

Final Event 21 / 22 November 2023

# **Test Orchestration – The way to Seamless Testing**

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Supported by:

Federal Ministry for Economic Affairs and Climate Action

on the basis of a decision by the German Bundestag

### Agenda



- Test Orchestration within the Assurance Framework
- Test Orchestration Process & Methods
- Test Execution
- Test Evaluation
- Summary



# **Test Orchestration within the Assurance Framework**



### **Test Orchestration within the Assurance Framework**





### **Test Orchestration within the Assurance Framework**





### **Test Orchestration follows Test Planning**







Operational Concept	Design & Realization	Verification & Validation
Operational concept Concept of operation Stakeholders	(apabilities (System & Organizational)	VEV Concept
apability Layer	Functional Architecture & Design	Test Planning Func. Evaluation
ingineering Layer controlled scenarios)	Technical Architecture & Design	Test Orchestration Test Execution
ieal World Layer	Physical Construction	

# **Test Orchestration – Process & Methods**



### **Goal of the Test Orchestration**

![](_page_7_Picture_1.jpeg)

The goal is to generate technical test specifications that distribute test cases to test instances on the different available test platforms.

Seamless Testing must be realized:

- Complementarity
- Efficiency
- Reuseability
- Consistency
- Flexibility

![](_page_7_Figure_9.jpeg)

#### Input from Test Planning

![](_page_8_Figure_2.jpeg)

![](_page_8_Picture_3.jpeg)

Output

to

**Test Execution** 

![](_page_9_Picture_1.jpeg)

#### **Functional Test Specification**

![](_page_9_Figure_3.jpeg)

10

![](_page_10_Picture_1.jpeg)

# Functional

![](_page_10_Figure_3.jpeg)

![](_page_11_Picture_1.jpeg)

#### Functional Test Specification

![](_page_11_Figure_3.jpeg)

![](_page_12_Picture_1.jpeg)

#### Functional Test Specification

![](_page_12_Figure_3.jpeg)

#### Technical Test Specifications

![](_page_13_Figure_1.jpeg)

#### **Functional Test Specification Test Orchestration** Functional Environment measured variables (test scenarios) Functional test object **Technical** Elements of tech. Allocation architecture Design Technical Technical test object Physical measured variables Availability & Design Choice (De)Composition Physical Test Alternative physical test object Assignment test object Platforms Physical chosen test measured variables instance **Technical Test Specifications**

![](_page_14_Picture_1.jpeg)

#### **Functional Test Specification** Functional **Technical** Elements of tech Allocation Design Allocation Physical Design Identification of the technical test object $\bullet$ based on $\bullet$ functional test object tracking of architectural elements from ightarrowTest the design process Platforms

**Technical Test Specifications** 

![](_page_15_Picture_1.jpeg)

#### Functional Test Specification

![](_page_15_Figure_3.jpeg)

![](_page_16_Picture_1.jpeg)

#### Functional Test Specification

![](_page_16_Figure_3.jpeg)

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**Technical** 

Design

![](_page_17_Picture_1.jpeg)

**Physical** Design

Test

Platforms

# **Functional Test Specification** Functional Elements of tech Assignment Choice of the test platform

- Based on considerations of
  - feasibility, effort, cost, availability  $\bullet$ and validity,
  - physical test object
  - test scenarios  $\bullet$

#### **Technical Test Specifications**

Assignment

![](_page_18_Picture_1.jpeg)

#### **Functional Test Specification Test Orchestration** Functional Environment (test scenarios) measured variables Functional test object **Technical** Elements of tech. Allocation architecture Design Technical Test Specifications: Physical Design Physical test object Physical measured variables Test instance (Dill) added by TP7 lead -ield Technicment Sustam under Te Textfal (1 bits N) Test Big LIDAR ats Tastablauf im Szanaria Platforms Exp: Ausschalten ESP in Althängigksit vom Aslauf immittelb des Scenarios d funktionale Teobowertung getre Nicht im Scope der AG7 2 Eirakuation in Textorchestnerung and Testplanang specifizi-Esp: Hebeband entfert Sensor reinigen **Technical Test Specifications**

### **Test Orchestration – complete process**

![](_page_19_Figure_1.jpeg)

![](_page_19_Figure_2.jpeg)

![](_page_20_Picture_0.jpeg)

Operational Concept	Design & Realization	Verification & Validation
Operational concept Concept Concept operation Concept of operation Stakeholders	(apabilities (System & Organizational)	VEV Concept
Capability Layer	Functional Architecture & Design	Test Planning Func. Evaluation
Technology I aver	Technical Architectura & Berian	Tech Columbia
controlled scenarios)		Execution Execution
Roal World Laver	Physical Construction	

# **Test Execution**

![](_page_20_Figure_3.jpeg)

### **Test Execution - Realizing Seamless Testing**

![](_page_21_Picture_1.jpeg)

#### Seamless Testing means:

- Complementarity
- Efficiency
- Reuseability
- Consistency
- Flexibility

Output :

technical test data

![](_page_21_Figure_10.jpeg)

### Please visit us at booths 13 and 14.

![](_page_22_Picture_0.jpeg)

Operational Concept	Design & Realization	Verification & Validation
Operational concept of concept of operation Stakeholders	Capabilities (System & Organizational)	VEV Concept
αραστική ταητή	Functional Architecture & Design	Test Planning Func. Evaluation
ingineering Layer controlled scenarios)	Technical Architecture & Design	Test Orchestration Test Execution Evaluation

# **Test Evaluation**

![](_page_22_Figure_3.jpeg)

### **Technical Evaluation – Functional Evaluation – Aggregation**

![](_page_23_Picture_1.jpeg)

![](_page_23_Figure_2.jpeg)

### **Functional Evaluation – Metrics – Challenges**

![](_page_24_Picture_1.jpeg)

![](_page_24_Figure_2.jpeg)

#### **Functional Evaluation:**

![](_page_24_Figure_4.jpeg)

Challenge: How to aggregate multiple results? Vision: Aggregation based on Risk Model.

![](_page_25_Picture_0.jpeg)

# Summary

![](_page_25_Picture_2.jpeg)

### **Summary**

![](_page_26_Picture_1.jpeg)

- Test Orchestration
  - follows the concept of division into functional and technical level
  - distributes concrete test cases to test instances
- Test Execution
  - realizes seamless testing
  - Please attend the next presentation for further information and examples.
- Test Evaluation
  - Challenge: Aggregation of multiple results on functional level
  - Vision: Aggregation based on a parameterized risk model

Please visit us at booths 13 and 14.

![](_page_27_Picture_0.jpeg)

# Thank you!

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![](_page_27_Picture_3.jpeg)

A project developed by the VDA Leitinitiative autonomous and connected driving Supported by:

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