

E. L. LOHSE, Editor

PROPOSED USA STANDARD

Procedures for the Standardization Process*

Editor's Note

This proposed American Standard has been accepted for publication for a four-month period followed by a six-week letter ballot by USA Standards Committee X3 Computers and Information Processing. In order that the final version of the proposed standard reflect the largest public consensus, X3 authorized publication of this document to elicit comment, and general public reaction with the understanding that such a working document is an intermediate result in the standardization process and is subject to change, modification, or withdrawal in part or in whole. Comments should be addressed to the X3 Secretary, Business Equipment Manufacturers Association, 235 East 42 Street, New York, NY 10017.—E. L.

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1. Introduction

This document describes the procedures and criteria to be used in the process of standardizing programming languages from initial consideration through recommendation (by X3.4) of a proposed standard.

Sections 8 through 11 of the report present the criteria and other considerations applied at various stages. Section 2 outlines the overall procedure, with Sections 3 through 7 describing in more detail some of the major steps.

Comprehension of this process is assisted by noting the several levels of documentation that exist during standardization. There are various working documents and reports employed as source material in the development of a standard specification for a programming language. Once a specification has been agreed upon by the committee formed for preparation of the specification, that document passes through the following designations:

- PDPS—Proposed Draft Proposed Standard: specification agreed upon by the committee established for that purpose.
- DPS—Draft Proposed Standard: specification agreed upon by the standardization committee and cast in acceptable form for a USA Standard programming language specification.
- PS—Proposed Standard: published for review by the data processing community and being voted upon as a standard.
- S—Standard: approved by the USA Standards Committee responsible for standards on computers and data processing (X3) and accepted by USASI as a standard.

The committee structure within which the standardization occurs is shown in Figure 1.

2. General Procedure

2.1 PROCESSING STEPS

Successful processing of standards for a programming language, from initial interest in the candidate to issuance of a proposed standard passes through six major steps.

No exceptions to the processing procedure, past or present, are to be regarded as precedents for future deviations. The only alteration of these formal procedures shall be by explicit amendments.

2.1.1 Initial Investigation. When a language is called to the attention of USASI Working Group X3.4.2, it is determined whether further investigation is appropriate (Section 3).

Generally, further investigation is inappropriate only if a language conspicuously fails to meet the criteria for suitability of programming language standardization (Section 8).

2.1.2 General Evaluation. Working Group X3.4.2 attempts to form a suitable *ad hoc* committee (designated X3.4.2x) for evaluating the potential standardization of the language (Section 4).

Generally, further investigation is inappropriate if an *ad hoc* committee cannot be formed, or if, once formed, the *ad hoc* committee is unable to come to a conclusion, or if the *ad hoc* committee concludes that the language is unsuitable for standardization.

2.1.3 Recommendation for Standardization. If the *ad hoc* committee reports favorably to X3.4.2, and X3.4.2 concurs, then X3.4.2 submits a motion to parent Subcommittee X3.4 recommending that a standardization committee (X3.4.i) be formed. The motion shall contain a statement of the proposed scope and program of work for the standardization committee.

If the *ad hoc* subcommittee reports unfavorably to X3.4.2, and X3.4.2 concurs, the candidate language is dropped from further consideration.

Whether the *ad hoc* committee reports favorably or unfavorably to X3.4.2, if X3.4.2 disagrees with that recommendation then X3.4.2 submits a report to X3.4. The *ad hoc* committee may submit a dissenting report to X3.4. Further action will take place only by direction from X3.4.

2.1.4 Development of Draft Specifications. USASI Subcommittee X3.4 forms a standardization committee (X3.4.i) charged with preparation and approval of a Proposed Draft Proposed Standard (PDPS) specification for the language (Section 5).

Appropriateness of further processing is determined by Subcommittee X3.4.

2.1.5 Review of Draft Specification. Upon completion of standardization committee effort, the PDPS is reviewed by X3.4.2, which then recommends whether X3.4 should accept the document as a Draft Proposed Standard (DPS).

If X3.4.2 determines that the PDPS fails to meet the Criteria for Draft Proposed Standards (Section 9), it will be X3.4.2's recommendation that the PDPS be returned to X3.4.i for further processing and subsequent re-evaluation by X3.4.2 (Section 6).

X3.4.2 may also choose to recommend return to X3.4.i for further processing if the language specified fails to meet the overall criteria or is judged by X3.4.2 to be intrinsically deficient (see, e.g. Section 10).

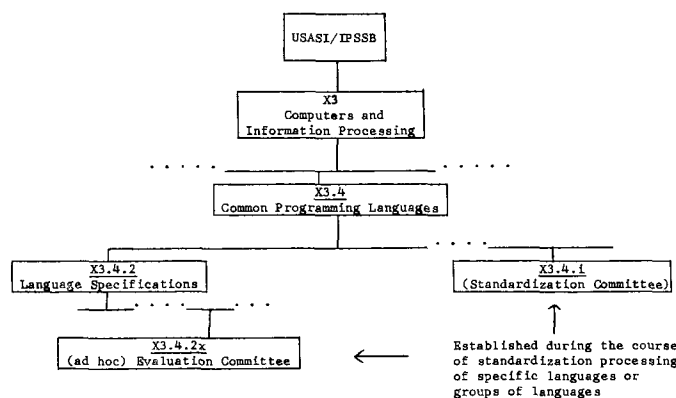


FIG. 1

* USASI Document X3.4/68-1, X3/SAC/93, 1968 July 10

2.1.6 Endorsement of Proposed Standards. X3.4 evaluates, as a DPS, the PDPS transmitted from X3.4.i, together with X3.4.2's evaluation, and recommends that USA Standards Committee X3 accept the document for further processing as a proposed standard (Section 7).

Appropriateness of further processing is determined by X3.4.

2.2 MODIFICATION OF PROCESSING

At any time, processing may be reinitiated at an earlier stage to take actions determined to be essential for further processing. If processing is terminated at an early stage, there is the possibility of subsequent reinitiation. The manner of reinitiation depends on individual circumstances.

A reason for reiteration or termination of the standardization process is that criteria previously determined to be satisfied are subsequently determined not to be satisfied.

Finally, it is recognized that there must be additional stages to account for the maintenance of an approved standard. The problem of maintenance has not been considered in this report (cf., however, Section 7, final paragraph).

2.3 APPLICATION OF CRITERIA

The criteria for suitability of programming language standardization (Section 8) are to be applied throughout the processing of a language.

The criteria for Draft Proposed Standards (Section 9) must be met before a Proposed Draft Proposed Standard will be accepted by X3.4 as a Draft Proposed Standard.

It is recognized that criteria are subject to change. The applicability of such changed criteria to standardization activities already in progress must be established on a case-by-case basis.

3. Initial Investigation of a Language

"When a language is called to the attention of USASI subcommittee X3.4.2, it is determined whether further investigation is appropriate." (Section 2.1.1)

3.1 WAYS OF CALLING ATTENTION TO LANGUAGES

The phrase "called to the attention of... X3.4.2" is deliberately vague. Ways by which the subcommittee's attention may be called to a particular language include (but are not restricted to):

- (a) Independent deliberations of X3.4.2
- (b) Specific direction from subcommittee X3.4
- (c) Requests from individuals or groups outside of the USASI X3 structure
- (d) Examination of results of surveys of the status of programming language developments in the industry

3.2 ESSENTIAL DETERMINATIONS

At this stage, there must be an attempt to determine whether general candidacy criteria (Section 8) have been (or will be) met. It may well be that the particular characteristics cannot be determined at such an early stage. Nevertheless, such criteria are to be applied to determine that there is, at least, no conspicuous basis for rejection without further processing. In that regard, more weight is generally given at this time to the potential advantage of standardization; general suitability of the language per se will usually require further investigation for determination.

The *proposer* of a language is that agency which calls the language to the attention of X3, X3.4, or X3.4.2. It is the responsibility of the proposer to insure that relevant documentation will be supplied to X3.4.2. (Relevant documentation, in this context, includes at least the following: (1) the most complete existing set of language specifications; (2) primers, if available; and (3) descriptions of subsets and dialects, if any.) The proposer is also expected to state a case for the probable need of standardization. It is assumed that X3.4.2 will not undertake processing unless such fundamental steps are carried out. Having fulfilled such minimal requirements, the proposer of a language is not subject to any further obligations.

The *sponsor* of a language is that agency (possibly the same as the proposer; possibly a specially formed committee) which is identified as the source of continuing definition for the language and of additional technical information. The sponsor(s) of a language is relied upon as a source of essential material for the standardization process. If sponsorship cannot be established for a language or if the sponsor is unable to disclose essential information, further processing is not possible.

The sponsoring and proposing agencies, which may be the same, may be individuals, institutions, organizations, or cooperative committees (possibly within USA Standards Committee X3).

At any stage the unobtainability of information essential to performance of the standardization process is sufficient reason for the suspension of processing. In addition, such information must be available without restriction for those uses which are customary or essential to the standardization process.

4. Evaluation of Language and Application Area

"Working Group X3.4.2 attempts to form a suitable *ad hoc* committee (designated X3.4.2*i*) for evaluating the potential standardization of the language." (Section 2.1.2)

If, on initial investigation, X3.4.2 determines that there is a potential need for standardization, an *ad hoc* committee is formed to perform a prestandardization investigation of the language and the intended application area.

A scope and program of work is assigned to the *ad hoc* committee, directing the committee to report to X3.4.2 regarding the language in relation to its intended application area, regarding the general need for standards in the application area, regarding other languages (emerging) in the application area, and regarding the suitability of already standardized languages used in the application area.

SCOPE:

To investigate the programming language _____ for the purpose of determining its suitability as a candidate for standardization.

PROGRAM OF WORK:

The *ad hoc* committee shall do at least the following in considering the suitability of a language for standardization:

- (1) Delineate the present and, if possible, the potential, application area(s).
- (2) Consider and report on other *existing* languages which are now, or may in the near future be, used in the delineated application area(s); these other languages include, but are not restricted to: _____.
- (3) Recommend disposition of the language under consideration according to a determination of whether general suitability criteria (as described in section _____ of Procedures for the Standardization Process, document number _____) appear to be met and without prejudice to the standardization of the other languages identified by the *ad hoc* committee under (2).
- (4) Comment regarding the standardization of the other languages identified by the *ad hoc* committee under (2).
- (5) Provide documentation of deliberations and conclusions reached in examining the criteria (see section _____ of _____) and work done under points (1)-(4) above.

5. Preparation of the Draft Specifications

"If the *ad hoc* committee reports favorably to X3.4.2, and X3.4.2 concurs, then X3.4.2 submits a standard motion to parent Subcommittee X3.4 requesting that a standardization committee (X3.4.i) be formed. The motion shall contain a statement of the proposed scope and program of work for the standardization committee." (2.1.3)

"USASI subcommittee X3.4 forms a standardization committee (X3.4.i) charged with preparation and approval of a Proposed Draft Proposed Standard (PDPS) specification for the language." (2.1.4)

The standardization committee, X3.4.i, is responsible for completing the documentation and making those alterations necessary for the standard language to fulfill the criteria applicable for programming language standards (Section 8).

As part of the standardization, it may be necessary to determine appropriate subsets (Section 11). Such subset standardization shall be undertaken by the same committee, X3.4.i. The subcommittee has the responsibility for determining that the subset conditions are met and there is an advantage resulting from the standardization of each and every subset.

The standardization committee, X3.4.i, prepares a PDPS fulfilling the requirements for a Draft Proposed Standard (DPS: Section 9); the standardization committee may utilize any available resources for this purpose.

To insure that all standardization advantages are realized and that the PDPS represents a thoughtful solution to the requirements of the intended users, it is required that standardization committee X3.4.i be suitably representative. Standardization committee X3.4.i cannot delegate either authority or responsibility for approval of the PDPS.

6. Review of Draft Specifications

"Upon completion of standardization committee effort, the PDPS is reviewed by X3.4.2 which then recommends whether X3.4 should accept the document as a Draft Proposed Standard (DPS)." (2.1.5)

Review by X3.4.2 will not commence until the standardization committee (X3.4.i) has fully processed the PDPS according to Section 5 and has fully approved the PDPS. X3.4 will not establish schedules which inhibit or discourage careful review of a PDPS.

The PDPS is evaluated by X3.4.2 primarily, but not exclusively, as a document. The standardization committee X3.4.i is advised of deficiencies which must be rectified before X3.4.2 will recommend acceptance of the PDPS as a DPS. In addition, X3.4.2 determines whether suitable explanations accompany the PDPS, as appendices, to explain the selection of the language, motivation for standardization, criteria applied in obtaining a standard specification, compromises made, and alterations made from possible existing implementations to satisfy the governing criteria.

In the event that such ground rules are not met in the opinion of X3.4.2, then X3.4.2 will recommend that the PDPS be returned to X3.4.i for further processing, reapproval, and subsequent reevaluation by X3.4.2.

7. Endorsement of Proposed Standards

"X3.4 evaluates, as a DPS, the PDPS transmitted from X3.4.i, together with X3.4.2's evaluation, and recommends that USA Standards Committee X3 accept the document for further processing as a proposed standard." (2.1.6)

The evaluation by X3.4 is a final review according to all criteria.

If X3.4 approves the DPS, it is submitted to X3 for publication as a Proposed USA Standard (PS) and balloting for approval as a USA Standard.

It has been tentatively proposed that prior to submission of a DPS to X3, a representative national body (which may be the X3.4.i standardization committee) must undertake to accept the responsibility for the maintenance of the standard (as opposed to language maintenance), e.g. resolve any ambiguity, complete or alter the way in which the language is defined in the standard, and establish procedures for potential incorporation of modifications and additions. Such a group, as part of interpreting the standard, might also be called upon to specify procedures by which an implementation can be shown evidently to be in conformance with the standard. (It is recognized that such procedures can generally not be exhaustive.)

8. Criteria for Suitability of Programming Language Standardization

Suitability for standardization is determined according to the apparent advantage of standardization, the general suitability of the language, and the appropriateness of the purpose of the language. (Consideration of intrinsic merits of languages is discussed in Section 10.)

8.1 ADVANTAGES AND DISADVANTAGES OF STANDARDIZATION

A need for a standard must either exist or be reasonably expected to exist. More generally, there must be a definite advantage to standardization.

For example, although a language might have limited utility as a programming language, there nonetheless may be an advantage to having a precise definition associated with the name of the language. The standardization process might be the best method for securing such a definition.

Against the apparent need for a standard must be weighed the disadvantages of standardization at a particular time. E.g. if the technical area for which the standard is intended is not fully understood, is unstable, etc., standardization may be premature.

Similarly, if the amount of effort and the time lapse inherent in producing a standard appear to cancel any advantage of standardization, then standardization may well be undesirable.

8.2 GENERAL SUITABILITY OF A LANGUAGE

The following requirements must be met for a language to be accepted as a standard:

(1) A substantial number of prospective users of the standard language must exist. The number of prospective users must also be a significant proportion of the number of potential users in the area of application. The smaller the number of potential users in an absolute sense, the greater the required proportion of prospective users in the area of application.

(2) The language must accommodate a substantial portion of the problems confronting the potential users.

(3) The language should be compatible with those standards, recommendations, and accepted practices which are considered applicable; deviations and discrepancies must be justified.

(4) The language must be such that a processor for the language can be implemented with hardware and software facilities generally available to the potential users.

The *ad hoc* committee is to interpret the above criteria in the light of the candidate language, the intended area of application, and the state-of-the-art when the interpretations are made. These interpretations, as well as the results of applying the interpreted criteria, are to be provided to X3.4.2 as part of the report of X3.4.2x.

8.3 PURPOSE OF A LANGUAGE

A standard programming language must serve an appropriate purpose, such as:

- (1) Cover a previously uncovered area of application
- (2) Provide a language suited to the needs of a particular class of users in an already covered application area
- (3) Improve the technical coverage of an already covered area
- (4) Provide economic advantage for manufacturer or user
- (5) Provide a combination of language features differing from those combinations available in existing languages, to cover areas of application not satisfactorily covered by any one existing language

9. Criteria for Draft Proposed Standards¹

9.1 The Draft Proposed Standard must be prepared in the format and in the style required of a Proposed Standard. This includes following the general recommendations of the Style Manual for USA Standards, plus

¹ This supercedes those approved on 12/5/63.

Webster's New International Dictionary; the University of Chicago Manual of Style; applicable USA Standards for symbols, abbreviations, definitions, diagrams, drafting, vocabulary, and documentation; and other requirements developed expressly for programming language standards.

9.2 The definition of the language must be clear, precise, and self-consistent.

The rigorous use, where appropriate, of well-defined artificial meta-languages, diagrams, etc., is preferred, but concise natural language may be acceptable. In some cases, compilation algorithms may be employed for adequate definition. Any combination of techniques may be used to enhance clarity of definition. Usage of these techniques must be compatible with applicable standards in the field.

9.3 The description of the language must be such that any program written in the language is capable of one and only one interpretation according to the Draft Proposed Standard. In that regard, elements having an interpretation which is indefinite must be identified; the standard should prescribe the manner by which more definite interpretation may be determined. (E.g. the standard may stipulate interpretation in terms of parameters whose values are not uniquely prescribed by the standard. Specific values for the parameters determine a more definite interpretation.) A program which fails to admit of an interpretation according to the standard is not a "program written in the language."

9.4 There must be appendixes giving suitable explanations of: selection of the language, motivation for standardization, criteria applied in obtaining the standard specification, alternatives considered and compromises made, language features where interpretation is indefinite, and deviations from existing practices which are necessary to satisfy the criteria deemed significant in the development of this standard. If subsets, media representations, and hardware representation are not specified by the standard, they must be discussed in appendixes. Devices such as indexes and a table of contents are recommended where they will facilitate the use of the document.

10. Consideration of Intrinsic Language Merit

The procedures for standardization of programming languages do not impose requirements on the intrinsic characteristics of a language and do not stipulate the manner in which a language is recognized as being a programming language. Such prescriptions are not to be inferred from this specification. Nevertheless, it is difficult to imagine that evaluation for standardization (as in, say, Section 2.1.2) would occur without some consideration of intrinsic features. While this document does not prescribe criteria for such characteristics, nor weights to be attached, nor points of application, it is clear that criteria such as the following apply at least informally.

10.1 It should not be needlessly difficult for the intended user to learn the language.

10.2 It should be natural to write programs in the language which are easily understandable to the intended users of the language.

10.3 The language should have no needless arbitrary limitations or exceptions in its rules. Since this objective may be compromised by other requirements, any limitations should be clearly justifiable with respect to such requirements, e.g. learning ease, processing efficiency, and available capacity.

10.4 The language should provide the intended user with appropriate access to facilities for effective communication with the environment.

The *ad hoc* committee is to interpret the above criteria in the light of the candidate language, the intended area of application, and the state-of-the-art when the interpretations are made. These interpretations, as well as the results of applying the interpreted criteria, are to be provided to X3.4.2 as a part of the report of X3.4.2x.

11. Determination of Language Subsets²

11.1 REFERENCE, NUCLEUS, AND INTERMEDIATE SUBSETS

It is assumed to be a basic requirement of any establishment of subsets that there be two clearly recognizable extreme cases: the maximal language, *L*, and the minimum feasible subset, *N* (for nucleus).

The nucleus language, *N*, is the agreed upon minimum version of the language. At least *N* must be completely specified as a single standard language.

The maximal language, *L*, includes all facilities incorporated as features in a single language. *L* need not be a standard language. Whether or not *L* is a standard language, it is desirable that there be a complete specification for *L*.

If there are, as well, additional subsets *I*₁, *I*₂, ..., *I*_{*m*} then it is re-

² The considerations for subset development are based on the French proposal for criteria, ISO/TC 97/SC 5 (France 5) 49E, December, 1968, on the ECMA analysis of language levels, ISO/TC 97/SC 5 (ECMA-7) 112, March, 1965, and on the technique of language modules devised in USASI Working Group X3.4.4 and employed for proposed USA Standard COBOL.

quired that (1) each I_j be a proper subset of L , and (2) N be a proper subset of each I_j .

In set-theoretic notation,

$$L \supseteq I_1 \cup I_2 \cup \dots \cup I_m$$

$$N \subseteq I_1 \cap I_2 \cap \dots \cap I_m \cap L$$

where "U" denotes the union of features and "∩" denotes the intersection of features (selection of only those common to both the two operands).

11.2 MODULAR SPECIFICATION OF SUBSETS

Modular specification of subsets is an equivalent method for determining the intermediate subsets of a language by other than explicit enumeration.

In the modular approach, there is a nucleus, N , and a set of modules, M_i , where each module is a collection of language additions to N . The nucleus has no feature in common with any module. (That is, $N \cap M_i = \varnothing$ (empty).)

The standard subsets are the nucleus in combination with any one or more of the modules:

$$I_i = N \cup M_{i_1} \cup M_{i_2} \cup \dots \cup M_{i_p}$$

with

$$L \supseteq N \cup M_1 \cup M_2 \cup \dots \cup M_n$$

for a language having n modules.

With the module approach, it might be possible to achieve L only by inclusion of more than one module. Secondly, there may be nested, overlapping, or mutually exclusive modules. That is, it is not necessary

that either

$$L = N \cup M_i \quad \text{for some } i,$$

or that

$$\varnothing = M_i \cap M_j \quad \text{for all } i, j \quad \text{where } i \neq j.$$

Note that given N , L , and some intermediate subsets, then a set of modules capable of generating precisely those subsets (and L) can be determined.

When there are to be multiple subsets, specification in terms of modularity is preferable.

11.3 METHODS OF SPECIFICATION

(To be submitted for approval at a later date.)

11.4 SOME RESTRICTIONS

As with standards in general, a standard programming language represents a floor, not a ceiling. Thus L or a subset may be the basis of a more extensive programming language.

Suppose some programming language X purports to include I (a subset of L), but not all of L . In order for X to be an acceptable extension of I , X must not contradict L . That is, X must not contain a syntactic form or syntactic feature of L to which X ascribes a different meaning from the one ascribed by L . It is permissible, however, for X to provide a new syntactic form to achieve an effect already obtainable in L or even in I . In other words, any extensions made to a subset of L must be permissible extensions to L itself.

If the definition of L involves modules which are defined to be mutually exclusive, L as such is excluded from the standard. However, it must be possible to form L as an extension to the standard. In other words, modules must not be mutually exclusive on the basis of contradiction but only on the basis of appropriateness.

PROPOSED USA STANDARD

Code Extension Procedures for Information Interchange*

Editor's Note

This proposed American Standard has been accepted for publication for a four-month period followed by a six-week letter ballot by USA Standards Committee X3 Computers and Information Processing. In order that the final version of the proposed standard reflect the largest public consensus, X3 authorized publication of this document to elicit comment, and general public reaction with the understanding that such a working document is an intermediate result in the standardization process and is subject to change, modification, or withdrawal in part or in whole. Comments should be addressed to the X3 Secretary, Business Equipment Manufacturers Association, 235 East 42 Street, New York, NY 10017.—E. L.

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* USASI Document X3.4/248, June 14, 1968

Foreword

(This foreword is not a part of the USA Standard Code Extension Procedures for Information Interchange, X3. . .)

The proposed USA Standard Code for Information Interchange (ASCII-USASI X3.4-19) provides coded representations for a set of graphic and control characters having general utility in information interchange. In some applications it may be desirable to augment the standard repertoire of characters with additional graphic symbols or control functions.

The Code includes several special characters intended to facilitate the representation of such additional symbols or functions, a process known as *code extension*. Although the basic nature of code extension—providing for encoding of information beyond the standard—limits the degree to which it may be standardized, there are advantages to adherence to certain standard rules of procedure. These advantages include minimized risk of conflict between systems required to interoperate, and the possibility of including advance provision for code extension in the design of general purpose data handling systems.

These standard procedures were developed after extensive study of various potential applications and of trends expected in system design.

1. Scope

This standard specifies a set of procedures for the representation, by characters of ASCII¹, of graphic symbols or control functions, not directly represented in ASCII, which may be required for a specific application or system. This standard does not make specific assignment of such characters or functions.

¹ USA Standard Code for Information Interchange