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| --- |
| ToR TTF XXX (TC MTS / WG TDL) |
| Version: 0.4 |
| Author: Ulrich, Makedonski – Date: 2020-07-24 |
| Last updated by: Ulrich – Date: 2020-08-12 |
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Terms of Reference –Testing Task Force Proposal

TTF XXX (TC MTS / WG TDL)

TDL and TOP Enhancements for RESTful API Services Testing

Summary information

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| --- | --- | --- | --- |
| Approval status | Approved by TC MTS (doc ref: XXXX) | | **YES\*** |
| Reference Body | TC MTS / WG TDL | | |
| ETSI Funding | **Maximum budget : 108,600 EUR** | | |
| Minimum of 4 ETSI Members Support | **YES** | | |
| Time scale | **From** | 2021-02-01 | |
| **To** | 2022-03-31 | |
| Work Items | See clause 3.2 below | | |
| TTF Roadmap reference |  | | |

\*) In progress.

Part I –TTF Technical Proposal

# Rationale & Objectives

## Rationale

In recent years ETSI TC MTS has invested heavily into the development of the Test Description Language (TDL) and the associated TDL Open Source Project (TOP). TDL supports the stepwise transformation from requirements over test purpose specifications to test descriptions. It offers the necessary concepts for modelling tests and expressing these models in textual and graphical syntaxes. Moreover, a TDL specification enables a semi-automatic transformation to executable tests, whether being expressed in TTCN-3 or another programming language. Complementary to the standardization of TDL, the tools developed in TOP provide a proof-of-concept of all designed TDL concepts and, more importantly, serve as a common platform to accelerate the adoption of TDL and lower the barrier to entry for both, users and tool vendors. Meanwhile, TDL and TOP have reached a level of maturity that enables first applications of this technology within ETSI TBs and elsewhere in industry.

The current TDL/TOP roadmap was discussed and agreed at the TDL#4 working group meeting on 11 May 2020.[[1]](#footnote-1) This ToR results from this roadmap.

TDL seeks to bridge the methodological gap between declarative test objectives and executable test cases by providing a formalised model-based solution for the specification of test descriptions. At its core there is a common meta-model (abstract syntax) with well-defined semantics which can be represented by means of different concrete notations (concrete syntaxes). A TDL test description created in one notation can be reviewed and approved in other notations, customised to suit the preferred notational conventions of different stakeholders. TDL can also serve as an exchange and visualisation platform for generated tests, contributing to the ongoing activities within ETSI TC MTS to establish MBT technologies within standardisation.

The principles which allow the adaptation of TDL according to the users’ needs are based on a formal basis, which in turn paves the way for tool support and the introduction of the approach to different application domains. The TDL user community as well as first ETSI internal projects adopting TDL and TOP tools create additional needs on the available technologies. It is essential for the continued acceptance of TDL that the language specification keeps evolving to address these needs. Additionally, the tool implementations need to comply with these changes.

## Objectives of the work to be executed

The work of the proposed TTF will concentrate on language features to better support RESTful API testing specified using OpenAPI, an industry standard for API specifications with open source tool support, as well as on resolving the submitted change requests to the TDL standard series and the TOP tools. Moreover, initial work will be undertaken to support testing of AI systems.

The work on the definition of a methodology for specification and testing of RESTful APIs within STF 576 culminating in the final draft of EG 203 647 (currently in approval) identified potential new features and improvements for TDL and TOP to better support the outlined methodologies in EG 203 647, in particular regarding the support of data type definitions in OpenAPI and the realisation of test execution engine for supporting RESTful API testing.

Textual syntaxes for both structured test objectives and test descriptions have proven to be the preferred way for users to create and manipulate TDL models. Currently, the textual syntaxes provided by TDL are only informative, serving as examples. A standardised textual syntax for test descriptions and test purposes has been one of the most requested additions to TDL to increase the confidence in adopting it. Additionally, refinements to the syntax can improve its usability.

While there is a standardised way of deriving test cases in TTCN-3 from test descriptions in TDL defined in Part 6 of the TDL standards, there are different ways of deriving test descriptions from test purposes. A guideline with a well-defined way to derive test descriptions from structured test objectives to support a (semi-) automatic workflow would benefit users and streamline test specification processes by setting clear expectations for the resulting test descriptions.

Systems powered by Artificial Intelligence (AI) are increasingly adopted across all ICT domains, including telecommunications. Several topics related to AI systems are also relevant to standardisation with numerous initiatives at ETSI. It is therefore essential to solicit requirements for the testing of AI and self-adaptive and autonomous systems with TDL.

Finally, the work of the proposed TTF will ensure that all parts remain consistent and that the TOP implementation faithfully implements TDL language features. The results of this TTF will be the delivery of the updated ETSI standard series ES 203 119 (multi-part document) in April 2022 and an update of the aligned reference tool implementations that are part of TOP. In more details this includes:

* Part 1: An adaptation and extension of the current TDL meta-model addressing the specification of test descriptions for RESTful APIs specified using OpenAPIs as well as change requests handed in from the TDL user community;
* Part 2: An adaptation of the TDL graphical syntax according to the changes in Part 1, including change requests from users;
* Part 3: An adaptation of the TDL exchange format specification according to the changes in Part 1;
* Part 4: An adaptation and extension of the capabilities for structured test objective specification to include additional features that are in the interest of ETSI technical bodies and other users, as well as well as a standardised textual syntax;
* Part 6: An adaptation and extension of the mapping from TDL to TTCN-3 to offer a wider semantical coverage of language concepts and to furnish evidence of a workable solution for early adopters;
* Part 7: An adaptation of the TDL Extended Test Configurations features according to changes in part 1;
* Part 8: A revision and standardisation of the TDL textual syntax previously defined as informative annex Part 1, including change requests from users;
* Updated TOP tools together with an updated Technical Report documenting the available tools and their usage.

## Previous funded activities in the same domain

The previous standardisation efforts on TDL can be briefly summarised as follows:

* STF 454 (TDL phase 1) laid the foundation of TDL in 2013 in terms of the basic concepts and their semantics. It also experimented with various syntaxes and demonstrated how TDL could be applied to the domain of 3GPP for the specification of User Equipment conformance test descriptions and IMS interoperability testing. Validation activities within the STF showed that the suggested design of TDL is feasible.
* STF 476 (TDL phase 2) added the necessary functionality to integrate TDL test descriptions into test automation frameworks. It also developed a standardized concrete graphical syntax for end-users, a TDL exchange format to be used by tools as well as an extension to test objective specifications.
* STF 492 (TDL phase 3) accelerated the adoption of TDL by providing a reference implementation of TDL to lower the barrier to entry for users and tool vendors. The reference implementation comprises graphical viewers, textual editors as well as a UML profile for TDL to enable its interoperability with UML-based environments. STF 492 contributed to the public launch of TDL at UCAAT 2015, a major milestone in the development of TDL.
* STF 522 (TDL phase 4) established the connection between the two standardised ETSI languages TDL and TTCN-3, enabling the semi-automatic generation of executable tests from TDL and allowing the re-use of existing TTCN-3 tools and frameworks for test execution. In addition, continuous language maintenance was performed based on CRs submitted by users, and new features deemed necessary for the mapping of TDL to TTCN-3.
* STF 577 (TDL phase 5) focussed on maintenance and enhancements, including inheritance support to improve reusability of TDL specifications and improved separation of totally ordered and locally ordered test descriptions, as well as improved guidelines for different usage scenarios.

The extended scope of TDL led to an increased interest among various stakeholders in adopting TDL, prompting the need for the availability of additional means to apply TDL in their respective working environments and building upon the current momentum of TDL.

## Consequences if not agreed

Establishing this TTF as a continuation of the work done in earlier STFs will speed up progress in the adoption of TDL. Without this TTF, the application of the TDL standard by end users such as other ETSI technical bodies and industrial partners 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 standardisation bodies, notably OMG, will continue their activities on formalising and extending UML. In addition, more and more practises on system and software design are influenced from open-source technologies that implement commonly agreed approaches in system and software engineering and make them freely available. This development could lead to a fragmented landscape of system and test specification languages that might not be in ETSI’s interest as it needs a common strong and sound formal approach to certification and other ways of testing of the complex systems it designs. Moreover, ETSI might lose influence in the area of modern system and software engineering practices.

# ETSI Members Support

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| **#** | **ETSI Member** | **Supporting delegate** |
| 1 | Cinderella ApS | Finn Kristoffersen |
| 2 | Elvior LLC | Martti Käärik |
| 3 | Ericsson Hungary Ltd | Dr. György Réthy |
| 4 | Institut für Informatik, Universität Göttingen | Prof. Dr. Dieter Hogrefe |
| 5 | Siemens AG | Dr. Andreas Ulrich |

# Deliverables

## Base documents

|  |  |  |
| --- | --- | --- |
| **Document** | **Title** | **Status** |
| 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 | On approval |
| ES 203 119-2 V1.4.1 | Methods for Testing and Specification (MTS); The Test Description Language (TDL); Part 2: Graphical Syntax | On approval |
| ES 203 119-3 V1.4.1 | Methods for Testing and Specification (MTS); The Test Description Language (TDL); Part 3: Exchange Format | On approval |
| ES 203 119-4 V1.4.1 | Methods for Testing and Specification (MTS); The Test Description Language (TDL); Part 4: Structured Test Objective Specification (Extension) | On approval |
| ES 203 119-6 V1.2.1 | Methods for Testing and Specification (MTS); The Test Description Language (TDL); Part 6: Mapping to TTCN-3 | On approval |
| ES 203 119-7 V1.2.1 | Methods for Testing and Specification (MTS); The Test Description Language (TDL); Part 7: Extended Test Configurations | On approval |
| TR 103 119 V1.2.1 | Methods for Testing and Specification (MTS); The Test Description Language (TDL); Reference Implementation and User Guidelines | In preparation |
| EG 203 647 V1.1.1 | Methods for Testing and Specifications (MTS); Methodology for RESTful APIs specifications and testing | In preparation |

## New deliverables

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| --- | --- | --- | --- |
| **Deliv.** | **Work Item code**  **Standard number** | **Working title** | **Expected date for publication** |
| D1\* | RES/ES 203 119-1 V1.6.1 | Methods for Testing and Specification (MTS); The Test Description Language (TDL); Part 1: Abstract Syntax and Associated Semantics | 2022-04 |
| D2\* | RES/ES 203 119-2 V1.5.1 | Methods for Testing and Specification (MTS); The Test Description Language (TDL); Part 2: Graphical Syntax | 2022-04 |
| D3\* | RES/ES 203 119-3 V1.5.1 | Methods for Testing and Specification (MTS); The Test Description Language (TDL); Part 3: Exchange Format | 2022-04 |
| D4\* | RES/ES 203 119-4 V1.5.1 | Methods for Testing and Specification (MTS); The Test Description Language (TDL); Part 4: Structured Test Objective Specification (Extension) | 2022-04 |
| D5\* | RES/ES 203 119-6 V1.3.1 | Methods for Testing and Specification (MTS); The Test Description Language (TDL); Part 6: Mapping to TTCN-3 | 2022-04 |
| D6\* | RES/ES 203 119-7 V1.3.1 | Methods for Testing and Specification (MTS); The Test Description Language (TDL); Part 7: Extended Test Configurations | 2022-04 |
| D7 | DES/ES 203 119-8 V1.1.1 | Methods for Testing and Specification (MTS); The Test Description Language (TDL); Part 8: Textual Syntax | 2022-04 |
| D8 | RTS/TR 103 119 V1.3.1 | Methods for Testing and Specification (MTS); The Test Description Language (TDL); Reference Implementation and User Guidelines | 2022-04 |

\*) Work items of the TDL standard series which are not affected by CRs will not be updated.

# Maximum budget

## Task summary/Manpower Budget

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| --- | --- |
| **Task short description** | Budget (EUR) |
|
| T0 Project Management | 5,700 |
| T1 TDL Evolution | 34,200 |
| T2 TOP for RESTful API Services | 39,900 |
| T3 TDL Methodology | 22,800 |
| **TOTAL** | **102,600** |

## Travel budget

Travel is required for the TTF lead or deputy to attend the three MTS Plenary Meetings and TDL Work Group Meetings to discuss the achieved progress. Additional budget is required for promotion activities at conferences and workshops inside and outside ETSI.

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| **Expected travels** | **Cost estimate (EUR)** |
| Participation at MTS#83 (May 2021) | 1,000 |
| Participation at MTS#84 (Sep 2021) | 1,000 |
| Participation at MTS#85 (Jan 2022) | 1,000 |
| Participation at an international conference or workshop to promote TDL and TOP (to be determined) | 3,000 |
| **TOTAL** | **6,000** |

Part II – Details on TTF Technical Proposal

# Tasks, Technical Bodies and other stakeholders

## Organization of the work

The major goal of this TTF is to handle existing and incoming user requests for updates to the TDL standards and the TDL open source project. It is essential for the continued growth of the TDL user community that TDL is maintained and the TDL open source project is aligned with these changes. It targets stakeholders both within ETSI and within the industry. The work is organized around the activities necessary to maintain the TDL standards and the TDL open source project (TOP) based on feedback from various stakeholders who have been adopting TDL early on. The activities are focused on 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.

Intermediate stable drafts and final drafts will be delivered at milestones set in regular intervals which coincide with the plenary sessions of TC MTS. Once draft versions of the TDL updated standards become available, they will be sent out to ETSI MTS and parties outside of ETSI for review and feedback. There are multiple milestones intended for soliciting feedback such that there is enough room for delivering enhanced and improved TDL standards and updates of the tools that fit the needs of different organizations and users.

The working group MTS TDL will, acting as a steering group, oversee and advise the work of the proposed TTF. It will plan regular meetings between the TTF working sessions to monitor the progress of the work and provide technical advice.

## Other interested ETSI Technical Bodies

In principal we expect interest in TDL and TOP from ETSI Technical Bodies that already investigated into TTCN-3. But other TBs that are interested into expressive test objective specifications are in focus, too. The following ETSI TBs are expected to contribute to the TTF by providing feedback on the developed TDL methodology: NFV, MEC, INT, ITS, ERM, oneM2M, 3GPP.

## Other stakeholders

Additionally, the following organizations are expected to be interested in the outcome from this TTF: OMA, TCCA (former TETRA Association), Ipv6Forum. Standardisation bodies from other domains such as automotive run similar initiatives in providing solutions for their specific needs in testing. These initiatives should be also interested in the results of the proposed TTF.

Part III: Execution of Work

# Work plan, time scale and resources

## Task description

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| **Task 0** | **Project Management** |
| **Objectives** | * Planning, organisation, and preparation of TTF meetings * On-going reporting * Participation at TC/WG meetings * Delivery of the TTF final report |
| **Input** | * This ToR * Information from the preparatory meeting * Expertise availability information and other project management data * TDL CRs in the ETSI Mantis system and reports from the TOP ETSI Labs project |
| **Output** | * Session planning * Materials for WG and TC meetings * Progress reports * Final report |
| **Interactions** | * The TTF leader will interact with the MTS TDL Working Group and the MTS * Communicating with other stakeholders and TTFs * Additional support will be provided by the ETSI secretariat |
| **Resources required** | Resource planning, reporting, and coordination  5,700 € |

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| **Task 1** | **TDL Evolution** |
| **Objectives** | * Resolving open CRs * Design of new features according to the submitted CRs * Standardised textual syntax for TO and TD, indentation-based * Parameterizable test objectives * Re-usable events in TDL-TO * New language features for supporting RESTful API services testing through their OpenAPI interface specification |
| **Input** | * CRs from ETSIs Bug Tracker (Mantis) * All base documents mentioned in Section 3.1 |
| **Output** | * Revised versions of the series of TDL standard documents ES 203 119-x |
| **Interactions** | * The TDL Working Group is involved to provide technical advice in case there are or conflicting opinions on technical matters * Additional discussions with users and tool vendors (via Mantis) according to the submitted CRs |
| **Resources required** | CR resolution  34,200 € |

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| **Task 2** | **TOP Maintenance and Support for RESTful API Services** |
| **Objectives** | * TOP maintenance in accordance to updates of its base software (Eclipse) * Resolving open CRs and alignment of TOP according to TDL changes performed in Task 1 * Implement the elaborated workflow for RESTful API services testing from Task 3 * Provision of a TDL-TD code generator and execution engine to support the execution of RESTful API services tests |
| **Input** | * The TOP project * CRs from the TOP issue tracking system * Revised versions of the input documents from Task 1 (working and final drafts) * Interim versions of TR 103 119 V1.3.1 from Task 3 |
| **Output** | * The updated TOP project and TOP libraries (plug-ins) |
| **Interactions** | * The TDL Working Group is involved to provide technical advice in case there are or conflicting opinions on technical matters * Additional discussions with users and tool vendors (via Mantis) according to the submitted CRs |
| **Resources required** | CR resolution, software maintenance, new feature development  39,900 € |

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| **Task 3** | **TDL Methodology** |
| **Objectives** | * Elaborate a defined way to derive TDs from TOs * Provide guidelines for a semi-automatic workflow * Elaborate a workflow to specify TOs/TDs for RESTful API services starting from an OpenAPI specification in accordance with EG 203 647 * Demonstrate and describe the application of TOP for RESTful API Services testing * Update online documentation, wiki, examples * Solicitation of requirements for describing tests of AI systems and ML models |
| **Input** | * New releases of the TOP plugins from Task 2 (interim versions) * TR 103 119 V1.2.1 (previous user guidelines) and existing examples and online documentation |
| **Output** | * Updated online documentation * TR 103 119 V1.3.1 |
| **Interactions** | * The TDL Working Group is involved to provide technical advice in case there are or conflicting opinions on technical matters * Communicating with other stakeholders, TCs and TTFs |
| **Resources required** | Elaborating an approach and documenting it  22,800 € |

## Milestones

Milestone A – Title

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| --- | --- | --- |
| **Milestone** | **Description** | **Cut-Off Date** |
| **A** | First progress report to TC MTS | MTS#83 |
| Reference Body Deliverable | First progress report to be approved by TC MTS  Early drafts for T1 |
| ETSI Deliverable | Early drafts of D1, D2, D4, D6 |

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| **Milestone** | **Description** | **Cut-Off Date** |
| **B** | Second progress report to TC MTS | MTS#84 |
| Reference Body Deliverable | Second Progress report to be approved by TC MTS  Stable drafts for T1  Early drafts for T3 |
| ETSI Deliverable | Stable drafts of D1 – D7  Early draft of D8 |

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| **Milestone** | **Description** | **Cut-Off Date** |
| **C** | Final drafts to TC MTS | 20/12/21 |
| Reference Body Deliverable | Final drafts to be approved by TC MTS  Final drafts for T1 and T3 |
| ETSI Deliverable | Final drafts of D1 – D8 |

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| **Milestone** | **Description** | **Cut-Off Date** |
| **D** | Final report to TC MTS | MTS#85 |
|  | Final report to be approved by TC MTS |

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| **Milestone** | **Description** | **Cut-Off Date** |
| **E** | Deliverables submitted for publication, TTF closed | 31/03/22 |

## Task summary

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| --- | --- | --- | --- | --- |
| **Code** | **Task / Milestone** | Target Date | | Estimated Cost (EUR) |
| From | To |
|  | Start of work | 01/02/21 |  |  |
| T0 | Project Management | 01/02/21 | 31/03/22 | 5,700 |
| T1 | TDL Evolution | 01/02/21 | 31/12/21 | 34,200 |
| Milestone A | First progress report to TC MTS | MTS#83 | 15/05/21 |  |
| T2 | TOP for RESTful API Services | 15/05/21 | 31/12/21 | 39,900 |
| T3 | TDL Methodology | 15/05/21 | 31/12/21 | 22,800 |
| Milestone B | Second progress report to TC MTS | MTS#84 | 15/09/21 |  |
| Milestone C | Final drafts to TC MTS |  | 20/12/21 |  |
| Milestone D | Final report to T*C* MTS | MTS#85 | 31/01/22 |  |
| Milestone E | Deliverables submitted, TTF closed |  | 31/03/22 |  |
|  | | | | **102,600** |

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| **Task/ Mil.** | **J** | **F** | **M** | **A** | **M** | **J** | **J** | **A** | **S** | **O** | **N** | **D** |  | **J** | **F** | **M** | **A** | **M** | **J** | **J** | **A** | **S** | **O** | **N** | **D** |
| T0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| T1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| MA |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| T2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| T3 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| MB |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| MC |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| MD |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ME |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

# Expertise required

## Team structure

(Up to) 4 participants to ensure the following mix of competences:

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| --- | --- |
| **Priority** | **Qualifications and competences** |
| High | Deep understanding of the existing TDL and its application. |
| High | Deep understanding of black-box testing and testing of communicating real-time systems. |
| High | Experiences in modelling and description techniques such as TTCN-3, UML, MSC. |
| High | Experiences in Eclipse ecore meta-modelling and tooling. |
| High | Experiences in the design of software languages and compiler/transformation techniques, including model-transformation techniques. |
| High | Experiences in the model-based implementation of software languages including concrete graphical and textual syntax implementation, syntactical and semantic model validation. |
| High | Deep knowledge of RESTful API design and implementation. |

Part IV: TTF performance evaluation criteria

# Performance Indicators

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| --- | --- |
| **Select relevant Performance indicators applicable for these ToR (X)** | |
| Contribution from ETSI Members to TTF work | |
| Direct financial contribution (co-funding) |  |
| Support to the TTF work (e.g., provision of test–beds, organization of workshops, events) |  |
| Steering Group meetings (number of meetings / participants / duration) | X |
| Number of delegates directly involved in the review of the deliverables | X |
| Contributions/comments received from the Reference Bodies | X |
| Contributions/comments received from other Reference Bodies | X |
|  |  |
| **Contribution from the TTF to ETSI work** | |
| Contributions to Reference Body meetings (number of documents / meetings / participants) | X |
| Contributions to other Reference Bodies |  |
| Presentations in workshops, conferences, stakeholder meetings |  |
|  |  |
| **Liaison with other stakeholders** | |
| Stakeholder participation in the project (category, business area) |  |
| Cooperation with other standardization bodies |  |
| Potential interest of new members to join ETSI |  |
| Liaison to identify requirements and raise awareness on ETSI deliverables | X |
| Comments received on drafts (e.g. on WEB site, mailing lists, etc.) |  |
|  |  |
| **Quality of deliverables** | |
| Approval of deliverables according to schedule | X |
| Respect of time scale, with reference to start/end dates in the approved ToR | X |
| Comments from Quality review by Reference Body | X |
| Comments from Quality review by ETSI Secretariat | X |
|  |  |

# Document history

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Date** | **Author** | **Status** | **Comments** |
| 0.0 | 2020-07-20 | Ulrich | Initial draft |  |
| 0.1 | 2020-07-30 | Makedonski | Refined draft |  |
| 0.2 | 2020-08-06 | Ulrich | Refined draft |  |
| 0.3 | 2020-08-07 | Makedonski | Refined draft |  |
| 0.4 | 2020-08-12 | Ulrich | Final draft |  |

1. See <https://docbox.etsi.org/MTS/TDL/05-CONTRIBUTIONS/2020/MTSTDL(20)004001_TDL_Roadmap__update_from_TDL_4_.pptx>. [↑](#footnote-ref-1)