



# **SWE.5 according to Automotive SPICE 4.0**

## **22<sup>nd</sup> Workshop Automotive SPIN Italia**

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## SWE.5 and SW Unit Integration in ASPICE 3.1

- The Automotive SPICE 3.1 process SWE.4 Software Unit Verification focuses on unit tests derived from SW's detailed design and aims to show compliance.
- On the other hand, the SWE.5 Software Integration and Integration Test focused on tests to be derived from SW architectural design and aimed at showing compliance with it.
- In version 3.1, it is unclear whether integration happening within an individual SW component should be mapped to SWE.4 or SWE.5.
- Automotive SPICE 4.0 clarifies this aspect and better explains what should be mapped to the new SWE.5 Software Component Verification and Integration Verification Processes.

**SWE.4.BP2: Develop criteria for unit verification.** Develop criteria for unit verification that are suitable to provide evidence for compliance of the software units, and **their interactions within the component**, with the software detailed design and with the non-functional requirements according to the verification strategy.

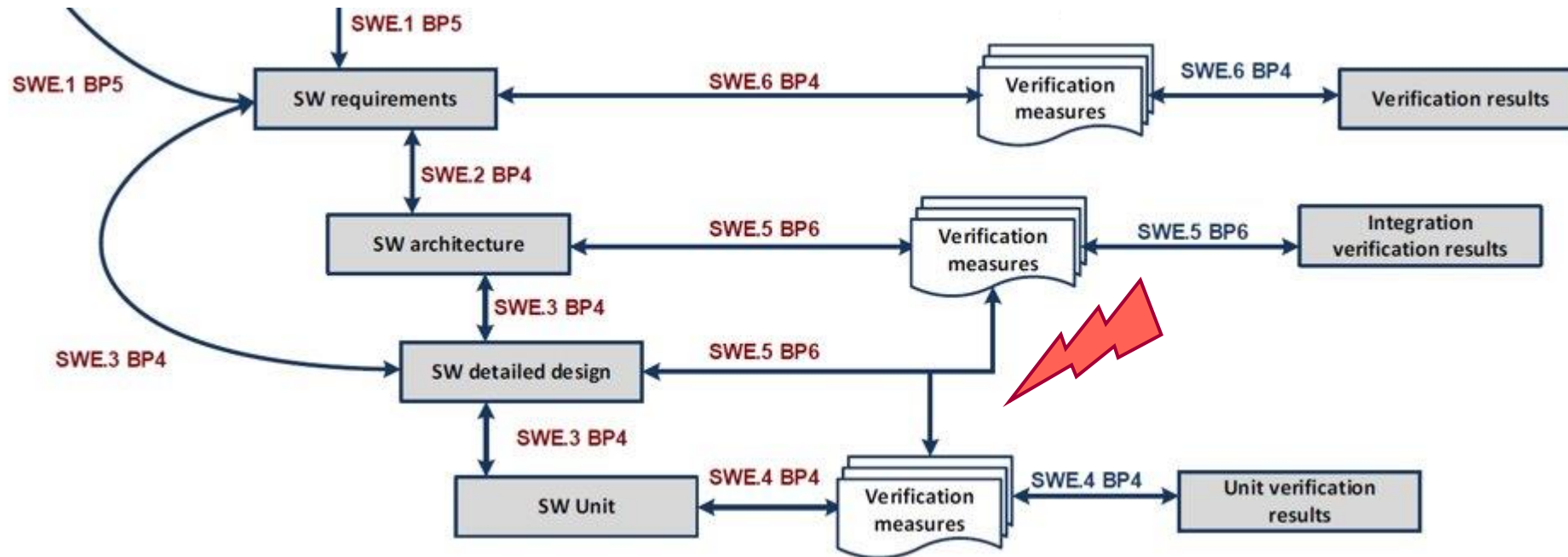
**SWE.5.BP3: Develop specifications for software integration test.**

Develop the test specification for the software integration test, including the test cases according to the software integration test strategy for **each integrated software item**. The test specification shall be suitable for providing evidence of the integrated software items' compliance with the software architectural design.

Source Automotive SPICE® Vers. 3.1

## SWE.5 Software Component Verification and Integration Verification

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





## Agenda

1. SWE.2: the behavior of the SW components
2. SWE.3: the concept of unit, design unit, code unit
3. SWE.4: unit verification without verification of the interaction among units
4. SWE.5: the integration of units and components
5. The traceability diagram – corrected

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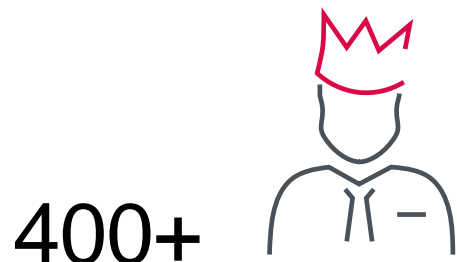
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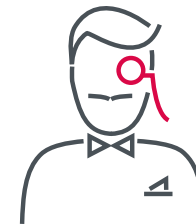
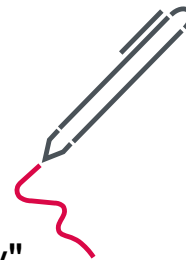


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## Co-authors

“ASPICE for Cybersecurity”  
“ME SPICE PAM,” “EE SPICE PAM,”  
“ML SPICE PAM,” “DM SPICE PAM”  
“Automotive SPICE® in practice”  
“Automotive SPICE® Essentials”



21

Principal assessors

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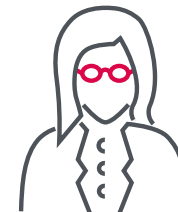
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## Agenda

1. SWE.2: the behavior of the SW components
2. SWE.3: the concept of unit, design unit, code unit
3. SWE.4: unit verification without verification of the interaction among units
4. SWE.5: the integration of units and components
5. The traceability diagram – corrected

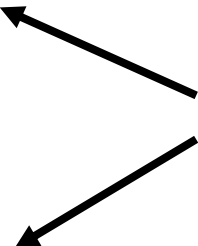
## SWE.2 vs SWE.5: The behavior of the SW components

- SWE.2 requires the description of the behavior of each SW component, in terms of static and dynamic specifications
- SWE.5 requires verification measures to test against the documented behavior of the SW components

**SWE.2.BP1: Specify static aspects of the software architecture.** Specify and document the static aspects of the software architecture with respect to the functional and non-functional software requirements, including external interfaces and a defined set of software components with their interfaces and relationships.

**SWE.2.BP2: Specify dynamic aspects of the software architecture.** Specify and document the dynamic aspects of the software architecture with respect to the functional and non-functional software requirements, including **the behavior of the software components and their interaction** in different software modes and concurrency aspects.

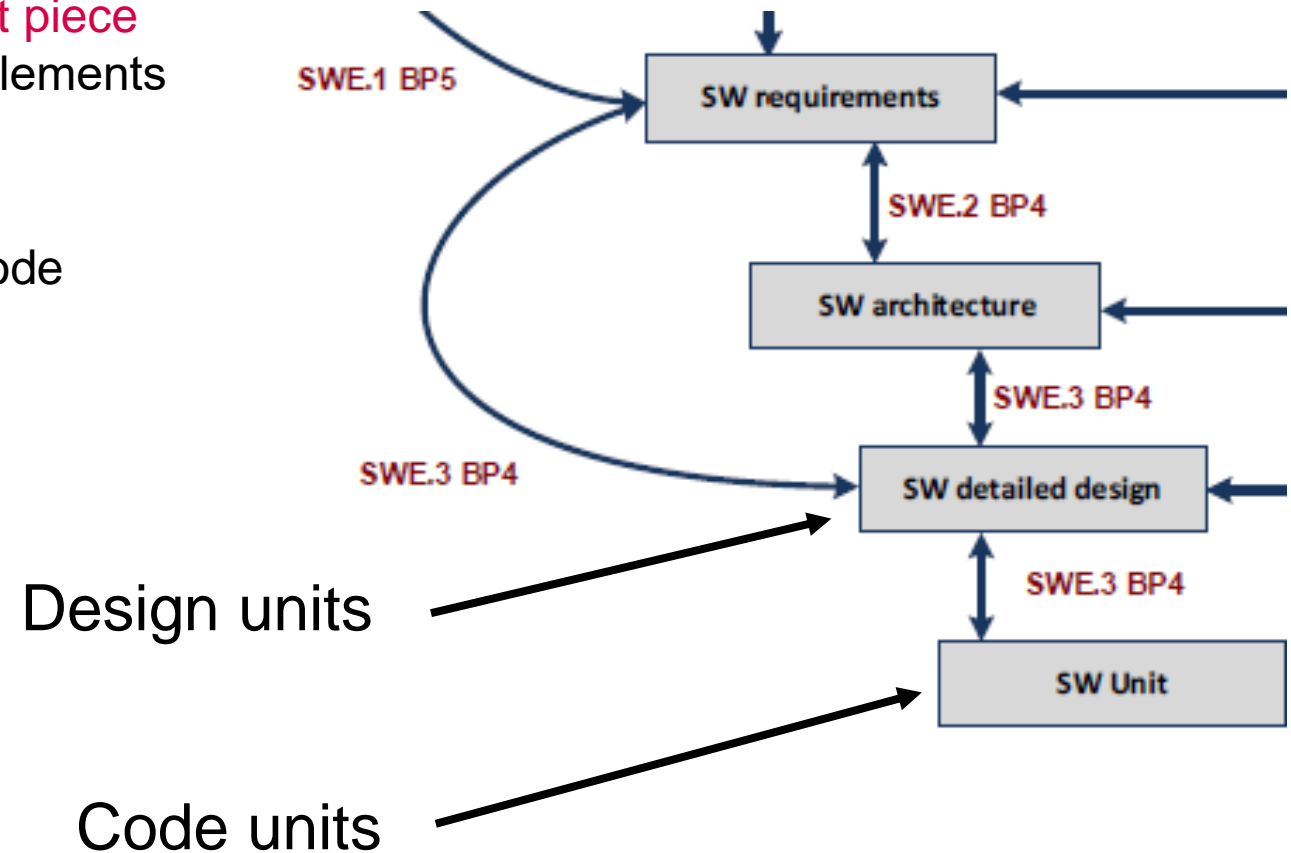
**SWE.5.BP2: Specify verification measures for verifying software component behavior.** Specify verification measures for software component verification against the defined **software components' behavior** and their interfaces in the software architecture.



## SWE.3: The concept of SW unit, design unit, code unit

A SW unit is a “**logical modeling term**,” a semantical abstraction of the code. “It is an **inseparable coherent piece of behavior**,” regardless of how many functions it implements or how many .h and .c files it physically represents.

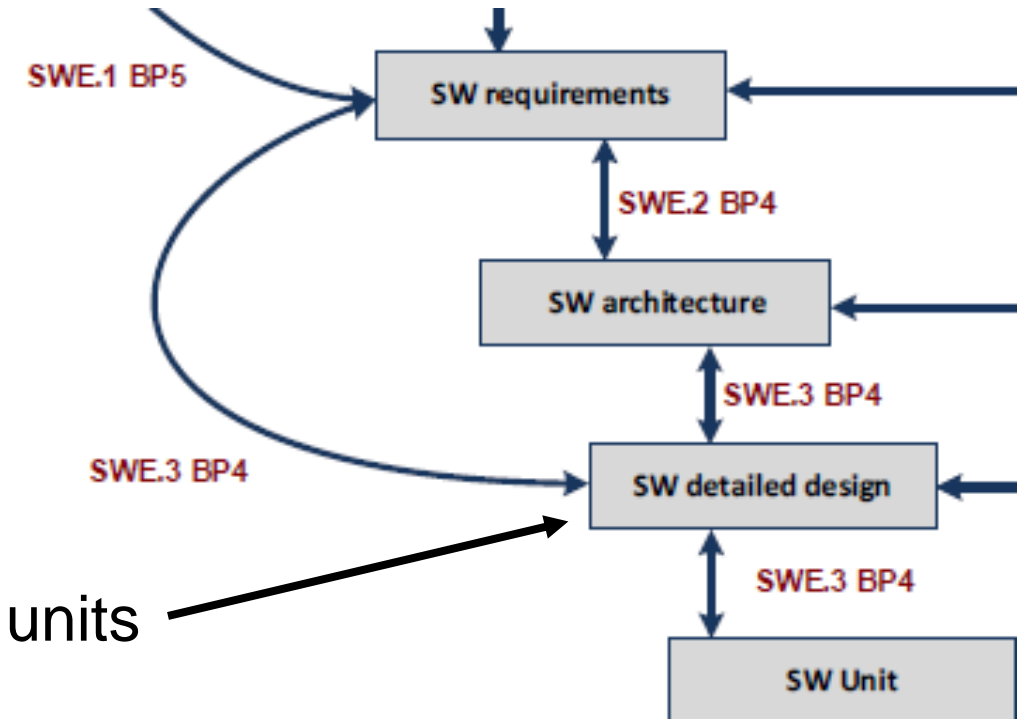
- There are “design units” at the design level.
- There are “developed units” (code units) at the code level.



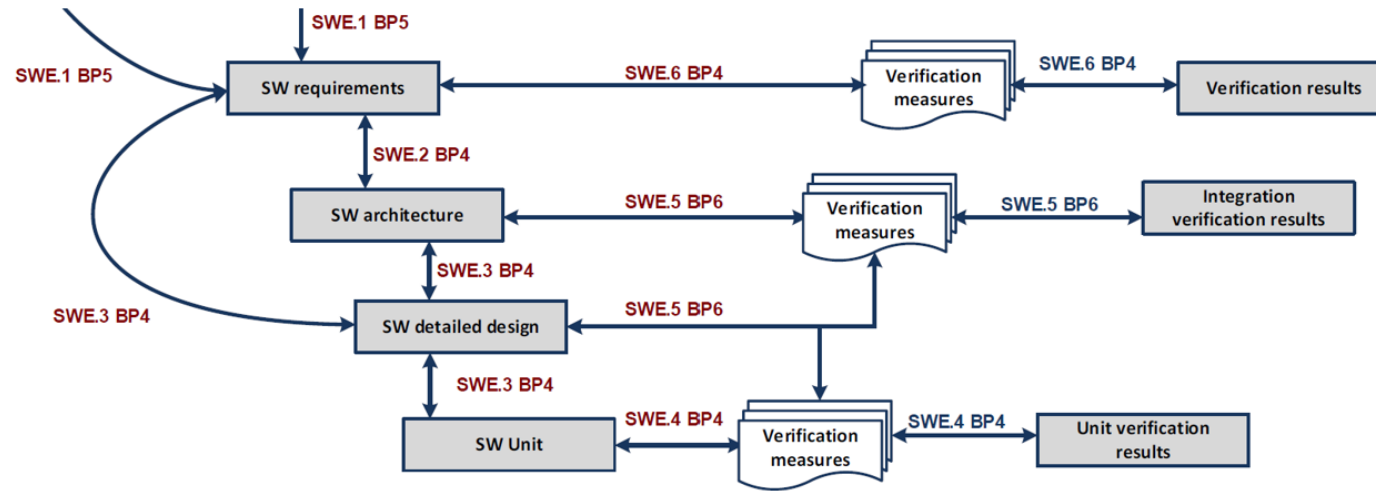
## SWE.3: The interactions between SW units

**SWE.3.BP2: Specify dynamic aspects of the detailed design.** Specify and document the dynamic aspects of the detailed design concerning the software architecture, including the **interactions between relevant software units** to fulfill the component's dynamic behavior.

Interactions between SW units

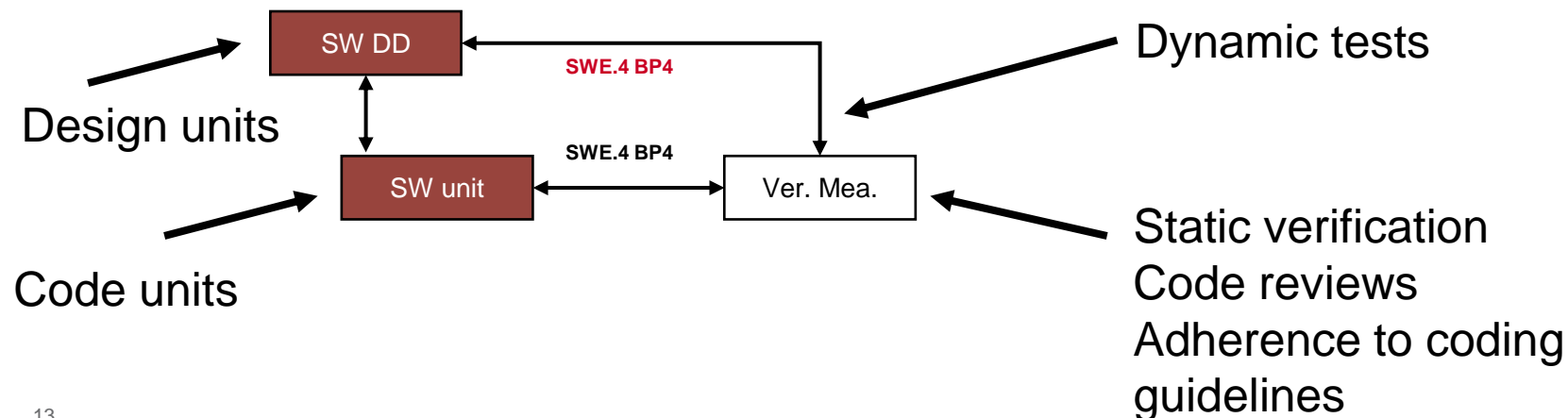


# SWE.4: Unit verification without verification of the interaction among units



Source: [Automotive-SPICE-PAM-v40.pdf \(vda-qmc.de\)](#)  
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SWE.4 does not require the verification of the interactions among units (SW unit integration)



## SWE.5 Software Component Verification and Integration Verification

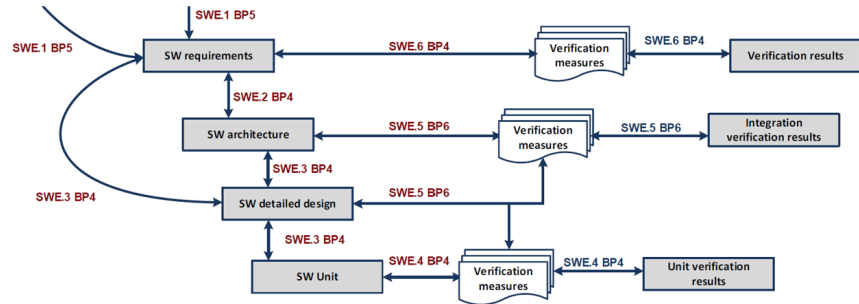
**SWE.5.BP1: Specify software integration verification measures.** Specify verification measures based on a defined sequence and preconditions for integrating **software elements** against the software architecture's defined static and dynamic aspects.

**SWE.5.BP2: Specify verification measures for verifying software component behavior.** Specify verification measures for **software component verification** against the defined **software components' behavior and their interfaces in the software architecture**.

**SWE.5.BP4: Integrate software elements and perform integration verification.** **Integrate the software elements** until the software is fully integrated according to the specified interfaces and interactions between the **software elements** and the defined sequence and preconditions.

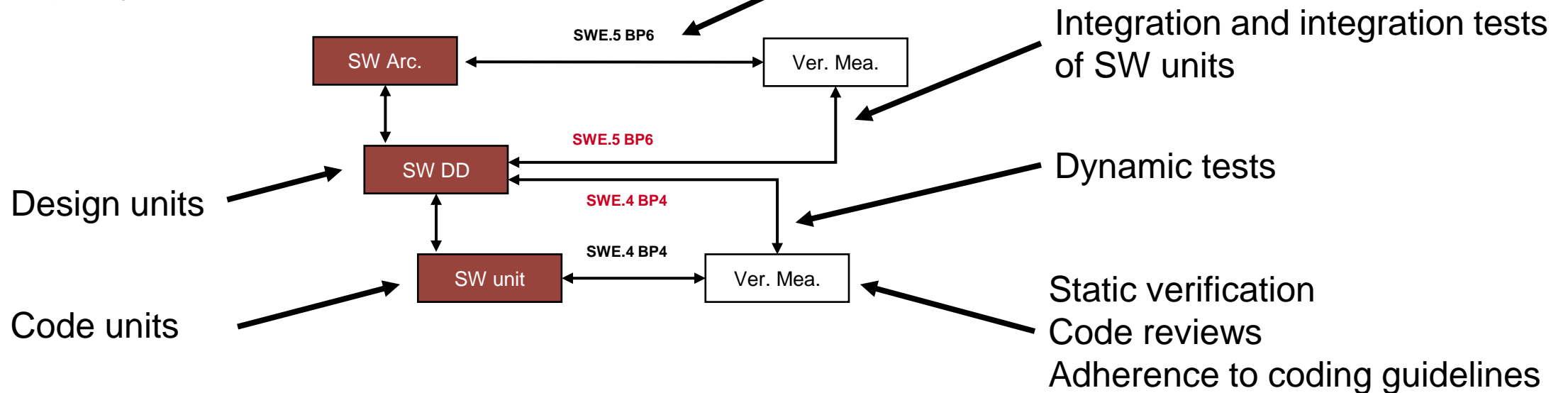
**SWE.5.BP6: Ensure consistency and establish bidirectional traceability.** Ensure consistency and establish bidirectional traceability between verification measures and the static and dynamic aspects of the **software architecture and detailed design**. Establish bidirectional traceability between verification results and verification measures.

# The traceability diagram – corrected



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# Thank you!

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