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| ETSI_logo_Office_Colour_Small | ***ToR STF XXX (TC MTS)*** |
| Version: 0.3 |
| Author: Andreas Ulrich – Date: 09 Oct 2013 |
| Last updated by: Firstname Lastname – Date: dd mmm yyyy |
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Terms of Reference - Specialist Task Force

STF XXX (TC MTS)

TDL Adaptation to Users

**Summary information**

|  |  |
| --- | --- |
| Approval status | Approved by TC MTS by remote consensus ending XX-Oct-2013 (**to be updated**)  To be approved by Board#XX (XX-XXX-2013) |
| Funding | 103,600 €  voluntary contribution 20% of total manpower |
| Time scale | Feb 2014 to Dec 2014 |
| Work Items | RES/ES 203 119-1 V1.2.1, DES/ ES 203 119-2 V1.1.1, DES/ ES 203 119-3 V1.1.1 |

Part I – Reason for proposing the STF

# Rationale

The process of stepwise development of tests from requirement specifications is well established and used in both, standardization and industry. This process is supported by methods and languages produced by TC MTS. The proposed STF contributes to the work of MTS on the continued development of the “Test Description Language” (TDL), which acts as an intermediator between TPLan for the specification of test purposes and TTCN-3 for the specification of test cases.

TDL bridges the gap between declarative test purpose specifications (what shall be tested?) and imperative test case specifications (how shall it be tested?) by offering a standardized language for the specification of test descriptions. Moreover, TDL contributes to the ongoing activities in MTS to establish model-based testing (MBT) technologies within ETSI.

It is expected that test descriptions in a standardized language ease the development of executable tests because tools can be built to analyze the correctness of test descriptions beforehand and enable their integration into test automation frameworks, e.g. based on TTCN-3. In addition, such test descriptions are easier to review by non-testing experts. All these prospective benefits will improve the general productivity and quality of test development in industry as well as in the standardization process.

STF 454 laid the foundation of TDL in 2013 in terms of the basic concepts and their semantics. It also experimented with various syntaxes to support the test description specification for projects such as 3GPP UE conformance testing and IMS interoperability testing.

This STF will build on the work of STF 454 as part of Phase II of TDL development within TC MTS. The purpose of this second phase is to add the necessary language functionality to better integrate TDL test descriptions into test automation frameworks. It will also elaborate a standardized concrete graphical syntax for end-users and a TDL exchange format to be used by tools to foster tool interoperability.

Phase III of TDL in 2015 will deal with the requirements for generating test descriptions from appropriate test models that are currently only handled by proprietary model-based testing tools requiring proprietary modelling notations.

# Objective

The final result of this STF will be the delivery of the final draft ETSI standard ES 203 119 (multi-part document) in December 2014 that contains:

* Part 1: An extension of the current TDL meta-model covering the design of new features to support automation of the generation of concrete (e.g. TTCN-3) tests;
* Part 2: The description of a graphical TDL default syntax that provides full coverage of the extended meta-model, i.e. it describes a concrete syntax for all elements of the meta-model;
* Part 3: The description of a TDL exchange format that represents a TDL specification in an unambiguous format used to exchange specifications between tools.

In addition, the STF will perform an analysis of the current needs and requirements at ETSI and 3GPP for a textual TDL language to support their test specification processes. The result of this analysis will potentially steer new activities within MTS. As a consequence of this analysis, there could be a request to extend this proposed STF in the second half of 2014 to work out the details of a TDL textual language.

# Relation with ETSI strategy and priorities

The proposed STF relates to the following aspects of the ETSI long term strategy and priorities:

* Keep ETSI effective, efficient and recognised as such
* Create high quality standards for global use and with low time-to-market.
* Stay in tune with changing nature of the global ICT industry (innovation)
* Establish leadership in key areas impacting members' future activities
* Engage in other industry sectors besides telecoms, (cross-sector ICT)
* Innovation in mature domains
* Emerging domains for ETSI
* Standards enablers/facilitators (conformance testing, interoperability, methodology)
* Horizontal activities (quality, security, etc.)

# Context of the proposal

## ETSI Members support

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| --- | --- | --- |
| **ETSI Member** | **Supporting delegate** | **Motivation** |
| Conformiq | Dr. Stephan Schulz | Over the past 10 years industrial testing practice has moved from a programmatic approach to higher level approaches. This work is critical for ETSI to remain at the forefront of testing methods & practice. It is critical to keep the current momentum of TDL specification process in MTS to ensure that the language will actually fill the gap it is trying to fill. Conformiq strongly supports this STF. |
| Elvior | Dr. Andres Kull | Elvior sees TDL as an easy-to-use formal notation for test descriptions that can fill the gap between model-based test design and manual scripting methods such as TTCN-3. TDL should be an easier alternative for those who see model-based and scripting based approaches as too much of a time investment. TDL should also be able to serve as an intermediary between generated test cases and their execution platform. |
| Ericsson | Dr. György Réthy | Over the past decade automated testing and in particular TTCN-3 has gained a major role in our software product development from functional testing to performance and robustness testing. However product development efficiency shall continuously be increased and time-to-market shall be shortened. This requires raising the abstraction level at which testers are working with their test cases and test execution results. Except increasing the efficiency of existing users of test automation technologies, the test description language (TDL) will also open the door to employ automated test systems for users not familiar with programming. Therefore, TDL is a key factor not only in technologies, like model-based testing (MBT), but also in “traditional” test case-based software development, market adaptation of software products and customer support. Ericsson strongly supports the request for this STF. |
| Fraunhofer FOKUS | Prof. Dr. Ina Schieferdecker | Fraunhofer FOKUS is actively involved in both the development of TTCN-3 and the UML Testing Profile. Fraunhofer FOKUS is highly interested to strengthen the methodological links of TDL with TTCN-3 and the UML Testing Profile in order to support interoperability between methods and tools and to prevent incompatible standards. Fraunhofer FOKUS strongly supports the request for this STF. |
| Siemens | Dr. Andreas Ulrich | Siemens endorses TDL as the way forward to establish model-driven software engineering methods in testing. Current model-based testing solutions that rely on elaborated system models often do not live up to their promises since in practice these models are hard to deliver and available tools frequently suffer from intrinsic problems of their generation algorithms. TDL offers a simpler approach by raising the abstraction of individual tests without the costs of system modelling. Based on experiences made with TTCN-3, TDL is a big step forward on the evolution path of test specification languages. It is expected to revive the tool market for a new generation of testing tools based on standards. Therefore Siemens strongly supports the request for this STF. |

**Motivation by CTI, Anthony Wiles**

CTI strongly supports this STF proposal. TDL offers a *standardized* approach for the systematic *design* of tests before they are coded in TTCN-3. With full tool support, this can lead to an increased efficiency and quality of test suites developed by ETSI STFs. Another benefit is that TDL can be used in applications where TTCN-3 may not be suitable or even needed, for example, as a precise format for the specification of interoperability tests.

## Market impact

The ETSI TTCN-3 standard has been in place for over ten years and can now be considered to be a very mature technology for the handling of test automation of very large software systems. Although TTCN-3 was designed with multiple representation formats in mind, only the textual representation is used in practice. On the other hand, UML has become the ubiquitous modelling notation replacing even well established technologies such as SDL or MSC. However, the imprecise semantics of UML leads to very different tool-dependent solutions, even when the same kind of modelling diagrams are used. This observation extends also to the UML Testing Profile.

TDL provides a precise notation and semantics for the task of specifying test descriptions for black-box tests of communicating and reactive systems. Black-box testing becomes the major testing approach since it offers good support for test-driven and agile software development processes that more and more replace traditional waterfall and iterative processes.

In the standardization of conformance test suites TDL offers a clear way forward from detailing test case specifications in TTCN-3 to the specification of more abstract test descriptions. Also, it enables the potential deployment of model-based testing methods in standardization. Once TDL has been set as a standard, it will have a tremendous impact on the way tests are designed and described in a broad range of application areas beyond telecommunications.

Subsequently:

* TC MTS believes that it is highly desirable to develop an established ETSI standard on a common Test Description Language to set the pace for the design of tests for current and future systems. If this work would be delayed, there is the danger that ETSI can lose the grip on the testing market;
* The penetration of ETSI’s TTCN-3 test language has reached a mature state and will not likely progress beyond the current scope of covered domains and applications, most of which are already mature. TDL will offer a clear way forward from that state to a model-driven design of tests;
* 3GPP has a large quantity of test specifications in prose (MS Word format) for 3G and 4G mobiles / UEs. The development of TDL will further provide a methodology for describing these tests and help develop better test standards for 3GPP UE interoperability.
* TDL allows industry to develop automated tests more efficiently and to apply test automation more widely. Leveraging TDL relieves the test engineer from working on details of test implementations and does not require him to use programming languages.

## Tasks that cannot be done within the TB and for which the STF support is necessary

The previous STF 454 was the very first STF to tackle the design of TDL. It created the foundation for TDL mainly in terms of a well-defined abstract syntax (meta-model) and exemplified application of suggested concrete syntaxes in the context of 3GPP. Besides, further efforts are required to boost the TDL standardisation effort in order to create a high impact on the testing community.

The mix of expertise needed for language development is not commonly available in standardization bodies or from industrial members; though such knowledge is available from academic partners, i.e. research institutes and universities that are not in the position of financing voluntary contributions to the development and maintenance of a specification language.

In addition, the character of work may require the development of tool prototypes to validate the proposed concepts. Such developments require expertise and skills not generally available within the TB.

The design of a new modelling language is a laborious activity, in particular when it needs to cover the different requirements within a standardisation process and common use in industry. In particular the creation and design of the TDL default concrete syntax requires close interactions with CTI and other experts at ETSI to ensure the acceptance of TDL by its future users.

## Related voluntary activities in the TB

A steering group within MTS was created already for controlling the preceding STF 454 and will still be active to control the progress of the new STF and provide guidance. Besides this activity, additional efforts will be spent to validate the new concepts and features of TDL in the context of the individual partners’ work environment.

Other funded activities within the proposed STF will contain 20% of voluntary efforts to meet ETSI’s STF funding guidelines.

## Outcome from previous funded activities in the same domain

The previous STF 454 laid the foundation of TDL by defining the concepts in terms of the abstract syntax, i.e. the meta-model, and the semantics of the various language elements. It also demonstrated how TDL could be applied to the domain of 3GPP for the specification of user equipment conformance test descriptions. Moreover, validation activities within the STF, mainly the creation of TDL editors using different technologies, showed that the suggested design of TDL is feasible and delivers the requested support for the manual specification of tests.

## Consequences if not agreed

Establishing this STF as a continuation of STF 454 will speed up progress in the standardization efforts on TDL. Without this STF, the application of the TDL standard by end users would be delayed. Users will continue with their largely informal solutions that are mainly designed ad-hoc and thus, without proper tool support, tend to be error-prone and expensive.

Other standardization bodies, notably OMG, will continue their activities that might gain popularity over the TDL solution and might not be in ETSI’s interests and needs for describing conformance and interoperability test suites. Moreover, ETSI would lose influence in the area of model-driven engineering.

Part II - Execution of the work

# Technical Bodies and other Organizations involved

## Leading TB

The work of this STF is embedded within the ETSI TB MTS.

## Other interested ETSI Technical Bodies

Similar to the maintenance of the TTCN-3 standards, the following ETSI TBs are expected to contribute to the STF by providing feedback on the developed TDL methodology: 3GPP, INT, ITS, ERM.

## Other interested Organizations outside ETSI

The following organizations are expected to be interested in the outcome from this STF: OMA, TCCA (former TETRA Association), oneM2M, IPv6Forum.

Moreover, the automotive industry took already initiative in providing solutions for their specific needs of hardware-in-the-loop testing. These initiatives should be also interested in the results of the proposed ETSI STF.

The ITEA research project “Combined Methods for Analysis and Testing (MBAT)” brings together academia and industry from the transportation domain (automotive/avionics/rail) to work on a so-called reference technology platform intended to support, among other things, testing activities across the different transportation domains. Therefore the provision of platform-independent test descriptions is one of the key issues; <http://www.mbat-artemis.eu/home/>.

# Working method/approach

## Organization of the work

The goal of this STF is to enhance the existing ETSI standard on the “Test Description Language (TDL)”. Therefore the work is organized around the usual stages of developing standards, i.e. delivery of an early draft, stable draft, and final draft that are defined as milestones M1–M4 below. The STF consists of just one single phase of development.

Once draft versions of the TDL standard become available, they will be sent out to ETSI MTS and parties outside of ETSI for review and feedback. Since there are two milestones M1 and M2 foreseen to solicit feedback, there is sufficient room for delivering an enhanced and improved TDL standard that fits the needs of different organizations and users.

The TDL standard ES 203 119 will be enhanced by breaking it up into following parts that are handled by individual tasks.

* Task 1 on ES 203 119-1: General TDL concepts, TDL meta-model (abstract syntax) and its semantics;
* Task 2 on ES 203 119-2: TDL graphical syntax;
* Task 3 on ES 203 119-3: TDL exchange format;
* Task 4 on the analysis of ETSI’s and 3GPP’s needs for a textual (including tabular) TDL concrete syntax and their requirements.

Effort estimation for the various tasks of the STF is centred around the number of sessions that can be organized within the timeframe of this STF and the number of experts involved in each task: assumption of 6 sessions within 10 months; each task is accomplished by 2 experts.

In addition, the proposed STF is controlled by a dedicated steering group.

Note, the outcome of Task 4 will be taken as the basis for decision at MTS to start implementation work of a standardized TDL textual syntax. If agreed, an extension of this STF will be considered, which will result in an additional request for funding. The MTS will deliver this request to the Board for consideration at the second phase of budget allocation in 2014 in due time.

## Base documents

|  |  |  |  |
| --- | --- | --- | --- |
| **Document** | **Title** | **Current Status** | **Expected date for stable document** |
| ETSI ES 201 873-1 V4.5.1 | Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 1: TTCN-3 Core Language | Published |  |
| ETSI ES 202 553 V1.2.1 | Methods for Testing and Specification (MTS); TPLan: A notation for expressing Test Purposes | Published |  |
| ETSI ES 202 951 V1.1.1 | Methods for Testing and Specification (MTS); Model-Based Testing (MBT); Requirements for Modelling Notations | Published |  |
| ETSI ES 203 119 V0.0.3 | Methods for Testing and Specification (MTS); Model-Based Testing (MBT); Test Description Language | Stable Draft |  |

## Deliverables

|  |  |  |
| --- | --- | --- |
| **Deliv.** | **Work Item code**  **Standard number** | **Working title**  **Scope** |
| D1 | RES/ES 203 119-1 V1.2.1 | Test Description Language; Meta-Model and Semantics  Scope: common concepts, meta-model, semantics |
| D2 | DES/ ES 203 119-2 V1.1.1 | Test Description Language; Graphical Syntax  Scope: TDL graphical concrete syntax for end users |
| D3 | DES/ ES 203 119-3 V1.1.1 | Test Description Language; Exchange Format  Scope: TDL exchange format for tool interoperability |

## Deliverables schedule:

RES/ES 203 119-1 Test Description Language (TDL), Meta-Model and Semantics

* Start of work 01-Feb-2014
* Early draft 01-May-2014 MTS#62
* Stable draft 01-Sep-2014 MTS#63
* Final draft 31-Dec-2014
* TB approval 31-Jan-2015 MTS#64
* Publication 01-Mar-2015

DES/ ES 203 119-2 Test Description Language (TDL), Graphical Syntax

* Start of work 01-Feb-2014
* Early draft 01-May-2014 MTS#62
* Stable draft 01-Sep-2014 MTS#63
* Final draft 31-Dec-2014
* TB approval 31-Jan-2015 MTS#64
* Publication 01-Mar-2015

DES/ ES 203 119-3 Test Description Language (TDL), Exchange Format

* Start of work 01-May-2014
* Early draft 01-Sep-2014 MTS#63
* Final draft 31-Dec-2014
* TB approval 31-Jan-2015 MTS#64
* Publication 01-Mar-2015

## Work plan, time scale and resources

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **N** | **Task / Milestone / Deliverable** | From | To | Funded experts (days) | CTI experts (days) |
| M0 | Start of work | 01-Feb-2014 | |  |  |
| T0 | Project management | 01-Feb-2014 | 31-Dec-2014 | 6 |  |
| T1 | Task 1: Extended TDL meta-model | 01-Feb-2014 | 31-Dec-2014 | 60 | 5 |
| T2 | Task 2: TDL graphical syntax | 01-Feb-2014 | 31-Dec-2014 | 84 | 10 |
| T4 | Task 4: Analysis TDL textual syntax | 01-Feb-2014 | 01-May-2014 | 10 | 5 |
| M1 | Early draft for review | 01-May-2014 | |  |  |
| T3 | Task 3: TDL exchange format | 01-May-2014 | 31-Dec-2014 | 48 | 5 |
| M2 | Stable draft for review | 01-Sep-2014 | |  |  |
| M3 | Final draft for TB approval & final report | 31-Dec-2014 | |  |  |
| M4 | Publication | 01-Mar-2015 | |  |  |
| **Total** | | | | **208** | **25** |

## Task and milestone description

Task 0 – Project management

**Activities**:

* Planning, organisation, and preparation of STF meetings;
* Ongoing reporting;
* Participation at SG and TC meetings;
* Delivery of the STF final report.

**Efforts estimation**: 6 days, i.e. 2 days per milestone M1—M3 for the STF lead

Task 1 – Extended TDL meta-model

**Activities**:

* Identification of the parts of the current meta-model that need to be extended to support integrating TDL into test automation frameworks, for example,
* Expression languages for guard expressions, time constraints, user-defined data,
* Introduction of variables,
* Refinement of actions;
* Maintenance of the meta-model according to feedback received from early adaptors, e.g.,
* Specification of sub test configurations,
* Support for arrays of data types and component and gate types,
* Support for concurrent interactions (aka co-regions in MSC);
* Validation of the new and updated concepts.

**Efforts estimation**: 60 + 5 PD; 6 sessions at 4 days + 1 day homework per session for 2 experts + CTI support.

Task 2 – TDL graphical syntax

**Activities**:

* Solicitation of requirements from an end user’s perspective on a TDL graphical syntax;
* Analysis of existing approaches for graphical syntax definitions such as OMG’s Diagram Definition;
* Definition of a graphical representation of each meta-model element;
* Definition of the mapping of the graphical syntax element to/from the meta-model element.

**Efforts estimation**: 84 + 10 PD; 6 sessions at 4 days + 3 days homework per session for 2 experts + CTI support.

Task 3 – TDL exchange format

**Activities**:

* Analysis of existing approaches for exchange formats such as OMG’s Test Information Interchange Format;
* Definition of an exchange format for each TDL meta-model element;
* Definition of the mapping of the exchange format element to/from the meta-model element

**Efforts estimation**: 48 + 5 PD; 4 sessions at 4 days + 2 days homework per session for 2 experts + CTI support.

Task 4 – Analysis TDL textual syntax

**Activities**:

* Solicitation of end-user requirements on a potential TDL textual or tabular language from various technical bodies;
* Collecting and categorising these end-user requirements;
* Work out of a decision paper for MTS#62 to decide on a TDL textual language.

**Efforts estimation**: 10 + 5 days; 5 days for 2 experts + CTI support.

Milestone 1 – Early draft for review

* Delivery of the early draft on Part 1: TDL meta-model and semantics that addresses all needed extensions w.r.t. automation;
* Delivery of the early draft on Part 2: TDL graphical syntax that covers a majority of meta-model elements;
* Delivery of the analysis report on the ETSI’s needs for a TDL textual syntax.

Milestone 2 – Stable draft for review

* Delivery of the stable draft on Part 1: TDL meta-model and semantics that addresses all needed extensions and improves their semantics description.
* Delivery of the stable draft on Part 2: TDL graphical syntax that covers all meta-model elements and an initial mapping between concrete syntax elements and meta-model.
* Delivery of the early draft on Part 3: TDL exchange format that covers all meta-model elements and an initial mapping between concrete syntax elements and meta-model.

Milestone 3 – Final draft for TB approval & STF Final Report

* Delivery of the final draft on Part 1: TDL meta-model and semantics with complete contents.
* Delivery of the final draft on Part 2: TDL graphical syntax with complete contents.
* Delivery of the final draft on Part 3: TDL exchange format with complete contents.
* Delivery of the STF final report that summarises the achievements and discusses the agreed key performance indicators. This milestone concludes the work of this STF.

Milestone 4 – Publication

Publication of the updated and extended ETSI Standard on TDL.

# Required expertise

Up to 4 experts to ensure the following mix of skills:

* Deep understanding of black-box testing and of testing communicating real-time systems;
* Experiences in modelling and description techniques such as TTCN-3, UML, MSC;
* Experiences in UML meta-modelling;
* Experiences in the design of software languages and compiler/transformation techniques, including model-transformation techniques.

Part III: Financial conditions

# Estimated cost

## Manpower cost

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| --- | --- | --- | --- |
| **Description** | **Working days** | **Rate €/day** | **Total cost  €** |
| Contracted experts (remunerated) | 166 | 600 | 99600 |
| Contracted experts (voluntary, 20% from total) | 42 | 0 | 0 |
| CTI staff (voluntary) | 25 | 0 | 0 |
| **Total manpower cost** | **233** |  | **99600** |

## Travel Costs

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| --- | --- |
| **Description** | **Cost estimate** |
| Attending MTS plenary meetings (3 travels within Europe to MTS#62, #63, #64) | 3000 € |
| Presentation at UCAAT 2014 or a related conference (1 travel within Europe) | 1000 € |
| **Total cost** | **4000 €** |

## Other Costs

– none –

Part IV: STF performance evaluation criteria

# Key Performance Indicators

In the course of the project, the STF lead will collect the relevant data necessary to calculate the performance indicators used to evaluate the outcome of the STF. The results will be presented in the Final Report. The following indicators will be used:

**Interests of ETSI and non-ETSI stakeholders**

* Voluntary work of experts directly involved in the STF or outside the STF
* Presentations to other ETSI TBs
* Contributions received from other ETSI TBs
* Contributions presented to TB MTS meetings (number, type, comments received)
* Presentations in workshops, conferences, stakeholder meetings (outside ETSI)
* Comments received on drafts (e.g. from personal communication, mailing lists, etc.)

**Quality of the STF results**

* Availability of a TDL reference implementation featuring major TDL concepts
* Application of the ETSI drafting rules
* Approval of deliverables according to schedule
* Respect of time scale, with reference to start/end dates in the approved ToR

# Document history

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| --- | --- | --- | --- | --- |
|  | **Date** | **Author** | **Status** | **Comments** |
| 0.1 | 07-Oct-2013 | A. Ulrich | Initial | Creation of document |
| 0.2 | 08-Oct-2013 | A. Ulrich | Update | Incorporation of first feedback received |
| 0.3 | 09-Oct-2013 | A. Ulrich | MTS approval | Ready for submission |