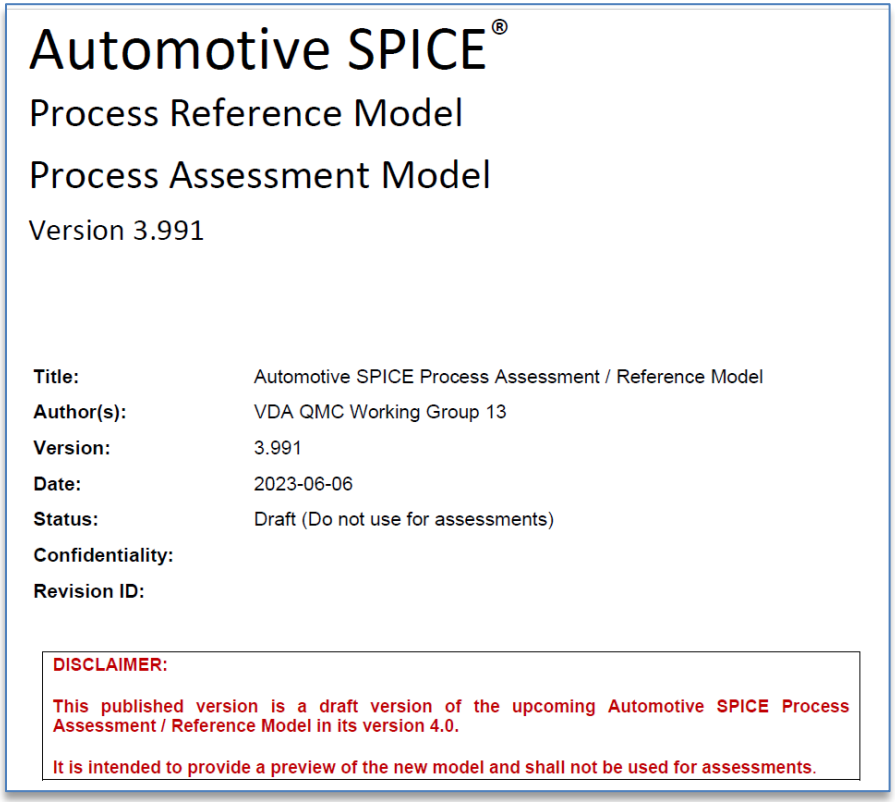
Automotive SPICE® 4.0 Evolution or Revolution?

Holger Höhn

July 25th, 2023

Yellow Draft of Guidelines and Automotive SPICE 4.0



Automotive SPICE®

Process Reference Model

Process Assessment Model

Version 3.991

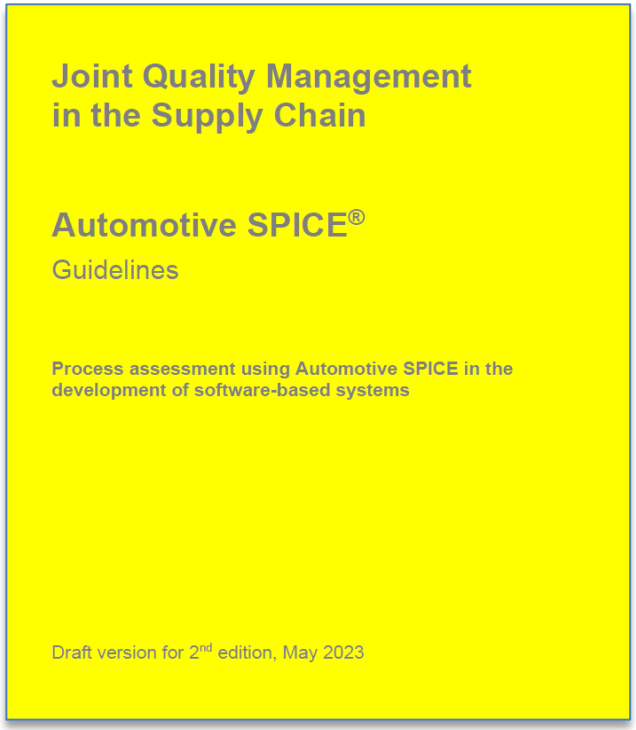
Title:	Automotive SPICE Process Assessment / Reference Model
Author(s):	VDA QMC Working Group 13
Version:	3.991
Date:	2023-06-06
Status:	Draft (Do not use for assessments)
Confidentiality:	
Revision ID:	

DISCLAIMER:

This published version is a draft version of the upcoming Automotive SPICE Process Assessment / Reference Model in its version 4.0.

It is intended to provide a preview of the new model and shall not be used for assessments.

- The published version is a „Yellow Draft“
- Updates / Changes to the official version 4.0 are expected!



Joint Quality Management in the Supply Chain

Automotive SPICE®

Guidelines

Process assessment using Automotive SPICE in the development of software-based systems

Draft version for 2nd edition, May 2023

- This presentation is showing not **not all changes** in the new model.
- Interpretations haven't been discussed in the community so far!

Download: https://vda-qmc.de/publikationen-und-apps/gelbbaende/

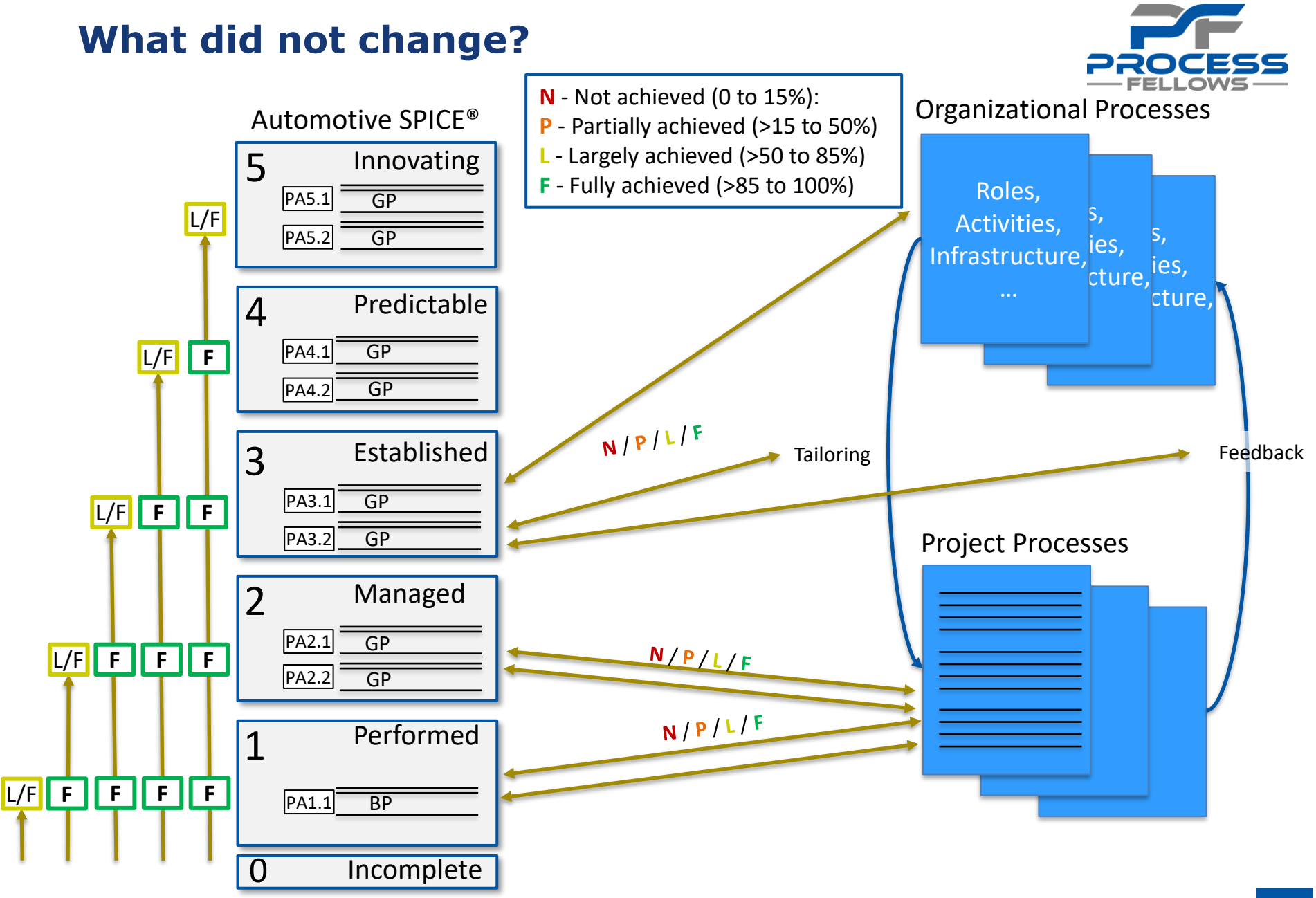
What did not change?

Software
Process
Improvement and
Capability
d**E**termination

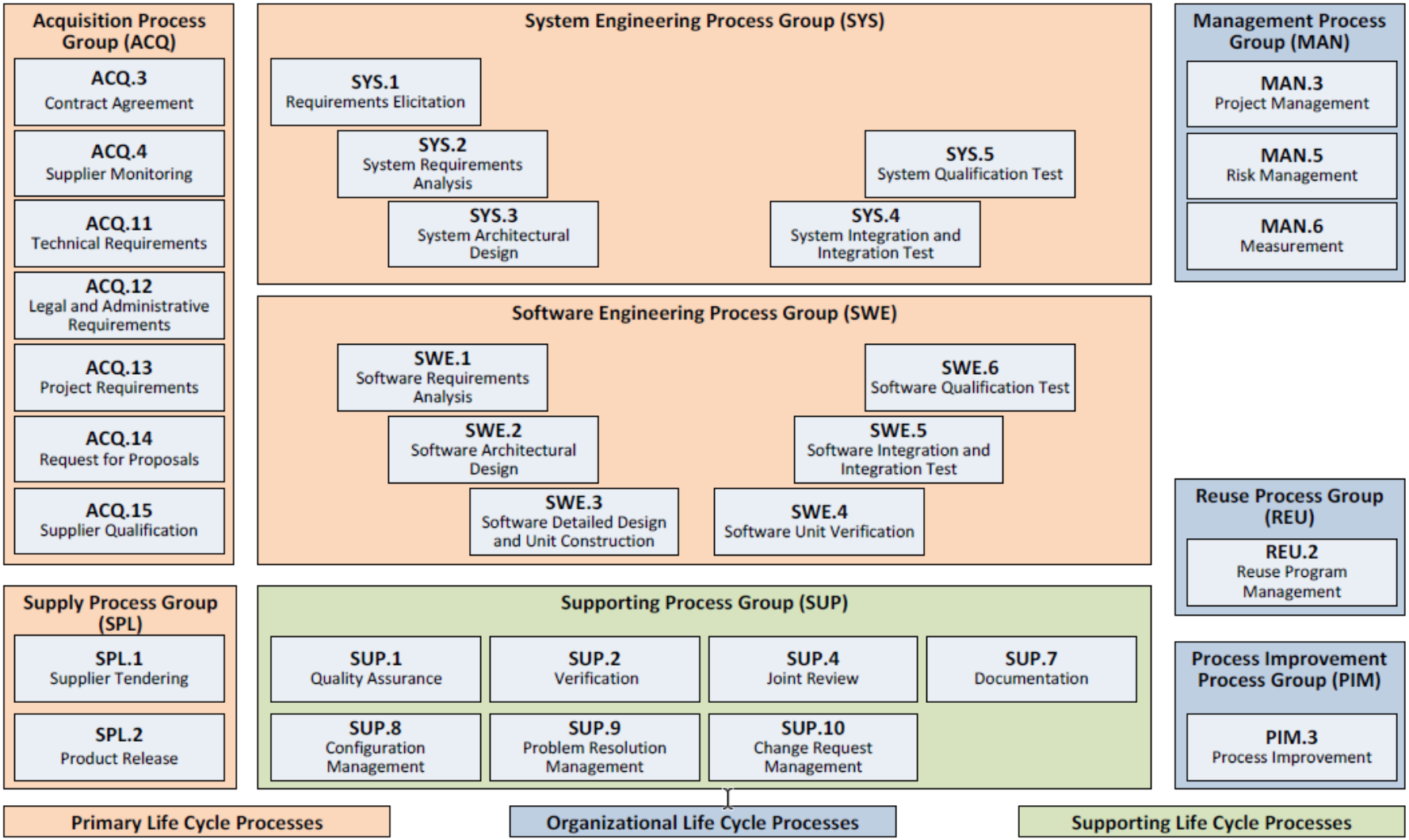
Identify possibilities to improve your development processes

Check the capability of your development processes

What did not change?



Processes



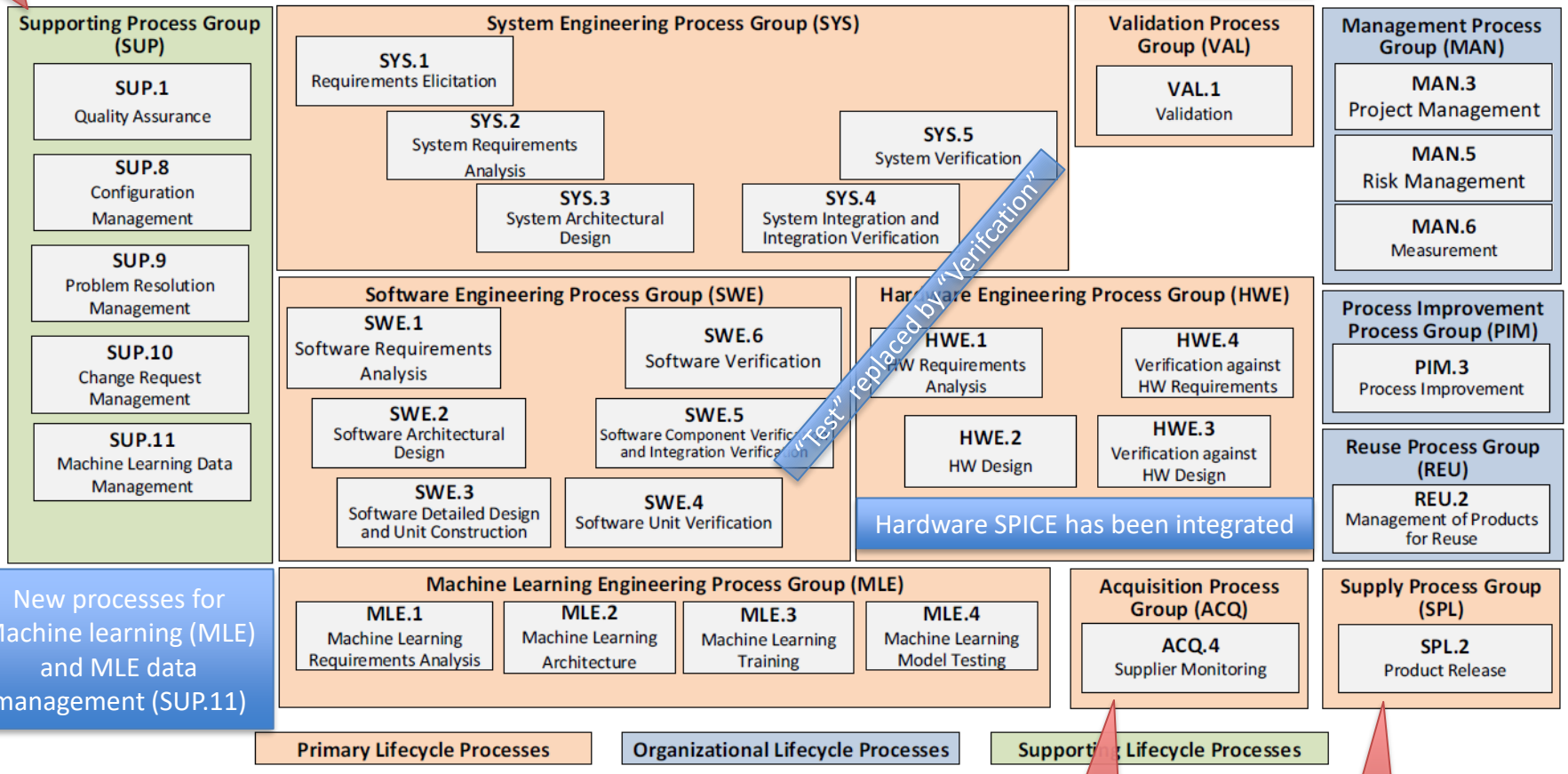
Processes

SUP.2, 4, 7 removed

The process VAL.1 Validation centers around "intended use", thereby addressing the product's end users. It therefore excludes looking at pure embedded software products, an ECU, or a drive (comprising a motor and an ECU), none of which providing a direct end user interface.

Source: BGB_A-SPICE-Guidlines-2.0_V8

New process for Validation (VAL.1)



New processes for Machine learning (MLE) and MLE data management (SUP.11)

Figure 2 — Automotive SPICE process reference model - Overview

Source: Automotive-SPICE-PAM-40-Draft

ACQ.3,11,12, 13,14,15 removed

SPL.1 removed

4.0

Processes - VDA Scope

Base + at least one Plug-In

Other processes are optional

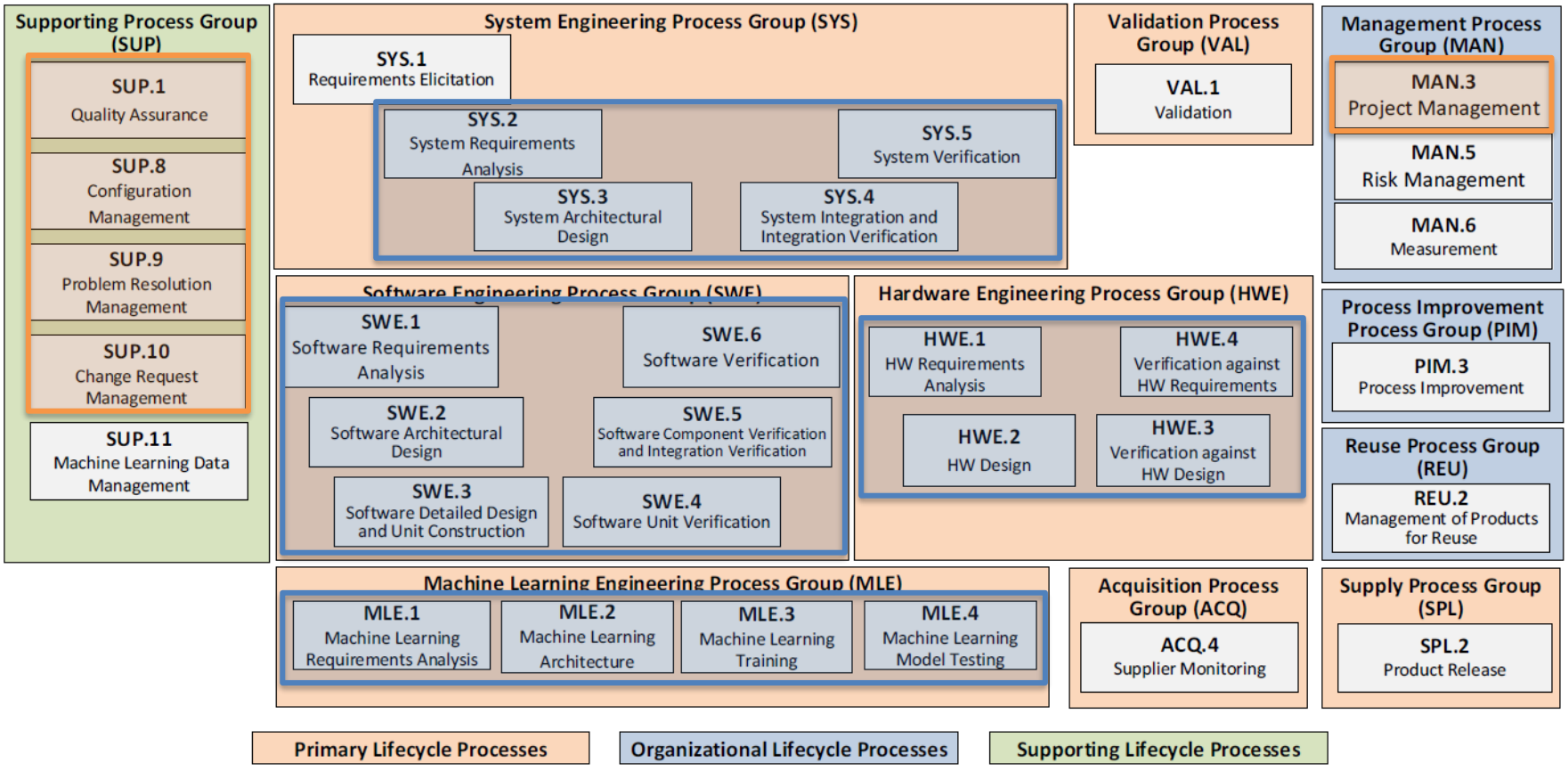


Figure 2 — Automotive SPICE process reference model - Overview

According to: BGB_A-SPICE-Guidlines-2.0_V8

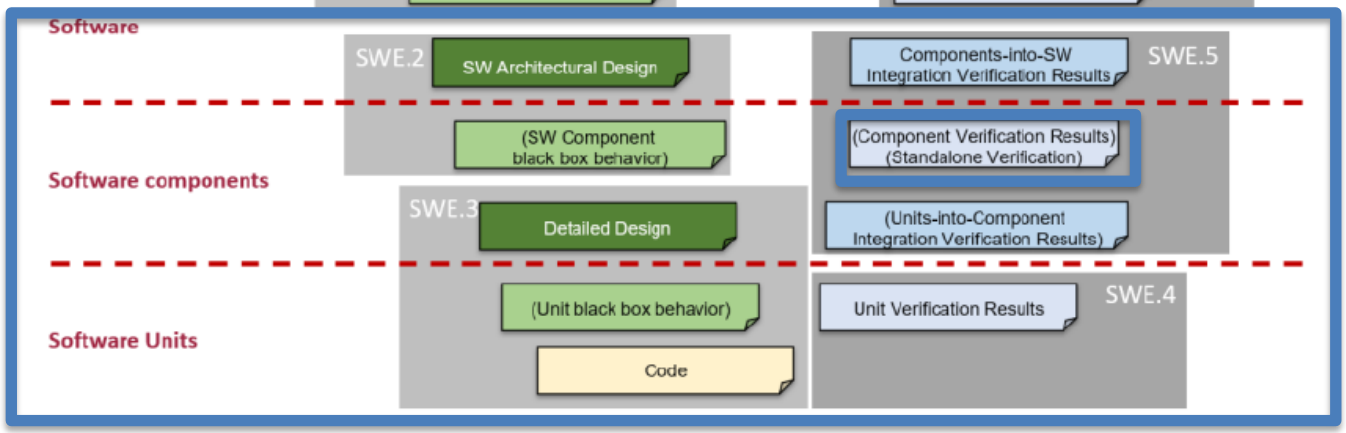
Scope of SW Processes

3.1

SWE.5: The purpose … is to integrate the software units into larger software items up to a complete integrated software consistent with the software architectural design and to ensure that the software items are tested to provide evidence for compliance of the integrated software items with the software architectural design, including the interfaces between the software units and between the software items.

4.0

SWE.5: The purpose is to verify that software components are consistent with the software architectural design, and to integrate software elements and verify that the integrated software elements are consistent with the software architecture and software detailed design.



Source: ASPICE-Guidelines-2.0_Draft, section 2.2

4.0

Scope of SW Processes

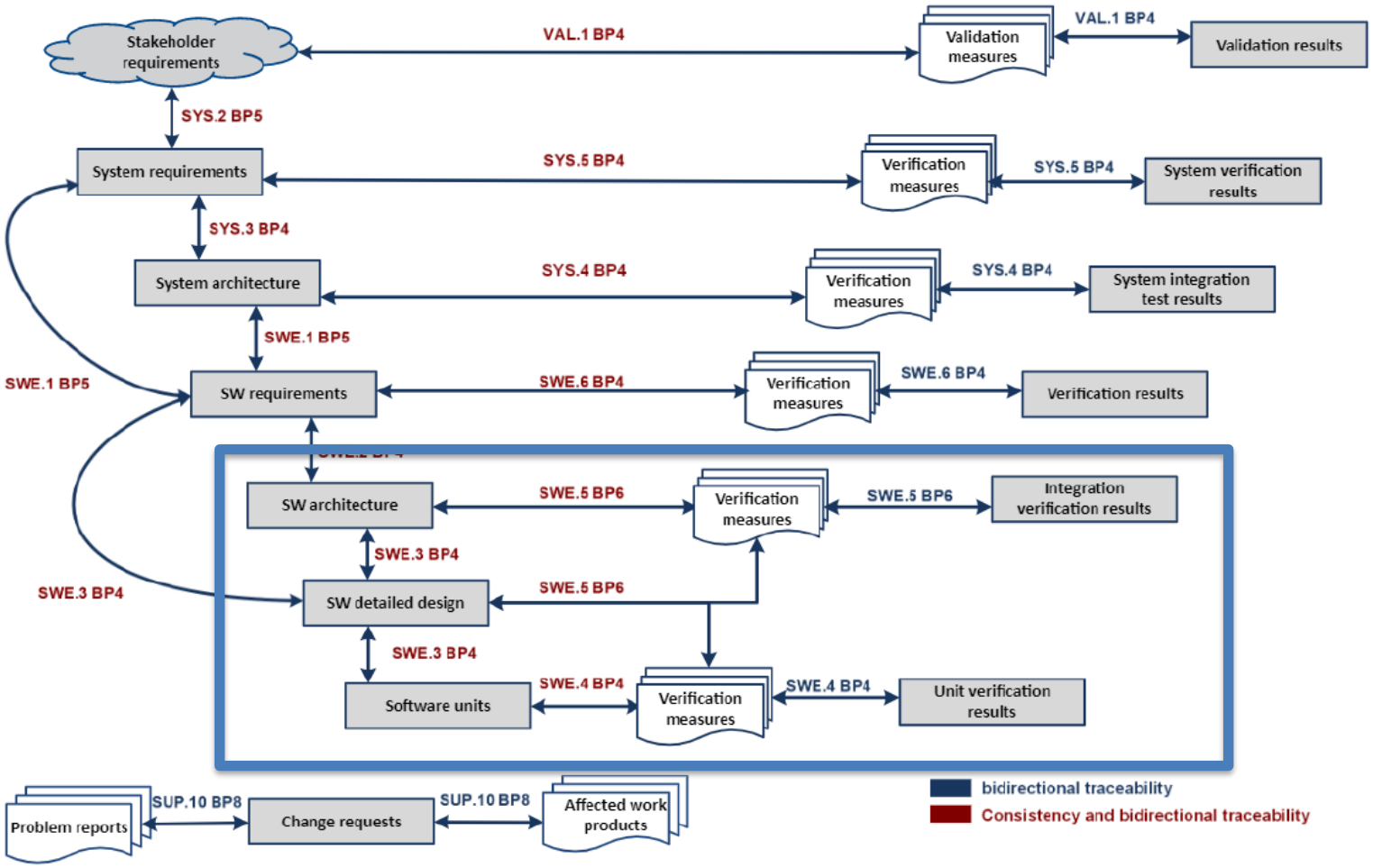


Figure 2-4: Traceability between system and software work products

Source: ASPICE-Guidelines-2.0_Draft

4.0

Traceability and Consistency

"Traceability" and "Consistency" have been combined (again) in one BP

3.1

SYS.2.BP6: Establish bidirectional traceability. Establish bidirectional traceability between stakeholder requirements and system requirements. [OUTCOME 6]

NOTE 7: Bidirectional traceability supports coverage, consistency and impact analysis.

SYS.2.BP7: Ensure consistency. Ensure consistency between stakeholder requirements and system requirements. [OUTCOME 6]

NOTE 8: Consistency is supported by bidirectional traceability and can be demonstrated by review records.

4.0

SYS.2.BP5: Ensure consistency and establish bidirectional traceability. Ensure consistency and establish bidirectional traceability between system requirements and stakeholder requirements.

Note 7: Bidirectional traceability supports consistency, facilitates impact analyses of change requests, and supports the demonstration of coverage of stakeholder requirements.

Source: Automotive-SPICE-PAM-40-Draft

Traceability and Consistency

3.1

Granularity of traceability

The granularity is required to be respectively at least on the lowest granularity mentioned in the PAM:

- single stakeholder requirement
- single system requirement
- single system architecture element
- single software requirement
- single software architecture component
- single software detailed design element
- single software unit
- single verification criterion
- single test case
- single test result
- single change request
- single problem record

4.0

2.1.6.2 Granularity of traceability

The following list defines allowed levels of traceability granularity:

- requirements
  - single requirement
  - cluster of requirements[1]
- architecture
  - single architectural element
  - cluster of architectural elements[2]
  - cluster of software components[2]
- software detailed design
  - single software Unit
  - cluster of software Units[2]
- hardware design
  - single HW Part
  - single HW component (i.e. a functionally coherent cluster of HW parts)
  - cluster of HW components
- verification/validation measures
  - single verification/validation measure
  - a cluster of verification measure
- verification results
  - single verification/validation result
  - cluster of verification/validation results
- single change request
- single problem record

Source: ASPICE-Guidelines-2.0_Draft

Traceability and Consistency

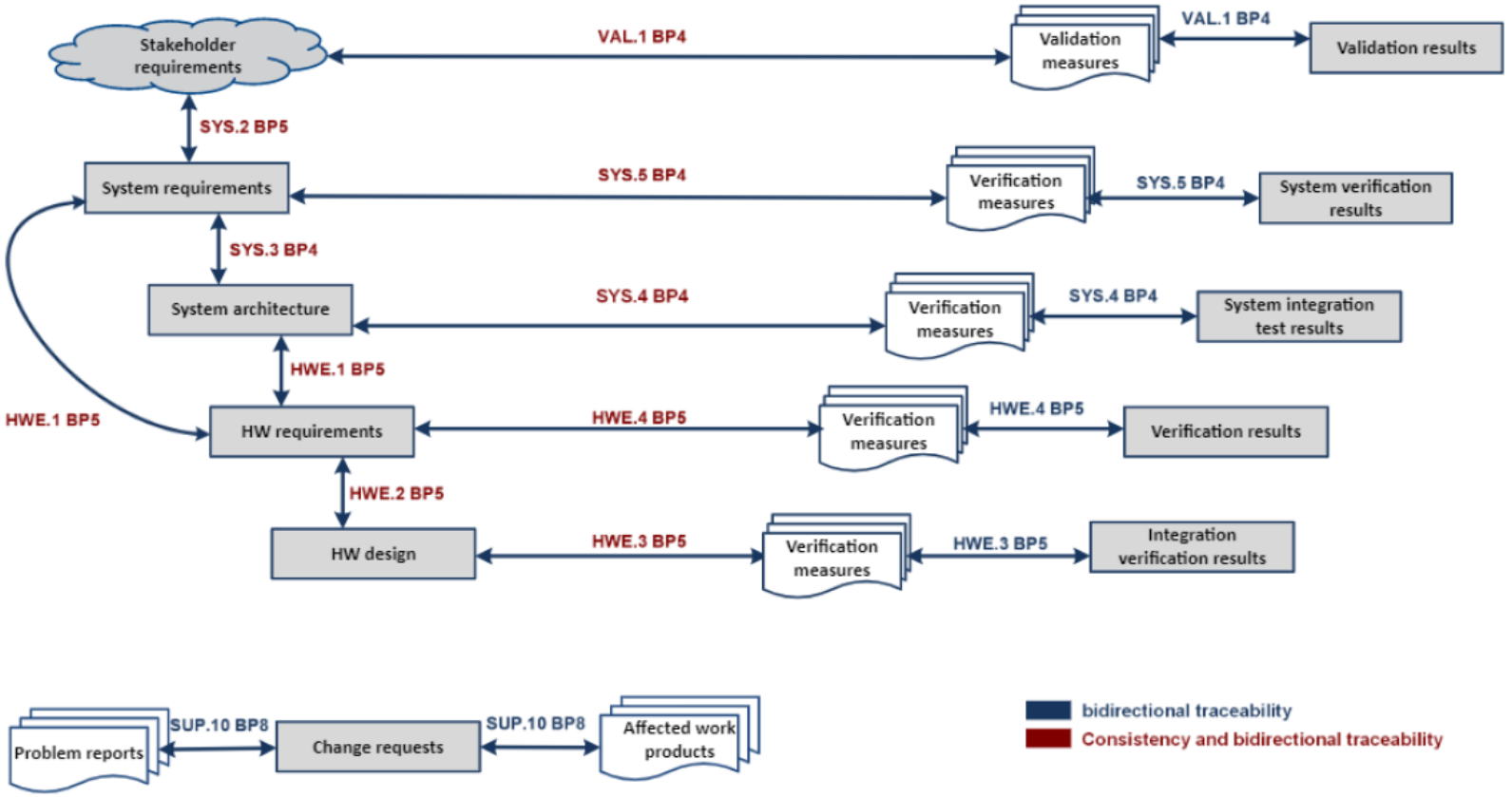


Figure 2-5: Traceability between system and hardware work products

Source: ASPICE-Guidelines-2.0_Draft

4.0

Output Work Products vs Information Items

- Work products and their characteristics are renamed to **"information items (II)"** and their **"characteristics (IIC)"**
- Tables show the relationship of Base Practices or Information items to the Outcomes

3.1

Output work products			
	08-50 Test specification	→	[OUTCOME 2, 3]
	08-52 Test plan	→	[OUTCOME 1]
	13-04 Communication record	→	[OUTCOME 6]
	13-19 Review record	→	[OUTCOME 5]
	13-22 Traceability record	→	[OUTCOME 5]
	13-50 Test result	→	[OUTCOME 4, 6]

WP ID	WP Name	WP Characteristics
01-00	Configuration item	• Item which is maintained under configuration control: - may include components, subsystems, libraries, test cases, compilers, data, documentation, physical media, and external interfaces • Version identification is maintained • Description of the item is available including the: - type of item - associated configuration management library, file, system - responsible owner - date when placed under configuration control - status information (i.e., development, baselined, released) - relationship to lower level configured items

4.0

SWE.6 Software Verification	Outcome 1	Outcome 2	Outcome 3	Outcome 4	Outcome 5
Output Information Items					
08-60 Verification Measure	X				
08-58 Verification Measure Selection Set		X			
15-52 Verification Results			X		
13-51 Consistency Evidence				X	
13-52 Communication Evidence					X
Base Practices					
BP1: Specify verification measures for software verification	X				
BP2: Select verification measures		X			
BP3: Verify the integrated software			X		
BP4: Ensure consistency and establish bidirectional traceability.				X	
BP5: Summarize and communicate results					X

Annex B Information item characteristics

ID	Name	Characteristics
01-00	Configuration item	• Item which is maintained under configuration control: - may include components, subsystems, libraries, test cases, compilers, data, documentation, physical media, and external interfaces - Version identification is maintained • Description of the item is available including the: - type of item - associated configuration management library, file, system - responsible owner - date when placed under configuration control - status information (i.e., development, baselined, released) - relationship to lower level configured items - identification of the change control records - identification of change history

Source: Automotive-SPICE-PAM-40-Draft

Strategies

Strategies have been moved from level 1 to GP 2.1.1 (see later Level 2)
Affected processes: all supporting processes, all test processes

3.1

SUP.8.BP1: Develop a configuration management strategy. Develop a configuration management strategy, including

- responsibilities;

3.13.1 Rating recommendations

3.13.1.1 Strategy

Generic aspects, rules and recommendations regarding the strategy are given in chapter 2.1.4 and shall also be considered for rating of SUP.8.

The expectations for a successful strategy cover these aspects:

a) All organizational and/or project-specific aspects like disciplines (e.g., system, software, and electronics), sites, and processes (including engineering processes, management processes, and supporting processes) are included.
b) An overall strategy is developed, especially if different solutions are defined for different disciplines, sites, or processes.
c) The definition of access rights.
d) The definition of required activities and tools, (e.g., infrastructure, resources like file shares, repositories, or dedicated configuration management systems) in accordance to the complexity of the product to be developed.
e) The criteria for the identification of configuration items, including naming convention (for e.g., items, folder structures). Examples for criteria are categories such as documents, requirements, source code, development tools, third-party software.
f) The conditions to create a revision of a configuration item.
g) The definition of the approach for the creation of baselines, including the event that creates the baseline (required or optional), the procedures used to establish the baseline, their naming convention, and their relationship to revisions of items.
h) The definition for handling of variants, creation and merging of branches for items and sets of items (e.g., requirements for variants). This includes in which cases branching is permissible, whether authorization is required, and how branches are merged.
i) The revision history approach of for configuration items.

Recommendations and rules:

[SUP.8.RL.1] If the strategy does not include all aspects above, the indicator BP1 must not be rated F.

4.0

SUP.8.BP1: Identify configuration items. Define selection criteria for identifying relevant work products to be subject to configuration management. Identify and document configuration items according to the defined selection criteria.

NOTE 1: Configuration items are representing work products or group of work products which are designated for configuration management and treated as a single entity in the configuration management process.

NOTE 2: Configuration items may vary widely in complexity, size and type, ranging from an entire system including all hardware, software and documentation, to a single module or a minor hardware component.

NOTE 3: The selection criteria may be applied to single work products or a group of work products.

SUP.8.BP2: Define configuration item properties. Define the necessary properties needed for the modification and control of configuration items.

NOTE 4: The configuration item properties may be defined for single configuration items or a group of items.

NOTE 5: Configuration item properties may include a status model (e.g. under work, checked in, tested, released, etc.), storage location, access rights, etc.

NOTE 6: The application of properties may be implemented by attributes of the configuration items in the configuration item list.

SUP.8.BP3: Establish configuration management. Establish configuration management mechanisms for control of identified configuration items including the configuration item properties, including mechanisms to control parallel modifications of configuration items.

NOTE 7: This may include specific mechanisms for different configuration item types, such as branch and merge management or checkout control for software or drawing revisioning for mechanic and hardware

SUP.8.BP4: Control modifications. Control modifications using the configuration management mechanisms.

NOTE 8: This may include the application of a defined status model.

SUP.8.BP5: Establish baselines. Establish baselines for internal purposes and for external

The definition and existence of documented information related to a strategy is not relevant for the rating of PA 1.1 of a certain process.

support the monitoring of the current work product progress and status.

NOTE 9: Regular communication of the configuration status, e.g. based on a defined status model

Source: Automotive-SPICE-PAM-40-Draft

MAN.3 Project Management

"Adjust" has been removed from BPs and is now part of "Ensure consistency"

3.1	4.0
BP1: Define the scope of work.	BP1: Define the scope of work.
BP2: Define project life cycle.	BP2: Define project life cycle.
BP3: Evaluate feasibility of the project.	BP3: Evaluate feasibility of the project.
BP4: Define, monitor and adjust project activities.	BP4: Define and monitor work packages.
BP5: Define, monitor and adjust project estimates and resources.	BP5: Define and monitor project estimates and resources.
BP6: Ensure required skills, knowledge, and experience.	BP6: Define and monitor required skills, knowledge, and experience.
BP7: Identify, monitor and adjust project interfaces and agreed commitments.	BP7: Define and monitor project interfaces and agreed commitments.
BP8: Define, monitor and adjust project schedule.	BP8: Define and monitor project schedule.
BP9: Ensure consistency. Ensure that estimates, skills, activities, schedules, plans, interfaces, and commitments for the project are consistent across affected parties.	BP9: Ensure consistency. Regularly adjust estimates, resources, skills, work packages and their dependencies, schedules, plans, interfaces, and commitments for the project to ensure consistency with the scope of work.
BP10: Review and report progress of the project.	BP10: Review and report progress of the project.

Requirement Processes

- SYS.2 / SWE. 1: No separate BP for verification criteria.
  Instead: "characteristics" for requirements in BP 1

SYS.2

3.1	4.0
BP1: Specify system requirements. BP2: Structure system requirements. BP3: Analyze system requirements. BP4: Analyze the impact on the operating environment. BP5: Develop verification criteria. BP6: Establish bidirectional traceability. BP7: Ensure consistency. BP8: Communicate agreed system requirements	BP1: Specify system requirements. BP2: Structure system requirements. BP3: Analyze system requirements. BP4: Analyze the impact on the system context. BP5: Ensure consistency and establish bidirectional traceability BP6: Communicate agreed system requirements and impact on the system context.

Architecture/Design Processes

- SYS.3/SWE.2/(SWE.3)
  - "Define Interfaces …" now (implicitly) part of BP.1
  - "Allocate requirements" has been removed
  - "Evaluate alternative …" is now part of new BP "Analyze Architecture"

SYS.3

3.1

BP1: Develop system architectural design.
BP2: Allocate system requirements.
BP3: Define interfaces of system elements.
BP4: Describe dynamic behavior.
BP5: Evaluate alternative system architectures.
BP6: Establish bidirectional traceability.
BP7: Ensure consistency.
BP8: Communicate system architectural design

4.0

BP1: Specify static aspects of the system architecture.
BP2: Specify dynamic aspects of the system architecture.
BP3: Analyze system architecture.
BP4: Ensure consistency and establish bidirectional traceability
BP5: Communicate agreed system architecture

Test Processes

"Test cases" have been replaced by umbrella term "**verification measures**"

SYS.5	3.1	4.0
BP1: Develop system qualification test strategy including regression test strategy. BP2: Develop specification for system qualification test. BP3: Select test cases. BP4: Test integrated system. BP5: Establish bidirectional traceability. BP6: Ensure consistency. BP7: Summarize and communicate results.		BP1: Specify verification measures for system verification. BP2: Select verification measures. BP3: Perform verification of the integrated system. BP4: Ensure consistency and establish bidirectional traceability BP5: Summarize and communicate results.

PA 2.1 Process Performance Management

3.1	4.0
GP 2.1.1 Identify the objectives for the performance of the process	GP 2.1.1 Identify the objectives and define a strategy for the performance of the process
GP 2.1.2 Plan the performance of the process to fulfill the identified objectives	GP 2.1.2 Plan the performance of the process
GP 2.1.3 Monitor the performance of the process against the plans	GP 2.1.5 Monitor and adjust the performance of the process
GP 2.1.4 Adjust the performance of the process	
GP 2.1.5 Define responsibilities and authorities for performing the process	GP 2.1.3 Determine resource needs
GP 2.1.6 Identify, prepare, and make available resources to perform the process according to plan	GP 2.1.4 Identify and make available resources
GP 2.1.7 Manage the interfaces between involved parties	GP 2.1.6 Manage the interfaces between involved parties

PA 2.2 Work product management:

➔ No major changes

PA 2.1 Process Performance Management

During the identification of objectives and process performance criteria, and for the definition of the strategy the following characteristics shall be considered:

a) Process scope (including e.g. related objects, issues, disciplines, domains, and sites to be considered)
b) Needs, objectives, to be satisfied, including criteria to evaluate the achievement of the process performance goals
c) Process performance criteria (e.g., entry/exit, lifecycle related process achievement goals, frequency of activities)
d) Options, approach, and methods, tools, and environment to perform the process activities and appropriate to handle the level of product and organizational complexity (e.g., multi-site development, technical system complexity)
e) Assumptions and constraints (given implicitly by e.g., budget, resources, efforts, milestones, and due dates)
f) References to relevant regulatory requi
customer requirements
g) Deliverables including completeness cr
done) and approach to handle internal
(relevant input to / outputs of affecte
customer)
h) approach for the monitoring of the proce
metrics)
i) approach for the handling of deviations (e.g., in case of problems and failures during process performance)

Process performance objectives can either be quantitative (e.g., requirements to be implemented for specific releases, maximum/minimum efforts to be spent) or qualitative (e.g., adherence to Automotive SPICE capability level).

The strategy must consider the relevant process outcomes and enable the achievement of the process purpose. The strategy must neither be described in a specific document, nor for each process. Any aggregation of information regarding strategy in common documents (e.g., Master Test Plan, Requirement Engineering Plan, Problem and Change Management Plan, Project Management Plan) shall be considered and rated as a suitable implementation approach of GP2.1.1.

GP 2.1.1 Identify the objectives and define a strategy for the performance of the process

PA 3.1 Process Definition

3.1	4.0
GP 3.1.1 Define and maintain the standard process that will support the deployment of the defined process	GP 3.1.1 Establish and maintain the standard process
GP 3.1.2 Determine the sequence and interaction between processes so that they work as an integrated system of processes	
GP 3.1.3 Identify the roles and competencies, responsibilities, and authorities for performing the standard process	GP 3.1.2 Determine the required competencies
GP 3.1.4 Identify the required infrastructure and work environment for performing the standard process	GP 3.1.3 Determine the required resources
GP 3.1.5 Determine suitable methods and measures to monitor the effectiveness and suitability of the standard process	GP 3.1.4 Determine suitable methods to monitor the standard process

PA 3.2 Process Deployment

4.0

GP 3.1.1 Establish and maintain the standard process

GP 3.1.2 Determine the required competencies

GP 3.1.3 Determine the required resources

GP 3.1.4 Determine suitable methods to monitor the standard process

GP 3.2.1 Deploy a defined process that satisfies the context specific requirements of the use of the standard process.

GP 3.2.2 Ensure required competencies for the defined roles.

GP 3.2.3 Ensure required resources to support the performance of the defined process.

GP 3.2.4 Monitor the performance of the defined process.

Exemplary Other Changes: Process Purpose

Purposes of engineering processes have been shortened to the main topic

3.1

Process ID	SYS.2
Process name	System Requirements Analysis
Process purpose	The purpose of the System Requirements Analysis Process is to transform the defined stakeholder requirements into a set of system requirements that will guide the design of the system.

4.0

SYS.2
Process name
System Requirements Analysis
Process purpose
The purpose is to establish a structured and analyzed set of system requirements consistent with the stakeholder requirements.

Source: Automotive-SPICE-PAM-40-Draft

Exemplary Other Changes: Guideline

- No recommendations anymore
- Rules cover ALL processes in ASPICE 4.0

	ASPICE 3.1	ASPICE 4.0
# Pages	312	269
# Processes	**16**	**32**
# Pages	312	269
# Pages/Process	19,5	8,4
# Rules	286	291
# Rules/Process	17,9	9,1
#Recommendations	215	0
#Recommendations/Process	13,4	0,0
	3.1	4.0

Exemplary Other Changes: Guideline

2.1.5.3 "Functional" and "Nonfunctional" do not serve as requirements types

In this context, the notions "functional" and "nonfunctional" are no relevant classification or categorization criteria for requirements. Reasons:

- A particular requirement may, and on most cases will, contain both functional and non-functional information, a
into both categories. See Section 2.1.5.1 fo
- Differentiating would not have any
requirements are further processed, i.e. th
needs for traceability, verification/validation

1.4.2 Independent rating of processes

A process assessment model provides a two-dimensional view of a process quality characteristic. Each process within the scope (process dimension) shall be rated individually on the scale provide within the capability dimension.

This means that only weaknesses of that very process alone shall be the source of a potential downrating. This implies that only base practices explicitly referring to another process (such as the Consistency/Traceability BP's) can be downrated, because these are the only "connection points" between processes.

[GEN.RL.1] A rating of PA 1.1 of P or N for a process X shall not be used to downrate PA 1.1 of the process Y.

Conclusion B: direct or indirect tracing

The stakeholder requirements may include sub-domain requirements or design constraints (e.g. software hardware) which, clearly, do not affect the system requirements (SYS.2) or the system architecture (SYS.3). In such a case, the sub-domain requirement (SWE.1/HWE.1) may be traced directly to SYS.1. However, this must be agreed on by the sub-domain and syste

2.3.3 Development external to the assessed project (DEX)

Exemplary Other Changes: Guideline

- Many rules like "If …., then …. shall not be downrated", e.g.

[TAC.RL.3] If there is no explicitly documented review record or analysis record proving consistency between related information in favor of approaches such as performing pair working or group work, peer spot checks, maintaining revision histories in documents, or providing change commenting (via e.g. meta-information) of database or repository entries, then the 'Consistency and Traceability' BP shall not be downrated.

[TAC.RL.4] If consistency and traceability is established and ensured between information that is not part of baselines, then the 'Consistency and Traceability' BP shall not be downrated.

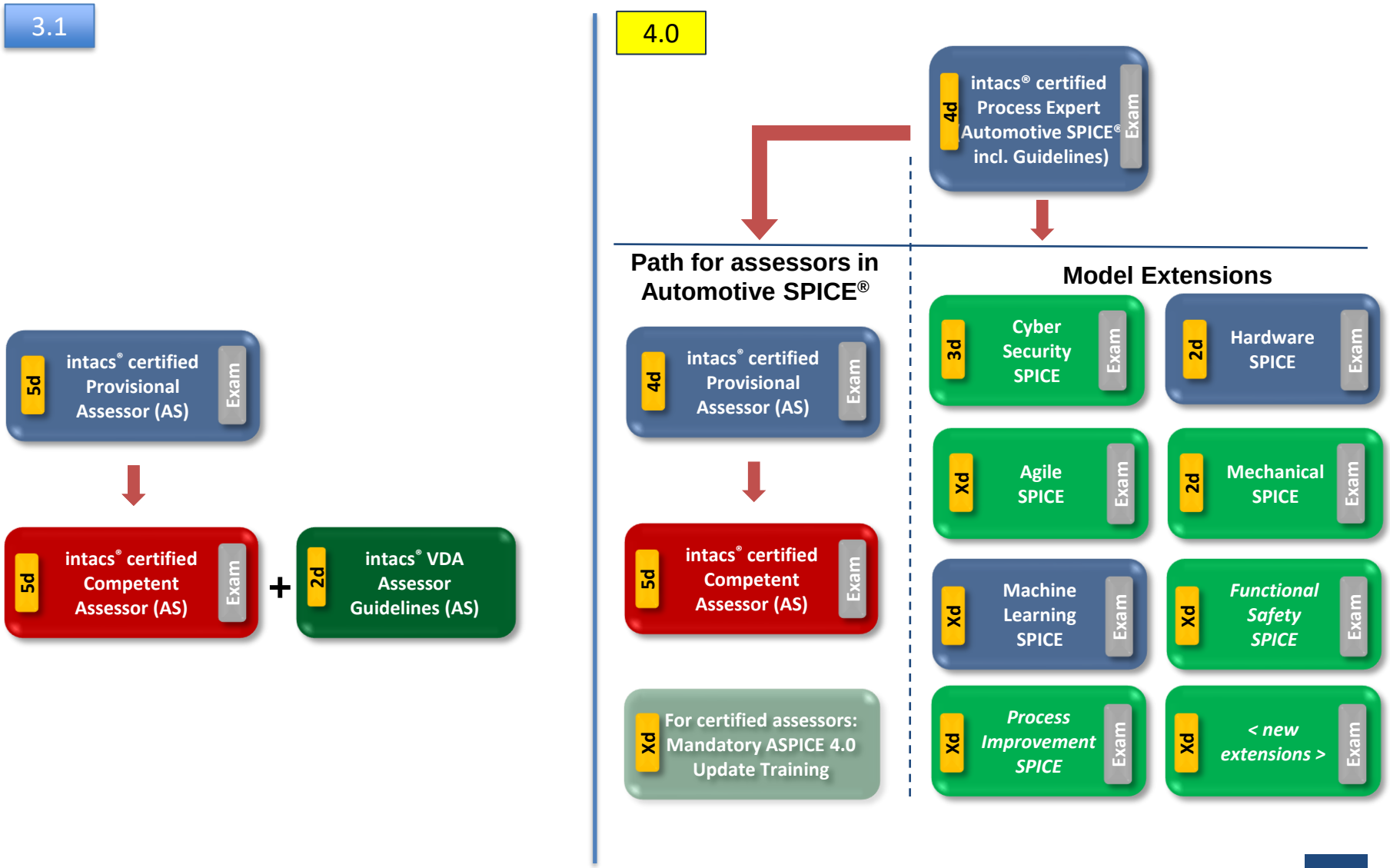
[COM.RL.1] If effective communication of agreed information at Capability Level 1 is not done based on information baselines or by explicitly documented communication or review records then BP "Communicate" shall not be downrated.

[SYS.4.RL.4] If selection of verification measures is properly done but based on an inadequate or incomplete release plan, then SYS.4.BP2 shall not be downrated.

What happens next?

- Presentation and Recording will be published on our website
- Process Fellows ASPICE 4.0 Roadshow: Free of cost onsite events. Dates will be published soon.
- Autumn 2023: Official Release of ASPICE 4.0 and VDA Guideline
- First quarter 2024: Assessor Training ASPICE 4.0
  ➔ see next slide
- Afterwards: Usage of ASPICE 4.0 in assessments

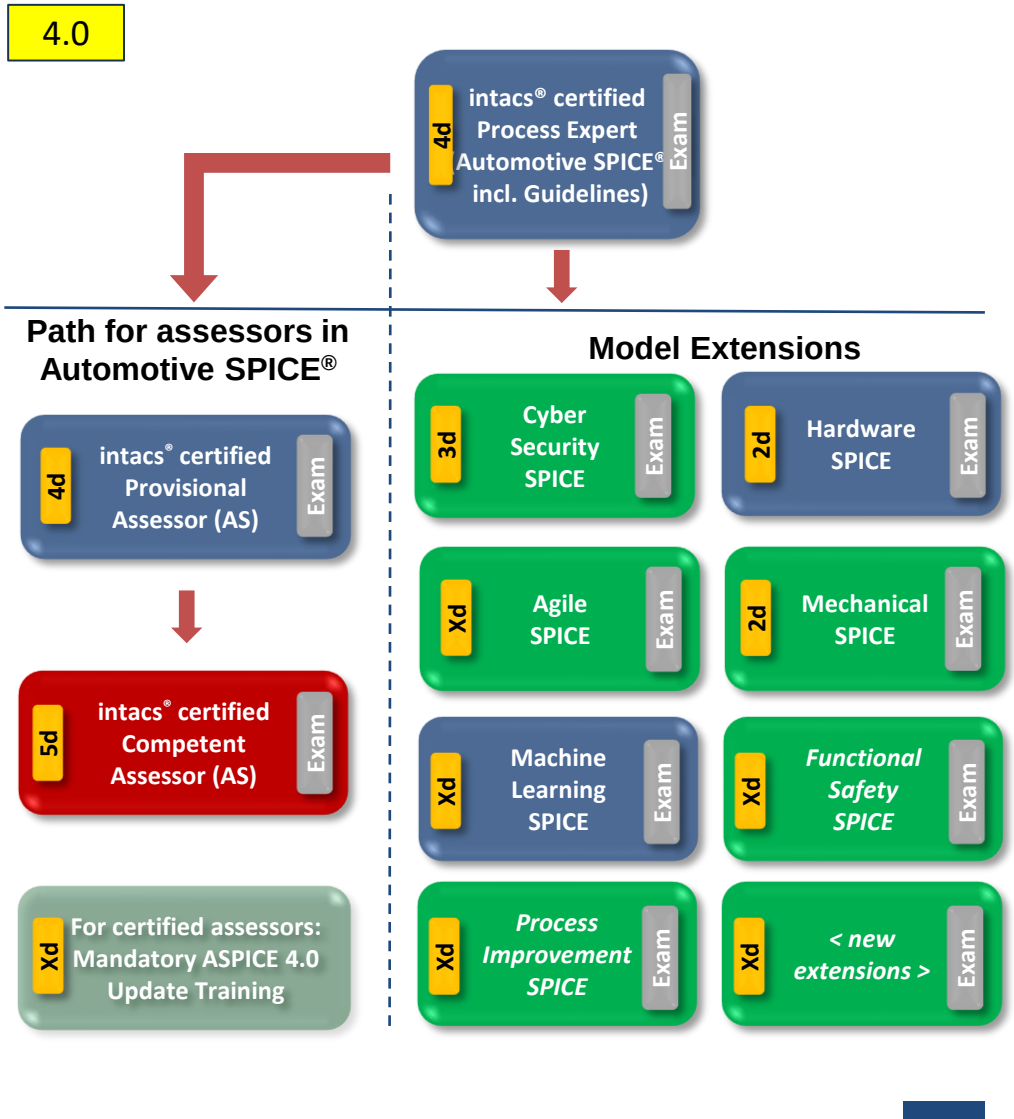
Assessor Training



Assessor Training

In addition: intacs® independent trainings, e.g.

- Automotive SPICE® in a Nutshell
- Automotive SPICE® - A Practical Introduction
- Automotive SPICE® and Functional Safety – combined
- Mechanical SPICE: Model and Reality



Process Fellows GmbH | Schlegelleithe 8 | 91320 Ebermannstadt | GERMANY
Phone: +49 9194 3719 957 | Fax: +49 9194 3719 – 579
Website: www.processfellows.de | E-Mail: info@processfellows.de

Holger Höhn
holger.hoehn@processfellows.de