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Methods for Testing and Specification (MTS);
The Test Description Language (TDL);
Part 4: Structured Test Objective Specification (Extension)

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Foreword

This ETSI Standard (ES) has been produced by ETSI Technical Committee Methods for Testing and Specification (MTS).

The present document is part 4 of a multi-part deliverable. Full details of the entire series can be found in part 1 [1].

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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Introduction

Test purposes play an essential role in test specification processes at ETSI. Currently, TDL treats test purposes, and test objectives in general as informal text without any additional structural constraints. This extension package for TDL refines and formalizes test objective specification within TDL by introducing relevant meta-model concepts and a corresponding syntactical notation, both of which are related to TPLan ETSI ES 202 553 [i.1] and TPLan-like notations already established at ETSI. This enables test purpose specification to enter the modelling world and paves the way for improved tool support and better structured test objectives, as well as additional formal verification and validation facilities down the road by integrating and unifying the means for the specification of test purposes and test descriptions, while relying on the same underlying meta-model and benefiting from other related technologies built around this meta-model.

The present document describes the relevant abstract syntax (meta-model) extensions as well as the corresponding concrete syntactical notation.

NOTE: The use of underline (additional text) and strikethrough (deleted text) highlights the differences between base document and extended documents.

1 Scope

The present document specifies an extension of the Test Description Language (TDL) enabling the specification of structured test objectives. The extension covers the necessary additional constructs in the abstract syntax, their semantics, as well as the concrete graphical syntactic notation for the added constructs. In addition textual syntax examples of the TDL Structured Test Objectives extensions as well as BNF rules for a textual syntax for TDL with the Structured Test Objectives extensions are provided. The intended use of the present document is to serve both as a foundation for TDL tools implementing support for the specification of structured test objectives, as well as a reference for end users applying the standardized syntax for the specification of structured test objectives with TDL.

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2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at https://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are necessary for the application of the present document.

[1] ETSI ES 203 119-1 (V1.5.1): "Methods for Testing and Specification (MTS); The Test Description Language (TDL); Part 1: Abstract Syntax and Associated Semantics".

[2] ETSI ES 203 119-2 (V1.4.1): "Methods for Testing and Specification (MTS); The Test Description Language (TDL); Part 2: Graphical Syntax".

[3] ETSI ES 203 119-3 (V1.4.1): "Methods for Testing and Specification (MTS); The Test Description Language (TDL); Part 3: Exchange Format".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] ETSI ES 202 553 (V1.2.1): "Methods for Testing and Specification (MTS); TPLan: A notation for expressing Test Purposes".

[i.2] ETSI TS 136 523-1 (V10.2.0): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA) and Evolved Packet Core (EPC); User Equipment (UE) conformance specification; Part 1: Protocol conformance specification (3GPP TS 36.523-1 version 10.2.0 Release 10)".

[i.3] ETSI TS 186 011-2: "Core Network and Interoperability Testing (INT); IMS NNI Interoperability Test Specifications (3GPP Release 10); Part 2: Test descriptions for IMS NNI Interoperability".

3 Definition of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the terms given in ETSI ES 203 119-1 [1] and the following apply:

context: set of circumstances related to the occurrence of an event

entity: object that may be involved in the occurrence of an event as part of a specific context

entity type: alias for additional meta-information that may be used to describe one or more entities

event: observable phenomenon or state that may occur in a specific context

NOTE: Related to a term of the same name defined in ETSI ES 202 553 [i.1].

event occurrence: description of the occurrence of an event in a specific context

event type: alias for additional meta-information that may be used to describe one or more events

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

BNF	Backus-Naur Form
EBNF	Extended Backus-Naur Form
IMS	IP Multimedia Subsystem
IUT	Implementation Under Test
OCL	Object Constraint Language
PICS	Protocol Implementation Conformance Statement
SUT	System Under Test
TDL	Test Description Language
TPLan	Test Purpose Notation

4 Basic principles

4.1 Structured Test Objective Specification

The present document defines an extension for TDL enabling the specification of structured test objectives. Rather than rely on external documents or informal text provided by the default test objective specification facilities of TDL, this extension enables users to describe test objectives in a more structured and formalized manner which may enable subsequent generation of test description skeletons and consistency checking against test descriptions realizing a given test objective. In addition, the structured approach to test objective specification also enables syntactical and semantical consistency checking of the test objectives themselves.

The abstract concepts and the concrete syntax are based on TPLan ETSI ES 202 553 [i.1] to a large extent, as they also reflect concepts and practices already established at ETSI. The fundamental concept in the specification of a structured test objectives is the event occurrence which describes the occurrence of an abstract event in a specific context, comprising one or more involved entities, an event argument, as well as a time label and/or a time constraint.

Events and entities referenced in an event occurrence shall be defined in advance as part of a domain description which may then be reused across all structured test objective specifications in that domain. An entity is an abstract representation of an object involved in an event occurrence that may be realized as a component instance or a gate instance within a test description realizing the structured test objective.

An event argument may either refer to a data instance for data already defined with the facilities provided by TDL, or, following a more light weight approach, describe data inline without the need to define all data types and instances in advance. Pre-defined data and inline data may be integrated to a certain degree. Inline data may refer to pre-defined data, but pre-defined data shall not refer to inline data.

Event occurrence specifications are organized in the different compartments of a structured test objective, including initial conditions, expected behaviour, and final conditions. Multiple event occurrences are combined by means of an 'and' or 'or' operand indicating how subsequent event occurrences are related to each other (as a sequence or as alternatives, respectively).

Structured test objectives may also include references to PICS which may be used as selection criteria for the concrete realization of the test objectives. The PICS shall be defined in advance as part of the domain description. Multiple PICS references within the same structured test objective are combined by means of an 'and' or 'or' operand indicating how subsequent referenced PICS are related to each other.

4.2 Document Structure

The present document defines the structured test objective specification extension for TDL comprising:

- Meta-model extension describing additional concepts required for the specification of structured test objectives (clause 5).
- Concrete syntax extension describing corresponding shapes for the representation of the additional concepts (clause 6).
- An informative annex with examples in a textual concrete syntax (annex A).
- An informative annex with production rules for the example textual syntax (annex B).

4.3 Notational Conventions

The present document inherits the notational conventions defined in ETSI ES 203 119-1 [1] and ETSI ES 203 119-2 [2].

The abstract syntax specification and the classifier descriptions follow the notational conventions defined in clause 4.5 of Abstract Syntax and Associated Semantics [1]. The concrete syntax notation specification follows the notational conventions described in clause 4.5 of the Graphical Syntax [2].

4.4 Element Operations

The following operations shall be provided in an implementation of the TDL-TO extension to the TDL meta-model in order to ensure the semantic integrity of TDL-TO models, in addition to the operations defined for the TDL meta-model in ETSI ES 203 119-1 [1]. The operations are also used as reusable shortcuts for the specification of the formalized constraints and are required for their interpretation, in addition to the operations provided by the standard library of OCL:

- OclAny **getTestObjective** (): StructuredTestObjective - applicable on any TDL 'Element', returns the 'StructuredTestObjective' that contains the construct directly or indirectly.
- OclAny **contains** (object : OclAny): Boolean - applicable on any TDL 'Element', accepts a TDL 'Element' as parameter 'object', returns 'true' if the 'Element' contains the 'object' and 'false' otherwise.
- StructuredTestObjective **indexOf** (object : OclAny): Integer - applicable on a 'StructuredTestObjective', accepts a TDL 'Element' as parameter 'object', returns the position of the 'object' within the flattened list of all 'Element's directly and indirectly contained within the 'StructuredTestObjective'. The list is flattened according to a depth-first approach.

4.5 Conformance

For an implementation claiming to conform to this extension of the TDL meta-model, all concepts specified in the present document and in ETSI ES 203 119-1 [1], as well as the concrete syntax representation specified in the present document shall be implemented consistently with the requirements given in the present document and in ETSI ES 203 119-1 [1]. The electronic attachment from annex A in ETSI ES 203 119-1 [1] may serve as a starting point for a TDL meta-model implementation conforming to the present document and the overall abstract syntax of TDL [1].

5 Meta-Model Extensions

5.1 Overview

The structured test objective specification is defined within a single package in the TDL meta-model. It relies on several concepts from the 'Foundation', 'Data', and 'Time' packages of the TDL meta-model.

5.2 Foundation Abstract Syntax and Classifier Description

5.2.1 Entity

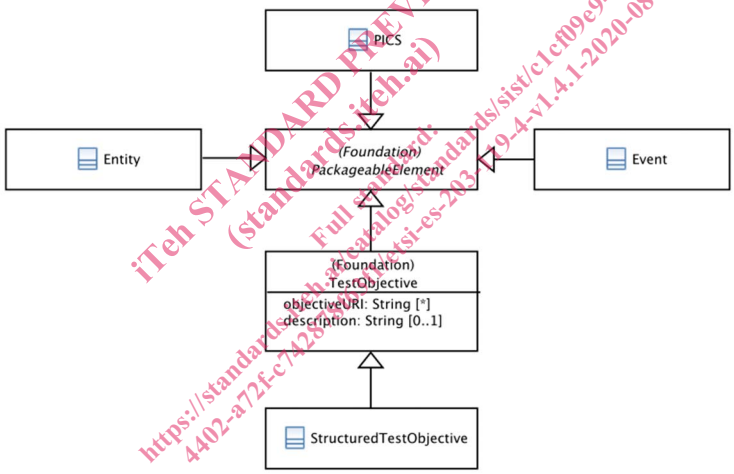

Figure 5.1: Structured Test Objective Specification Foundation Concepts

Semantics

An 'Entity' is a 'PackageableElement' that describes a participant in an 'EventOccurrence'. User defined entities, such as IUT, SUT, Tester, etc., may be referenced by means of an 'EntityReference' within an 'EventOccurrence' as the source and/or target of an 'Event' referenced in a corresponding 'EventReference'. Whether an 'Entity' corresponds to a 'ComponentInstance' or a 'GateInstance' is not specified in advance. 'Annotation's may be used to provide an indication for the type and role of the 'Entity'.

Generalizations

- PackageableElement

Properties

There are no properties specified.

Constraints

There are no constraints specified.

5.2.2 Event

Semantics

An 'Event' is a 'PackageableElement' that describes a user defined event or activity that may be referenced in an 'EventOccurrence'. The direction of an 'Event' with respect to the 'Entity' or 'Entity's referenced in the 'EventOccurrence' depends on the interpretation of the 'Event', where 'Annotation's may be used to provide additional information as an indication of the intended interpretation.

Generalizations

- PackageableElement

Properties

There are no properties specified.

Constraints

There are no constraints specified.

5.2.3 PICS

Semantics

A 'PICS' is a 'PackageableElement' that may be referenced in 'StructuredTestObjective's to indicate selection criteria for the 'StructuredTestObjective' based on features required for and/or tested with the realization of the 'StructuredTestObjective'.

Generalizations

- PackageableElement

Properties

There are no properties specified.

Constraints

There are no constraints specified.

5.3 Test Objective Abstract Syntax and Classifier Description

5.3.1 StructuredTestObjective

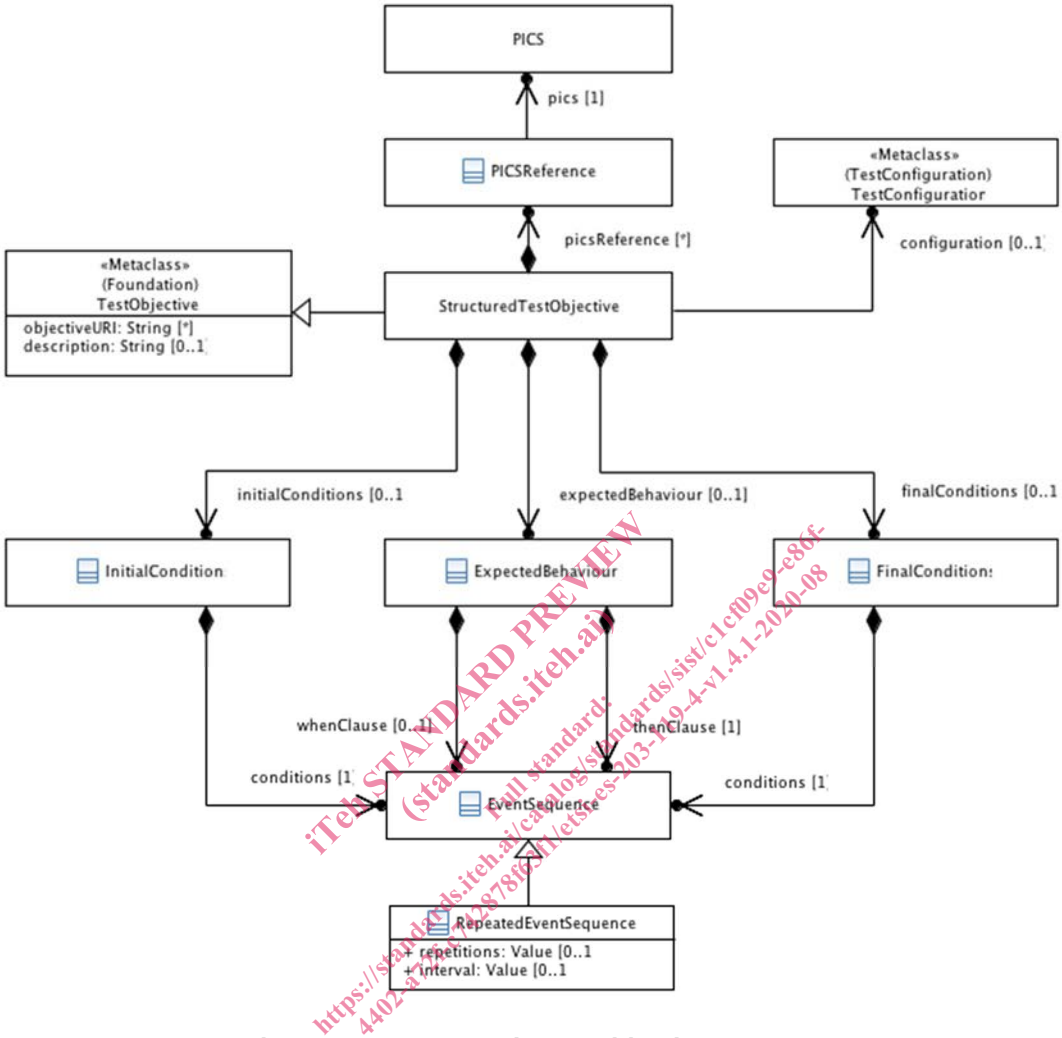

Figure 5.2: Structured Test Objective Concepts

Semantics

A 'StructuredTestObjective' is a refinement of 'TestObjective' that enables the use of additional constructs in order to formalize the description of 'TestObjective's. In addition to the 'description' and 'objectiveURI' properties inherited from 'TestObjective', a 'StructuredTestObjective' includes 'PICSReferences', 'InitialConditions', 'ExpectedBehaviour', and 'FinalConditions'. A 'StructuredTestObjective' may optionally reference a 'TestConfiguration' on which the 'StructuredTestObjective' shall be realized. The referenced 'TestConfiguration' provides descriptive information regarding the intended setup for the 'StructuredTestObjective'.

Generalizations

- TestObjective

Properties

- picsReference : PICSReference [*] {ordered}
  An ordered set of 'PICSReferences' to 'PICS'.

- configuration : TestConfiguration [0..1]
  A reference to a 'TestConfiguration'.

- initialConditions : InitialConditions [0..1]
  Initial conditions description for the 'StructuredTestObjective'.

- expectedBehaviour : ExpectedBehaviour [0..1]
  Expected behaviour description for the 'StructuredTestObjective'.

- finalConditions : FinalConditions [0..1]
  Final conditions description for the 'StructuredTestObjective'.

Constraints

There are no constraints specified.

5.3.2 PICSReference

Semantics

A 'PICSReference' is an 'Element' that enables the referencing of 'PICS' within a 'StructuredTestObjective'.
A 'Comment' with body containing an 'and' or 'or' shall be used as a Boolean operand if there are two or more 'PICSReference's specified within a 'StructuredTestObjective', starting with the second 'PICSReference' to indicate how the referenced 'PICS' shall be interpreted with regard to the other referenced 'PICS' within the same 'StructuredTestObjective'. A 'Comment' with body containing 'not' may be used to indicate that the referenced 'PICS' is to be negated.

Generalizations

- Element

Properties

- pics : PICS [1]
  The referenced 'PICS'.

Constraints

- **Combining Multiple 'PICSReference's**
  A 'Comment' with body containing an 'and' or 'or' shall be attached to the 'PICSReference' as a Boolean operand if there are two or more 'PICSReference's and it is not the first 'PICSReference'.
  inv: **MultiplePICS**:
  self.container().picsReference->size() < 2
  or self.container().picsReference->forAll(p |
  self.container().picsReference->at(0) = p
  or (not p.comment->isEmpty()
  and (p.comment->first().body = 'and'
  or p.comment->first().body = 'or')))

5.3.3 InitialConditions

Semantics

'InitialConditions' is an 'Element' containing an 'EventSequence' describing the initial conditions of a 'StructuredTestObjective'.

Generalizations

- Element