UML TESTING PROFILE 2
A LANGUAGE FOR TEST AUTOMATION

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Fraunhofer FOKUS

UML TESTING PROFILE 2

Goal of this talk

- Understand the scope of UTP 2
- Find its place in the ocean of testing standards
- Become aware of its capabilities regarding the creation of model-based test specifications
- Learn more about test actions and arbitration specification to build reusable test specifications

AGENDA

1. The UML Testing Profile @ a Glance

2. What can I do with UTP 2?
   - Test Action and Procedural Elements
   - Arbitration Specifications

3. What has not yet been said

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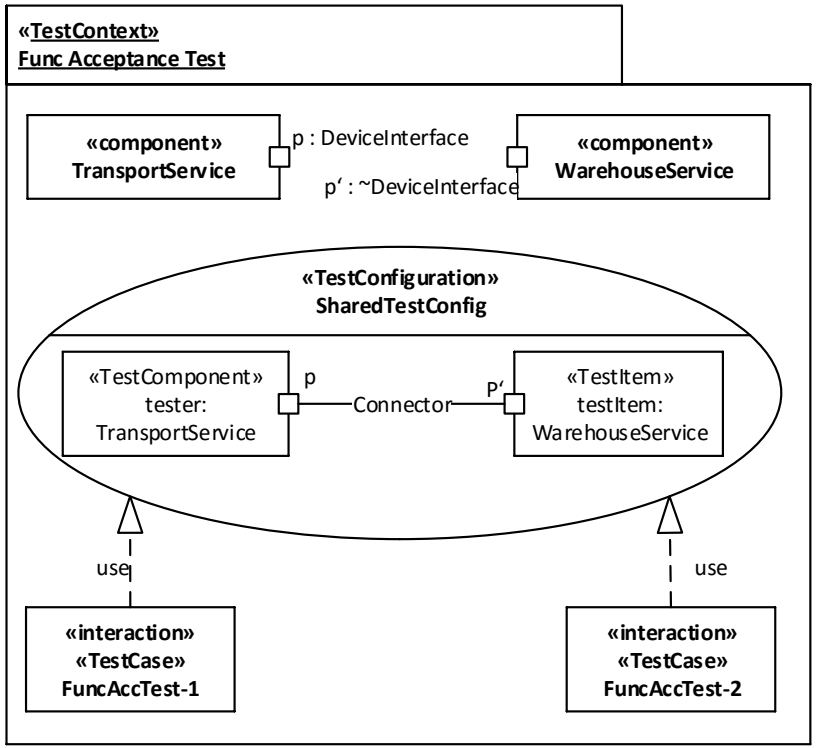
THE UML TESTING PROFILE @ A GLANCE

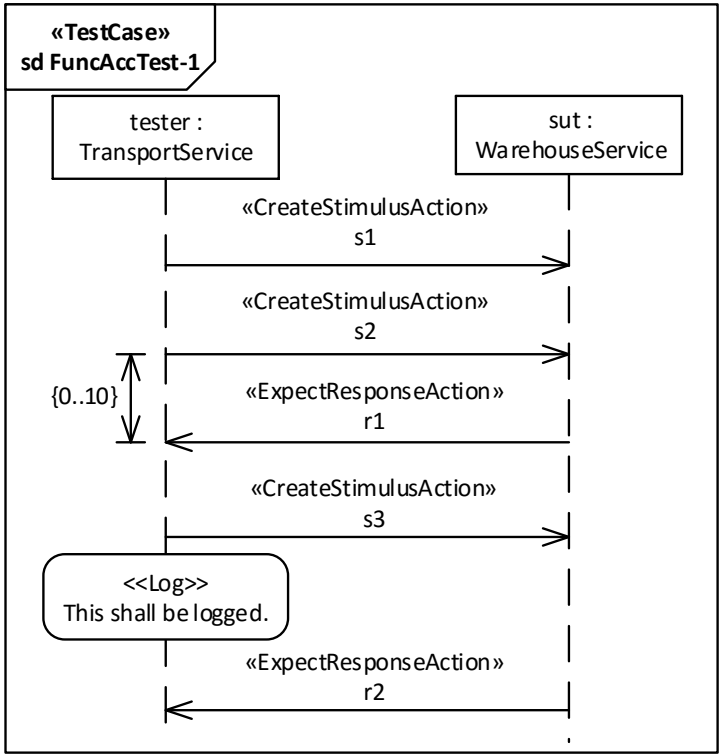
Understanding UTP

- A **test modeling language** based on UML
- Supports **(test) engineers** in carrying out (manual or automated) (dynamic) **test design activities**
- Specification of **test models and test logs**
- Facilitates (manual or automated) **test execution** and **evaluation**
- Simplifies **communication and understanding** among stakeholders
- Vendor- and methodology-independent (i.e., open) standard

UTP abides by the idea of model-driven engineering but for testing (test automation) purposes

THE UML TESTING PROFILE @ A GLANCE





THE UML TESTING PROFILE @ A GLANCE

Understanding UTP – Out of Scope

- Methodologies
- Modeling of test processes and/or higher-level test management concepts (such as test strategies, role concepts etc.)
- Static testing such as audits/reviews, static code analysis, etc.

THE UML TESTING PROFILE @ A GLANCE

From UTP 1.2 to UTP 2 – Reasons for a major revision

- UTP 1.0 was ahead of its time – in the meantime, things have changed
  - Incorporate experiences with model-based development and testing
  - Incorporate experiences of using UML and profiles
  - Incorporate new standards like ISO 29119 or ETSI ES 202 951 (MBT)
- Lack of/insufficiently elaborated concepts
  - Test design facility, test data values, test logging facility
- OMG policies to introduce new concepts in a minor revision are restrictive

UTP 2 is rather a technical modernization of the language instead of a reinvention of the wheel

THE UML TESTING PROFILE @ A GLANCE

UTP in the ocean of testing and domain-specific standards

ISO 29119-1

IEEE:ATML

ETSI TDL

ISTQB CMBT

ISO 26262

ETSI MBT

ETSI TTCN-3

ISO 29119-4

SoaML

Do-178C

TestIF

IEEE:829

ISO 29119-3

ISTQB TAE

UML

EN 50129

ISO 29119-5

ETSI TPLan

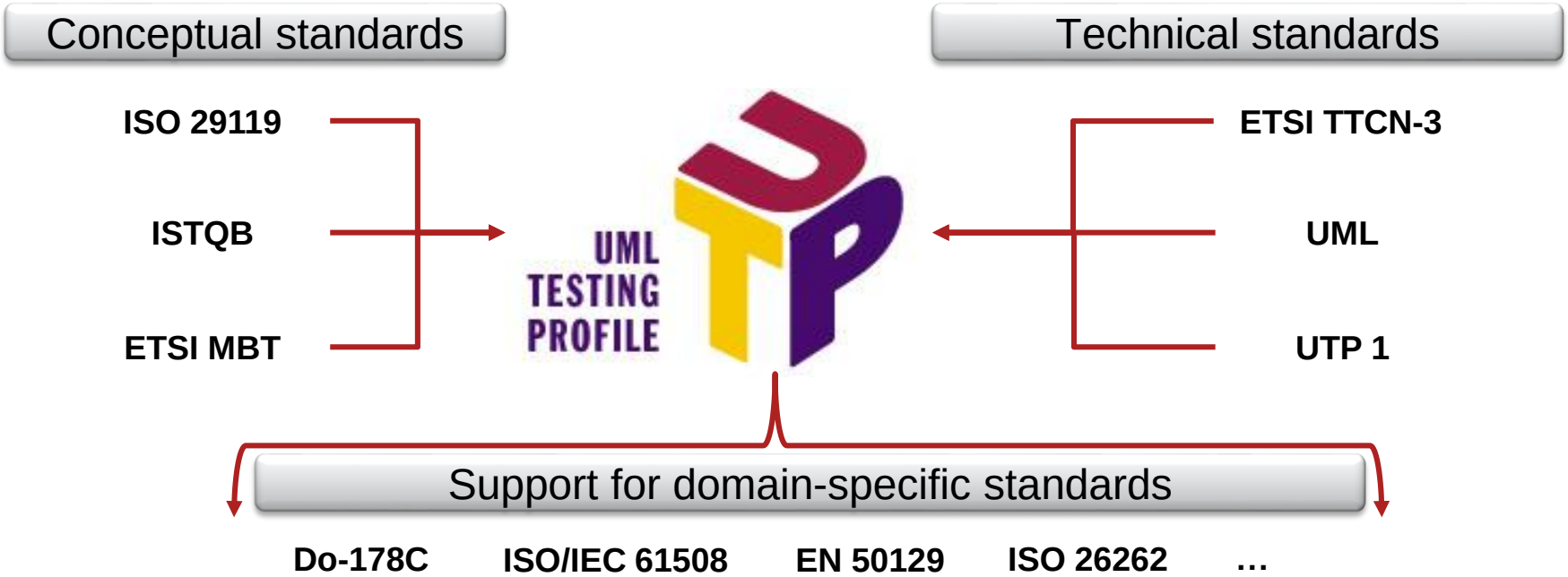
SysML

ISO/IEC 61508

UTP 1

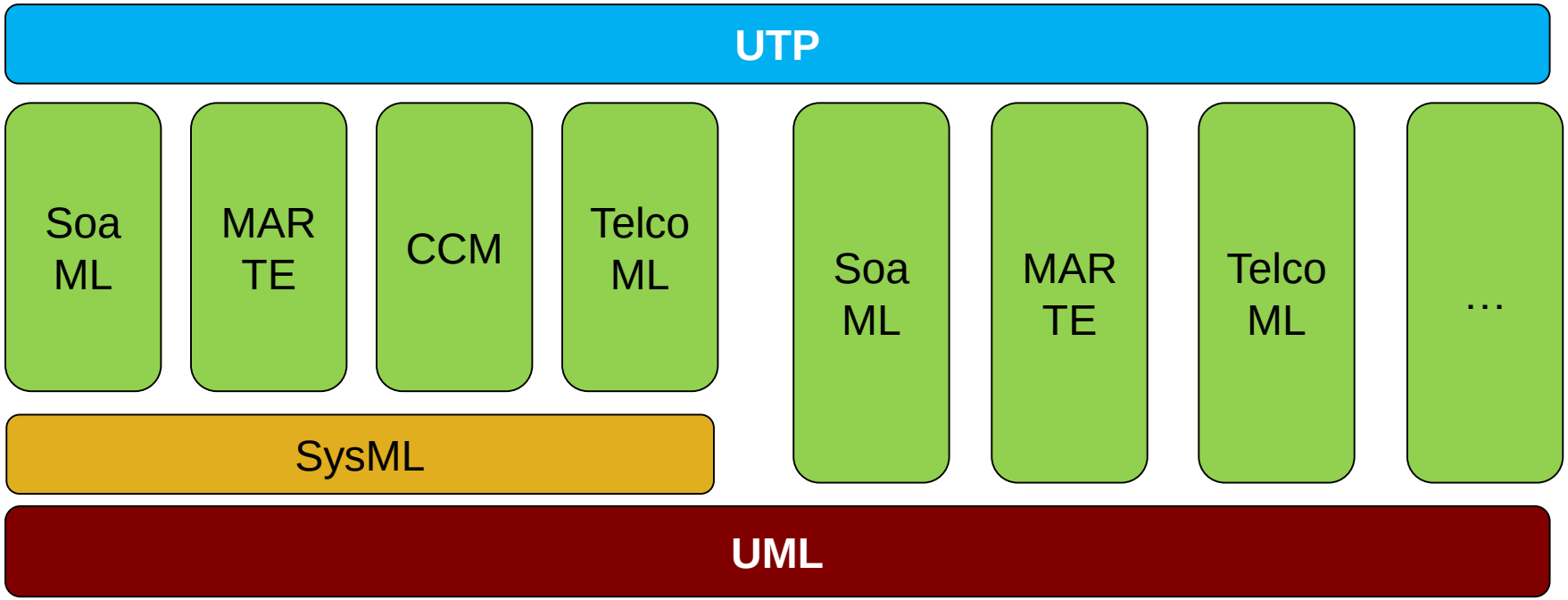
THE UML TESTING PROFILE @ A GLANCE

Influencing standards



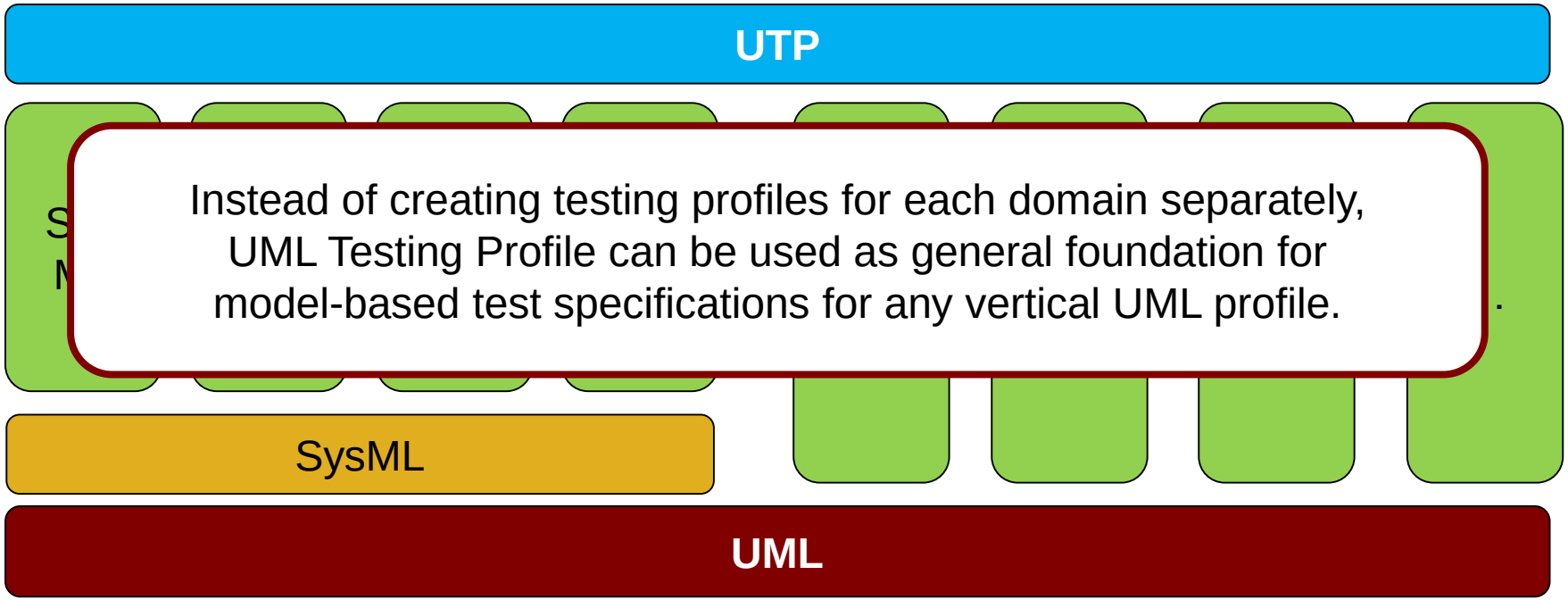
THE UML TESTING PROFILE @ A GLANCE

UTP in the UML ecosystem



THE UML TESTING PROFILE @ A GLANCE

UTP in the UML ecosystem



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1. The UML Testing Profile @ a Glance

2. What can I do with UTP 2?

3. What has not yet been said

WHAT CAN I DO WITH UTP 2?

With UTP 2, I as a test engineer would want to

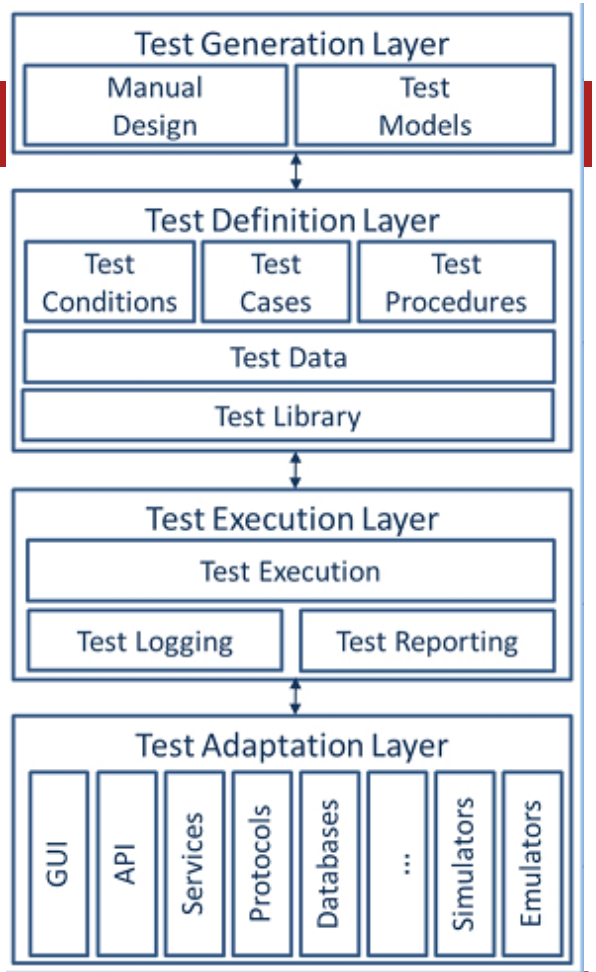
- Specify test (automation) architectures in a technology-independent manner…
- (Automatically) design test cases, test data and test schedules …
- Visualize test cases, test data and test schedules …
- Specify and reuse test environments …
- Capture test execution results for further test evaluation…
- Specify matching mechanisms for actual and expected responses…
- Specify arbitration rules for verdict arbitration…
- Generate executable test scripts and test results for a dedicated target platform…
- Produce test reports in a desired format…

… so that comprehensibility and communication among stakeholders are improved, important knowledge is preserved and the degree of automation is increased

WHAT CAN I DO WITH UTP 2?

Building test architectures with UTP 2

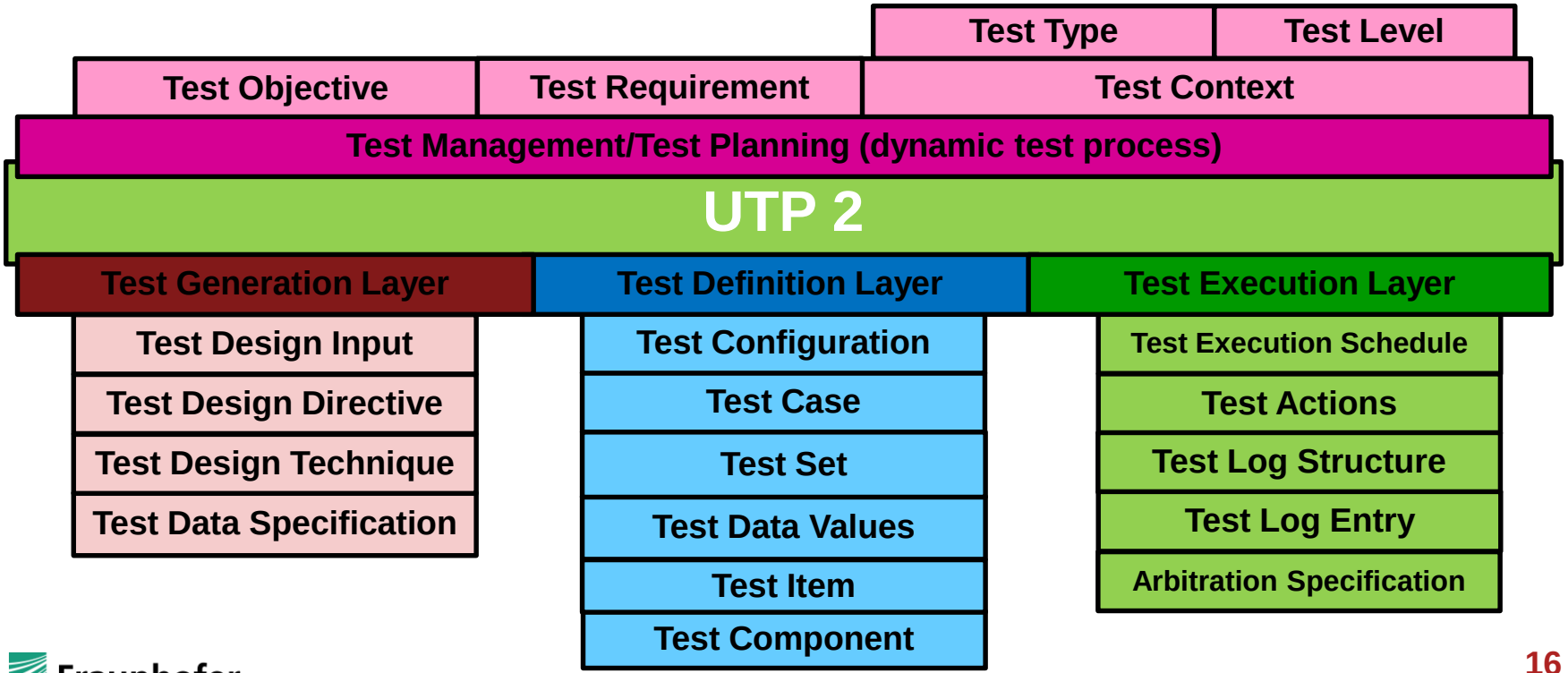
- Test Generation Layer
  Manual / automated design of test cases / test data
- Test Definition Layer
  Specification of test cases, test data, test procedures…
- Test Execution Layer
  Execution of test cases, logging of test execution, test evaluation & verdict arbitration
- Test Adaptation Layer
  Establishing communication with the system under test in order stimulate and observes it



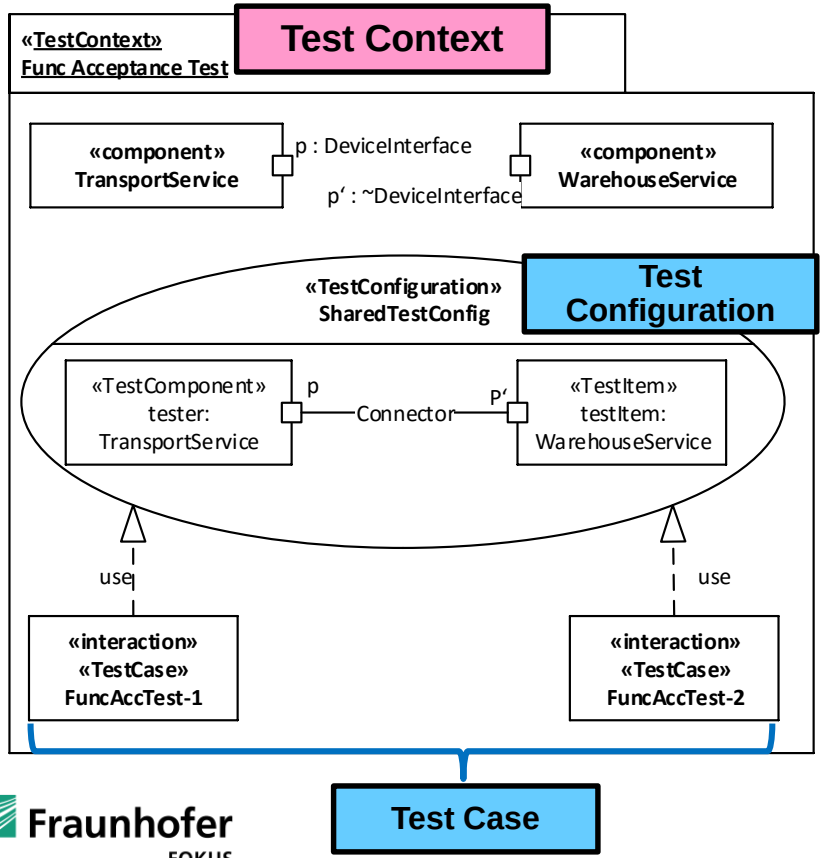
UTP 2 offers explicit concepts for the test generation, test definition and test execution layer

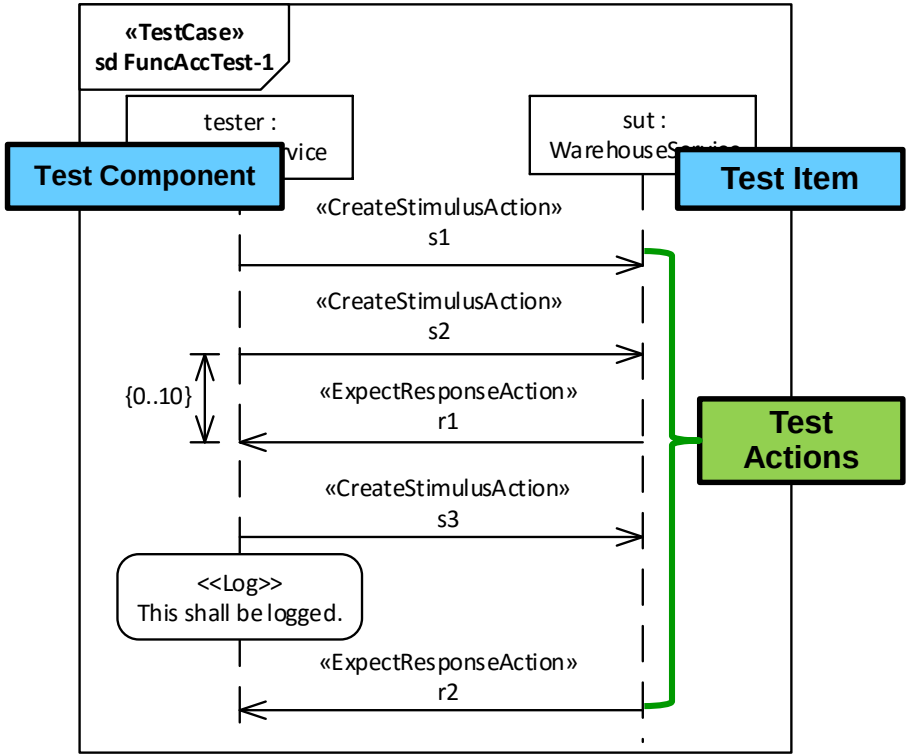
WHAT CAN I DO WITH UTP 2?

Conceptual overview



WHAT CAN I DO WITH UTP 2?





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2. What can I do with UTP 2?

- **Test Action and Procedural Elements**
- Arbitration Specifications

3. What has not yet been said

WHAT CAN I DO WITH UTP 2?

Dedicated test actions in UTP 2

- Each UTP 2 **test case** consists of a **test procedure**
- A **test procedure** consists of **procedural elements**
- Procedural elements can be **atomic** (e.g., send a stimulus) or **non-atomic** (e.g. looping behavior)
- A special kind of atomic procedural actions are **test actions**

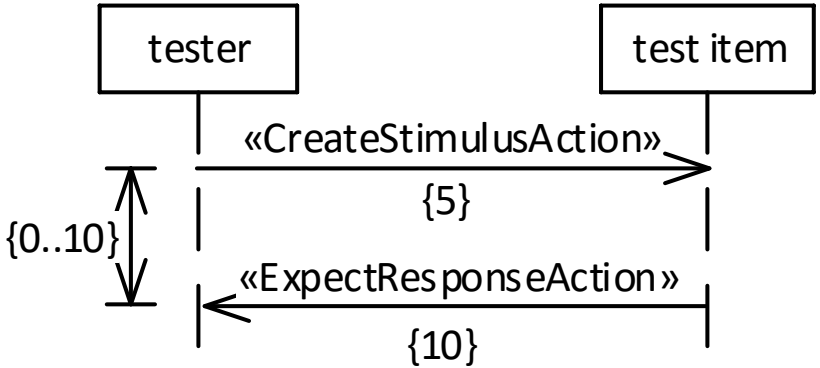
  > *„An atomic procedural element that is an instruction to the tester that needs to be executed as part of a test procedure within some time frame.” [UTP2]*

- „Tester“ stands for both automated (i.e., test components, test drivers, test stubs) and manual testers

WHAT CAN I DO WITH UTP 2?

Test action: Expect Response Action (with timing)

“A test action that instructs the tester to check the occurrence of one or more particular responses from the test item within a given time window.”



TTCN-3 equivalent

```
tester.send(Stimulus:{5});
timer.start(10);
alt{
[]tester.receive(Response:{10})
        {…}
[]timer.timeout
        {…}
}
```

WHAT CAN I DO WITH UTP 2?

Test actions (and procedural elements)

- The following test action (special kind of procedural elements) are provide in order to:
  - Stimuly the test item → **Create Stimulus Action**
  - Observe an expected response → **Expect Response Action**
  - Check some internal properties of the test item → **Check Property Action**
  - Submit a verdict to the arbitration specification → **Suggest Verdict Action**
  - Write something into the test log → **Create Log Entry Action**
- There are more procedural elements (e.g., loops, parallel, alternatives, procedure invocations etc.) that are used for building test procedures

UTP procedural elements are applicable to Interactions, State Machines and Activities

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- **Arbitration Specifications**

3. What has not yet been said

WHAT CAN I DO WITH UTP 2?

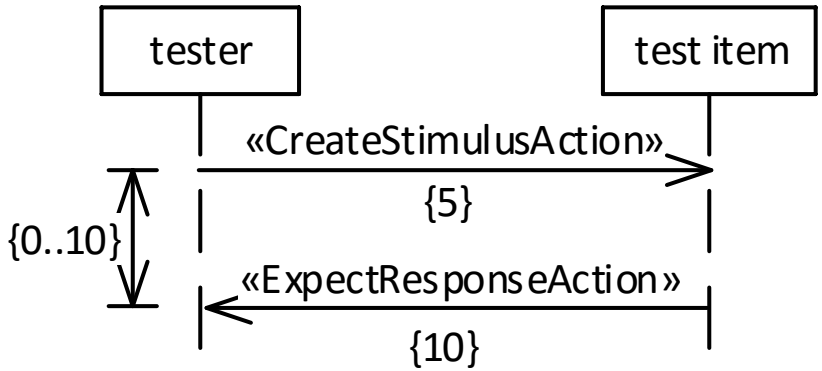
Introduction: Arbitration Specifications

- An arbitration specification (AS) is a **specification** of the rules that reasoning about verdicts
- Arbitration specifications can be defined for **test sets**, **test cases** and **test actions**
  - If no arbitration specification is set, a **default** one is set
  - Arbitration specifications can be **replaced** for certain test actions, test cases and test sets
- Arbitration specifications help keeping the test cases and test procedures **agnostic** of any verdict-related information

WHAT CAN I DO WITH UTP 2?

Arbitration Specifications

– What is the semantics of the following test case with respect to its verdict?



Semantics is given by the applied **arbitration specification**.

Questions

- What verdict shall be set, if the expected response is received?
- What verdict shall be set, if another response is received before?
- What is the initial verdict of the test case?
- Is there a precedence rule of verdicts similar to TTCN-3 (i.e., none < pass < inconclusive < fail < error)?

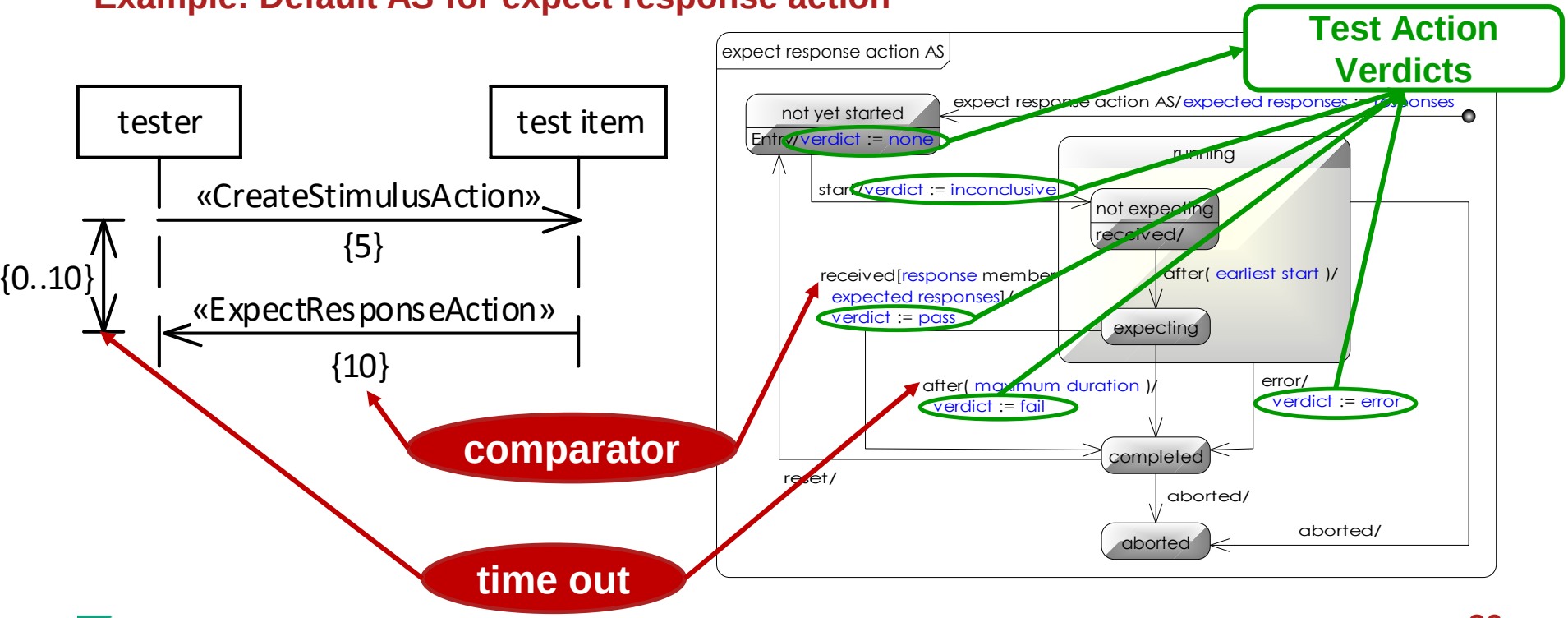
WHAT CAN I DO WITH UTP 2?

Interplay of arbitration specifications on different levels

- Test action, test case and test set represent ascending composition levels
- Each arbitration specification provides a verdict
  - Test action AS → test action verdict **(are summarized by)**
  - Test case AS → test case verdict **(are summarized by)**
  - Test set AS → test set verdict
- Test action verdicts result from the evaluation of atomic test actions
- Test action verdicts are conveyed to the test case AS that is responsible to calculate the test case verdict
- Test case verdicts are conveyed to the test set AS (if set) that is responsible to calculate the test set verdict

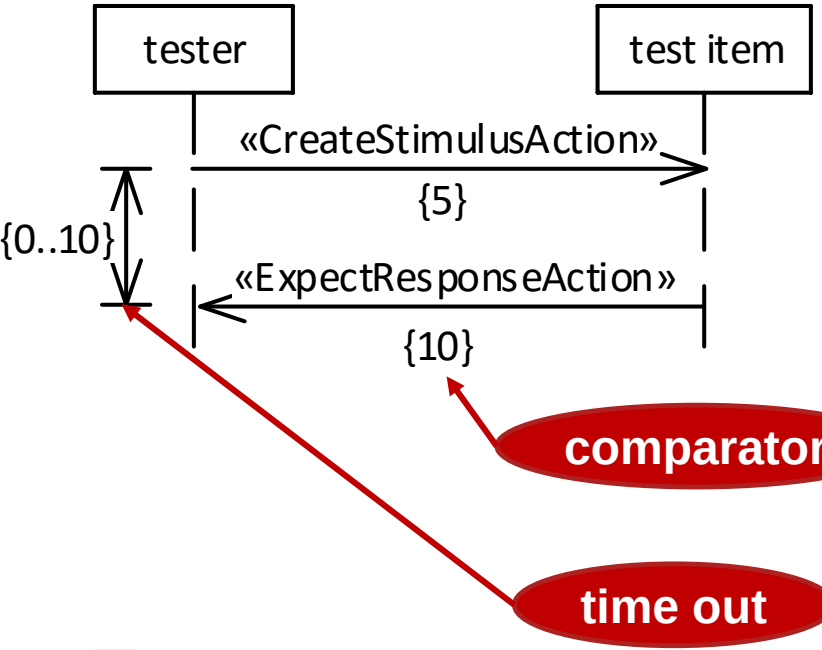
WHAT CAN I DO WITH UTP 2?

Example: Default AS for expect response action



WHAT CAN I DO WITH UTP 2?

Example: Default AS for expect response action



TTCN-3 equivalent

```
tester.send(Stimulus:{5});
timer.start(10);
alt{
     []tester.receive(Response:{10})
        {setverdict(pass);}
     []tester.receive
        {repeat;}
     []timer.timeout
        {setverdict(fail);}
}
```

WHAT CAN I DO WITH UTP 2?

Summary: Arbitration Specifications

- Arbitration specifications have been **newly introduced** (in contrast to Arbiter) by UTP 2
- Help keeping the test case **clean** of verdict/arbitration-related logic
- UTP 2 **provides default** arbitration specification for test actions, test case and test sets
  - If no explicit arbitration is given, the default one will be taken by definition
  - Easy replacement of arbitration specifications through tagged values
- Arbitration specifications **do not have** to be expressed in a formal, yet executable way → UTP 2 provides a formal semantics for its default AS

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2. What can I do with UTP 2?

3. Miscellaneous

MISCELLANEOUS

Many more concepts offered

- **Test design facility**: specify the test design techniques and there coverage goals to guide the test design process
- **Data specifications**: specify, modify and reuse data partitions, data specifications, data pools; optimized to describe and handle large sets of data for test data generation, test data selection and test case execution
- **ValueSpecification Extensions**: extensions to the UML ValueSpecifications for regual expression, range values, enumerated values, collections, complemented values
- **Test logging facility**: concepts to formalise, represents and/or visualize test execution traces; enables for post-execution comparison, test results harmonisation and integration etc.

MISCELLANEOUS

Relationship of UTP to SysML

- UTP and SysML are related in two ways
  - SysML re-specified/re-implemented the (UTP 1.x) concepts *test case* and *verdict*
  - UTP 2 re-specified/re-implemented the SysML (1.x) concept *verifies*

  →Technical compatibility ensures that both profiles could be applied simutaneously
- UTP 2 changed the concept test case and verdict
  - compatbility with UTP 2 is not given anymore
  - SysML 2 WG is interested in a liason with UTP to ensure compatibility and avoid unnecessary redundancy

MISCELLANEOUS

Timeline and Roadmap

- **June 2017**: Successful submission of revised submission; adoption by OMG as beta standard; charter of finalization task force (FTF)

- **June 2018**: Submission of FTF; release of UTP 2.0 by OMG expected; charter of UTP 2.1 revision task force

- **June 2019:** Release of UTP 2.1 expected

MISCELLANEOUS

Summary

- UTP 2 is a graphical modelling language based on ÚML
- A graphical modelling language to support test design activities
- Terminology in particular influenced by ISO 29119 and ISTQB
- Concepts provided to describe (parts of) test automation architectures
- Just a specification language! Transformations not part of UTP 2

WE ARE OVER AND DONE…

Thank you very much for your attention.
Questions?

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