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| ETSI_logo_Office_Colour_Small | ***STF 522 - Final Report for*** ***ETSI - EC/EFTA*** |
| **Grant agreement** | **Author:**  | ETSI |
| EC |  | **Date:**  | 23-01-2018  |
| EFTA |   | **Version** | 1.0  |
| **Doc**  |   | Page 1 of 9 |

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| **STF** | **522** |  | **STF leader** | Philip Makedonski |
| **TB/WG** | **MTS** |  | **TB responsible** | Emmanuelle Chaulot-Talmon |
|  |  |  | **STF Assistant** | Elodie Rouveroux |

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| **STF title:** |  A standardized mapping to facilitate the automatic generation of TTCN-3 code from TDL descriptions |

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| **Milestone** | **D** |  | **Status** | **Covers the period until (cut-off date)** | 29/01/2018 |
|   |
| **Objective** | Final Report and all deliverables required in the ToR approved by MTS#73 (Jan 2018). The draft documents must be uploaded on the MTS contributions area at least one week before the start of the meeting. |
| **Achieved** | Yes |  |
| **Remarks** |   |

**Achieved dates**

|  |  |  |
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| **Template** | **Draft report** | **ETSI approval** |
|  12-Jan-2018 | 23-Jan-2018  |   |

**Activities carried out by the STF in the period** **from 29/09/2017 to 29/01/2018**

# Executive summary

* This progress report covers the entire work of STF 522 spanning the period between 16-Jan-2017 and 29-Jan-2018. This period concludes the submission of the completed deliverables defined for Milestone D.
* STF 522 continued the work of STF 454, 476, and 492, implementing Phase 4 of the development of TDL at ETSI MTS.
* The work of STF 522 was done during two working sessions, accompanied by coordinated homework among the experts and technical discussions with the established steering group, which provided technical guidance.
* The work of STF 522 was main driving force for the TDL Open Source Project launch event at UCAAT 2017. Further dissemination activities have been performed by the experts and their respective organizations.
* The final deliverables have been submitted to the attention of TC MTS for approval at MTS#73.

# Introduction

This progress report covers the entire work of STF 522, done in the period between 16-Jan-2017 and 29-Jan-2018. This period concludes the submission of the deliverables defined for Milestone D. The work was done primarily during two working sessions at the University of Göttingen, accompanied by coordinated homework among the experts and technical discussions with the established steering group

## Scope, major aims of the STF work

The ToR defines the final result of this STF as the delivery of the final drafts of the multi-part ETSI standard ES 203 119 comprising:

* ES 203 119-1 V1.4.1 Test Description Language; Meta-Model and Semantics

Scope: common concepts, meta-model, semantics

* ES 203 119-2 V1.3.1 Test Description Language; Graphical Syntax

Scope: TDL graphical concrete syntax for end users

* ES 203 119-3 V1.3.1 Test Description Language; Exchange Format

Scope: TDL exchange format for tool interoperability

* ES 203 119-4 V1.3.1 Test Description Language; Structured Test Objective Specification

Scope: TDL extension for structured test objectives

* ES 203 119-5 V1.1.1 Test Description Language; UML profile for TDL

Scope: TDL to UML meta-model mapping

* ES 203 119-6 V1.1.1 Test Description Language; Mapping of TDL to TTCN-3

Scope: Mapping rules to automatically generate TTCN-3 test case skeletons from TDL test descriptions

* MTS-1029504TDLSecPerfReq TDL and its usage for security and performance testing; consolidated requirements (technical report) – cancelled during MTS#72 due to insufficient input from related TBs
* ES 203 119-7 V1.1.1 Test Description Language; Extended Test Configurations

Scope: Extensions to support the re-use of existing test configurations in TDL (new WI, originally defined as part of ES 203 119-1 V1.4.1

## STF activity and expected output

STF 522 contributes to the work of TC MTS on the development of the “Test Description Language” (TDL), which acts as an intermediary between test purpose specification with TPLan and test case specification and implementation with TTCN-3. The STF contributes to the ongoing activities in TC MTS to establish model-based testing (MBT) technologies within ETSI.

Building on the work of STF 454, 476, and 492, STF 522 covers Phase 4 of the development of TDL at ETSI MTS focusing on a standardised mapping to TTCN-3.

STF 522 targeted acceleration of the adoption of TDL by providing a standardised mapping to the test specification and implementation language TTCN-3, also standardised and widely used at ETSI, in order to lower the barrier to entry for both users and tool vendors in adopting TDL. STF 522 contributed to the public launch of the TDL Open Source Project at UCAAT 2017, another significant milestone in the development of TDL

## Relation with the reference TB and with other bodies, inside and outside ETSI

Guiding the development of TDL within the STF, the TC MTS set up a dedicated Steering Group to review intermediate results and provide recommendations for further development. In addition, several informal meetings of the STF with members of ITS, oneM2M, and 3GPP provided feedback from potential end-users of TDL. During the TDL Open Source Project launch at UCAAT 2017, feedback was gathered from various stakeholders inside and outside ETSI expressing interest in TDL.

# Overview of the organization of the activity

## Team composition and experts’ qualification

* Gusztav Adamis, Ericsson Hungary Ltd, gusztav.adamis@ericsson.com:
Expert in TTCN-3, SDL, MSC, UML, test automation.
* Martti Käärik, OU Elvior, martti.kaarik@elvior.com:
Expert in TTCN-3, modelling, model-based testing, testing and test design tooling.
* Finn Kristoffersen, Cinderella Aps, finn@cinderella.dk:
Expert on TTCN-3, tooling implementation, testing.
* Philip Makedonski, Institut für Informatik, University of Göttingen, makedonski@informatik.uni-goettingen.de:
Expert on meta-modelling, tooling, language design.
* György Réthy, Ericsson Hungary Ltd, gyorgy.rethy@ericsson.com:
Expert on TTCN-3, SDL, MSC, testing, test automation.

## STF teamwork, distribution of tasks, working methods

* Gusztav Adamis:
Rapporteur for ES 203-119-2, ES 203-119-5, ES 203-119-6, working on mapping of TDL to TTCN-3, maintenance and extension of ES 203-119-1, maintenance and extension of ES 203-119-1 and ES 203-119-1.
* Martti Käärik:
Rapporteur for ES 203-119-1, working on mapping of TDL to TTCN-3, maintenance and extension of ES 203-119-1 and ES 203-119-2 with new features for collections and procedure-based communication.
* Finn Kristoffersen:
Working on the requirements for the application of TDL in security and performance testing; (technical report), features for the support of extended test configurations (ES 209-119-7), mapping of TDL to TTCN-3.
* Philip Makedonski:
STF leader, rapporteur for ES 203-119-3, ES 203-119-4, ES 203-119-7, working on mapping of TDL to TTCN-3, maintenance and extension of ES 203-119-1, ES 203-119-3, ES 203-119-4.
* György Réthy:
Working on the requirements for the application of TDL in security and performance testing; (technical report).

The main working method used in the STF was group work. Sub-teams were created to prepare initial material for the individual tasks. Preliminary results from the work of the STF team members were presented, discussed, and iteratively refined within the whole team. Conference calls were organised between working sessions to discuss progress and coordinate work on interdependent tasks.

## Liaison with the reference TB and/or the Steering Group

To guide the development of TDL within the STF, a Steering Group was set up with members from MTS. The SG reviewed the intermediate results from the STF and gave recommendations for further development. There were seven joint coordination meetings between the STF and the SG as follows:

* 2017-01-25, preparatory discussion at MTS#70
* 2017-02-28, SG#1, conference call
* 2017-05-12, SG#2, conference call
* 2017-05-31, progress report and discussion at MTS#71
* 2017-09-07, SG#3, conference call
* 2017-09-26, progress report and discussion at MTS#72
* 2017-11-24, SG#4, conference call

## Meetings attended on behalf of the STF with the reference TB and other ETSI TBs

**2017-01-25/26, MTS#70, Berlin**

Participants: Makedonski, Käärik (remote), Adamis (remote), Kristoffersen (remote), Réthy

Main results:

* Preparatory discussion at MTS#70, due to administrative delays the start of work was pushed to January 2017, updated planning, discussion of scope and tasks with MTS and the TDL SG

**2017-05-31/06-01, MTS#71, Sophia-Antipolis**

Participants: Makedonski (remote), Käärik, Adamis (remote), Kristoffersen (remote), Réthy (remote)

Participants: Makedonski, Käärik (remote), Adamis (remote), Zeitoun (remote), Kristoffersen (remote)

Main results:

* Report on the progress of STF 522
* Drafts for Milestone B approved
* Scope, materials, and planning of the TDL Open Source Project launch event discussed.

**2017-09-26/27, MTS#72, Göttingen**

Participants: Makedonski, Käärik (remote), Adamis (remote), Kristoffersen (remote), Réthy

Main results:

* Report on the progress of STF 522
* Drafts for Milestone C approved
* Preparation and coordination for the TDL Open Source Project launch event.

**2018-01-23/24, MTS#73, Munich**

Participants: Makedonski, Käärik, Adamis (remote), Kristoffersen (remote), Réthy (remote)

Main results:

* Final report on the progress of STF 522
* Drafts for Milestone D approved
* Discussion of feedback from the TDL Open Source Project launch event at UCAAT 2017, the TDL webinar, as well as other promotion activities
* Discussion of future activities related to TDL

## STF communications, presentations, promotion, inside and outside ETSI, WEB pages etc

The results of the STF were presented in a detailed tutorial and an additional presentation at the ETSI User Conference on Advanced Automated Testing (UCAAT) 2017 in Berlin as part of the TDL Open Source Project launch event, addressing a large number of potential users for TDL both in- and outside of ETSI. During the event multiple speakers from different organisations showcased different perspectives on TDL from initial trials. Demos and further discussions during the coffee and lunch breaks further reinforced the presence of TDL at the event. Interest from different domains and organisations was expressed at the event and important connections with interested parties were established during the conference. The official TDL website was extended with a dedicated section for the TDL Open Source Project. A proposal for an additional website describing the work of the STF has been sent for to the ETSI secretariat for publishing at the ETSI portal. An article on TDL by the STF members and other co-authors was submitted for a special issue of the Software Quality Journal and is currently undergoing review. An article has been submitted for the next edition of The Standard. A keynote by a Steering Group member has been presented at the International Conference on Testing Systems and Software (ICTSS) 2017.

# Final status of the activity

## Overview of the STF work

The work of the STF resulted in the delivery of the Final Drafts of the multipart ES 203 119 "Methods for Testing and Specification (MTS); The Test Description Language (TDL);" including:

* ES 203 119-1 TDL Part 1: An adaptation of the current TDL meta-model including new features for the specification of collection data types and instances, procedure-based communication, as well as adaptations necessary for the mapping of TDL to TTCN-3 and other refinements;
* ES 203 119-2 TDL Part 2: An adaptation of the TDL graphical syntax according to the changes in Part 1;
* ES 203 119-3 TDL Part 3: An adaptation of the TDL exchange format specification according to the changes in Part 1 as well as support for the new features defined in Part 7;
* ES 203 119-4 TDL Part 4: An adaptation and extension of the capabilities for structured test objective specification to reflect changes in Part 1;
* ES 203 119-5 TDL Part 5: Extraction of the UML profile for TDL (previously included as Annex C of Part 1) into a separate document for easier maintenance and differentiated compliance;
* ES 203 119-6 TDL Part 6: A new document specifying a standardised mapping of TDL to TTCN-3;.
* ES 203 119-7 TDL Part 7: A new document specifying an extension to TDL adding features to support the reuse of existing test configurations within extended test configurations (previously defined as part of Part 1).

The STF supported the transition of the reference implementation of TDL developed within STF 492 to an open source project as well as related promotional activities.

## Technical risk, difficulties encountered and corrective actions taken

The following risks have been identified as potential difficulties for the progress of the work of the STF::

**Task (inter-) dependencies may create bottlenecks for the work of the STF**

Due to the parallel and distributed work on multiple deliverables across multiple experts, dependencies among individual activities may create hindrances for the progress of the STF.

Severity: Medium, Likelihood: Low

Mitigation strategies:

* Limit dependencies between activities where possible.
* Make dependencies explicit where these are inevitable in order to raise awareness, as well as monitor and control potential implications.
* Ensure communication and collaboration among experts working on inter-dependent tasks.
* Reassign experts where applicable in order to accelerate progress of delayed activities and eliminate bottlenecks in a timely manner.

**Misunderstandings and communication barriers hinder progress**

Misunderstandings and communication issues during discussions and individual work may negatively impact the progress of the STF work.

Severity: Medium, Likelihood: Medium

Mitigation strategies:

* Moderation and awareness – recognize and differentiate between misunderstandings, where clarification is needed, and technical disagreements, where different solutions are proposed.
* Emphasis on facts, substantiated and illustrated with examples, and written input and output of discussions, which describes ideas, problems, and solutions in sufficient detail, and can be referenced to in subsequent discussions.
* Identify fundamental differences in alternative proposals and their impact in order to establish a baseline for discussions, rather focusing discussions on superficial and non-essential differences.
* Communicate and resolve persistent issues and disagreements with the help of the steering group.

**Misalignment of expectations towards the STF and the output of the STF**

Due to potentially unrealistic or misaligned expectations towards the STF from different stakeholders, the output of the STF may not be able to meet these expectations.

Severity: Medium, Likelihood: Medium

Mitigation strategies:

* A steering group has been established to provide technical guidance and mediate technical disagreements.
* Frequent reporting and technical discussions with the steering group and TC MTS ensure that the work of the STF is aligned with its expectations. The STF has an opportunity to communicate any expectations that are perceived to be unrealistic back to the steering group and TC MTS.
* Concrete examples are prepared to support technical discussions and ensure alignment of expectations

**Insufficient stakeholders and/or insufficient requirements for Task 4**

Due to potentially insufficient number of stakeholders interested in using TDL for security and performance testing within ETSI, or inability to gather sufficiently detailed requirements from the available stakeholders, the progress and output on Task 4 may be compromised.

Severity: Medium, Likelihood: Happened

Mitigation strategies:

* A discussion within MTS shall provide guidance on how to proceed based on the current information. A decision is needed on whether further potential stakeholders shall be approached or whether the resources allocated to Task 4 shall be re-allocated to other tasks.
* Based on the current information, it was decided at MTS#72 to stop the current activities on Task 4 within STF 522 and re-allocate the remaining resources to Task 1 which proved to be more demanding that originally estimated. Subsequent activities related to Task 4 may be pursued within future initiatives related to TDL. Initial feedback at UCAAT 2017 provided new insights which may be taken into consideration when defining future activities related to Task 4.

## Lessons learnt

Based on the experiences with the STF and especially with respect to the identified the following observations and recommendations can be made:

* Dependencies among tasks can prove to be critical to the progress of the work. Delays with tasks on which other activities depend can negatively impact the progress and the quality of the work. It is recommended that important dependencies between tasks are formally taken into account during STF milestone planning and put right into the Terms of Reference.
* Expectations towards the output of the STF need to be kept in alignment the SG and other stakeholders in a timely manner. Issues raised late put unnecessary pressure on all parties involved and there may be no resources left to address them properly.

# ETSI deliverables

|  |  |
| --- | --- |
| Deliverable: RES/MTS-203119-1v1.4.1 (ES 203 119-1)Current status: Final draft for approvalWorking title: Methods for Testing and Specification (MTS); Test Description Language Meta-Model and Semantics | **Achieved date** |
| Creation of WI by WG/TB | 2016-04-13 |
| TB adoption of WI | 2016-05-03 |
| Start of work | 2017-01-16 |
| Early draft | 2017-05-16 |
| Stable draft | 2017-09-15 |
| Final draft for approval | 2017-12-15 |
| TB approval | 2018-01-24 |
| Draft receipt by ETSI Secretariat |  |
| Publication |  |
| Deliverable: DES/MTS-203119-2v1.3.1 (ES 203 119-2)Current status: Final draft for approvalWorking title: Methods for Testing and Specification (MTS); Test Description Language Graphical Syntax | **Achieved date** |
| Creation of WI by WG/TB | 2016-10-04 |
| TB adoption of WI | 2016-10-04 |
| Start of work | 2017-01-16 |
| Early draft |  |
| Stable draft | 2017-09-15 |
| Final draft for approval | 2017-12-15 |
| TB approval | 2018-01-24 |
| Draft receipt by ETSI Secretariat |  |
| Publication |  |
| Deliverable: DES/MTS-203119-3v1.3.1 (ES 203 119-3)Current status: Final draft for approvalWorking title: Methods for Testing and Specification (MTS); Test Description Language Exchange Format | **Achieved date** |
| Creation of WI by WG/TB | 2016-10-04 |
| TB adoption of WI | 2016-10-04 |
| Start of work | 2017-01-16 |
| Early draft |  |
| Stable draft | 2017-09-18 |
| Final draft for approval | 2017-12-16 |
| TB approval | 2018-01-24 |
| Draft receipt by ETSI Secretariat |  |
| Publication |  |
| Deliverable: DES/MTS-203119-4v1.3.1 (ES 203 119-4)Current status: Final draft for approvalWorking title: Methods for Testing and Specification (MTS) Test Description Language Extensions: Structured Test Objective Specification | **Achieved date** |
| Creation of WI by WG/TB | 2016-10-04 |
| TB adoption of WI | 2016-10-04 |
| Start of work | 2017-01-16 |
| Early draft |  |
| Stable draft | 2017-09-18 |
| Final draft for approval | 2017-12-15 |
| TB approval | 2018-01-24 |
| Draft receipt by ETSI Secretariat |  |
| Publication |  |
| Deliverable: DES/MTS-203119-5v1.1.1 (ES 203 119-5)Current status: Final draft for approvalWorking title: Methods for Testing and Specification (MTS) Test Description Language Extensions: UML Profile for TDL | **Achieved date** |
| Creation of WI by WG/TB | 2016-04-13 |
| TB adoption of WI | 2016-04-13 |
| Start of work | 2017-01-16 |
| Early draft | 2017-05-16 |
| Stable draft |  |
| Final draft for approval | 2017-12-16 |
| TB approval | 2018-01-24 |
| Draft receipt by ETSI Secretariat |  |
| Publication |  |
| Deliverable: DES/MTS-203119-6v1.1.1 (ES 203 119-6)Current status: Final draft for approvalWorking title: Methods for Testing and Specification (MTS) Test Description Language: Mapping to TTCN-3 | **Achieved date** |
| Creation of WI by WG/TB | 2016-04-13 |
| TB adoption of WI | 2016-05-03 |
| Start of work | 2017-01-16 |
| Early draft | 2017-05-16 |
| Stable draft | 2017-09-15 |
| Final draft for approval | 2017-12-15 |
| TB approval | 2018-01-24 |
| Draft receipt by ETSI Secretariat |  |
| Publication |  |
| Deliverable: DES/MTS-203119-7v1.1.1 (ES 203 119-7)Current status: Final draft for approval (previously as annex in Part 1)Working title: Methods for Testing and Specification (MTS) Test Description Language Extensions: Extended Test Configurations | **Achieved date** |
| Creation of WI by WG/TB | 2018-01-22 |
| TB adoption of WI | 2018-01-24 |
| Start of work | 2018-01-24 |
| Early draft | 2018-01-24 |
| Stable draft | 2018-01-24 |
| Final draft for approval | 2018-01-29 |
| TB approval | 2018-02-12 |
| Draft receipt by ETSI Secretariat |  |
| Publication |  |

1. Performance indicators
	1. Performance Indicators objectives achieved

The work of the STF had an impact on the performance indicators agreed within the ToR in the following way:

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

* **Voluntary work of experts directly involved in the STF or outside the STF:**Experts spent additional resources on a voluntary basis in order to ensure the progress and promotion of the work and address issues that need further clarification or input from external stakeholders. Additionally experts from MTS participated in the Steering Group for this STF.
* **Presentations to other ETSI TBs:**There were no formal presentations of the STF given to other TBs. Instead, potential users of TDL, such as 3GPP, ITS and oneM2M, were met on an informal basis to discuss with them their specific requirements.
* **Contributions received from other ETSI TBs:**The STF analysed contributions in terms of technical specifications from 3GPP RAN5, IMS, IPv6, ITS, oneM2M and others as input to the work on TDL and its mapping to TTCN-3.
* **Contributions presented to TB MTS meetings:**The STF reported regularly to MTS and also the SG its progress in the project and discussed acute issues.
* **Presentations in workshops, conferences, stakeholder meetings (outside ETSI):**A tutorial and a presentation were prepared as part of the TDL Open Source Project launch event at the ETSI UCAAT conference, in Berlin, October 2017. Feedback was received from various interested parties attending the conference, both from industry, standardisation, and academia. A keynote on TDL was presented at ICTSS in St. Petersburg, October 2017 (coinciding with the launch event for the TDL Open Source Project).
* **Comments received on drafts (e.g. from personal communication, mailing lists, etc.):**There was an extensive exchange of ideas, recommendations etc. between the STF and the MTS SG.
* **Potential interest of new members to join ETSI:**The work of MTS in general is attractive also outside of ETSI, multiple participants at the ETSI UCAAT 2017 expressed interest in contributing towards the work of MTS in general and the work on TDL in particular during discussions at the event.
* **Liaison to identify requirements and raise awareness on ETSI deliverables:**Informal discussions with interested stakeholders and related projects and activities of the STF members have contributed to raising awareness about the work on TDL.

**Quality of the STF results**

* **Application of the ETSI drafting rules:**Drafting rules were followed.
* **Approval of deliverables according to schedule:**All deliverables were submitted mostly in time, with minor delays for some additional polish and are in the process of receiving approval.
* **Respect of time scale, with reference to start/end dates in the approved ToR:**The timeframe of the ToR was followed, the overall timespan of the project was reduced to mitigate the impact of administrative delays.
	1. Performance Indicators objectives not achieved

This section does not apply since all performance indicators were achieved at various levels.