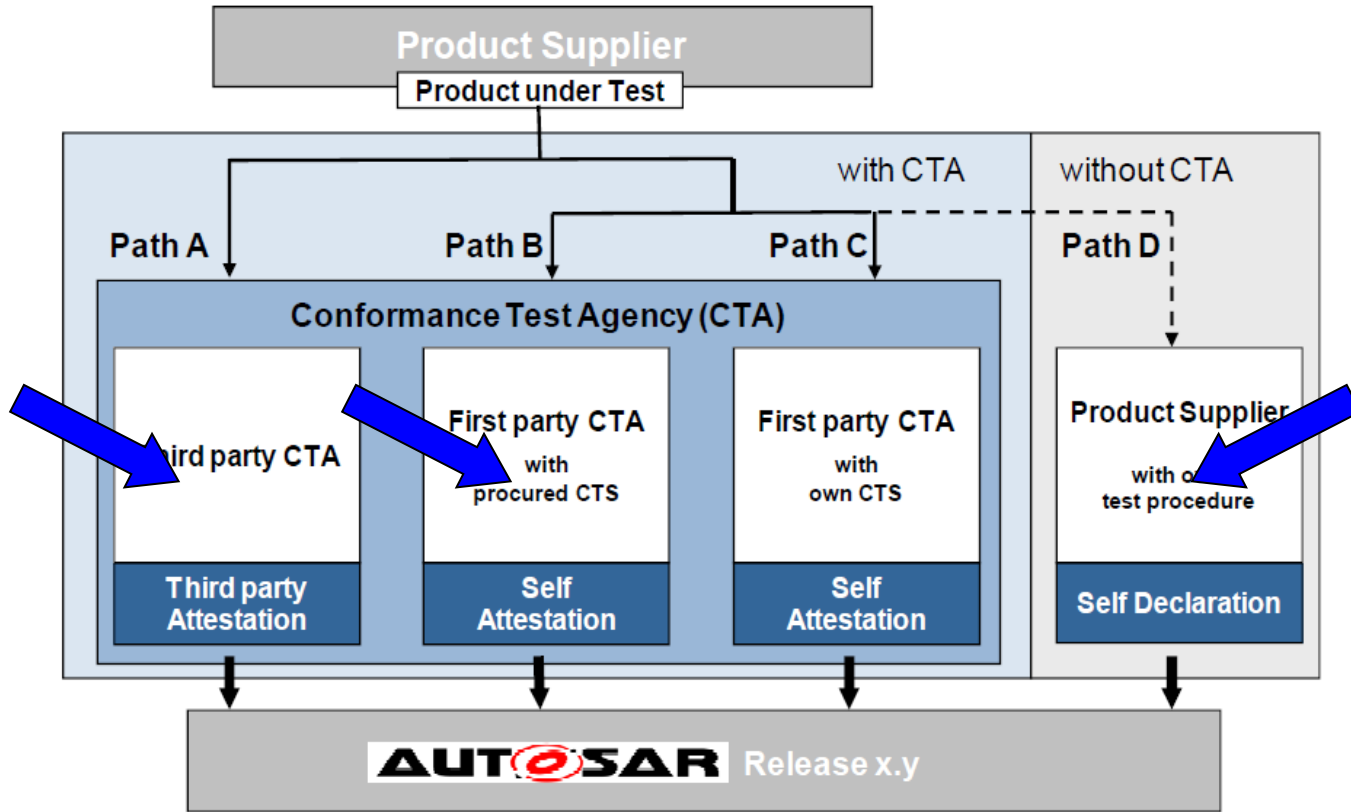
Test_strategy.ttcn (93): [MTC] local_verdict_changed: setverdict(pass)
Test_strategy.ttcn (99): [MTC] scope_left:
f_TestSetVerdict(
  in p_Verdict := pass
) return <undefined>
Validation_module.ttcn (133): [MTC] scope_left:
f_ValidateIntegerParam(
  in p_VP := "VPO2",
  in p_Operation := "Adc_GetVersionInfo",
  in p_Param := "su_patch_version",
  in p_ExpParam := 25,
  in p_ActParam := 25
) return <undefined>
Adc_api_functions.ttcn (420): [MTC] scope_left:
f_ApiAdcGetVersionInfo(
  in p_VP := "VPO2"
) return <undefined>
Adc_version_test_cases.ttcn (124): [MTC] component_stopped: 'MTC' stopped
Dem_stub.ttcn (454): [PTCDem] variable modified: vc_ExpDemEventArray[5] :=
Dem_stub.ttcn (455): [PTCDem] variable modified: vc_DemMaskArray[5] := 0
Dem_stub.ttcn (456): [PTCDem] variable modified: vc_DemEventIdArray[5] :=
Dem_stub.ttcn (452): [PTCDem] variable modified: y_Index := 6
Adc_test_suite.ttcn (91): [CPC] local_verdict_changed: setverdict(pass)
Dem_stub.ttcn (454): [PTCDem] variable modified: vc_ExpDemEventArray[6] :=
Dem_stub.ttcn (455): [PTCDem] variable modified: vc_DemMaskArray[6] := 0
Dem_stub.ttcn (456): [PTCDem] variable modified: vc_DemEventIdArray[6] :=
Dem_stub.ttcn (452): [PTCDem] variable modified: y_Index := 7
Adc_test_suite.ttcn (91): [CPC] local_verdict_changed: setverdict(pass)
Adc_test_suite.ttcn (91): [CPC] local_verdict_changed: setverdict(pass)
Adc_test_suite.ttcn (91): [CPC] local_verdict_changed: setverdict(pass)
Adc_test_suite.ttcn (91): [CPC] local_verdict_changed: setverdict(pass)
Adc_test_suite.ttcn (91): [CPC] testcase_ended: TC_ADC_0119() return <undefined>
Adc_test_suite.ttcn (91): [CPC] testcase_verdict: 'TC_ADC_0119' => pass

[final] MESSAGE Test case summary:
[final] MESSAGE
[final] MESSAGE none 0 (0%)
[final] MESSAGE pass 1 (100%)
[final] MESSAGE inconc 0 (0%)
[final] MESSAGE fail 0 (0%)
[final] MESSAGE error 0 (0%)
[final] MESSAGE total 1
  
```

Effort needed to develop a CTS suite



Where Intecs CTS is applicable



providing CTS and support...



For any questions and information please refer to:

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