INTERNATIONAL TELECOMMUNICATION UNION

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

Z.110
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SERIES Z: PROGRAMMING LANGUAGES

Criteria for the use and applicability of formal Description Techniques

Criteria for use of formal description techniques by ITU-T

ITU-T Recommendation Z.110

(Previously CCITT Recommendation)

ITU-T Z-SERIES RECOMMENDATIONS

PROGRAMMING LANGUAGES

Specification and Description Language (SDL)	Z.100–Z.109
Criteria for the use and applicability of formal Description Techniques	**Z.110–Z.199**
ITU-T High Level Language (CHILL)	Z.200–Z.299
MAN-MACHINE LANGUAGE	Z.300–Z.499
General principles	Z.300–Z.309
Basic syntax and dialogue procedures	Z.310–Z.319
Extended MML for visual display terminals	Z.320–Z.329
Specification of the man-machine interface	Z.330–Z.399
Miscellaneous	Z.400–Z.499

For further details, please refer to ITU-T List of Recommendations.

FOREWORD

The ITU-T (Telecommunication Standardization Sector) is a permanent organ of the International Telecommunication Union (ITU). The ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Conference (WTSC), which meets every four years, establishes the topics for study by the ITU-T Study Groups which, in their turn, produce Recommendations on these topics.

The approval of Recommendations by the Members of the ITU-T is covered by the procedure laid down in WTSC Resolution No. 1 (Helsinki, March 1-12, 1993).

ITU-T Recommendation Z.110 was revised by ITU-T Study Group 10 (1993-1996) and was approved by the WTSC (Geneva, 9-18 October 1996).

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NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

CONTENTS

SUMMARY

In view of the complexity and widespread use of Recommendations, it is imperative that advanced methods for the development and implementation of these Recommendations be used.

Formal Description Techniques (FDTs) such as SDL (Recommendation Z.100) and MSC (Recommendation Z.120) provide an important approach toward such advanced methods. The purpose of this Recommendation is to guide the use of FDTs to assure the quality of ITU-T Recommendations.

The effective use of FDTs requires phased procedures to introduce their use. This Recommendation states the procedures to accomplish this task.

Effective use of FDTs implies the use of state of the art tools.

Recommendation Z.110

CRITERIA FOR USE OF FORMAL DESCRIPTION TECHNIQUES[1] BY ITU-T

(revised in 1996)

1   Scope

This Recommendation applies to the use of FDTs in ITU-T Recommendations.

FDTs are intended to be used in the development, specification, implementation and verification of Recommendations (or parts thereof).

2   References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication the editions indicated were valid. All Recommendations are subject to revision; all users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations listed below. A list of the currently valid ITU-T Recommendations is regularly published.

– CCITT Recommendation X.208 (1988), *Specification of Abstract Syntax Notation One (ASN.1).*

– CCITT Recommendation X.292 (1992), *OSI Conformance testing methodology and framework for protocol Recommendations for CCITT applications – The Tree and Tabular Combined Notation (TTCN).*

– ITU-T Recommendation X.680 (1994) and Amendment 1 (1995), *Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation. Amd. 1: Rules of extensibility.*

– CCITT Recommendation X.722 (1992), *Information technology – Open Systems Interconnection – Structure of Management Information: Guidelines for the definition of managed objects.*

– ITU-T Recommendation Z.100 (1993), *CCITT Specification and Description Language (SDL).*

– ITU-T Recommendation Z.105 (1995), *SDL combined with ASN.1 (SDL/ASN.1).*

– ITU-T Recommendation Z.120 (1996), *Message Sequence Chart (MSC).*

3   Terms and definitions

This Recommendation defines the following terms.

3.1   Definitions

3.1.1   formal definition: Part of a Recommendation based on the use of description languages of formal description technique.

3.1.2   formal description technique: A specification method based on a description language using rigorous and unambiguous rules both with respect to developing expressions in the language (formal syntax) and interpreting the meaning of these expressions (formal semantics). The main FDTs Recommended by ITU-T are ASN.1 (Recommendations X.209, X.680), TTCN (Recommendation X.292), GDMO (Recommendation X.722), SDL (Recommendation Z.100), MSC (Recommendation Z.120) and SDL with ASN.1 (Recommendation Z.105).

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[1] The content of the previous version of this Recommendation was also published as ISO Resolution ISO/IEC JTC 1/N 145. The revised (1996) Recommendation reflects changes since the original version was published in 1988.

The statement on precedence in case of several descriptions contained in the JTC 1 document is omitted in this Recommendation.

3.1.3 **natural language description**: An example of an informal description technique using one of the languages used by ITU-T to publish Recommendations. It may be supplemented with mathematical and other accepted notation, figures, etc.

3.2 Abbreviations

This Recommendation uses the following abbreviations:

EDH   Electronic Document Handling

FD   Formal Definition

FDT   Formal Description Technique

4 FDTs

4.1 Objectives of an FDT

The goal of an FDT is to permit precise and unambiguous specifications. FDTs are also intended to satisfy objectives such as:

– a basis for analysing specifications for correctness, efficiency, etc. (by simulation, verification or systematic test derivation);

– a basis for determining completeness of specifications;

– a basis for validation of specifications against the requirement of the Recommendation;

– a basis for determining conformance of implementations to Recommendations;

– a basis for determining consistency of specifications between Recommendations;

– a basis for implementation support.

In some areas more than one FDT may be needed to accomplish all objectives, but where the FDT is being used as a basis of standardization only FDTs adopted by the involved standards organizations shall be used. If only ITU-T is involved then only FDTs Recommended by ITU-T shall be used.

4.2 Benefits of an FDT

The application of an FDT can provide benefits such as:

– improving the quality of Recommendations, which in turn reduces maintenance costs to both ITU-T and to users of Recommendations;

– reducing dependency on the natural language to communicate technical concepts in a multilingual environment;

– supporting the validation of Recommendations and the easier generation of conformance tests for Recommendations, which then makes it easier to test products;

– reducing development time of implementations by using tools that are based on the properties of the FDT;

– making the implementation easier, resulting in better products.

4.3 Use of FDTs

FDTs are advanced techniques which are widely used in industry. Significant investment in training and tools have been made by ITU-T members.

There are limited resources for the development (rather than use) of FDTs. The development of FDTs tends to be a lengthy and costly task.

Although there is expertise within the ITU-T Study Groups both to assess the technical merits of the formally described Recommendations and to reach consensus on them, this is also limited.

4.4 Support for FDTs

The development and availability of tutorial and educational materials helps to provide widespread understanding of the complexities and capabilities of FDTs. The benefits of using an FDT can only be assured after some training.

Tools to support an FDT that is used in a Recommendation is an important facility that can ensure that many defects in draft Recommendations can be removed before they are published, and that the FDT is used with the semantics defined in the FDT Recommendation. The use of EDH enables ITU-T members to analyse draft Recommendations and utilize approved Recommendations in their own preferred FDT tools.

5 Criteria for development and Recommendation of FDTs

It is important to avoid unnecessary proliferation of FDTs because of the cost and difficulty of supporting many FDTs both for ITU-T and for its members. The following criteria shall be met before adopting a new FDT for use in ITU-T Recommendations:

– the need for the FDT shall be demonstrated;

– evidence that it is based on a significantly different model from that of an existing FDT shall be provided;

– the usefulness and capabilities of the FDT shall be demonstrated;

– there shall be at least two tools that adequately support the FDT available to any party on fair and reasonable terms.

When a significant modification to an existing FDT is considered, this shall be treated in basically the same way as an new FDT, regardless of whether the change is backwards compatible or not. The objectives are to keep both the number of FDTs low and each FDT itself stable to the benefit of all parties.

6 Procedure for development of formal definitions

6.1   Only standard FDTs (or FDTs in the process of being standardized) shall be used in Formal Definitions (FDs) of Recommendations.

6.2   The adoption of a FDT for any particular Recommendation is a decision of the Study Group (in consultation with ISO for collaborative standards). If a FD is to be developed for a new Recommendation, the FD shall be progressed at least as fast as the Recommendation.

6.3   For the evolutionary introduction of FDs into Recommendations three phases can be identified. It is the responsibility of the Study Group to decide which phase initially applies to each FD and the possible evolution of the FD toward another phase. It is not mandatory for a FD to go through the three phases described below and, more generally, it is not mandatory for a FD to evolve.

Phase 1

This phase is characterized by the fact that widespread knowledge of FDTs, and experience in FDs, are lacking; there may not be sufficient resources in the Study Groups to produce or review FDs.

The development of Recommendations has to be based on conventional natural language approaches, leading to Recommendations where the natural language description is the definitive Recommendation.

Study Groups are encouraged to develop FDs of their Recommendations since these efforts will contribute to the quality of the Recommendations by detecting defects, may provide additional understanding to readers, and will support the evolutionary introduction of FDTs.

A FD produced by a Study Group that can be considered to represent faithfully a significant part of the Recommendation or the complete Recommendation should be published as an Appendix to the Recommendation.

Meanwhile Study Groups should develop and provide educational material for the FDTs to support their widespread introduction in the ITU-T and Liaison Organizations.

Phase 2

This phase is characterized by the fact that knowledge of FDTs and experience in FDs is more widely available; Study Groups can provide enough resources to support the production of FDs. However, it cannot be assured that enough ITU-T Members can review FDs in order to enable them to approve a proposed formally defined Recommendation.

The development of Recommendations should still be based on conventional natural language approaches, leading to Recommendation where the natural language description is the definitive standard. However, these developments should be accompanied and supported by the development of FDs of these standards with the objective of improving and supporting the structure, consistency, and correctness of the natural language description.

A FD, produced by a Study Group, that is considered to represent faithfully a significant part of the Recommendation or the complete Recommendation should be published as an Annex to the Recommendation.

Meanwhile educational work should continue.

Phase 3

This phase is characterized by the fact that a widespread knowledge of FDTs may be assumed; ITU-T Members can provide sufficient resources both to produce and review FDs, and assurance exists that the application of FDTs does not unnecessarily restrict freedom of the implementations.

Study Groups should use FDTs routinely to develop their Recommendations, and the FD(s) become part of the Recommendation together with natural language descriptions.

Whenever a discrepancy between a natural language description and a FD, or between two FDs, is detected, the discrepancy should be resolved by changing or improving the natural language description or the FDs without necessarily giving preference to one over the other(s). Any inconsistency between any two parts of a Recommendation (regardless of whether either part uses an FD or not) means that there is an error in the Recommendation that needs to be corrected.

6.4   The above procedures for phased development of FDs are intended to aid the progression of FDs within the standards process, not to hinder their progression. Should procedural problems arise, the Study Group responsible for Formal Description Techniques should be informed and, where possible, recommended procedural modifications should be proposed to alleviate the problems.

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