AUTOSAR Conformance Testing: an overview

Valentina Lomi

Milano, 17/02/2011

Contents

- 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

AUTOSAR Conformance Testing

DEFINITION

Definition

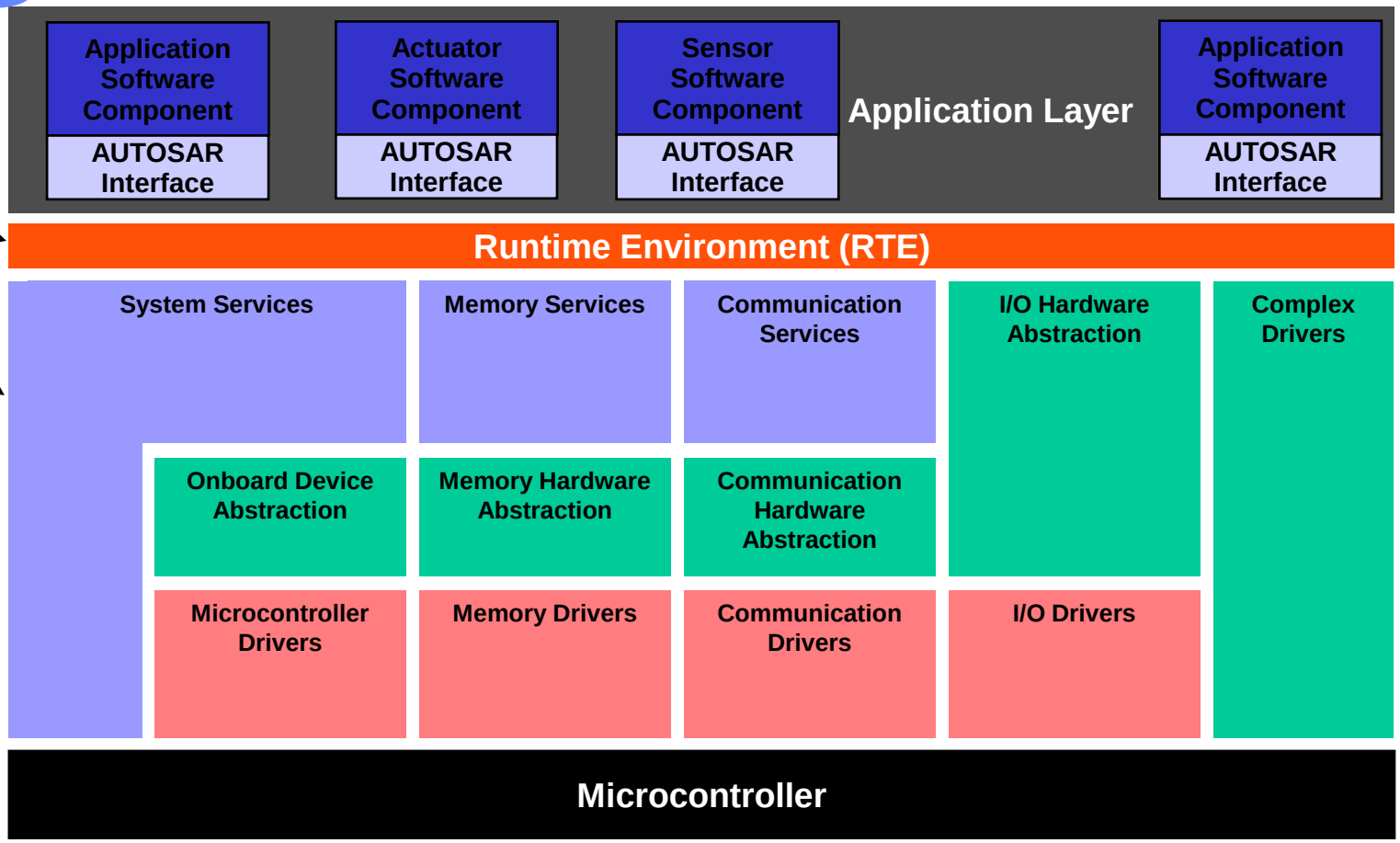
- **Definition:** verify that the test object (a software module) adheres to the relevant AUTOSAR specifications (i.e. it is “conformant”).
- **Nature:** Black box functional tests, focus on behaviour, interfaces and configuration of software modules
- **Object:** the Product Under Test (PUT) is a software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

APPLICABILITY AND AVAILABILITY

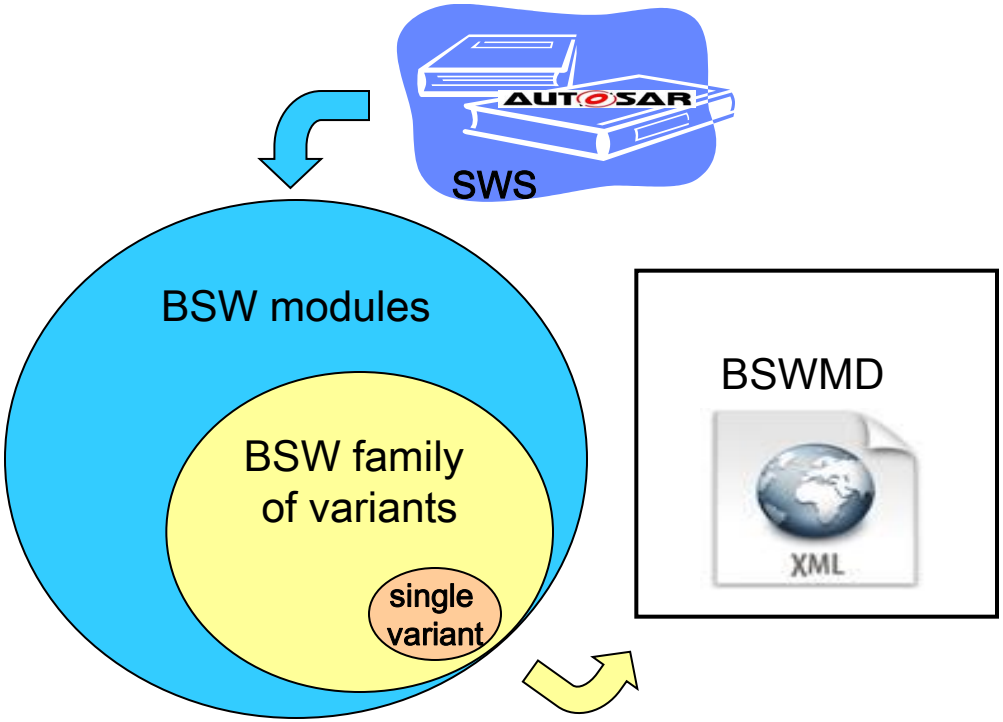
Applicability and availability

- **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



CONFIGURABILITY concept

- 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 System

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

Conformance Test System

Conformance Test System: CTSpecs

CTSpecs contain:

Dynamic test cases: to show the correct functionality of BSW modules in terms of their public input/ouput 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)

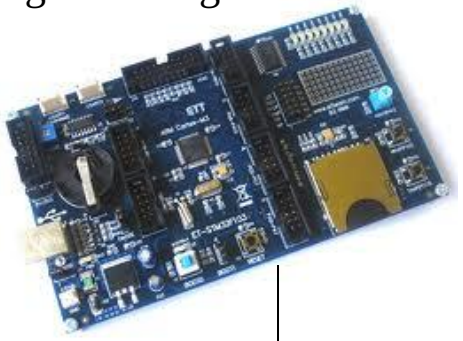
TTCN-3
Testing & Test Control Notation

Conformance Test System: CT Suite

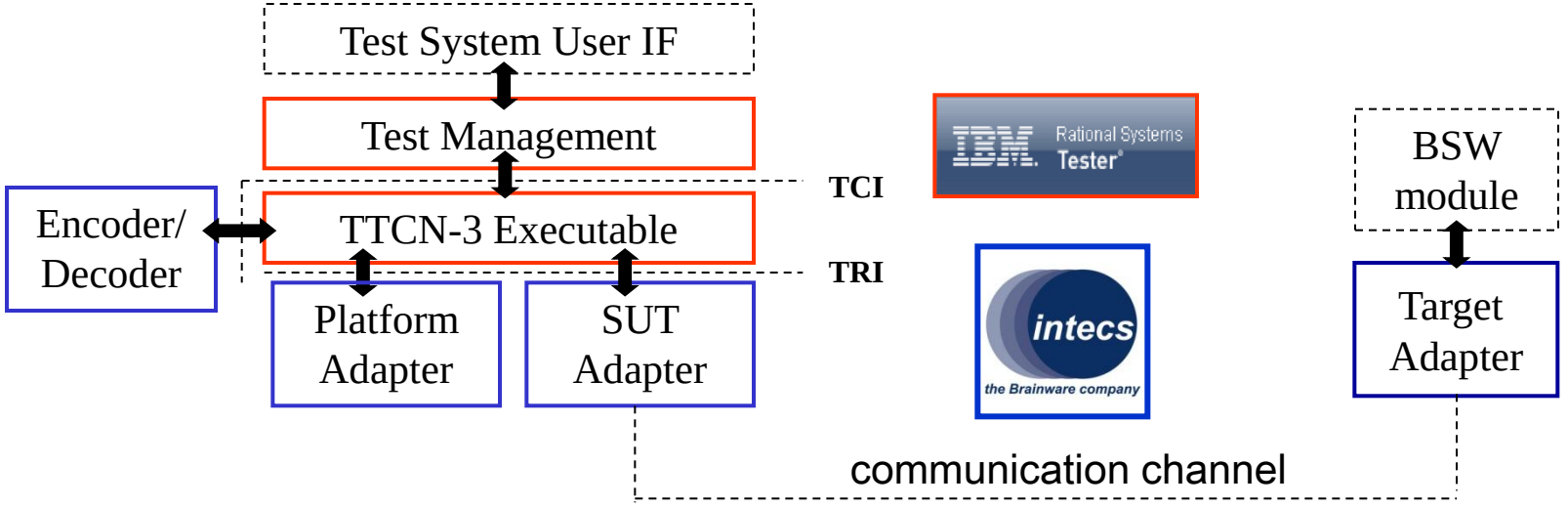
- Includes:
  - one or several test tools
  - the necessary service to install, configure and run the tests
  - the identification of the test environment:
    - Build environment
    - Test board/ PC emulation
    - Required software configuration
- Must allow performing a collection of test cases on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

An example of a CT Suite

Target running the PUT



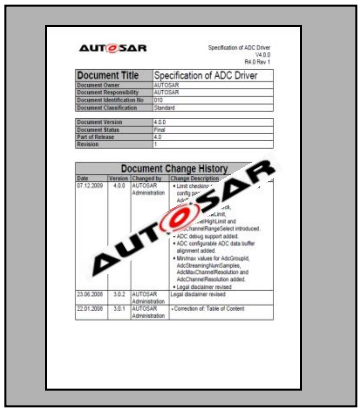
Ethernet, CAN, RS232, …



CONFORMANCE TEST PROCESS

Conformance Test Process : from SWS to Test Report

AUTOSAR SWS document

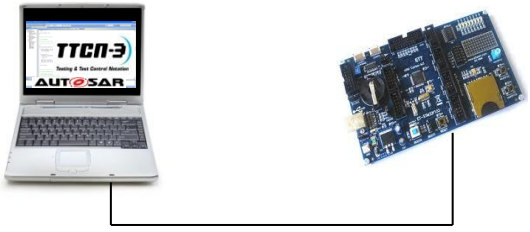


Conformance Test Specification

+

TTCN-3
Testing & Test Control Notation

CTS execution



Test report

- CTSpecs are obtained from AUTOSAR specifications
- CTSpecs are implemented into CTS
- CTS are used execute the specified test
- Test Reports are issued on the test results

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.			
Name of Company		Responsible Test Engineer	
Address of Company		Department	
Address of test facilities		Telephone	
		Mail	
		Date of the test (yyyy/MM/dd)	
2. Product developer			
Name of company			
Address of company			
Responsible inside company			
3. Product under test			
Name of product			
Product version number	(Identification of product under test with version number)		
Configuration	(Configuration of product under test, 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))		

template

- 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)	(Name of company)	Responsible Engineer	(Name of responsible individual inside company)
Address of Company (issuer of attestation)	(Adress of company)	Department	(Name of department)
		Date of attestation (yyyy/MM/dd)	
Product Developer			
Name of company (developer of product)	(Name of company)		
Address of company (developer of product)	(Adress of company)		
Product under test			
Name of product under test	(Name of product)		
Product version number	(Identification of product under test with version number)		
Date (yyyy/MM/dd)			
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))		
The product described above conforms to the AUTOSAR Release x.y specifications.			
Responsible's signature			

template

- AUTOSAR Confidential -

AUTOSAR Label

AUTOSAR Release x.y

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

Conformance attestation validity

- 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)

Definition of CTAs

- 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.

CTA responsabilities

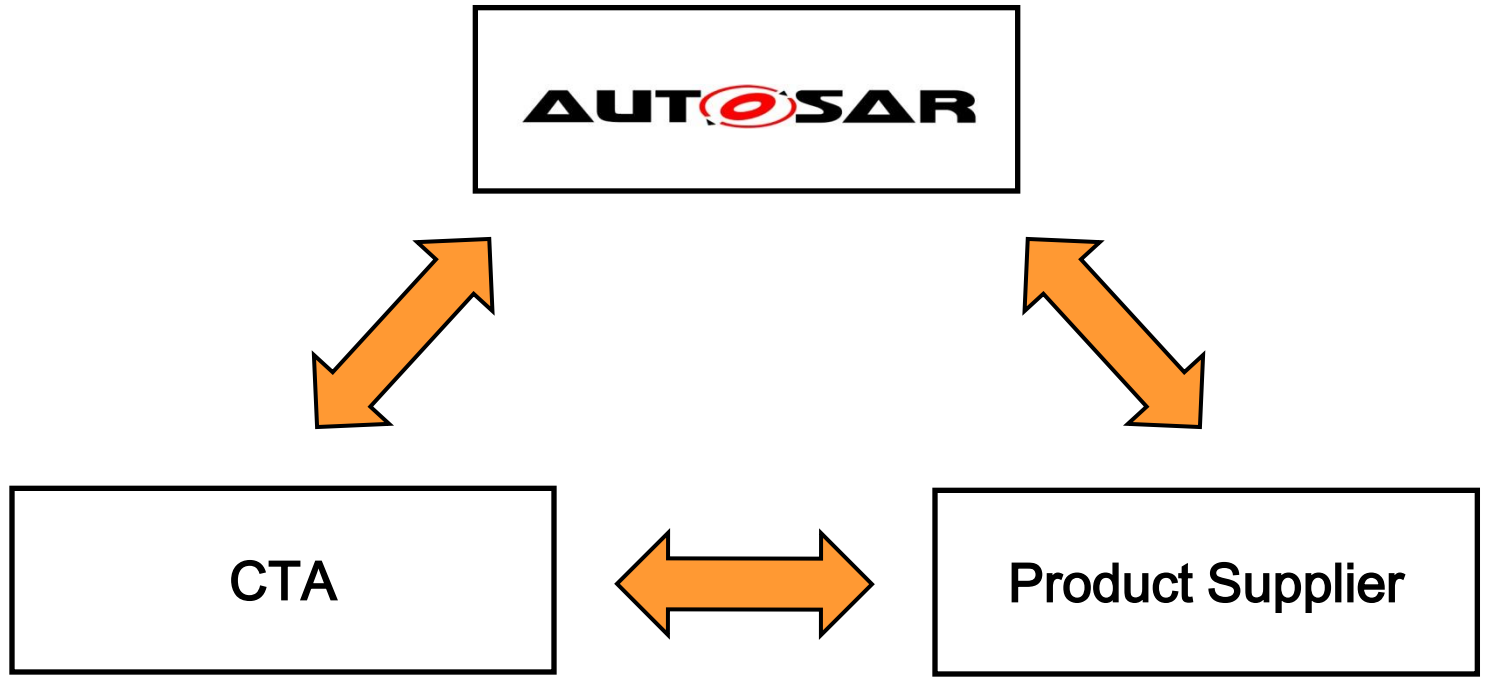
1. AUTOSAR objectives 2. Main requirements 3. detailed requirements 4. detailed specifications 5. Conformance test specifications [1)]	Scope of AUTOSAR standardization
6. Test implementations (CTS) 7. Conformance Test execution 8. Test report / conformance attestation	Scope of CTA tasks or responsibility

1) Including the conformance test methodology

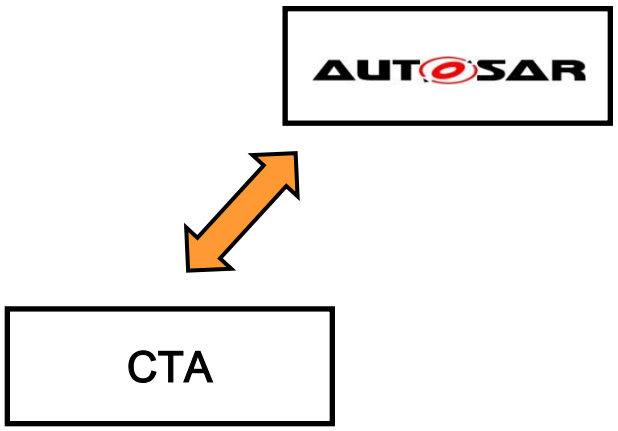
- CTA responsabilities:
  - CTS setup: must faithfully implement the CTSpecs of a PUT such that tests can be executed in a reliable, reproducible manner
  - CTS definition: attributes of the test environment must be identified
  - CTS maintenance: new standard releases, bugs in the CTS
  - Conformance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

ACTORS INVOLVED IN AUTOSAR CONFORMANCE TESTING

Actors involved in AUTOSAR Conformance Testing



Actors: AUTOSAR and CTA



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

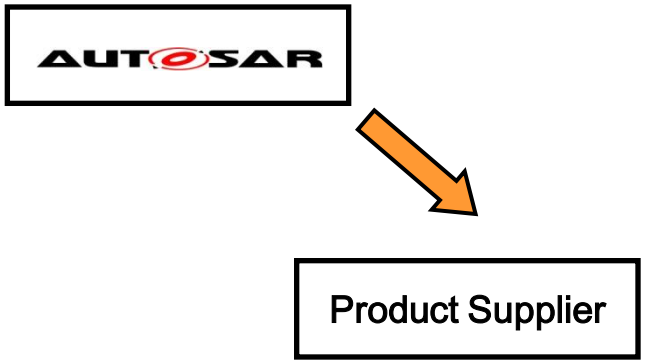
Actors: AUTOSAR and PS

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

Product Report template

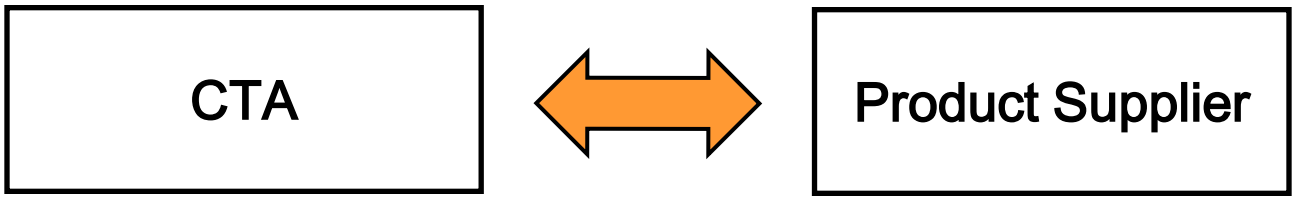
1. Product developer			
Product report no.			
Name of Company		Responsible Product Manager	
Address of Company		Department	
		Telephone	
		Mail	
		Date of the i (yyyy/M	
2. Product under test			
Name of product under test	(Name of product		
Product version number	(Identifi	oduct v sion number)	
Configuration		ation ins ecksum)	
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			

AUTOSAR template



Actors: CTA and PS

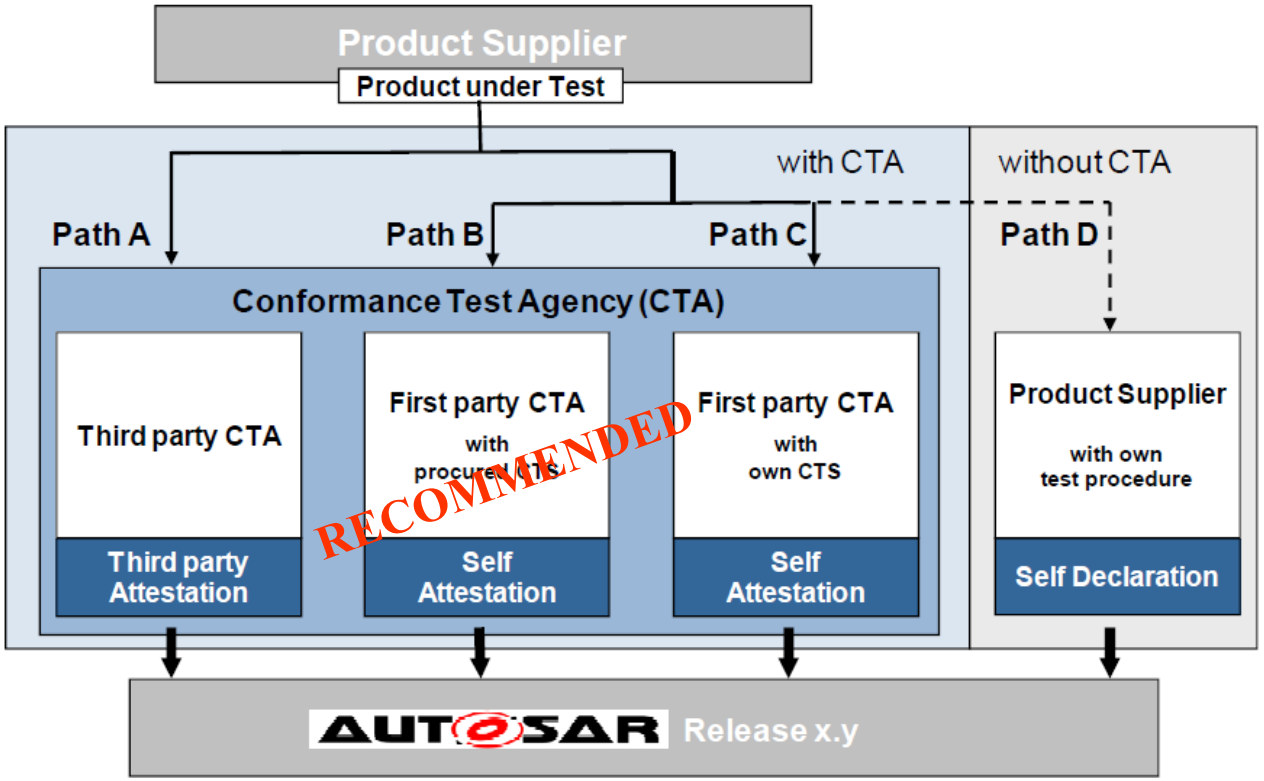
- CTA:
  - CTS SETUP AND MAINTENANCE: checks the applicability of the CTS for conformance testing, assures the reproducibility of the CTS results, identifies the attributes of the test environment; maintains CTS up-to-date.
  - CT EXECUTION: under its own qualty control or eyewitness onsite
  - SUPPORT: 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

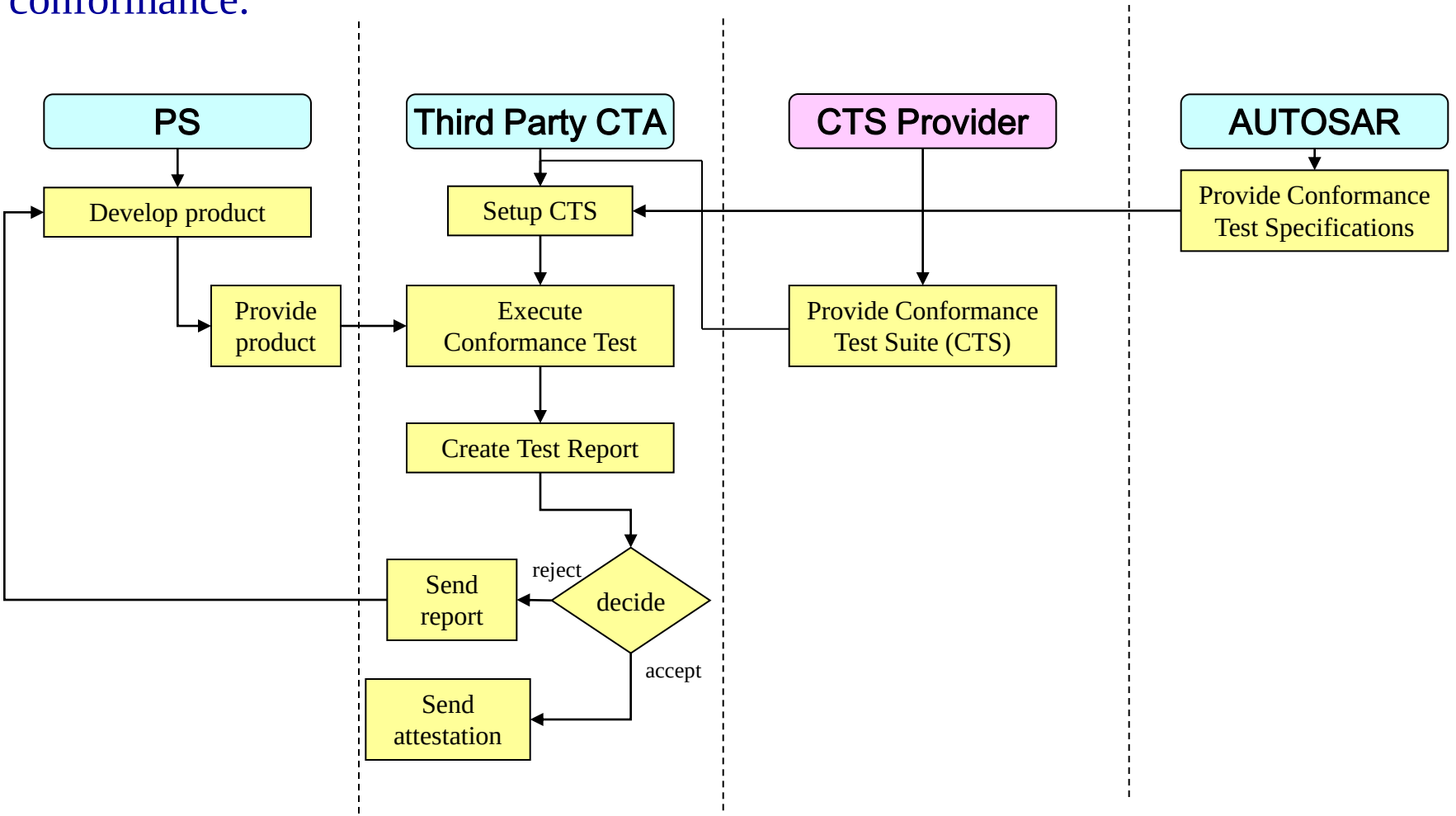
Available paths for the conformance test process

Conformance test process can follow one of paths A to D



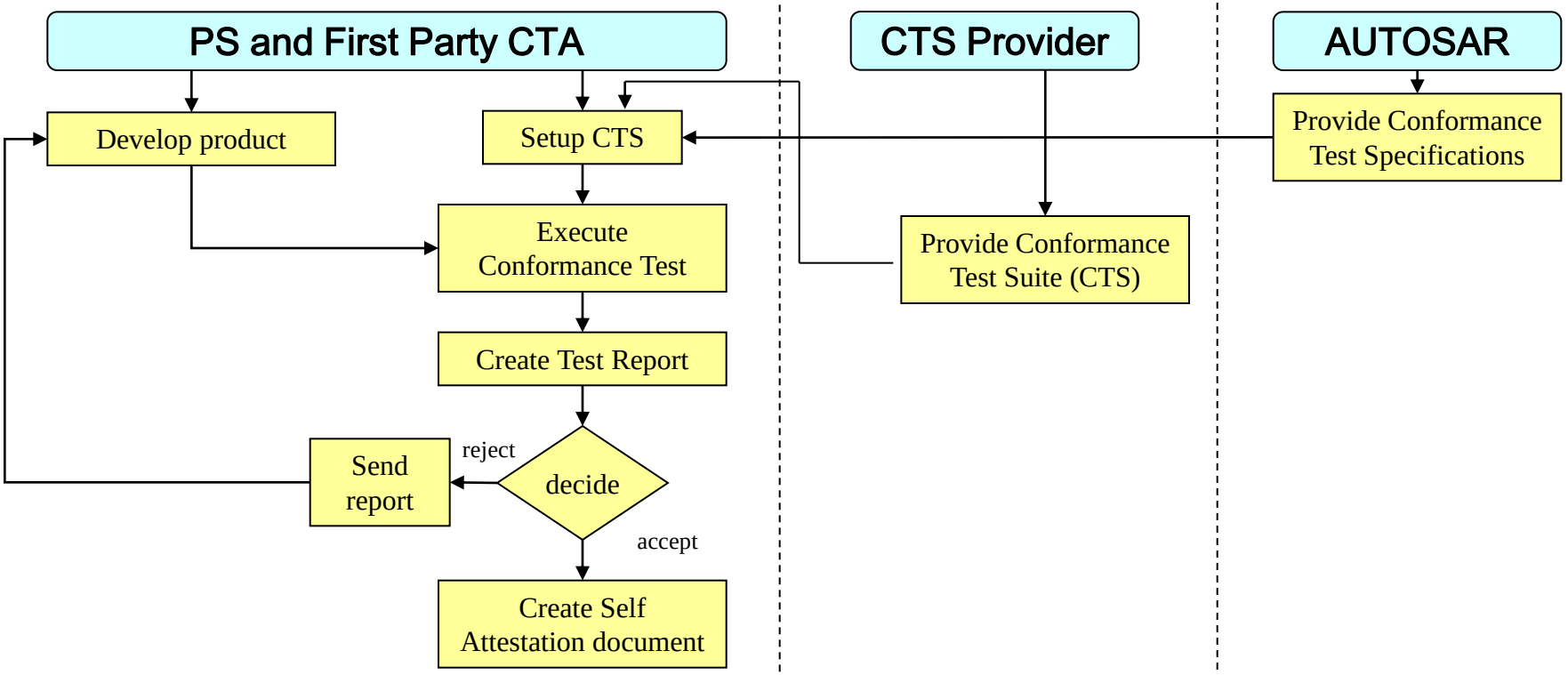
CT Process: path A

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



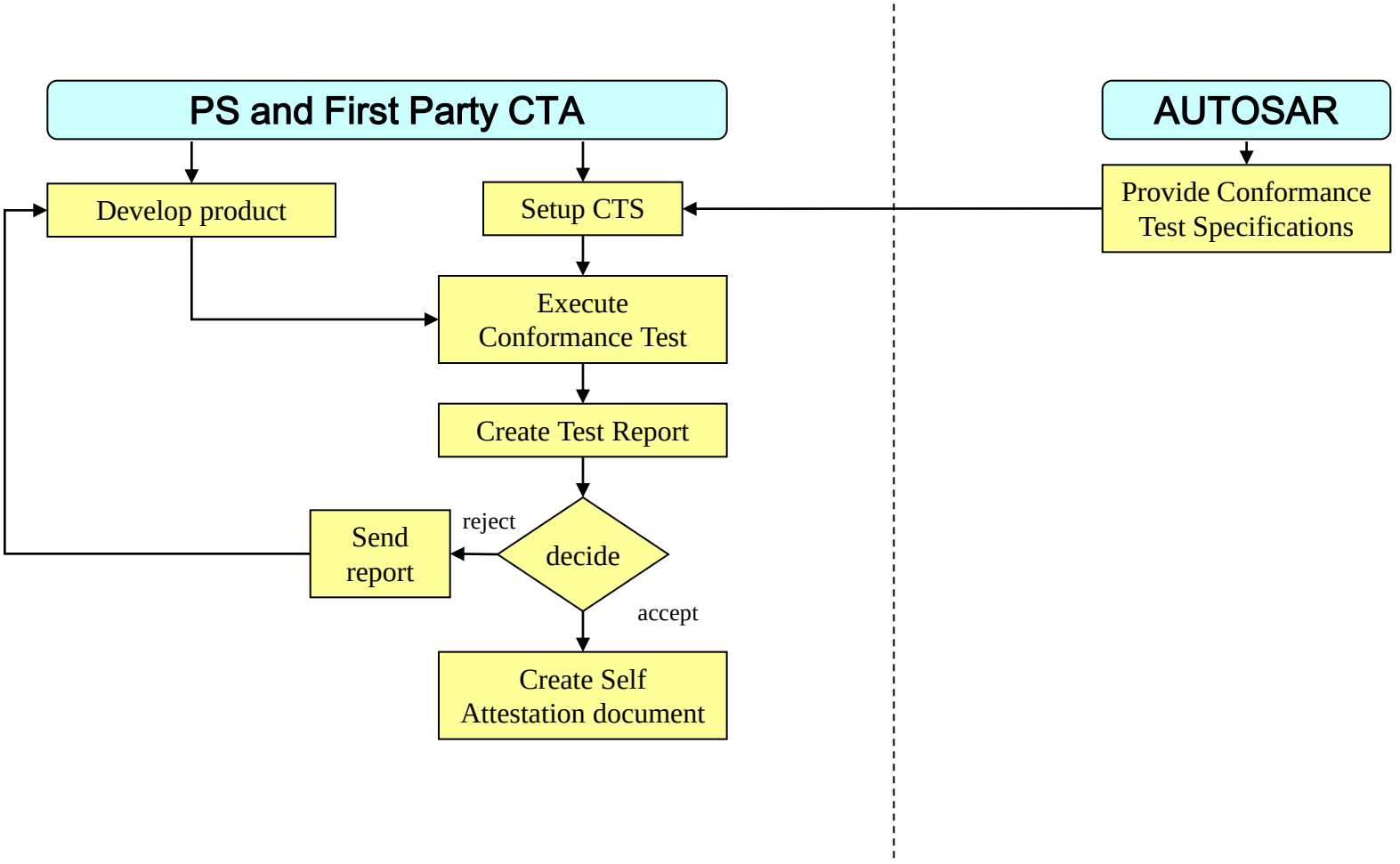
CT Process: path B

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.



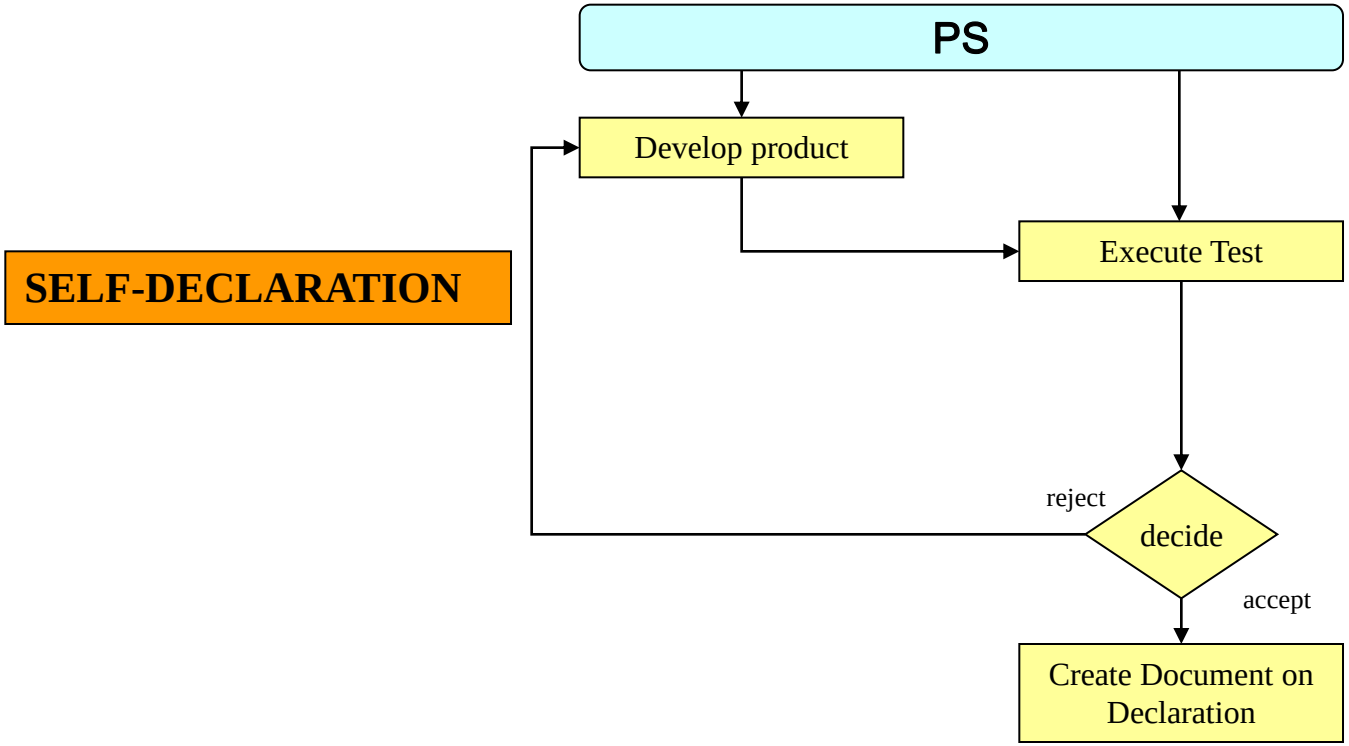
CT Process: path C

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).

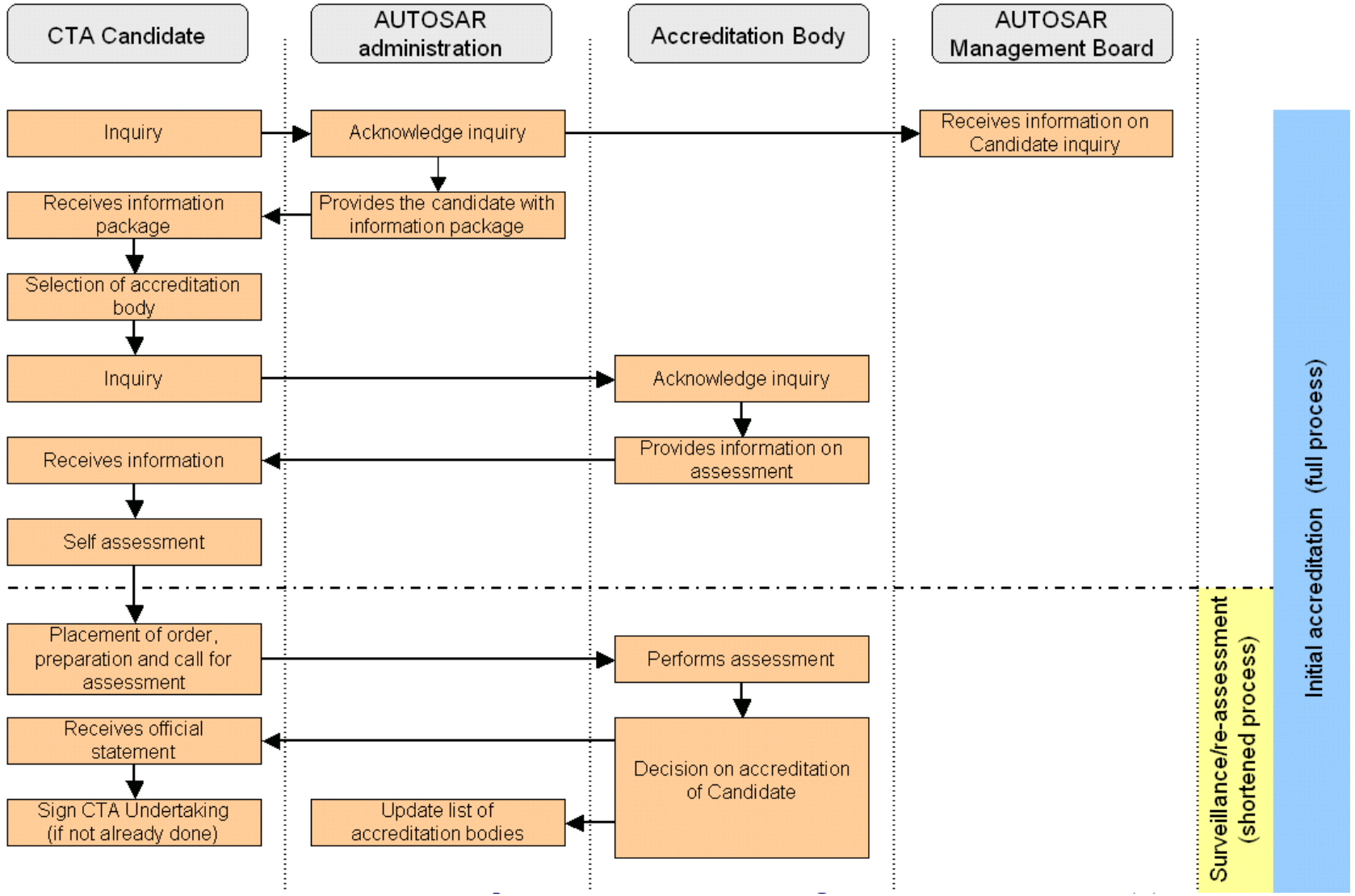


CTA ACCREDITATION

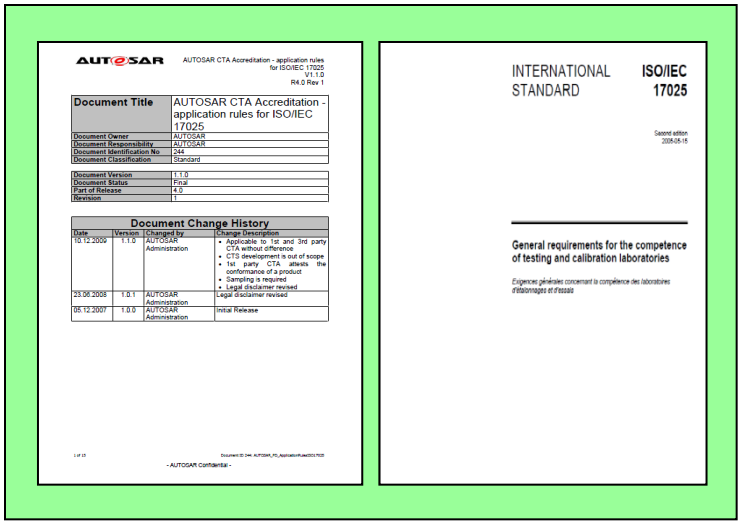
CTA Accreditation

- 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

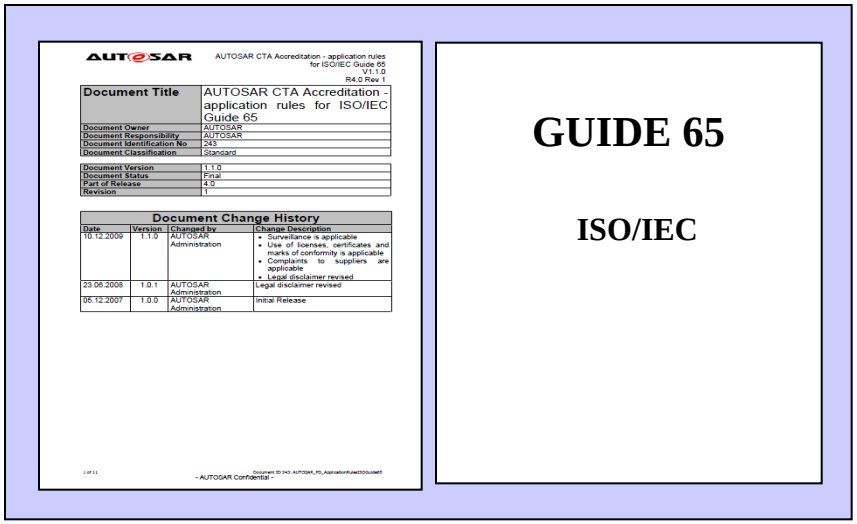


CTA candidate assessment criteria



ISO-IEC 17025:2005
guidelines for test laboratories

First party and third party CTAs accreditation



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

Only third party CTAs accreditation

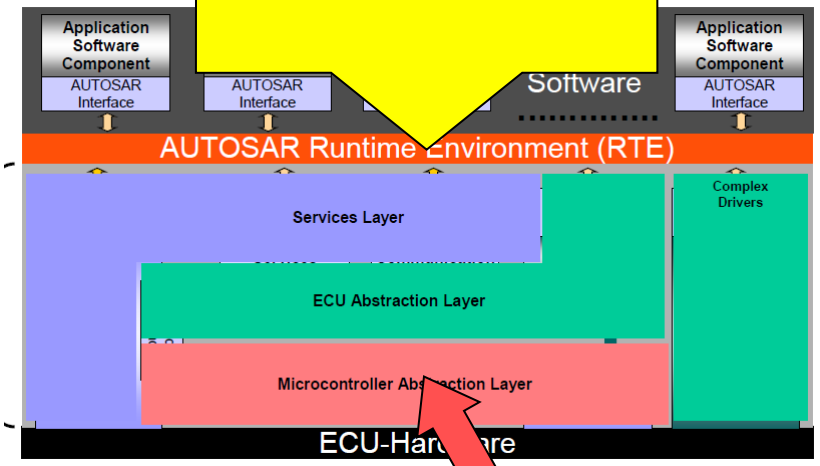
INTECS AND AUTOSAR CONFORMANCE TESTING

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.

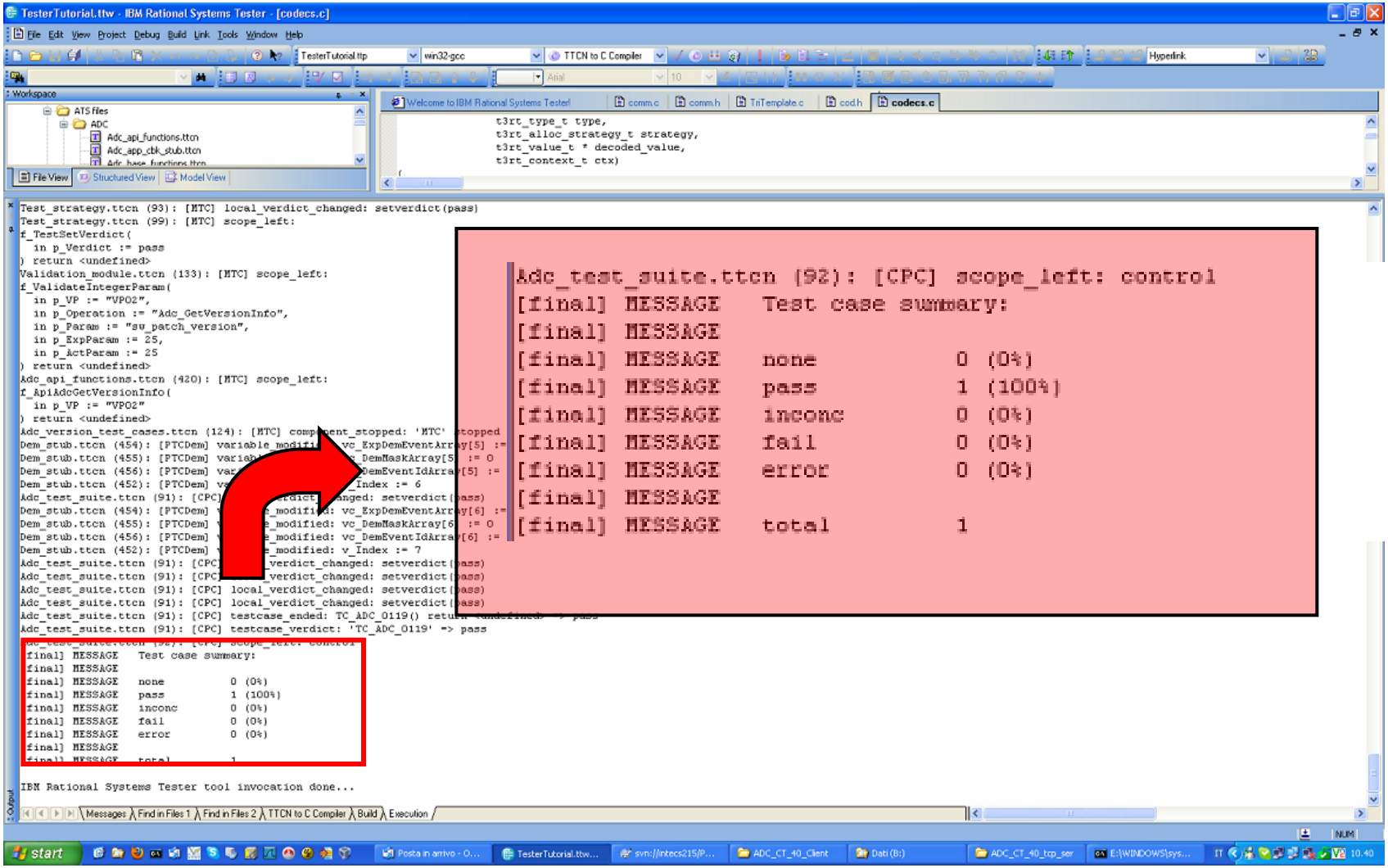
INTECS is developing a CTS for AUTOSAR Conformance Testing



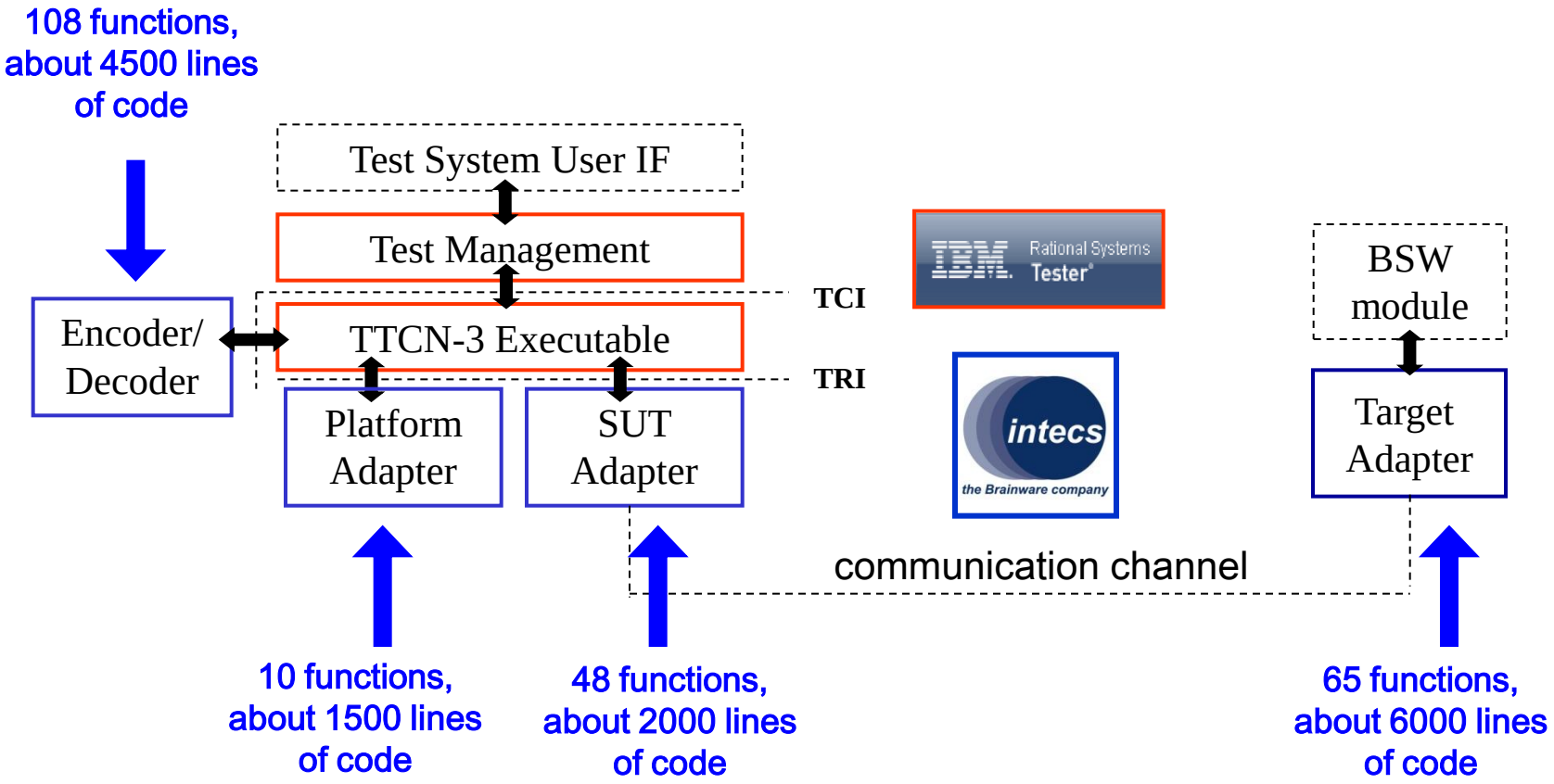
NOW

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

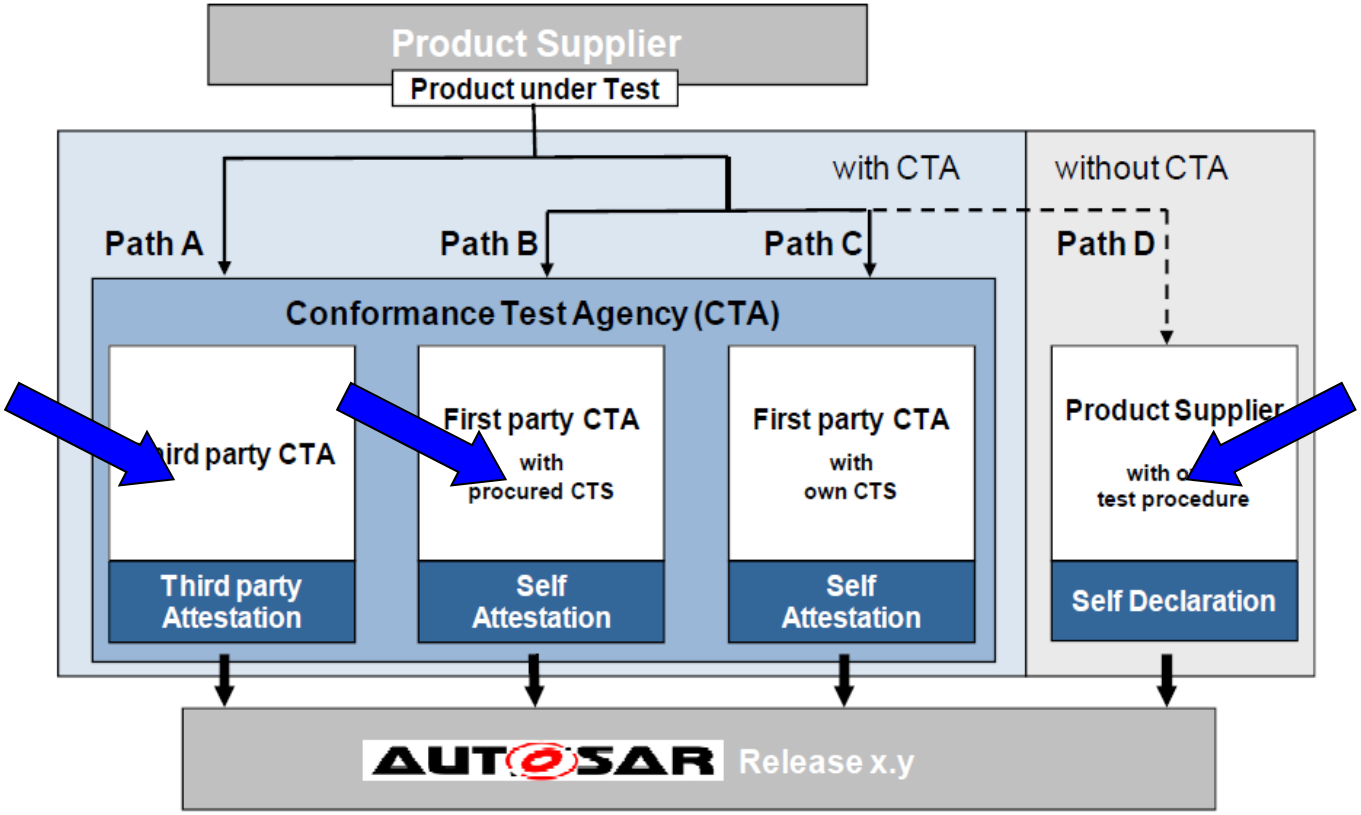
An example of an ADC test output



Effort needed to develop a CTS suite



Where Intecs CTS is applicable



providing CTS and support…

For any questions and information please refer to:

Valentina Lomi, Intecs S.p.A.
email: valentina.lomi@intecs.it

Via Umberto Forti, Polo di Attività Montacchiello
Loc. Ospedaletto, 56121 Pisa - Italy
tel: +390509657533
web-site: http://www.intecs.it/