IPG AUTOMOTIVE | 30 YEARS OF INNOVATION

PSA PEUGEOT CITROËN
Direction Recherche et Développement

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Karlsruhe (Germany)

Automated Testing of the Diagnostic Protocol and ODX 2.0.1 with PSADiagTool and CarMaker

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- Test Automation
- Diagnostic protocol and ODX 2.0.1 overview
- PSADiagTool

https://docinfogroupe.psa-peugeot-citroen.com/ead/doc/ref.01552_14_05935/v.vc/fiche

Test Automation

- 20 000 automated tests on IPG HIL bench to check ABS, ESC and EPB calculators.
- 12 HIL benches + 37 modules

IPG HIL bench

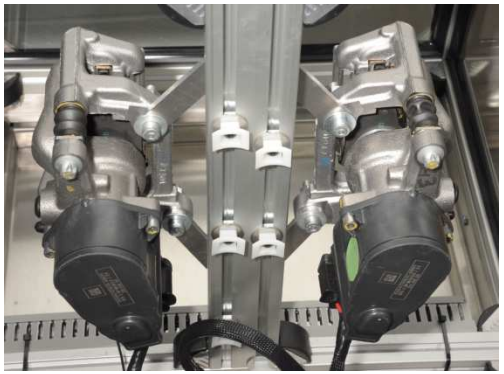
Modèle	Quantité
[+] ABS 8.1	1
[+] ABS MK100	1
[+] DAE	1
[+] DSG	1
[+] ESP 8.1	1
[+] ESP 8.1 HY	3
[+] ESP 8.1 LAS	4
[+] ESP 9 38v	4
[+] ESP 9 46v	4
[+] ESP 9 46v 3PS	2
[+] ESP MK100	3
[+] ESP MK100 PS100	2
[+] ESP MK60-o	1
[+] FSE B58	1
[+] FSE B7	1
[+] FSE B8	1
[+] FSE W2	1
[+] FSE X7	1

ESC Bosch 9 module

ESC

[+] Etriers réels	1
[+] Etriers simulés	3

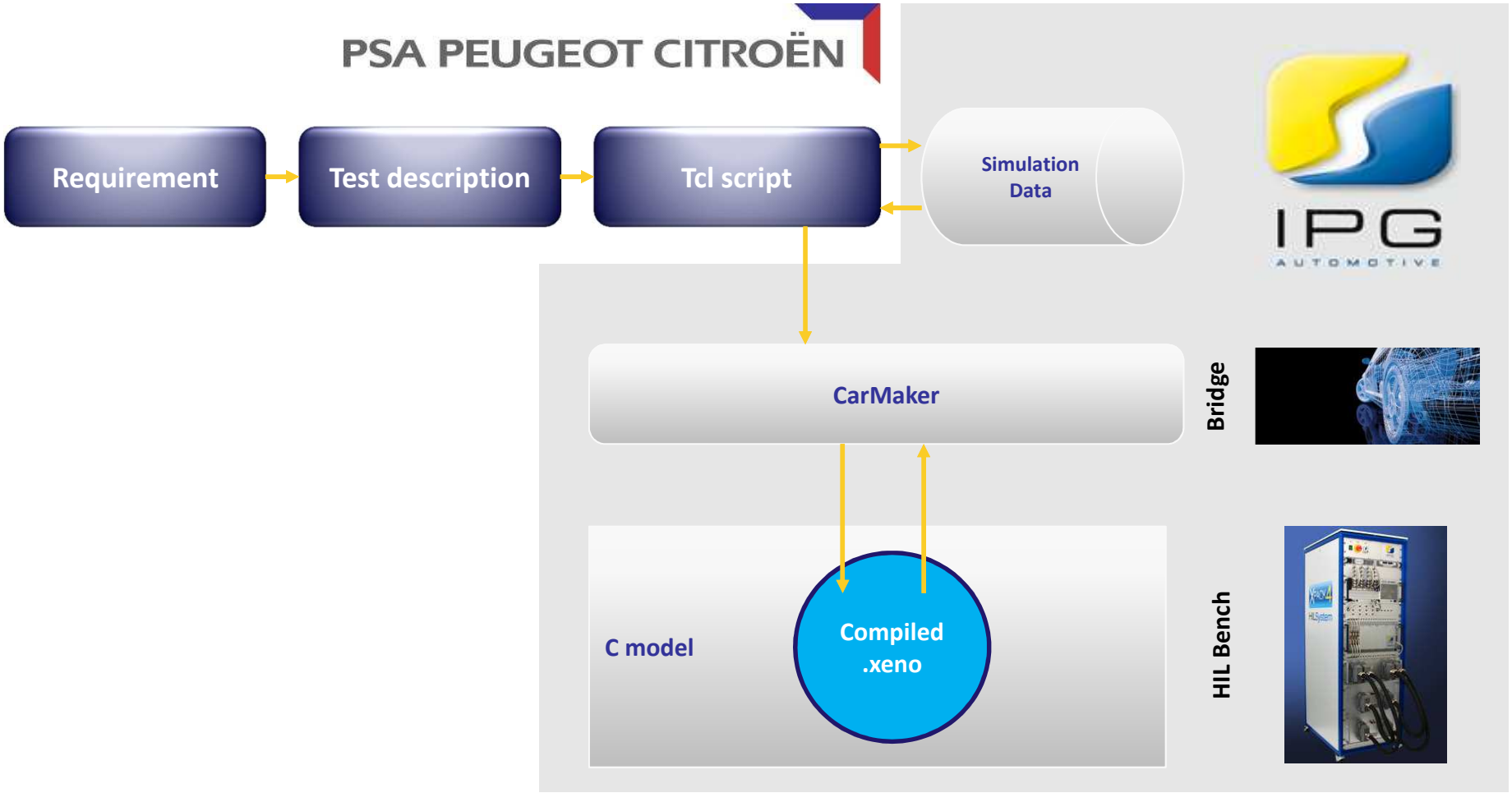
EPB + chassis



Motorized brake calipers

Test Automation

- 90% of all test scenarios are covered by Tcl scripts



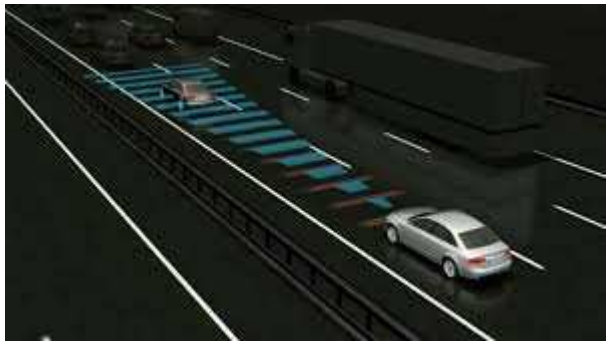
Test Automation

- ESC diversity is growing (engine + gearbox + carbody + braketype + …)
  Need to check all of them.

Engine	Gearbox	Variant
Gazoline	Manual	Coding_1
gazoline	Automatic	Coding_2
Diesel	Manual	Coding_3
Diesel	Automatic	Coding_4

- Tests description for an ESC are grouped in more than 30 functions

Park assist



Automatic Cruise Control

Hill Hold Control

Test Automation

Diagnostic uses

» Warning lamp informs the driver of a problem with its vehicle. In some cases, the car is stopped or some safety functions are inhibited.

» Even without warning lamp on, the car may stop. Diagnostic can find the reason.

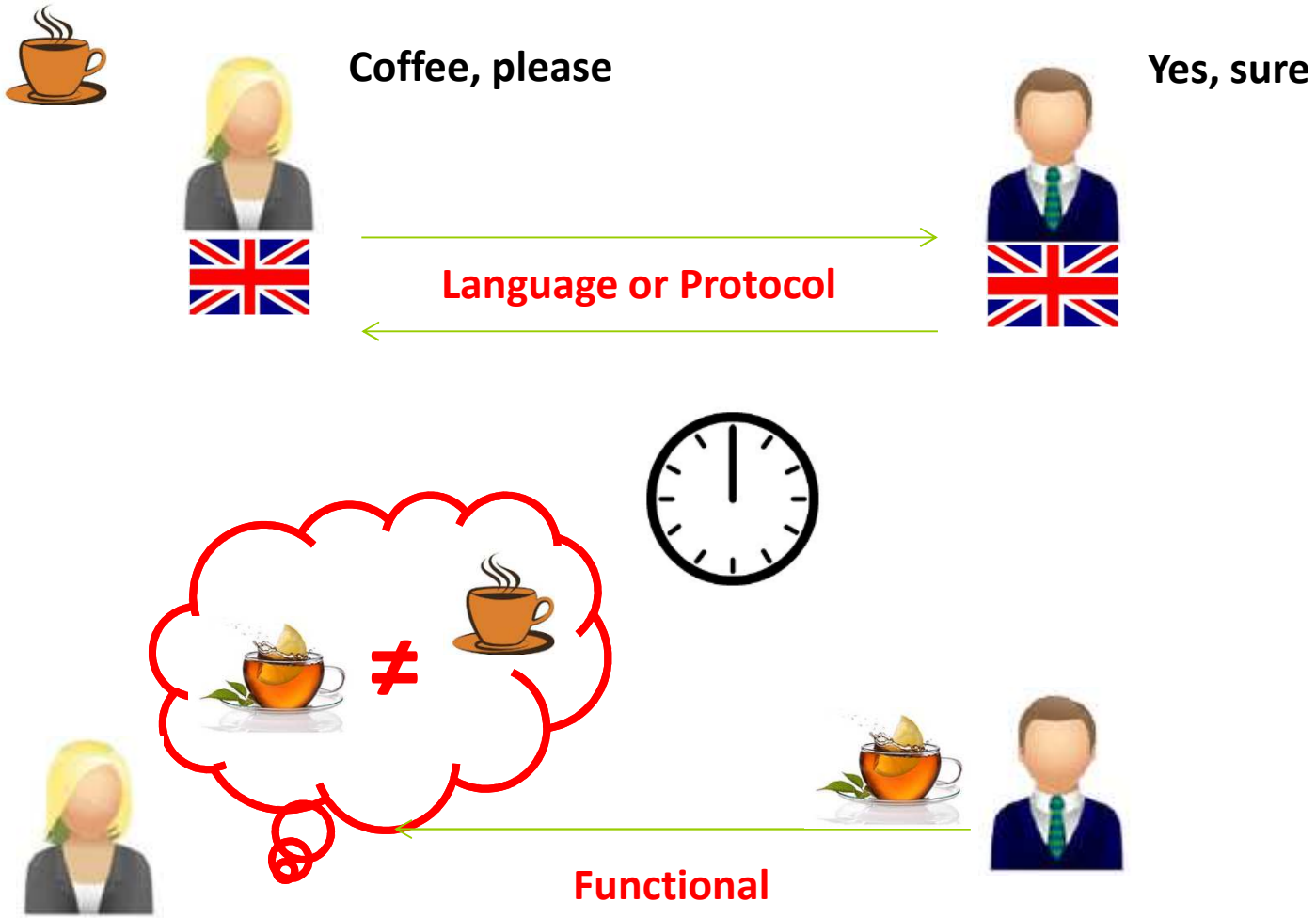
» An expert read default's snapshot to investigate if the car itself has not provoked an accident.

» Some specific diag sequences are executed during assembly line.

Diagnostic protocol and ODX 2.0.1 overview

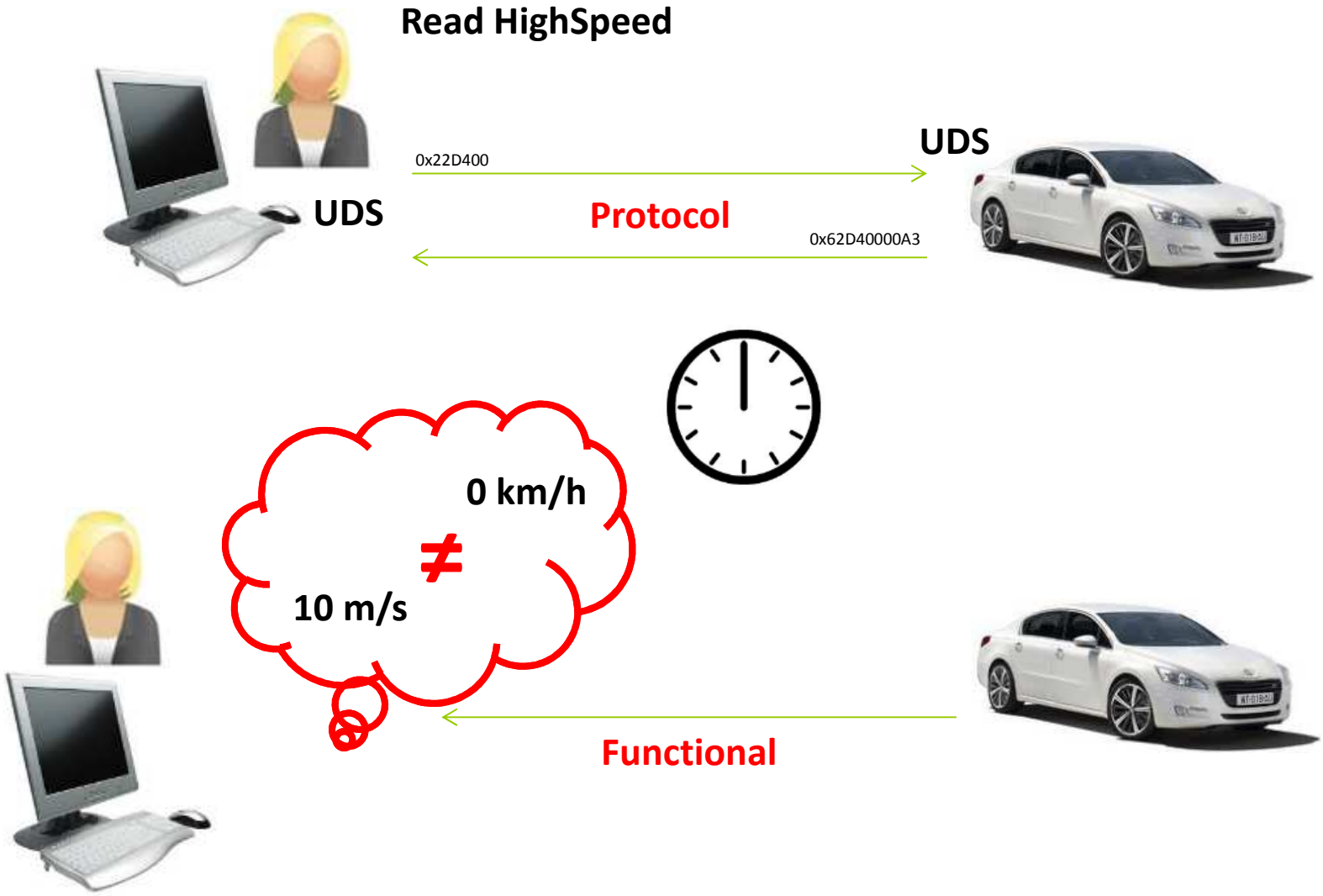
Diagnostic protocol and ODX 2.0.1 overview

- What is a diagnostic protocol in automotive ?



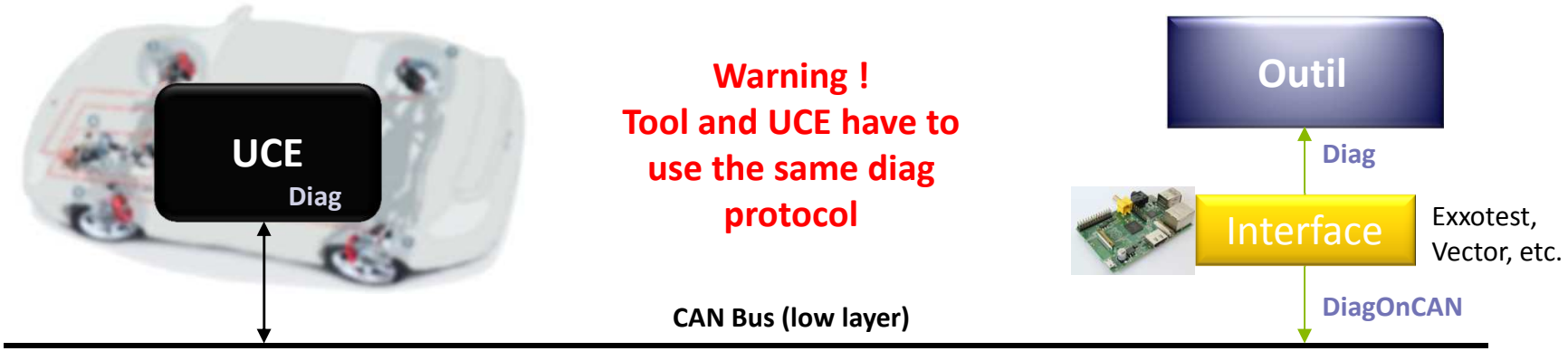
Diagnostic protocol and ODX 2.0.1 overview

- What is a diagnostic protocol in automotive ?



Diagnostic protocol and ODX 2.0.1 overview

- Diagnostic protocol is a computer language to communicate between a tool and one or several calculators of a vehicle (ESC, CMM, BV, etc).



- KWP2000 and UDS are the 2 protocols used in automotive

- How a diagnostic tool can handle all the different brands of Car Manufactures ?

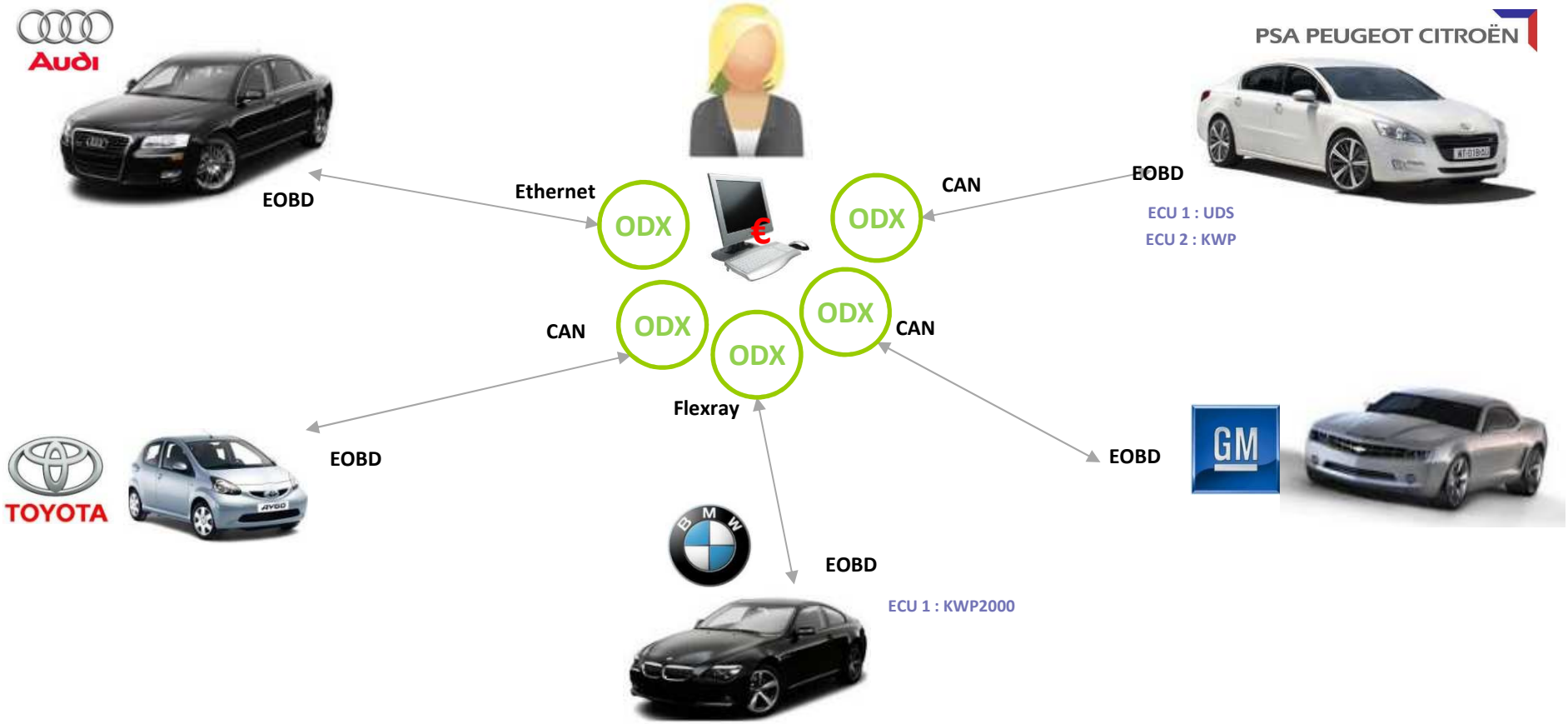
Diagnostic protocol and ODX 2.0.1 overview

- How a diagnostic tool can handle all the different brands of Car Manufactures ?
  - No ODX

Diagnostic protocol and ODX 2.0.1 overview

- How a diagnostic tool can handle all the different brands of Car Manufactures ?
  - Using ODX : Open Diagnostic Data eXchange

One tool for all cars



Diagnostic protocol and ODX 2.0.1 overview

- Tool using ODX
  - The protocol is specified in an ODX file (ASAM normalized)
  - Several version of ODX :
    - Version 1.0.0 (*.ODX)
    - Version 2.0.1 (*.PDX)
    - Version 2.1.0 (*.ODX)
    - Version 2.2.0 (*PDX)

Advantages :

+ A unique tool for all brands
+ No need to use brand's tool
+ Lower cost to developp a tool

Drawbacks :

- ODX file must be checked without error
- One ODX file for each car
- High ODX developpement cost

PSADiagTool

PSADiagTool

- Validate PDX file (ODX 2.0.1) on IPG bench
  - The goal is to check the protocol and information that it contains, not XML ASAM tags.

  - This step consists to view and compare expected services, request format and so on to what is written in a PDX file.

PSADiagTool

- Validate KWP / UDS protocol and functional on IPG bench based on PDX file and PSA requirements
  - One PDX file covers one or several ESC projects.
  - In case of several projects, « functional classes » are used to separate specific services to each project.
  - PSA requirements are implemented in PSADiagTool and can create diagnostic tests with expected results.
  - CarMaker's data dictionaries and modules allow PSADiagTool to communicate with an ECU and execute tests on the real-time system of a HIL bench.
  - Each test result is in a HTML format and XML format
  - Tests are performed with a PDX file to decode data

PSADiagTool

Tests session results

PSADiagTool version 0.8.3 release 6 - VALIDATION SESSION REPORT -

CDTCI - ClearDiagnosticInformation

Ce service permet d'effacer les informations associées aux DTC.
This service erases all the information associated to the DTC.
Les exigences associées à ce service sont décrites dans la spécification DC_TI_72 au paragraphe 6.7.2.
Requirements associated to this service are described in specification DC_TI_72 paragraph 6.7.2.

[OK]	100600	T-UDS-CDTCI_1.htm
[OK]	100601	T-UDS-CDTCI_2.htm
[OK]	100602	T-UDS-CDTCI_3.htm
[OK]	100603	T-UDS-CDTCI_4.htm

PDX	Name	SID	Sub-ID	S-Fun	SPRMIB	ADR.F	SS01	SS02	SS03	SS40	Description
Yes	CDTCI	14			No	Yes	NR 7F	NR 11	PR	PR	ClearDiagnosticInformation (CDTCI_14)
Yes	CDTCS	85		01	Yes	Yes	NR 7F	NR 11	PR	PR	Reprise de l'enregistrement des défauts local Reprise de l'enregistrement des défauts local : ControlDTCSetting (CDTCS_85)
Yes	CDTCS	85		02	Yes	Yes	NR 7F	NR 11	PR	PR	Arrêt de l'enregistrement des défauts local Arrêt de l'enregistrement des défauts local : ControlDTCSetting (CDTCS_85)
Yes	DSC	10		01	Yes	Yes	PR	PR	PR	PR	Session par défaut (état par défaut du calculateur) (régulations actives) Session par défaut (état par défaut du calculateur) (régulations actives) : DI
Yes	DSC	10		02	Yes	Yes	PR	NR 22	PR	PR	Session spécifique téléchargement Session spécifique téléchargement : DiagnosticSessionControl (DSC_10)
Yes	DSC	10		03	Yes	Yes	PR	NR 12	PR	PR	Session de diagnostic APV (régulations inhibées) Session de diagnostic APV (régulations inhibées) : DiagnosticSessionControl (DSC_10)
Yes	DSC	10		40	Yes	Yes	PR	NR 12	PR	PR	Session de diagnostic usine (régulations inhibées) Session de diagnostic usine (régulations inhibées) : DiagnosticSessionControl (DSC_10)
Yes	ER	11		03	Yes	Yes	NR 7F	NR 11	PR	PR	Reset logiciel. Redémarrage de l'applicatif. Reset logiciel. Redémarrage de l'applicatif. : ECUReset (ER_11)

PSADiagTool

Test result

PSADiagTool version 0.8.3 release 6 - Validation Test Report -

START SCRIPT

```
[ OK ] [      0.075  4  H  ON    ] Wake-up line = 1 and réveil_principal in frame h432 = 2
                      t=203.994     id=6AD [DIAG]    l=3, 22f186
                      t=204.051     id=68D [DIAG]    l=4, 62F18601
       [      0.141  4  H  ON    ] - Envoyer la requête DSC 0x1003 pour entrer en extended session (0x03)
                      t=204.059     id=6AD [DIAG]    l=2, 1003
                      t=204.173     id=68D [DIAG]    l=6, 500300C80014
[ OK ] [      0.266  4  H  ON    ] L'UCE répond 0x500300C80014 pour entrer en extended session (0x03)
       [      0.268  4  H  ON    ] - Envoyer la requête DSC 0x1001 (DiagnosticSessionControl)
                      t=204.186     id=6AD [DIAG]    l=2, 1001
                      t=204.279     id=68D [DIAG]    l=6, 500100C80014
[ OK ] [      0.370  4  H  ON    ] Le calculateur répond positivement (0x500100C80014)
```

ODX PARAMETERS DECODING

Position	Length	Name	Value	Description
0.0	8	DSC (DiagnosticSessionControl)	50	DiagnosticSessionControl : CODED-CONST = 80
1.7	1	SPRMIB (SuppresPosRspMsgIndicationBit_1)	0	Demande de réponse à la requête
1.0	7	DS_ (DiagnosticSessionType_1)	1	Session par défaut (état par défaut du calculateur) (régulations actives)
2.0	16	P2CAN_SERVER_MAX (P2CAN_Server_Max_2)	00C8	200.000 ms
4.0	16	P2_STAR_CAN_SERVER_MAX (P2*CAN_Server_Max_1)	0014	200.000 ms

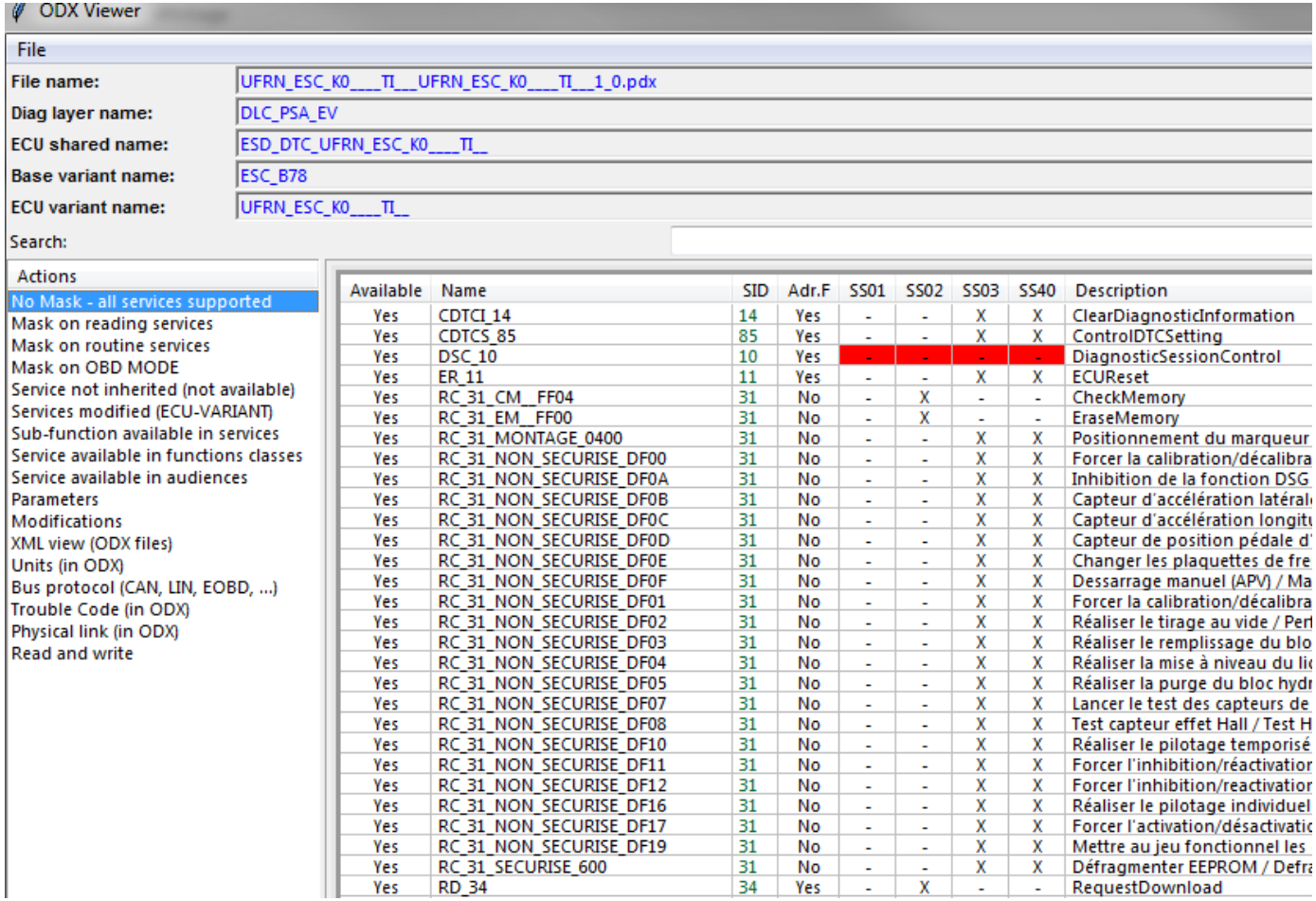
```
[ OK ] [      0.483  4  H  ON    ] Diag command length match with ODX specification (48 bits = 6 bytes)
```

END SCRIPT

REPORT INFORMATION

PSADiagTool

- Other functionalities implemented :
  - Parse, check, view and edit an ODX 2.0.1

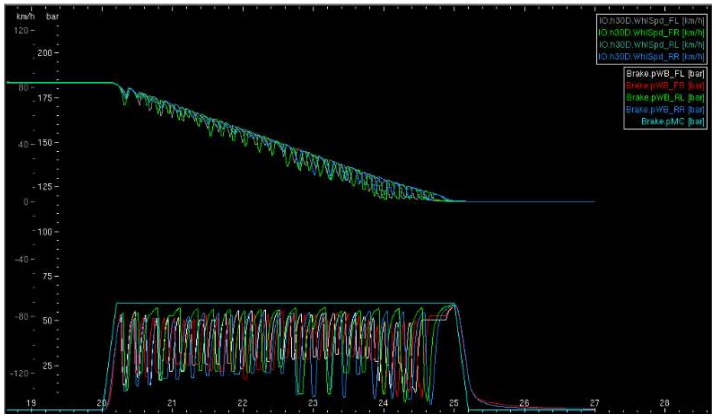


PSADiagTool

- Other functionalities implemented :
  - Decode request and response

6.0	8	FF	DTCSSRN (DTCSnapshotRecordNumber_1)
7.0	8	42	NB_ITER_DLF_EPF_PR_RDTCI_19_RDTCSSBDTC_04 (Nombre de
8.0	16	D400	Vitesse de roue ARG
10.0	16	0000	0.000 km/h
12.0	16	D401	Vitesse de roue ARD
14.0	16	0000	0.000 km/h
16.0	16	D402	Vitesse de roue AVG
18.0	16	001A	0.260 km/h
20.0	16	D403	Vitesse de roue AVD
22.0	16	0000	0.000 km/h
24.0	16	D404	Vitesse véhicule
26.0	16	0000	0.000 km/h
28.0	16	D405	Tension d'alimentation
30.0	8	88	13.600 V
31.0	16	D406	BLS - Contact de pédale de frein
33.1	7	0	RESERVE_1
33.0	1	0	Non appui pédale de frein
34.0	16	D408	Alerte niveau liquide de frein/Brake fluid level ala
36.1	7	0	RESERVE_1
36.0	1	0	Pas d'alerte

IPG Control



  - Create tests scenarios using PSA requirements
  - Execute tests on a real calculator and create HTML report
  - Replay a Vector ASC file
  - Build a request and response with user choice

: 31 RC_31_NON_SECURISE_DF01 (Forcer la calibration/décalibration du capteur de l'Unité de Mesure Inertielle / Force Inertial Measurement Unit sensor ca

3101DF0100 | Send | In Session de diagnostic APV (régulations inhibées) (03)

Ce service permet de lancer / arrêter et de demander la statut de routines (représentées par des RoutineIdentifiers). Les routines sont utilisées pour l'exécution d'
The RoutineControl service is used by the client to execute a defined sequence of steps and obtain any relevant results.

Position	length	Value	Description	
0.0	8	31	RoutineControl	
1.7	1	0	Demande de réponse à la requête	Permet d'indiquer si l'émetteur de
1.0	7	1	Lancement de la routine/Start Routine	Définit le type d'action à effectu
2.0	16	DF01	Forcer la calibration/décalibration du capteur de l'Unité de Mesure Inertielle / Force Inerti	Etude / Design
4.0	8	0	Décalibration de l'UMI / IMU decalibrating	Interdit

PSADiagTool

- 350 users already launched PSADiagTool on their computer in 38 different locations

BELCHAMP
BESSONCOURT
BORDEAUX - LE BOUSCAT - 357
BUENOS AIRES - PALOMAR
CARRIERES-SOUS-POISSY
CENTRE TECHNIQUE VELIZY A
KALUGA
KOELN - PSA
LA FERTE VIDAME
LA GARENNE-COLOMBES
MADRID
METZ
MEUDON-LA-FORET
MILANO - GALLARATE
MULHOUSE
NANTERRE - PONS
ORVAULT - MAIL
PARIS 17ème
PLATEAU FOURNISSEUR ENTREPRISE ETENDUE
POISSY - SITE INDUSTRIEL
PORTO REAL
RENNES
SANTIAGO
Sao Paulo - CORPORATE
SAO PAULO-TORRE SUL
SEVELNORD
SHANGAI-ATI2- GU MEI
SHANGHAI - TIANLIN
Site to be determined
SLOUGH
SOCHAUX
SPANGA
TREMERY
VALENCIENNES
VERSAILLES SPORT
VIGO
WUHAN

- For an ESC C4 Picasso PDX file, to cover all test cases (nominal, functional addressing, suppression bit, NACK 11, 12, 7F, 7E, 34, 33, 35, etc) there is around 10 000 tests created.
- Execution average time : less than 400ms.

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Thank you for your attention