

**Methods for Testing and Specification (MTS);
TPlan: A notation for expressing Test Purposes**

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Foreword

This ETSI Standard (ES) has been produced by ETSI Technical Committee Methods for Testing and Specification (MTS), and is now submitted for the ETSI standards Membership Approval Procedure.

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1 Scope

The present document specifies the syntax and use of a notation for the definition of Test Purposes, TPLan. This notation provides a structure and a common set of English keywords for the specification of Test Purposes. The basic notation is oriented towards testing of reactive, black-box communication systems and uses terminology derived from ISO/IEC 9646-1 [3]. However, facilities are also included to allow users to extend the notation with application-specific keywords of their own.

The use of TPLan as the means of specifying Test Purposes is optional but, if it is used, the requirements specified in the present document shall be met.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific.

- For a specific reference, subsequent revisions do not apply.
- Non-specific reference may be made only to a complete document or a part thereof and only in the following cases:
 - if it is accepted that it will be possible to use all future changes of the referenced document for the purposes of the referring document;
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NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

2.1 Normative references

The following referenced documents are indispensable for the application of the present document. For dated references, only the edition cited applies. For non-specific references, the latest edition of the referenced document (including any amendments) applies.

- [1] ETSI ES 201 873-1: "Methods for Testing and Specification (MTS); The Testing and Test Control Notation version 3; Part 1: TTCN-3 Core Language".
- [2] ETSI EG 202 568 (V1.1.1): "Methods for Testing and Specification (MTS); Internet Protocol Testing (IPT); Testing Methodology and Framework".
- [3] ISO/IEC 9646-1: "Information Technology - Open Systems Interconnection - Conformance Testing Methodology and Framework - Part 1: General concepts".
- [4] ISO/IEC 9646-2: "Information Technology - Open Systems Interconnection - Conformance Testing Methodology and Framework - Part 2: Abstract Test Suite specification".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

event: something observable (measurable) at a given place and time

NOTE: The cause of a stimulus or the result of a response.

notation: textual means of representing ideas

programming language: artificial language that can be used to control the behaviour of a machine

test case: specification of the actions required to achieve a specific test purpose, starting in a stable testing state, ending in a stable testing state and defined in either natural language for manual operation or in a machine-readable language (such as TTCN-3) for automatic execution

test description: systematic specification of the test steps (generally in tabulated text) that must be taken to reach a specific test verdict

test purpose: description of a well-defined objective of testing, focussing on a single interoperability requirement or a set of related interoperability requirements

test suite structure: logical grouping of test purposes or test cases which should be both relevant and convenient

3.2 Abbreviations

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

| | |
|--------|--|
| EBNF | Extended Backus-Nauer Form |
| EUT | Equipment Under Test |
| ICS | Implementation Conformance Statement |
| IP | Internet Protocol |
| IPT | Internet Protocol Testing |
| IUT | Implementation Under Test |
| PICS | Protocol Implementation Conformance Statement |
| QE | Qualified Equipment |
| RFC | Request For Comments (IETF terminology for a draft standard) |
| RQ | ReRequirement |
| TC | Test Case |
| TD | Test Description |
| TP | Test Purpose |
| TSS | Test Suite Structure |
| TTCN-3 | Testing and Test Control Notation edition 3 |

4 Introduction

4.1 TPLan: A formal notation for expressing test purposes

ISO/IEC 9646 [3] and [4] recommends that test specifications include a concise and unambiguous description of each test which focuses on its purpose. These Test Purposes, or TPs, define *what* is to be tested rather than *how* the testing is performed. The TPs are based on the *requirements* identified in the relevant standard (or standards) from which the test specification is derived. The detailed coding of each Test Purpose is specified in a Test Case. Often Test Cases, or TCs, are written in a test specification language such as TTCN-3 [1]. The specification of Test Cases is outside the scope of the present document.

Generally, Test Purposes are written in prose (possibly displayed in a tabular format). There is considerable benefit to be gained by having all TPs written in a similar and consistent way. With this in mind, a simple, structured notation called TPLan has been developed for the expression of TPs. TPLan is defined with a minimal set of test-oriented keywords but with the capability that permits users to define extensions to the notation. is an example of how TPLan can be extended into a specific application area; in this case, telecommunications.

The benefits of using TPLan are:

- consistency in test purpose descriptions - less room for misinterpretation;
- clear identification of the TP pre-conditions, test body, and verdict criteria;
- automatic syntax checking and syntax highlighting in text editors;
- a basis for a TP transfer format and representation in tools.

4.2 Extensibility of TPLan

TPLan provides a framework for a consistent representation (format, layout, structure and logical ordering) and a consistent use of words and patterns of words for expressing TPs. This is achieved without unnecessarily restricting the expressive power of pure prose.

TPLan allows the use of keywords in combination with free-text strings (enclosed by single quotes). Thus, the TP writer has considerable freedom of expression in the use of unstructured text between the keywords.

The basic set of pre-defined TPLan keywords has been kept to a minimum. These keywords are mainly concerned with providing structure to the TPs. The intention is that this set of keywords is extended by the user for specific testing applications through the use of user-defined keywords (see clause 8) which can be checked by automatic tools for consistency and, to some extent, correctness.

4.3 The Test Suite Structure

Test Purposes should be grouped in a tree-like structure. This structure is known as the Test Suite Structure, or TSS. The combination of structure and Test Purposes is known as the TSS&TP [3].

The general composition of a TPLan TSS&TP is as follows:

```
TSS Header           -- title, author, version etc.
Cross References     -- references to base standards, configuration descriptions etc.
Definitions         -- user-defined words, events, test entities, conditions, headers etc.
TSS Groups          -- if any and possibly nested
Test Purposes       -- contained in the groups (if any)
```

4.4 Areas of application

TPLan is not specific to a particular type or area of testing. The fundamental set of predefined TPLan keywords is oriented towards conformance and interoperability testing (keywords such as **IUT**, **TESTER** and **TD**) but the extensibility of the language means that the user can adapt TPLan to a wide range of testing contexts.

4.5 Limitations of TPLan

The TPLan grammar provides limited syntax checking and an enhanced visual representation of the TP in, for example, a syntax sensitive text editor. However, in order to retain expressive power, TPLan is only loosely defined in that no strict relation between certain words (especially the user-defined words) is specified. Thus, it is possible to write nonsensical constructions if care is not taken. Of course, appropriate tools may be able to identify such constructions but there are no constructs for doing this explicitly in the notation.

5 TPLan keywords, comments and identifiers

5.1 TPLan keywords

Only those words listed in table 1 shall be considered to be valid TPLan keywords.

Table 1: TPLan keywords

| TSS header keywords | |
|------------------------------------|------------|
| author | Author |
| date | Date |
| title | Title |
| TSS | tss |
| version | Version |
| Cross-references keywords | |
| xref | Xref |
| Definitions keywords | |
| condition | Condition |
| context | Context |
| def | Def |
| entity | Entity |
| event | Event |
| value | Value |
| unit | Unit |
| word | Word |
| TP grouping keywords | |
| end | End |
| group | Group |
| objective | Objective |
| TP header keywords | |
| config | Config |
| id | Id |
| ref | Ref |
| role | Role |
| RQ | rq |
| summary | Summary |
| TC | tc |
| TD | td |
| TP | tp |
| TP body keywords | |
| ensure | Ensure |
| that | That |
| with | With |
| when | When |
| then | Then |
| Test entity keywords | |
| IUT | iut |
| TESTER | tester |
| TPLan glue words | |
| a | A |
| an | An |
| as | As |
| in | In |
| is | Is |
| no | No |
| of | Of |
| the | The |
| Logical words | |
| and | And |
| not | Not |
| or | Or |
| Stimulus and Response words | |
| receives | Receives |
| sends | Sends |
| Data-related words | |
| containing | Containing |
| indicating | Indicating |

| Direction-related words | |
|-------------------------------|-----------|
| from | From |
| to | To |
| Time- and order-related words | |
| after | After |
| before | Before |
| unordered | Unordered |
| within | Within |

5.2 Comments

Comments shall be introduced by the string "--" and terminated at the end of the same line.

5.3 TPLan identifiers

Letters, numbers and special characters may be used in a TPLan identifier, as follows:

- alphabetic
 - a..z;
 - A..Z;
- numeric
 - 0..9;
- special characters
 - |,._-&%\$*@?!><\/#.

Typical TPLan identifiers are TP identifier, event names, cross reference identifiers and requirements identifiers. For example:

```
MyTSS&TP
TP_UMTS_0789_01
RQ_001_789
REQ3952.Arev2
CONF/HOST/INVALID/#75
CF_MOB_02
PICS_c.2
```

A TPLan identifier shall not contain any white space (e.g. tabs or spaces).

NOTE: In certain contexts it can be desirable to overlay TPLan with an additional level of checking related to a particular methodology or naming convention. Generally, such overlays are outside the scope of this present document. However, the ETSI IPT Testing Framework [2] includes naming rules for TPs and other identifiers. These conventions are summarized in Annex B.

5.4 Uniqueness of identifiers

All user-defined words, headers, entities, conditions and events shall be unique in the scope of one TSS&TP. Parameter names of events shall be unique in the scope of the list in which they are declared.

No user-defined name shall be the same as any pre-defined TPLan keyword.

5.5 Including files

TPLan supports a limited form of file inclusion. This shall be indicated by the pre-processing directive, **#include**, followed by the location of the included file enclosed in quotes. TPLan does not define the form of this location reference. Typical locations may be a file path, reference to an ETSI standard, an object identifier or a URL. For example:

```
#include 'root/MyTPLan/MyDefs.txt'
#include 'root/MyTPLan/MyTPs.txt'
```

The include statement shall only be used to include definitions (see clause 8) or complete test purposes comprising the test purpose header and body (see clauses 10 and 11). Thus, the included file shall follow the syntax for definitions and test purposes as defined in annex A.

6 TSS Header

6.1 Standard TSS header entries

A TPLan specification (i.e. a TSS&TP) shall begin with the following headers (though not all entries are mandatory, see Annex A):

- TSS identifier (mandatory)
 - the keyword **TSS** followed by the formal identifier of the TSS&TP;
- Title (optional)
 - the keyword **title** followed by the name of the TSS&TP as quoted free text;
- Version (optional)
 - the keyword **version** followed by the version number as any number of numeric values separated by dots (".");
- Date (optional)
 - the keyword **date** followed by three numeric values separated by dots ("."), forward slash ("/") or dash ("-"). The following examples are all valid date entries:
 - 01-12-2007;
 - 1.12.07;
 - 31/5/2007;
 - 05-31-07.
- Author (optional)
 - the keyword **author** followed by the document author(s) as quoted free text.

Each TSS header keyword shall be followed by a colon (":").

A complete TSS&TP header:

```
TSS      : UMTS_TSS
title    : 'My TSS&TP as an example'
version  : 1.0          -- other examples may be 1.0.0 or 11.01
date     : 29.11.2004  -- could also be written as 29/11/2004 or 29-11-2004
author   : 'ETSI PTCC'
```

6.2 User defined TSS Header entries

Additional user-defined TSS&TP headers may be included with the standard headers. A user-defined TSS header may comprise one or more defined header words, followed by a list of one or more identifiers separated by commas, or a quoted string separated by a colon (see clause 8.2). For example:

```
TSS      : UMTS_TSS
title    : 'My TSS&TP as an example'
version  : 1.0
date     : 29.11.2004
author   : 'ETSI PTCC'
status   : 'Public'      -- user-defined TSS header
```

A user-defined header may also use the predefined keyword **ref**. For example:

```
PICS ref : 'Release 7'
```

A header (either predefined or user-defined) shall not appear more than once in a TSS.

7 External references

References to external sources of information shall be made using the **xref** keyword followed by an identifier and a list of the external sources. Examples of the use of the **xref** keyword are as follows:

- References to base standards or other sources from which the TPs have been derived. For example:

```
xref BaseStandards {TS123456-1, TS789345}
```

In the case where a PICS [3] is used the reference might be:

```
xref PICS {TS123456-1, TS123456-2}
```

The TPLan syntax allows reference to be made in any appropriate form such as Object identifiers or URLs. For example:

```
xref MyWebDocs {www.tplan.info}
```

- References to explicit test configurations. For example:

```
xref TestConfig1 {3GPPSpecXYZ_AnnexA_page10_fig1}
```

- The list of configuration sources may include references to file names as well as or instead of document information, thus:

```
xref TestConfig2 {OurProjectConfigs.pdf}
```

NOTE: The identifiers associated with **xref** statements could be used by software tools to check for consistency within the specifications of test purposes. For example, a tool could check that TPs refer only to configurations that have been previously declared in **xref** statements.

8 User definitions

8.1 User defined words

TPLan may be extended by the user with the **def word** keywords followed by one or more identifiers separated by commas:

```
def word tunnels, forwards
```

For information to the reader, each word definition may be followed by a description of that word as a quoted string. For example:

```
def word forwards ' receive a packet on one interface and transmit
                  that packet unchanged on another interface'
```

These words may be used in the **with**, **when** and **then** statements of the TP body (see clause 11).

Although the addition of new keywords can make a TPLan specification considerably easier to understand, care should be taken to avoid adding multiple words with almost identical meaning. Also, the **def context** construct (see clause 8.8) should be used wherever possible to limit the use of newly-defined keywords.

8.2 User-defined headers

The TSS and TP headers may be extended using the **def header** keywords followed by one or more identifiers separated by commas.

```
def header status
```

For information to the reader, each header definition may be followed by a description of the meaning of that header as a quoted string.

8.3 User-defined test entities

Explicit test entity names may be defined using the **def entity** keywords followed by one or more identifiers separated by commas.

```
def entity EUT, QE
```

For information to the reader, each entity definition may be followed by a description of the meaning of that entity as a quoted string.

These test entity names may be used in the **with**, **when** and **then** statements of the TP body (see clause 11).

8.4 User-defined events and parameters

Explicit event names may be defined using the **def event** keywords followed by one or more identifiers separated by commas. There is no strong definition of what an event is in TPLan, but, typically, these would be messages, timers or something else that is observable or, at least, measurable. In the present document the term "message" is generally used as an example of an event and, for clarity, event parameters are referred to as message fields, or fields for short. For example:

```
def event ICMP_Packet, SETUP
```

Optionally, the event name may be followed by a list of one or more parameter identifiers or user-defined values separated by commas. For example:

```
def event SETUP {f1, f2}
-- or
def event T1 {30sec}
```

For information to the reader, each event definition may be followed by a description of the meaning of that event as a quoted string.

These event and parameter names may be used in the **when** and **then** statements of the TP body (see clause 11).

NOTE: These are abstract definitions of events and are not intended to be, for example, records or similar constructs found in common programming languages.