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SERIES Z: LANGUAGES AND GENERAL SOFTWARE
ASPECTS FOR TELECOMMUNICATION SYSTEMS

Functional specification and description language (SDL)
Criteria for using formal description techniques (FDTs)

**CRITERIA FOR THE USE AND APPLICABILITY
OF FORMAL DESCRIPTION TECHNIQUES**

Reedition of CCITT Recommendation Z.110 published in
the Blue Book, Fascicle X.1 (1988)

NOTES

- 1 CCITT Recommendation Z.110 was published in Fascicle X.1 of the *Blue Book*. This file is an extract from the *Blue Book*. While the presentation and layout of the text might be slightly different from the *Blue Book* version, the contents of the file are identical to the *Blue Book* version and copyright conditions remain unchanged (see below).
- 2 In this Recommendation, the expression “Administration” is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

**CRITERIA FOR THE USE AND APPLICABILITY
OF FORMAL DESCRIPTION TECHNIQUES¹⁾**

1 Support for formal description techniques (FDTs)

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 provide an important approach toward such advanced methods.

In some areas, the use of FDTs is still relatively new and phased procedures are required to introduce their use. This Recommendation proposes the procedures to accomplish this task.

2 FDTs

2.1 Definitions

A **formal description technique (FDT)** is 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). FDTs are intended to be used in the development, specification, implementation and verification of Recommendations (or parts thereof).

A **natural language description** is an example of an informal description technique using one of the languages used by CCITT to publish Recommendations. It may be supplemented with mathematical and other accepted notation, figures, etc.

2.2 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 analyzing specifications for correctness, efficiency, etc.;
- a basis for determining completeness of specifications;
- a basis for verification 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 the current state of the art, in some areas more than one FDT may be needed to accomplish all objectives.

2.3 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 CCITT and to users of Recommendations;
- reducing dependency on the natural language to communicate technical concepts in a multilingual environment;
- 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.

¹⁾ The content of this Recommendation is also published as ISO Resolution ISO/IEC JTC 1/N 145.

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

2.4 *Problem with FDTs*

FDTs are advanced techniques which have not yet been widely introduced. In addition, there is a lack of resources in the development of FDTs and formal descriptions (FDs), as well as a lack of expertise within the CCITT Study Groups both to assess the technical merits of the formally described Recommendations and to reach consensus on them.

2.5 *Solutions*

The development of tutorial and educational materials will help to provide widespread understanding of the complexities of FDTs. Nevertheless, time must be permitted for their assimilation.

3 **Development and standardization of FDTs**

It is important to avoid unnecessary proliferation of FDTs. The following criteria should be met before adopting a new FDTs:

- the need for the FDT should be demonstrated;
- evidence that it is based on a significantly different model from that of an existing FDT should be provided, and
- the usefulness and capabilities of the FDT should be demonstrated.

4 **Development and acceptance of formal descriptions**

4.1 In future, only standard FDTs or FDTs in the process of being standardized should be used in formal descriptions of Recommendations.

4.2 It is considered that the development of a FD of 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 should be progressed, as far as possible, according to the same timetable as the rest of the Recommendation.

4.3 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 formal descriptions, are lacking; there may not be sufficient resources in the Study Groups to produce or review formal descriptions.

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 may 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 formal description 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 CCITT and Liaison Organizations.

Phase 2

This phase is characterized by the fact that knowledge of FDTs and experience in formal descriptions is more widely available; Study Groups can provide enough resources to support the production of formal descriptions. However, it cannot be assured that enough CCITT Members can review formal descriptions in order to enable them to approve a proposed formally described 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 formal descriptions of these standards with the objective of improving and supporting the structure, consistency, and correctness of the natural language description.

A formal description, produced by 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; CCITT Members can provide sufficient resources both to produce and review formal descriptions, 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 formal description, or between two formal descriptions, 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).

4.4 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. However, since there has been little or no actual experience with these procedures, any Study Group having to use them is urged to identify one or more pilot cases and carefully monitor the progress of each within the framework of the procedures. 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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