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| ***STF 577 - Final Report for ETSI*** |
| **Presented to ETSI meeting** |  |  | **Author:** | Mr. Philip Makedonski |
|   |   |   | **Date:** | 16/04/2020 |
| **Doc ref** |  |   | **Version** |   |
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|  |  |  |  |  |  |
| **STF** | **577** |   | **STF leader** | Mr. Philip Makedonski |
| **TB/WG** | **MTS** |   | **TB responsible** | Mr. Dirk Tepelmann |
|  |  |   | **Administrator** | Ms. Elodie Rouveroux |
|  |  |  |  |  |  |
| **STF title:** | TDL and TOP Enhancements and Maintenance |
|  |  |  |  |  |  |
| **Milestone** | **B** |  | **Status** | **Covers the period until (cut-off date)** | 15/05/2020 |
|  **Template** |
| **Objective** | Tasks 1, 2, and 3 completed.All deliverables on TDL and TOP, including user guide, are in their final drafts to be approved by MTS#80 TOP is updated to the latest versions (source code, documentation) and ready to use. All open CRs are closed or postponed with justification. STF Final Report to be approved by MTS#80. |
| **Achieved** | Yes/No | *Indicate whether the objective has been achieved* |
| *If the objective is not achieved, give a short explanation in the “remarks”* |
| **Remarks** |   |
|  |  |  |  |  |  |
| **Achieved dates** |  |  |  |  |  |
| **Template** | **Draft report** | **TB approval** | **ETSI approval** |  |  |
| 16/04/2020 |   |   |   |   |   |

# Executive summary

* This progress report covers the work of STF 577 on reaching Milestone B, done in the period between 01-Oct-2019 and 15-May-2020. This period concludes the submission of the deliverables defined for Milestone B.
* STF 577 continued the work of ETSI MTS on TDL and TOP adding new features and maintaining the existing TDL standards and their implementation within the TOP project.
* The work of STF 577 was done primarily by means of coordinated homework among the experts and technical discussions with the established working group, which provided technical guidance. Two coordinated working sessions were organized to facilitate more intense and focused work on TDL during key periods in the preparation of the deliverables.
* The work of STF 577 contributed to a booth presentation of TDL and TOP at the UCAAT 2019. 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 after MTS#80 by remote consensus.

# Introduction

This progress report covers the entire work of STF 577, done in the period between 01-Oct-2019 and 15-May-2020. This period concludes the submission of the deliverables defined for Milestone B. The work was done primarily by means of coordinated homework among the experts and technical discussions with the established steering group, which provided technical guidance. Two coordinated working sessions were organized to facilitate more intense and focused work on TDL during key periods in the preparation of the deliverables. The first one was at ETSI and the second, originally scheduled at Elvior, was converted to an online focus week due the ongoing global health crisis and travel restrictions.

## 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 and the accompanying TR 103 119, comprising:

* ES 203 119-1 V1.5.1 Test Description Language; Meta-Model and Semantics

Scope: common concepts, meta-model, semantics

* ES 203 119-2 V1.4.1 Test Description Language; Graphical Syntax

Scope: TDL graphical concrete syntax for end users

* ES 203 119-3 V1.4.1 Test Description Language; Exchange Format

Scope: TDL exchange format for tool interoperability

* ES 203 119-4 V1.4.1 Test Description Language; Structured Test Objective Specification

Scope: TDL extension for structured test objectives

* ES 203 119-6 V1.2.1 Test Description Language; Mapping of TDL to TTCN-3

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

* ES 203 119-7 V1.2.1 Test Description Language; Extended Test Configurations

Scope: Extensions to support the re-use of existing test configurations in TDL

* TR 103 119 V1.2.1 Test Description Language; Reference Implementation and User Guidelines

Scope: Implementation and usage guidelines for the TOP project

## STF activity and expected output

STF 577 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, 492, and 522, STF 577 continues the development of TDL at ETSI MTS focusing on enhancements and maintenance of TDL and the TOP.

STF 577 targeted maintaining the existing standards and the tool implementations within TOP according to new and changing requirements as well as providing further information and guidelines to streamline the adoption of TDL in order to lower the barrier to entry for both users and tool vendors in adopting TDL. STF 577 contributed to the booth presentation of TDL and the TOP at UCAAT 2020.

## 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 permanent Working Group to review intermediate results and provide recommendations for further development. During the UCAAT 2020, 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

* 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.

## STF teamwork, distribution of tasks, working methods

* Martti Käärik:
Rapporteur for ES 203-119-1, ES 203-119-6, working on extension and maintenance of the TDL meta-model, the mapping of TDL to TTCN-3, the graphical representation of TDL, as well as the maintenance of the graphical editor for TDL.
* Finn Kristoffersen:
Rapporteur for ES 203-119-2, ES 203-119-4, working on extension and maintenance of the TDL-TO extension, and the reference implementation and user guidelines.
* Philip Makedonski:
STF leader, rapporteur for ES 203-119-3, ES 203-119-7, TR 103-119, working on extension and maintenance of the TDL meta-model, the graphical representation of TDL, the TDL-TO and TDL-TC extensions, and the reference implementation and user guidelines, as well as the maintenance of the textual editor for TDL.

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 on a regular basis 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 permanent Working Group was set up with members from MTS. The WG reviewed the intermediate results from the STF and gave recommendations for further development. There were several joint coordination meetings between the STF and the WG as follows:

* 2020-01-28, MTS-TDL#3, co-located with MTS#79
* 2020-01-29, MTS #79, progress report and discussion
* 2020-04-24, activity review and discussion of future initiatives
* 2020-05-11, MTS-TDL#4, co-located with MTS#80
* 2020-05-12, MTS #80, progress report and discussion

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

**2020-01-28/29, MTS#79, Sophia-Antipolis**

Participants: Makedonski, Käärik, Kristoffersen

Main results:

* Report on the progress of STF 577
* Drafts for Milestone A prepared for RC
* Participation at co-located MTS-TDL WG and MTS-TST WG meetings, F2F working session.
* Discussion of feedback from UCAAT 2019

**2020-05-12, MTS#80e, Online**

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

Main results:

* Meeting was held online due to the ongoing global health crisis and severe travel restrictions
* Report on the progress of STF 577
* Drafts for Milestone B prepared for RC
* Preparation and coordination for future initiatives.

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

The results of the STF were expected to be presented at the ETSI User Conference on Advanced Automated Testing (UCAAT) 2020, addressing a large number of potential users for TDL both in- and outside of ETSI. The even as such will be postponed due to the ongoing global health crisis. Alternative formats are currently being discussed, where there may be short online sessions to maintain the connection to the community. TDL may be featured as part of the online format. The STF resources dedicated to the material preparation for the UCAAT 2020 are instead redirected towards preparation for materials for a workshop article for the 13th Workshop on System Testing and Validation (STV) 2020 (co-located with the 20th IEEE International Conference on Software Quality, Reliability, and Security (QRS) 2020). The materials may be reused for the online format of UCAAT 2020. A preview on the work of STF 577 was showcased at a booth presentation at UCAAT 2019. 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. A proposal for an additional website describing the work of the STF has been published at the ETSI portal. An ongoing transition to a more modern web platform for the TOP has been initiated by the STF.

# 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);" as well as TR 103 119, including:

* ES 203 119-1 TDL Part 1: An adaptation of the current TDL meta-model including new features for the specification of extensions and inheritance, as well as improved separation of totally ordered and locally ordered behaviour specification.
* 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, Part 4, and Part 7.
* ES 203 119-4 TDL Part 4: An adaptation and extension of the capabilities for structured test objective specification.
* ES 203 119-6 TDL Part 6: An adaptation and refinement of the standardised mapping of TDL to TTCN-3.
* ES 203 119-7 TDL Part 7: An adaptation and refinement to extended test configurations.
* TR 103 119: A revision to bring the report up to date with the developments in the TOP as well as the remaining TDL documents, new clause including user guidelines.

## 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 working 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 working group and TC MTS.
* Concrete examples are prepared to support technical discussions and ensure alignment of expectations

**Complex technological landscape may slow down progress on TOP maintenance**

Due to the complex and constantly evolving technological landscape surrounding the platform on which the TOP is based, unforeseen challenges may slow down the progress of the STF. Conversely, unforeseen benefits may also speed up the progress of the STF.

Severity: Medium, Likelihood: Medium

Mitigation strategies:

* Limiting the dependencies on third-party components.
* Keeping up with the latest developments so that maintenance is performed in smaller increments as the risks tend to increase with time.

## 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 WG 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.
* It may be reasonable to explore new features through TOP first in the future, so that they can be delivered to users early on and the users can report back to the STF before the features are standardized.

## Recommendations for future activities in related domains

* It may be reasonable to explore new features through TOP first in the future, so that they can be delivered to users early on and the users can report back to the STF before the features are standardized.

# ETSI deliverables

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| --- | --- |
| Deliverable: RES/MTS-TDL-203119-1v1.5.1 (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 | 2019-05-22 |
| TB adoption of WI | 2019-05-22 |
| Start of work | 2019-10-01 |
| Early draft | 2020-01-31 |
| Stable draft |  |
| Final draft for approval | 2020-05-12 |
| TB approval | RC 2020-05-21 |
| Draft receipt by ETSI Secretariat |  |
| Publication |  |
| Deliverable: DES/MTS-TDL-203119-2v1.4.1 (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 | 2019-05-22 |
| TB adoption of WI | 2019-05-22 |
| Start of work | 2019-10-01 |
| Early draft | 2020-01-31 |
| Stable draft |  |
| Final draft for approval | 2020-05-11 |
| TB approval | RC 2020-05-21 |
| Draft receipt by ETSI Secretariat |  |
| Publication |  |
| Deliverable: DES/MTS-TDL-203119-3v1.4.1 (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 | 2019-05-22 |
| TB adoption of WI | 2019-05-22 |
| Start of work | 2019-10-01 |
| Early draft | 2020-01-31 |
| Stable draft |  |
| Final draft for approval | 2020-05-11 |
| TB approval | RC 2020-05-21 |
| Draft receipt by ETSI Secretariat |  |
| Publication |  |
| Deliverable: DES/MTS- TDL-203119-4v1.4.1 (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 | 2019-05-22 |
| TB adoption of WI | 2019-05-22 |
| Start of work | 2019-10-01 |
| Early draft | 2020-01-31 |
| Stable draft |  |
| Final draft for approval | 2020-05-11 |
| TB approval | RC 2020-05-21 |
| Draft receipt by ETSI Secretariat |  |
| Publication |  |
| Deliverable: DES/MTS- TDL-203119-6v1.2.1 (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 | 2019-05-22 |
| TB adoption of WI | 2019-05-22 |
| Start of work | 2019-10-01 |
| Early draft |  |
| Stable draft |  |
| Final draft for approval | 2020-05-11 |
| TB approval | RC 2020-05-21 |
| Draft receipt by ETSI Secretariat |  |
| Publication |  |
| Deliverable: DES/MTS-TDL-203119-7v1.1.1 (ES 203 119-7)Current status: Final draft for approvalWorking title: Methods for Testing and Specification (MTS) Test Description Language Extensions: Extended Test Configurations | **Achieved date** |
| Creation of WI by WG/TB | 2019-05-22 |
| TB adoption of WI | 2019-05-22 |
| Start of work | 2019-10-01 |
| Early draft |  |
| Stable draft |  |
| Final draft for approval | 2020-05-11 |
| TB approval | RC 2020-05-21 |
| Draft receipt by ETSI Secretariat |  |
| Publication |  |
| Deliverable: RTR/MTS-TDL-103119v1.2.1 (TR 103 119)Current status: Final draft for approvalWorking title: Methods for Testing and Specification (MTS) Test Description Language (TDL) Reference Implementation  | **Achieved date** |
| Creation of WI by WG/TB | 2019-05-22 |
| TB adoption of WI | 2019-05-22 |
| Start of work | 2019-10-01 |
| Early draft |  |
| Stable draft |  |
| Final draft for approval | 2020-05-18\* |
| TB approval | RC 2020-05-26\* |
| Draft receipt by ETSI Secretariat |  |
| Publication |  |
|  |  |

\* The final draft for TR 103 119 was originally assigned to the wrong WI on the portal (DTR/MTS-TDL1 instead of RTR/MTS-TDL103119v121. ETSI MTS has been notified and a correction has been implemented.

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 Working Group for this STF.
* **Presentations to other ETSI TBs:**There were no formal presentations of the STF given to other TBs. Instead, the specific requirements of potential users of TDL, such as 3GPP, ITS and oneM2M, were discussed on an informal basis.
* **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 TOP.
* **Contributions presented to TB MTS meetings:**The STF reported its progress regularly to MTS and also to the WG and discussed acute issues.
* **Presentations in workshops, conferences, stakeholder meetings (outside ETSI):**Members of the STF set up a booth at the UCAAT 2019 to promote TDL and the work of the STF, resulting in numerous constructive discussions with other participants at the event. Feedback was received from various interested parties attending the conference, both from industry, standardisation, and academia. An article by STF members and members of MTS-TST is currently in preparation.
* **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-TDL WG.
* **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 2019 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.
	1. Performance Indicators objectives not achieved

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

1. Resources allocated and spent

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Author:**  | **ETSI - Funded Activities** |  |  |  |  |
| **Period covered:** | **From: 30/09/2019** | **To: 15/05/2020** |  |  |  |
| **Status:**  | **Final** |  |  |  |  |
| **Status date:**  | **16/04/2020** |  |  |  |  |

* 1. Summary of resources allocated and spent (real cost)

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| The resources allocated though the ETSI FWP was 94 600,00 € in total. |

These have been divided into Manpower and travel budgets. The total expenses are summarized in the table below.

Table 1: Summary of resources spent

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|   |   | **Expertise Service Provision** | **Travel** | **Total** |
| Resource Available | 91 600,00€ | 3 000,00€ | 94 600,00€ |
| Resource Usage |  91 600,00€  | 711,81€ | 92 311,81€ |
| **Variance (Avail. - Usage)** | 0,00€ | 2 288,19€ | **2 288,19€** |

This table provides a detailed view on the travels of the STF.

Table 2: Travels

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Expert Name** | **Event** | **Place** | **Date From** | **Date To** | **Cost (EUR)** |
| Philip Makedonski | Attending MTS#79 | Sophia-Antipolis | 28/01/2020 | 29/01/2020 | 517,12€ |
| Finn Kristoffersen | MTS#79 | Sophia-Antipolis | 27/01/2020 | 29/01/2020 | 194,69€ |

|  |
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| Total Travels: **711,81 €.** |

Travels planned for MTS#80 and UCAAT 2020 cannot take place due to the ongoing global health crisis, therefore there are no travel costs associated with these events.