

intacs™ PRM/PAM Hardware Engineering (HWE)

Intacs™ Working Group ‘HW Engineering Processes’

Carlo Donzella
Giuseppe Pepe
Claudio La Rocca

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PRM/PAM Hardware Engineering (HWE)

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PRM/PAM Hardware Engineering (HWE)

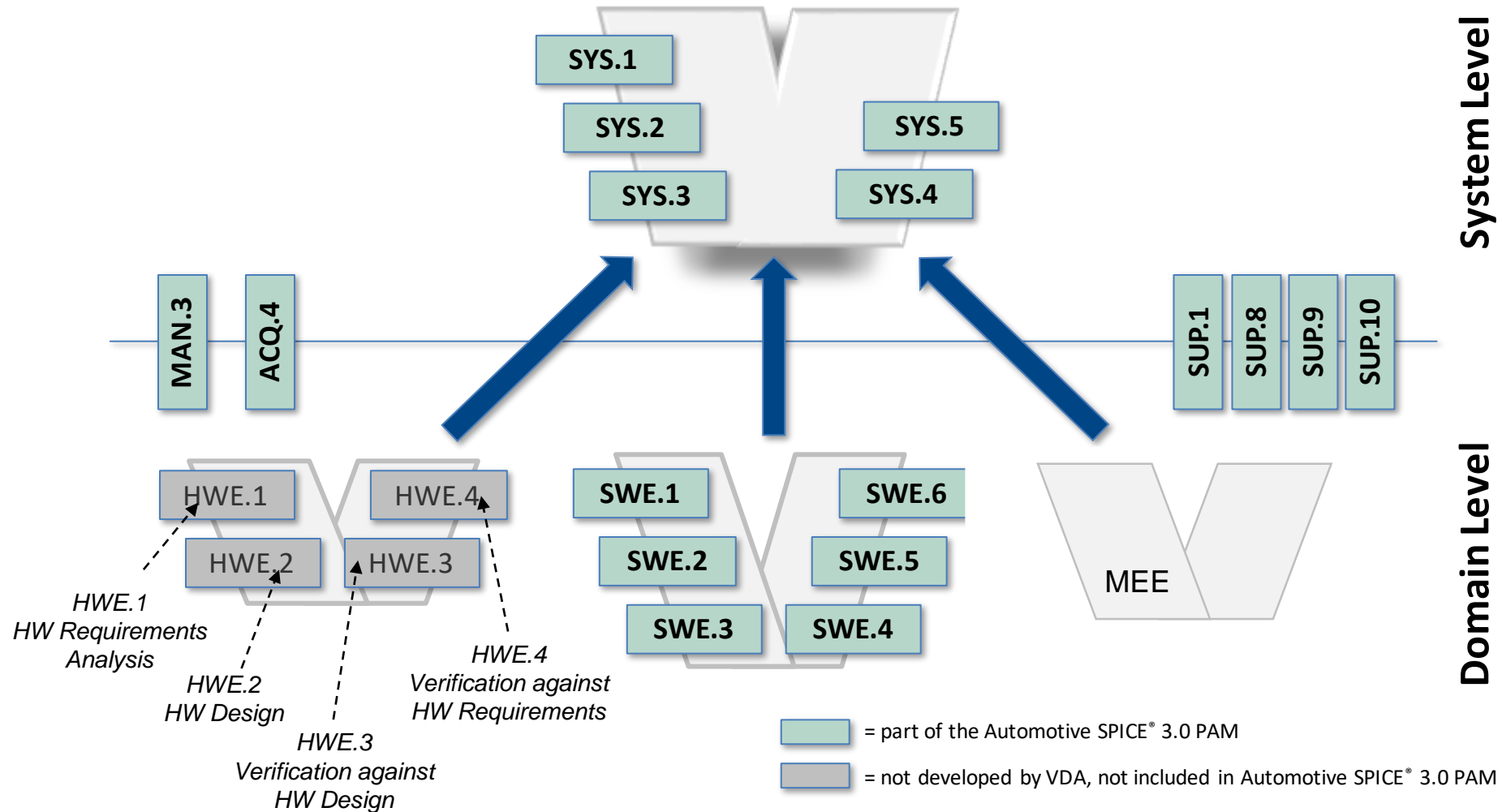
intacs™ Working Group ‘HW Engineering Processes’

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Background & history

- From its first edition (published in 2005) to PAM 2.5 (published in 2010) Automotive SPICE® identified only one group of engineering processes (the ENG group). Within this generic group, only two engineering domains were explicitly covered: System and Software.
- Automotive SPICE® v3.0 introduced process groups for different engineering domains (SWE and SYS). However, the SYS process group is still SW centric.
- In the automotive industry, a significant number of products are mechatronic products, i.e. comprising mechanical, electrical, electronical, electro-mechanical elements, and software.
- There is no overall Process Assessment Model yet providing indicators for all these product levels and aspects.
- Automotive SPICE® v3.0 introduced a "Plug-in" concept, allowing for hardware and mechanical lifecycle processes to be placed below the SYS.x and beside the SWE.x processes.
- The goal of the working group 'HW Engineering Processes' was to fill this gap by satisfying the growing need of companies to either assess hardware separately, or to assess overall mechatronic development.

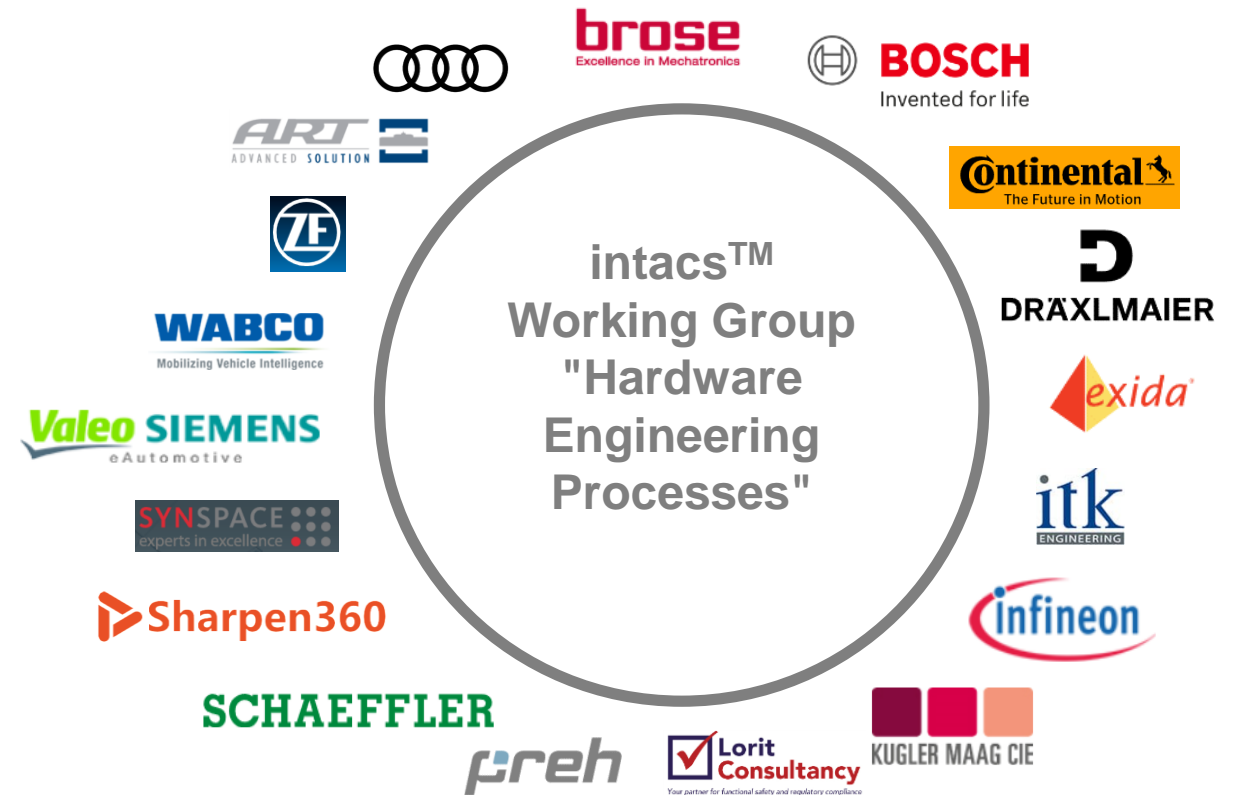
The “plug-in” concept introduced by PAM 3.0



intacs™ working group “HW Engineering Processes”

- In February 2018, the working group "Hardware Engineering Processes" was established.
- Goal: Develop an ISO/IEC 330xx-compliant PAM for electrical/electronic HW lifecycle processes as an extension proposal for Automotive SPICE® v3.1 in the context of the “plug-in concept”
- The HWE PAM/PRM v1.0 was published in November 2019.

Lead: Dr. Pierre Metz



Constraints and drivers

- The HW PRM/PAM adopts the Capability Dimension of Automotive SPICE[®], without changes. Exception: Generic Resource indicators are not used.
- It includes rating rules and recommendations aligned to "Automotive SPICE[®] Guidelines".
- It covers electronic engineering only (no mechanical engineering).
- It includes many examples for the BP's implemented as non-normative notes.
- It includes a proper interface to sample manufacturing, and production.
- It satisfies both the perspective of semiconductor manufacturers, and controller device suppliers.
- It contains a detailed Key Concepts section, that includes methodological and technical rationales to explain all the most relevant decisions.
- It contains a very detailed mapping to ISO 26262:2018 (mostly, but not exclusively, to Part 5: Product development at the hardware level).
- It includes a significant list of change request proposals against Automotive SPICE[®] PRM/PAM v3.1 that should be considered while performing a HWE assessment.

The four HWE processes

Hardware Requirements Analysis

The purpose of the process is to transform the hardware-related system requirements, and hardware-related system architectural design, into a set of hardware requirements

HWE.1

HWE.2

Hardware Design

The purpose of the process is to provide an evaluated design, that is suitable for manufacturing, and to derive production-relevant data.

HWE.4

HWE.3

Verification against Hardware Design

The purpose of the process is to ensure that the hardware is verified to provide evidence for compliance with the hardware design.

Verification against Hardware Requirements

The purpose of the process is to ensure that the complete hardware is verified to provide evidence for compliance with the hardware requirements.

HWE.1 Hardware Requirements Analysis

Base Practices

- BP1: Specify hardware requirements
- BP2: Structure hardware requirements
- BP3: Analyse hardware requirements
- BP4: Analyse the impact on the operating environment
- BP5: Establish bidirectional traceability
- BP6: Ensure consistency
- BP7: Communicate agreed hardware requirements

Rationales

- Nr. 3: Requirements Characteristics at CL1
- Nr. 4: No extra verification criteria BP (absorbed into BP1)
- Nr. 5: No usage of terms functional and non-functional

New Work Products

17-HW01 Hardware requirements specification

Base Practices

- BP1: Develop hardware architecture
- BP2: Develop hardware detailed design
- BP3: Define interfaces of the hardware components
- BP4: Describe dynamic behavior
- BP5: Allocate hardware requirements
- BP6: Evaluate the hardware architecture and the hardware detailed design
- BP7: Communicate all information needed for production
- BP8: Establish bidirectional traceability
- BP9: Ensure consistency
- BP10: Communicate the hardware architecture and hardware detailed design

Rationales

- Nr. 1: No production process
- Nr. 6: One HW Design process (no separation between HW Architectural Design and HW Detailed Design)
- Nr. 7: No system HW process
- Nr. 8: Mentioning of special characteristics
- Nr. 9: Evaluate instead of verify
- Nr. 10: No BP on evaluating alternative architectures

New Work Products

- 04-HW01 Hardware architecture
- 04-HW02 Hardware detailed design description
- 04-HW03 Schematics
- 04-HW04 Bill of materials
- 04-HW05 Layout
- 11-HW01 Hardware production data
- 11-HW02 Special characteristics

HWE.3 Verification against Hardware Design

Base Practices

BP1: Develop a strategy for the verification against hardware design

BP2: Develop specification for the verification against hardware design

BP3: Ensure use of compliant samples

BP4: Select verification measures

BP5: Verify hardware design

BP6: Establish bidirectional traceability

BP7: Ensure consistency

BP8: Summarize and communicate results

Rationales

Nr. 11: ISO 26262 Evaluation of HW Elements is not an alternative for HWE.3 and HWE.4

Nr. 12: HW Integration

Nr. 13: Choice of the term 'Verification' for right-hand side HWE Processes

Nr. 14: ISO 26262-8 Verification Planning vs. HWE PRM Outcome 'Strategy'

Nr. 15: ISO 26262 Evaluation of HW Elements

New Work Products

08-HW01 Verification plan

08-HW02 Verification specification

13-HW01 Verification result

HWE.4 Verification against Hardware Requirements

Base Practices

BP1: Develop a strategy for the verification against hardware requirements

BP2: Develop specification for the verification against hardware requirements

BP3: Ensure use of compliant samples

BP4: Select verification measures

BP5: Verify hardware

BP6: Establish bidirectional traceability

BP7: Ensure consistency

BP8: Summarize and communicate results

Rationales

Same rationales as HWE.3

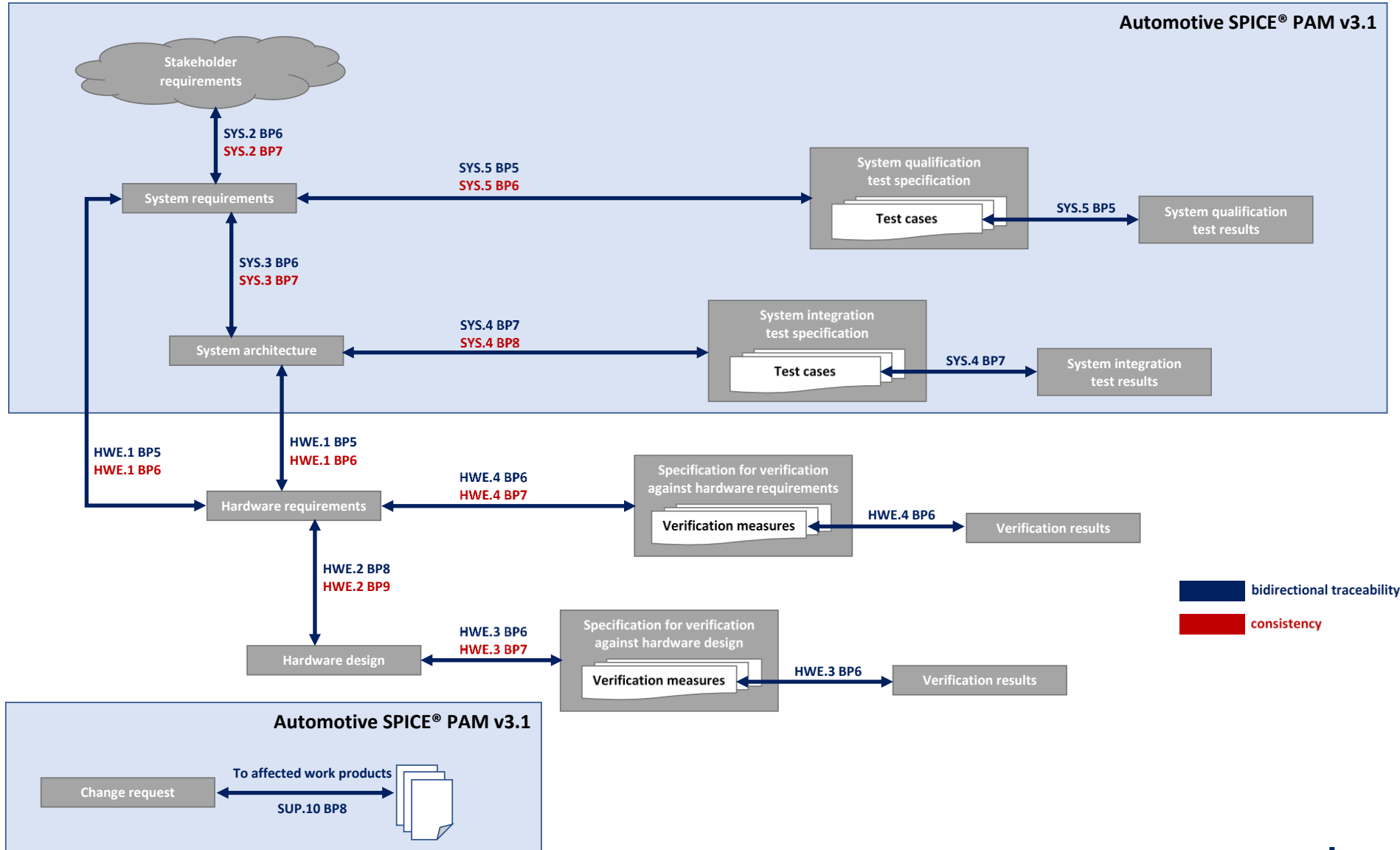
New Work Products

08-HW01 Verification plan

08-HW02 Verification specification

13-HW01 Verification result

Traceability and consistency



Planned targets for 2020

1. Release official syllabus / training material
2. Obtain official regulation from intacs board, needed for performing and logging formal assessments
3. Review change requests for the PRM/PAM Hardware Engineering (HWE) v1.0
4. Explore on specific semiconductor related practices (including ISO 26262-11)
5. Depending on the status of the working group, check mappings to ISO SAE 21434 (cybersecurity)

Conclusions

1. The PRM/PAM Hardware Engineering (HWE) has filled one of the biggest gaps of current Automotive SPICE[®], especially regarding the alignment and convergence with ISO 26262 and, more implicitly, with IATF 16949, too.
2. Given the degree of maturity of the PRM/PAM Hardware Engineering (HWE) it is recommended to begin familiarizing with it, in order to be ready for official assessments as soon as intacs board releases the respective official regulation.