Closing the loop from requirements management to verification execution for automotive applications

Walter Tibboel, Jan Vink
NXP Semiconductors

accellera SYSTEMS INITIATIVE

2015 DESIGN AND VERIFICATION™ DVCON CONFERENCE AND EXHIBITION EUROPE

Outline

- Motivation
- Verification flow
  - Verification hierarchy and traceability
  - Change is process; not a event
  - Flow & tooling
  - Future work
- Practical example
  - Automotive design example
  - Test environment
  - Progress tracking
- Conclusions
- Acknowledgement

Motivation

- **Verification & Validation challenges**
  - Full insight about verification coverage
  - Traceability between requirements, test items and test results
  - Change management: maintaining the overall consistency
  - Bridging the gab between requirements management system and verification environment

- **This work focusses on**
  - **Methodology** to make specification integral part of V&V flow
  - **Tooling** to ensure overall consistency:
    updates become explicit and well-controlled

Test items terminology

Functional

Pass/fail check on functional behavior

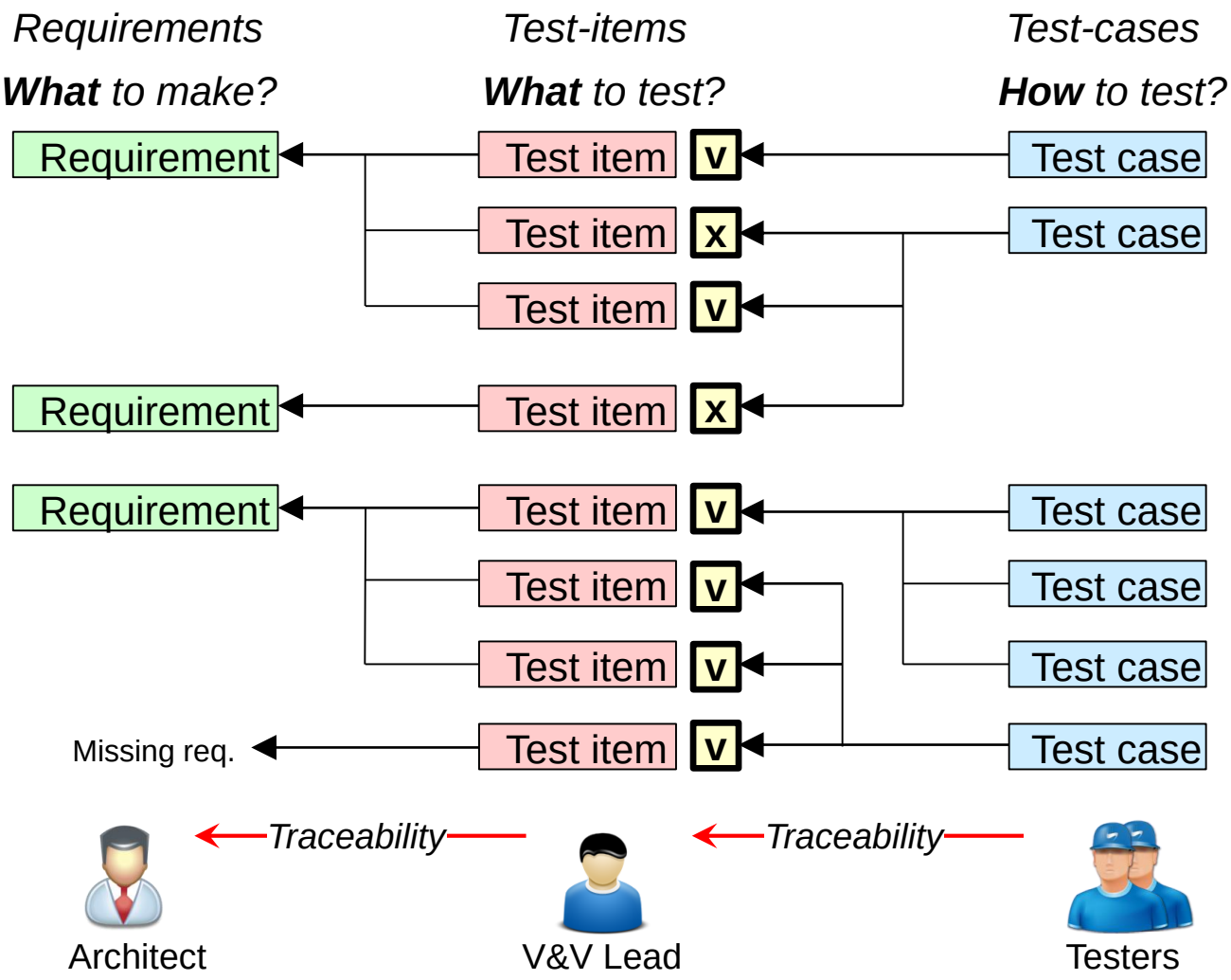
Test item Description	Test item Setup	Expected Results	…
Check wake-up	From sleep mode event X is fired	DUT is active mode	

Parametric

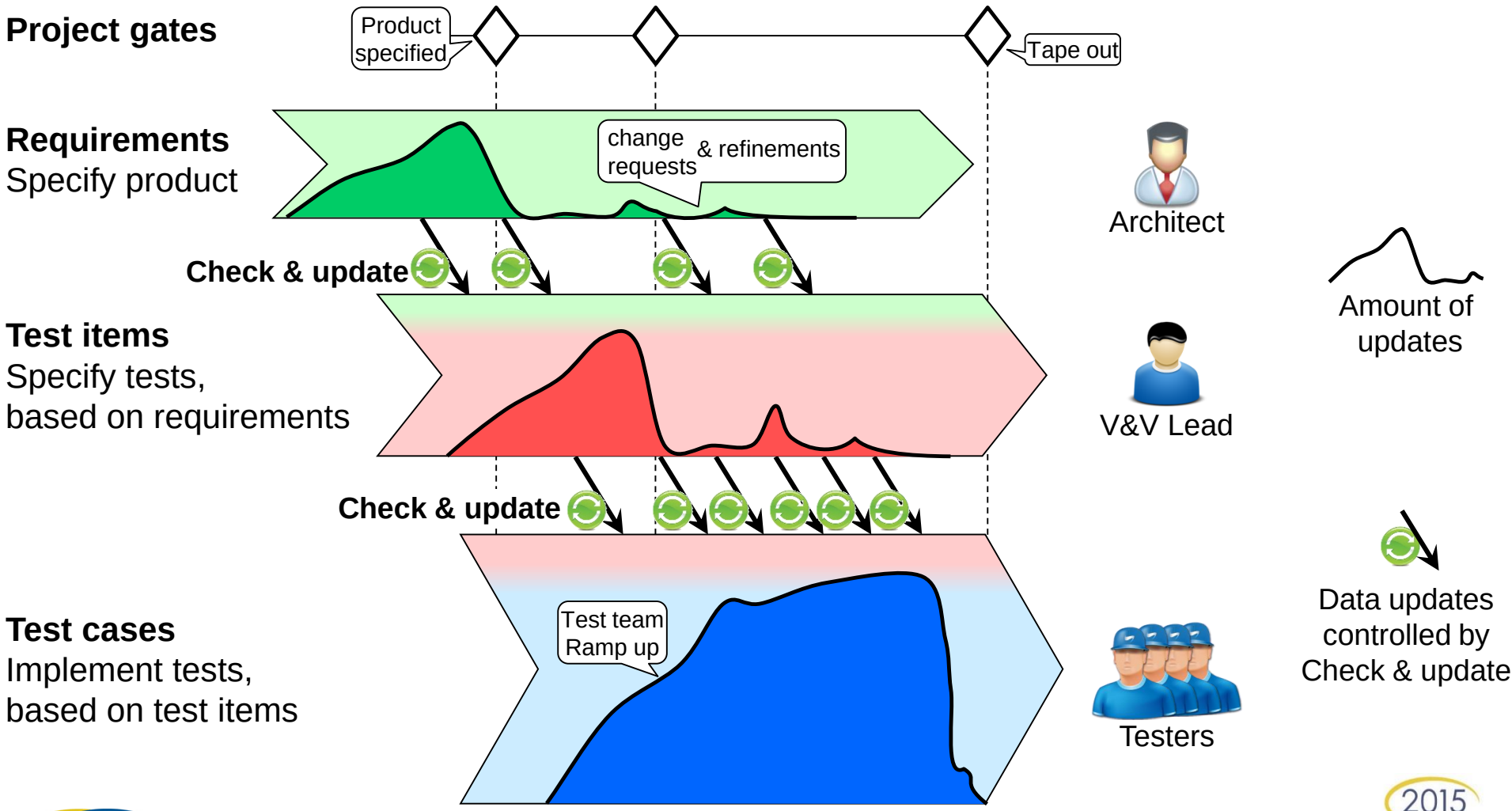
Check performance parameter under multiple PVT conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	…
I_{IL}	Input Leakage low VDD3V0	VDD = 3.0:3.5; T=25°C	4	-	5	uA	

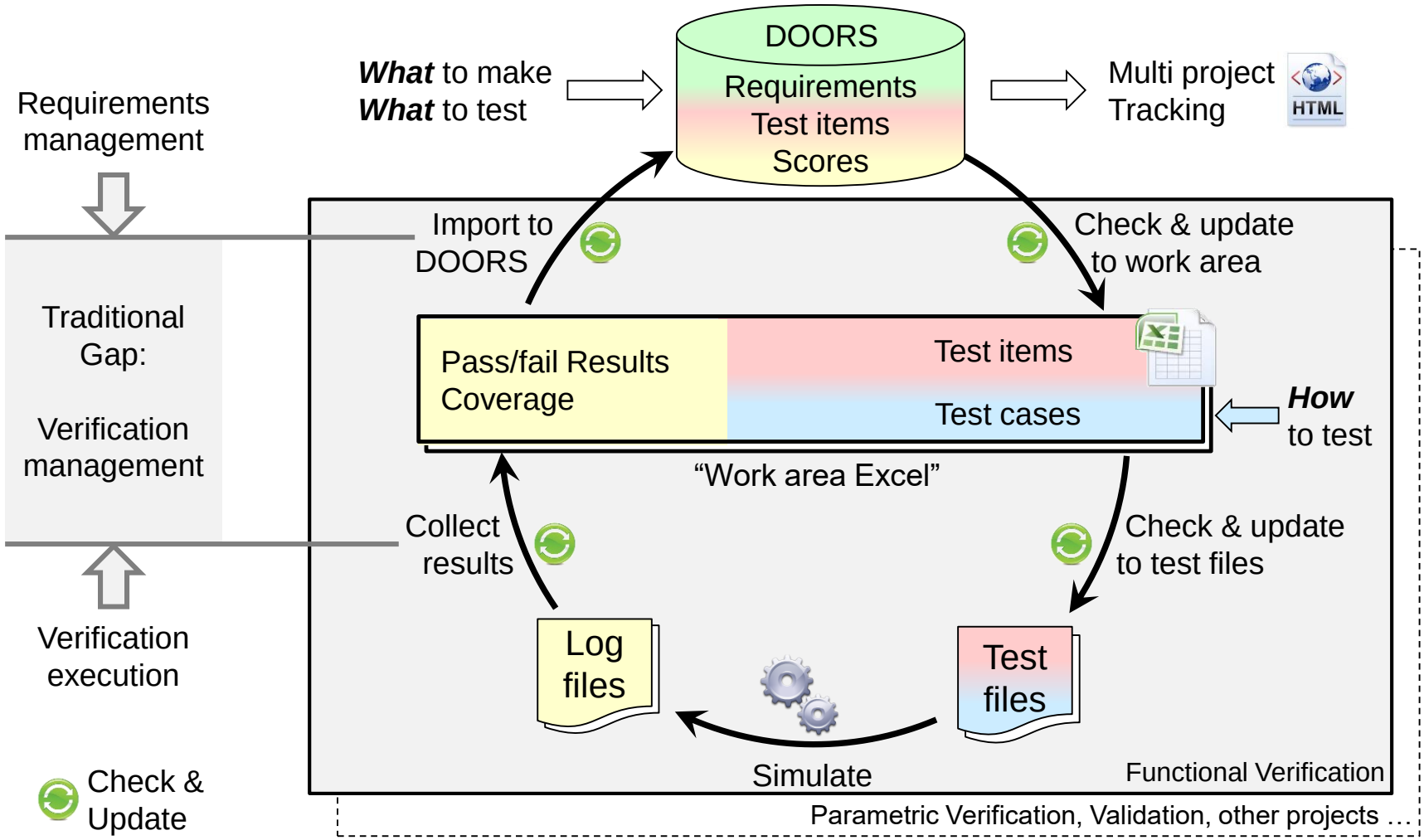
Verification hierarchy



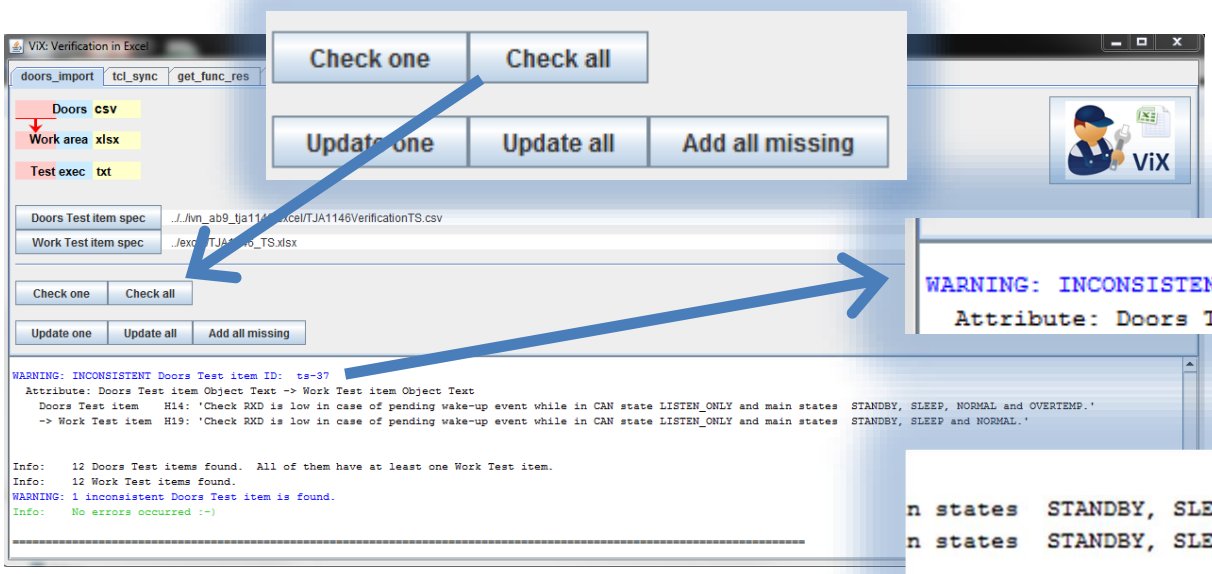
Change is a process; not an event

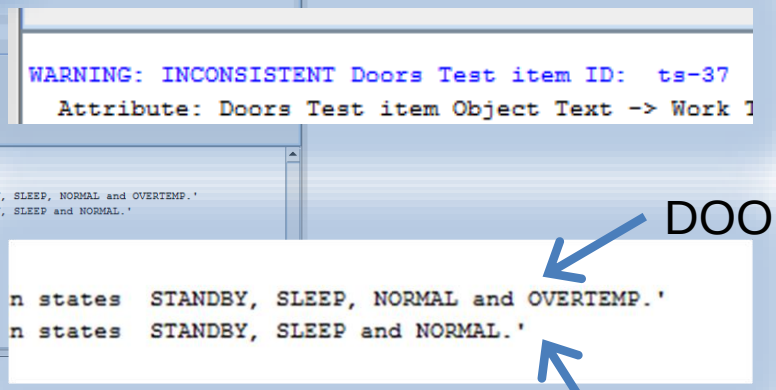


Functional verification flow



Check & update tooling



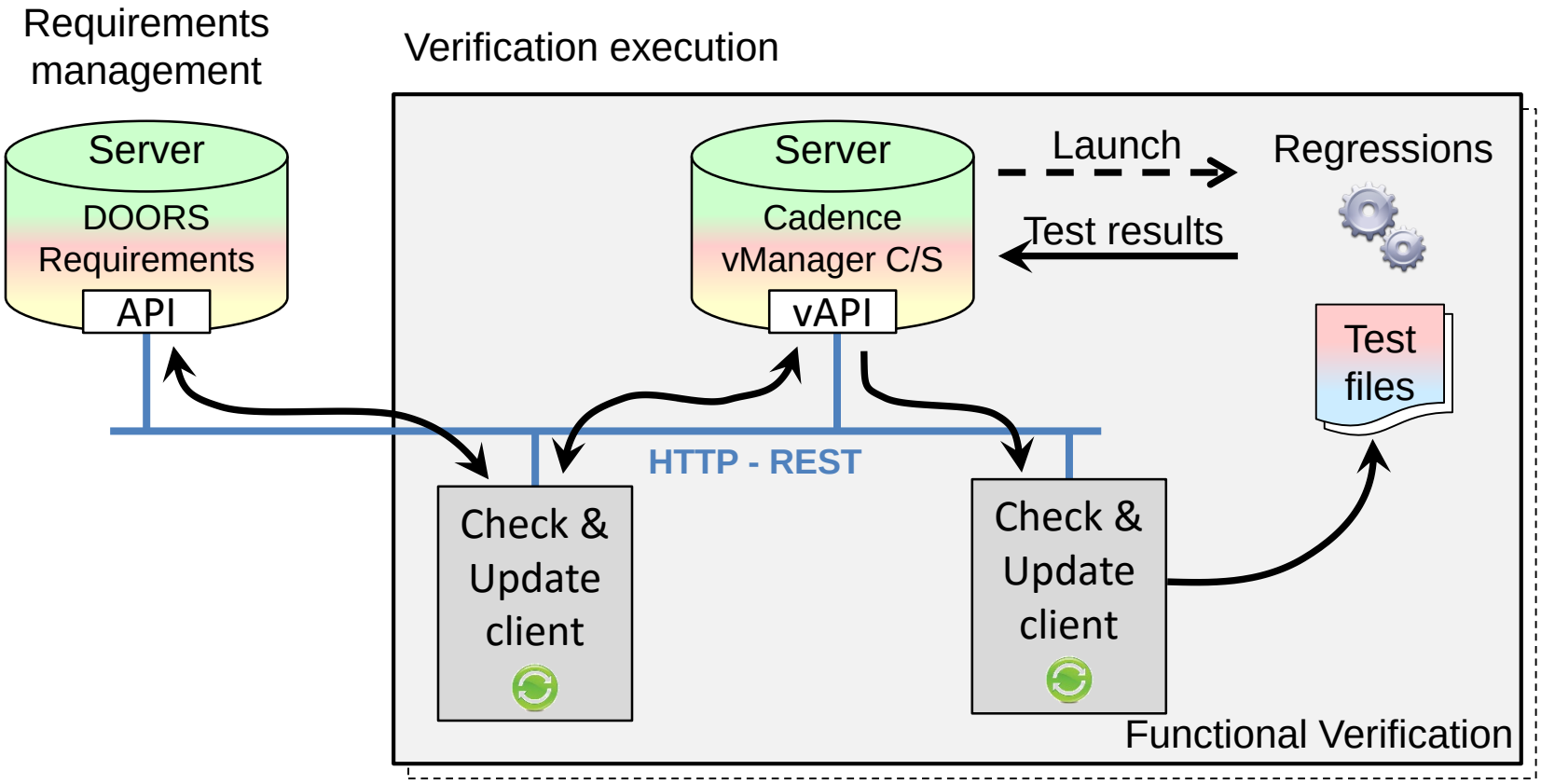


Object Identifier	RS Object Identifier	RS Object Text	Object Type	Object Text	Vr
ID	PIRS ID [R]	Req Text [R]	Object Type	Object Text	Vr
TS-19	FRS-138	It shall be possible to disable the WAKE functionality by setting WPRE=WPFE=0. The WAKE functionality is always enabled in NORMAL mode (mc=normal) independed from the WPRE/WPFE settings.	Test Item	It must be tested WPF is set after providing a falling edge on the WAKE pin	test
TS-16	FRS-138	It shall be possible to disable the WAKE functionality by setting WPRE=WPFE=0. The WAKE functionality is always enabled in NORMAL mode (mc=normal) independed from the WPRE/WPFE settings.	Test Item	It must be tested WPR is NC on the WAKE pin	
TS-17	FRS-138	It shall be possible to disable the WAKE functionality by setting WPRE=WPFE=0. The WAKE functionality is always enabled in NORMAL mode (mc=normal) independed from the WPRE/WPFE settings.	Test Item	It must be tested WPF is NC on the WAKE pin	
TS-37	FRS-56	If the CAN state is OFFLINE, OFFLINE_BIAS or LISTEN_ONLY the RXD pin shall be HIGH except when a wake-up event is detected it shall be LOW.	Test Item	Check RXD is low in case of pending wake-up event while in CAN state LISTEN_ONLY and main states STANDBY, SLEEP and NORMAL.	

Work-area

Test Item	Check RXD is low in case of pending wake-up event while in CAN state LISTEN_ONLY and main states STANDBY, SLEEP and NORMAL.

Future work: client/server

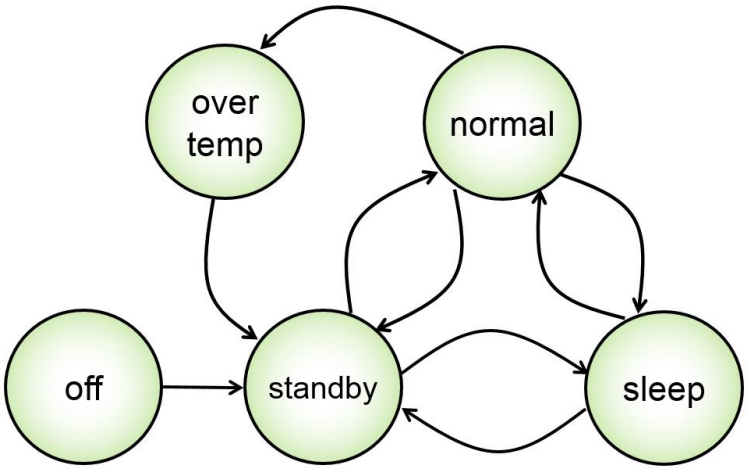


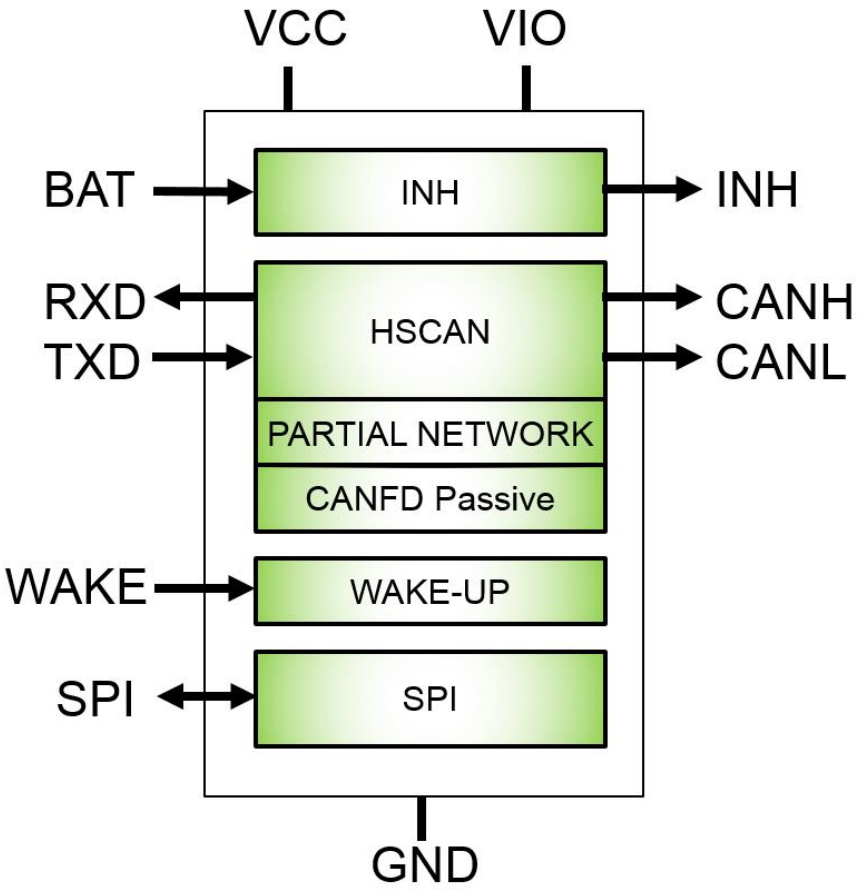
Standardization on the interfaces by means of API

API: Application Programming Interface

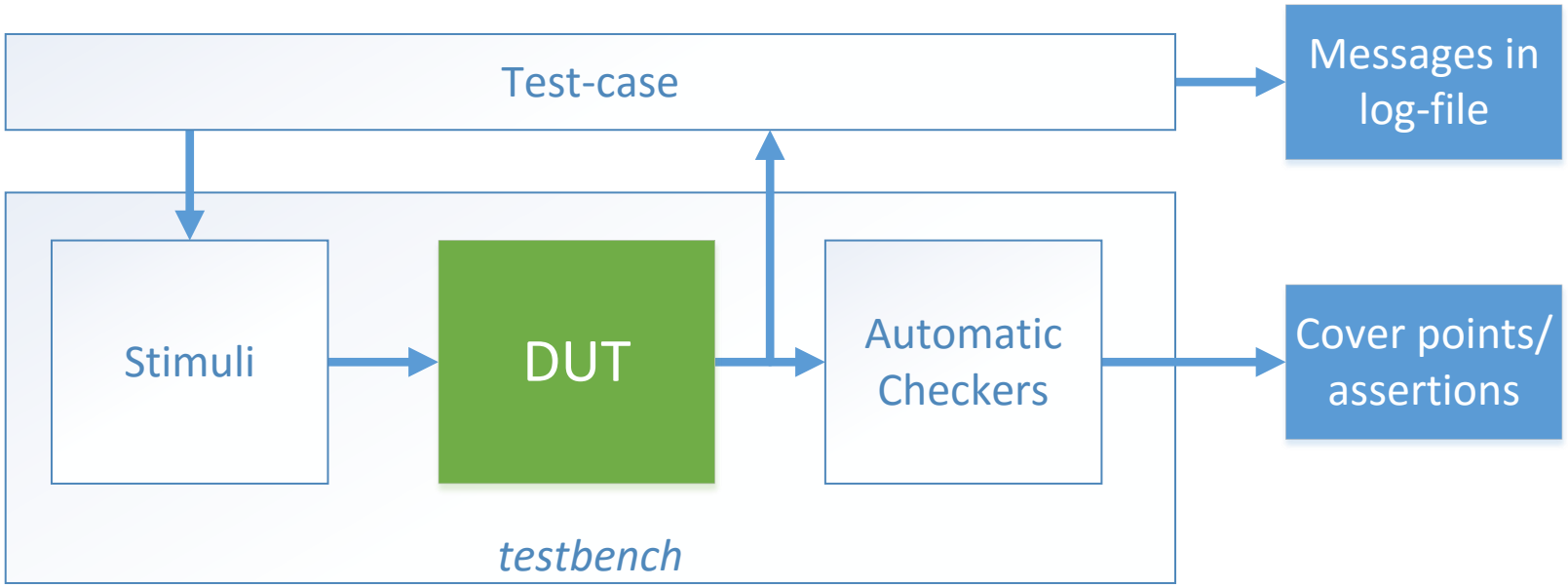
REST: Representational State Transfer

Practical example: the product



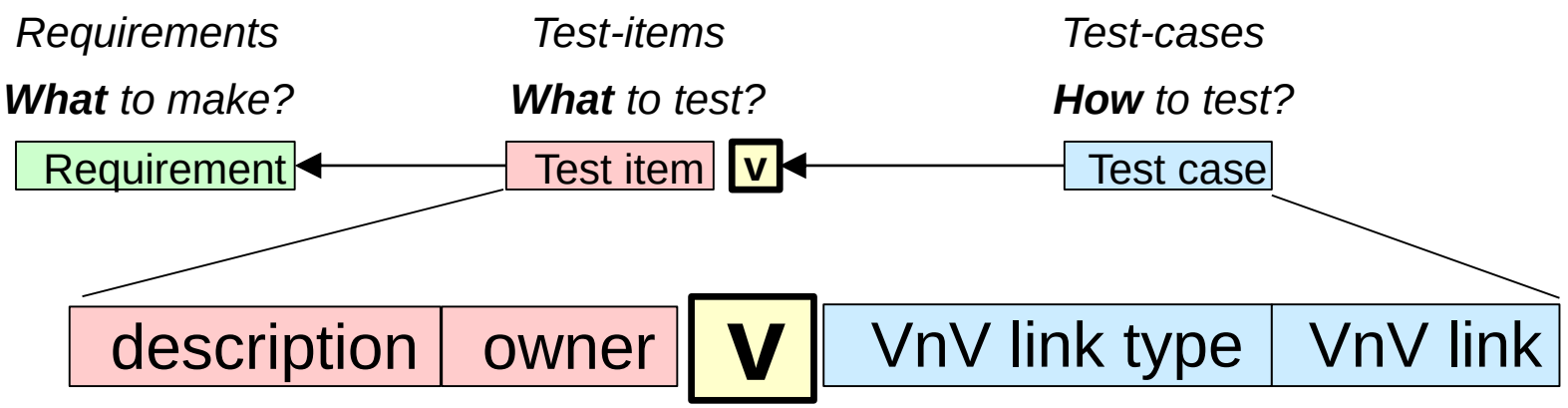


Practical example: test environment



Mix of directed tests at a specific point in time and automatic checkers always running in the back ground

Practical example: the V&V link



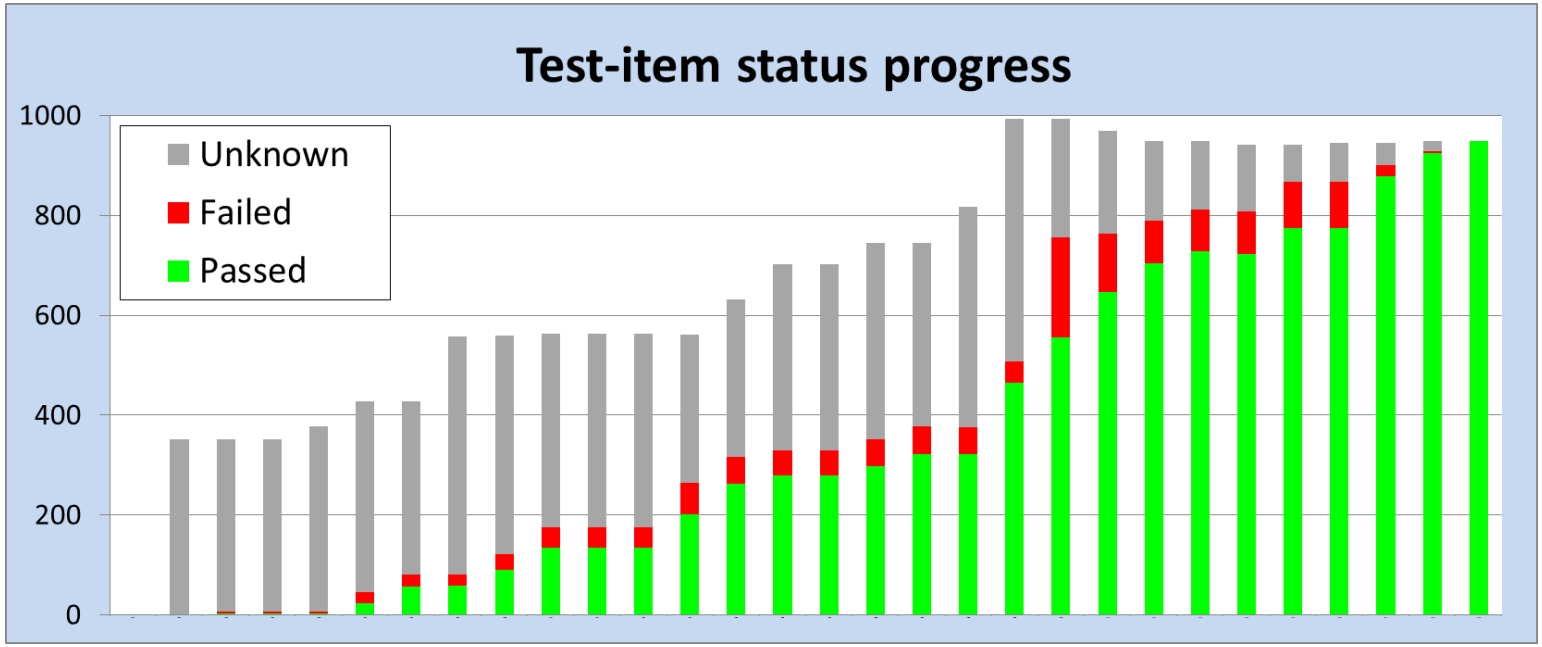
Pass/fail is automatically annotated to test-items using:

A. 'Test-item messages' in the log files from directed test-cases. One test-case can generate multiple messages.

B. Result from functional cover-points and assertions which are part of automatic checkers.

NOTE: test-case pass/fail information is NOT used directly.

Practical example: progress tracking



Progress is tracked using the status of all test-items.

Conclusions

- Methodology and tooling are presented that make specification an integral part of V&V flow.
- Achieved practical V&V flow bridging the gap between the DOORS requirements and the verification execution.
- During project execution, the check and update mechanism highly improved the overall consistency.
  - Triggering clearly on the exact changes.
  - Easy and well controlled updating.
- Future work will focus on standard interfaces (API) in client/server architectures.

Acknowledgment

- This work is partially sponsored by the European Commission in the CATRENE CA703 OpenES project.
- Special thanks for the automotive project team for smoothly picking up this new way of working in their tightly scheduled deliveries.
  - Steef Grimbergen
  - Leon Hesen
  - Marcel Oosterhuis
  - Veeresh Gaddeppanavar
  - Ute Essen - Willemsen
  - Dawn Johnston

Questions?