

The Origins of WG5

Introduction

Up to the late 1970s programming language standards were typically produced by the national standards organization of a single country or by an international organization other than ISO itself. For example Cobol, Fortran and PL/I standards were produced by the American National Standards Institute, Coral, Pascal and RTL/2 by the British Standards Institution and Pearl by the Deutsches Institut fuer Normung. Algol 60 was promoted to ISO level by IFIP.

Contrarily, in the mid 1970s there were independent projects by the US, UK and ECMA to standardize Basic and some activity also in Japan. There was also the disadvantage that national standards, which were used worldwide, could be adopted as ISO standards without many of their eventual users having had opportunity to specify their interests or requirements.

The need for a more systematized policy on programming language standardization was recognized at the meeting of TC97/SC5 (now JTC1/SC22) at The Hague in November 1977. It was agreed that national and international development of standards should be coordinated. So far as Fortran was concerned this led directly to the meeting of 'SC5 Fortran Experts' in London in November 1978, with further such meetings in 1980 and 1982, and then to formal establishment of SC5 Working Group 9 (Fortran) in 1984. Following a reorganization of SC5 in 1985, the Fortran group was renamed SC22/WG5.

The following paper by Brian Meek, written immediately after the Hague meeting, describes the discussions at the SC5 meeting so far as they concerned Fortran. They include discussion of technical details at a late stage of development of Fortran 77. The paper is reproduced unchanged, including the typos: "Halberton" for "Holberton" and with the subsections in section 10 mis-labelled.

David Muxworthy

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UK Report on FORTRAN developments

1. In the plenary sessions, FORTRAN came up in two contexts, that of the language itself and, under PLIP, that of real-time extensions. This report is confined to the first of these.
2. Under section 10.2 of the agenda, a report was made to the plenary session on Tuesday morning (15 November) on the current state of FORTRAN. This was given by Jeanne Adams, Chairman of the ANSI X3J3 committee. Although X3J3 regarded X3J3/90 (SCS/N397) as the final FORTRAN 77 report, there were some corrections and minor amendments to discuss, circulated as N410. Also, X3J3 were beginning to plan the work needed for the next revision, informally known as FORTRAN 82. Thus there was a need for an ad hoc working group on FORTRAN. This was agreed.
3. The ad hoc FORTRAN group met three times, on the Tuesday afternoon (15 November) for about three hours, Wednesday morning (16 November) for about two hours, and Wednesday afternoon (16 November) for about two hours. There were also informal discussions at other times, and a "FORTRAN dinner" on the Tuesday evening. The membership varied a little from meeting to meeting but the general pattern was U.S.A. 6, U.K., Netherlands and Japan 2 each, France, Germany and Sweden 1 each, with other delegates from U.K., Netherlands, Sweden and France attending for part of the time. As the meetings were scheduled in coordination with ALGOL meetings, Dr Hill was able to attend for most of the time, except when involved in Drafting Committee meetings. Mr Meek attended full-time, and Dr Addyman also attended most of the Wednesday sessions. The working group was chaired by Jeanne Adams and the other U.S.A. members were all X3J3 members: Richard Signor (who took minutes), Loren Meissner (secretary-elect of X3J3), Frances Halberton, Walt Brainerd and Lloyd Campbell.
4. Discussions in the working group were on four main topics, though somewhat overlapping and not discussed in this sequence:
 - (a) FORTRAN 77 in general and the N410 amendments to N397 in particular;
 - (b) the U.K. paper (N387) on criteria for programming language standardisation as they apply to FORTRAN;
 - (c) a Swedish request for READ/WRITE in the next revision to include certain capabilities;
 - (d) planning for the development of "FORTRAN 82".

For convenience these will be reported in this order, and separately, though the actual discussion was rather more discursive in places.

5. The U.S.A. delegates were especially anxious to find out the attitude of the other delegates to FORTRAN 77, and whether they were happy with the result and the way it was achieved. The general feeling expressed was that, although there were a number of things about it on doubts could be expressed, it was sufficient of an improvement over the old standard to be worth accepting. It became evident during discussion that very much reflected the view in the U.S.A., both inside X3J3, and outside. It was made clear more than once that FORTRAN 77 was presented in its final form not because it was thought perfect, but because it had already been 11 years since the last standard, many people

were waiting on the outcome of the revision, and it had eventually been decided that it was not worth spending more time in an attempt to reach agreement on further improvements.

6. There was a presentation of the amendments listed in N410. Most of these did not change the meaning of N397, but simply corrected minor slips or presented the same material in a clearer way. The three amendments which caused changes in the language itself were:
 - (i) N410 No.6. This changed the definition of INQUIRE so that constructs like

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INQUIRE (UNIT=I, ACCESS=A(I))
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which were previously unnecessarily excluded, are now permitted.
 - (ii) N410 No.12. This, the only major change, adds four further standard functions for determining the lexical relationship between operands of type character in accordance with the ASCII collating sequence defined in X3.4 (1968).
 - (iii) N410 No.14. This changes the definition of the length specification for character entities to bring it into line with the appropriate syntax chart. This was an unintentional irregularity in N397, and it was the syntax chart definition which had been the correct one.
7. There was general praise from the non-U.S.A. delegations for the way in which X3J3 had actively sought comments from other countries and had dealt with the comments received. The only difficulty experienced had been that the use of sea mail sometimes left too little, or even no, time to formulate and send in comments. The X3J3 members expressed their gratitude for the help they had received from outside the U.S.A., making special mention of the U.K.
8. The ad hoc group agreed to recommend to SC5 that N397 as amended by N410 be made the subject of a letter ballot for acceptance as a draft international standard. (This was unanimously accepted at the plenary meeting on Thursday 17 November.)
9. Discussion of the U.K. criteria document (N387) were confined to sections 5 and 6 (form of the standard, and guidelines for assessment) as FORTRAN clearly satisfied any sensible criteria for the need for standardisation. Sections 5 and 6 were discussed both in relation to FORTRAN 77, and how they might apply to future revisions.
10. The following points were made in connection with section 5 of N387.
 - (i) The US National Bureau of Standards would probably produce a set of validation routines for FORTRAN 77, though these would not be comprehensive.
 - (ii) There is a danger with validation routines that it is these rather than the defining document which effectively determine the standard.
 - (iii) FORTRAN 77 did not accord with all the requirements of section 5.
 - (iv) The chief difficulties for FORTRAN, present and future, were in items 5c (metalanguage), 5e (indefinite interpretation), and 5f (diagnostics).
 - (v) On metalanguages (against) it was pointed out that the FORTRAN 77 document is readable; that the syntax charts were intended to cover at least partly the purpose of a syntactic metalanguage; and that existing metalanguages, with their recursive structure, were perhaps more suitable to languages with a nested block structure, than to FORTRAN. On metalanguages (for) it was pointed out that they tend to shorten the

text and aid precision of definition; that a good one may enhance clarity; and that the use of one did not preclude the existence of a more informal description. (In this connection the possibility of two standard documents, or a formal standard plus an informal description, one for implementors and one for programmers, was briefly discussed.) It was noted that use of a metalanguage was already one of the items for discussion for FORTRAN 82.

- (vii) It was felt that the term "indefinite interpretation" in 5e of N387 was itself capable of indefinite interpretation. The view was strongly expressed that FORTRAN had a tradition of being "permissive" and "open-ended" in that it allowed implementations to include special features and extensions, and that this was something which was valuable and should be retained. It was remarked that section 6h did envisage the possibility of extensions.
- (viii) On diagnostics, it was pointed out (against 5f) that it was in part beyond the state of the art; that run-time messages were very dependent on the operating environment; that too detailed specification of error messages might determine the parsing algorithm; that certainly there would be too many constraints upon compiler writers; and that there would be problems for implementations on small machines which could not afford the full diagnostic messages. On diagnostics (for 5f) it was stated that programming languages were for programmers, not compiler writers; that standards in the area were badly needed; (re small machines) it was only stated that the form and content of error messages be specified, not that they should be readable, so that e.g. reference to a numbered list might be specified in a standard as acceptable for a small-machine compiler; and that different levels of run-time diagnostics for different optimisation levels were probably also acceptable. An example of the wild variety of error messages produced by different COBOL compilers for a simple error detectable by any conceivable parsing algorithm (derived from a draft paper by David Fisher) was presented with the remark that a similar situation must exist in FORTRAN. Even if the full criteria could not be met there was a case for at least minimum criteria. (It was noted later that diagnostics had already been mentioned in X3J3 as a possible work item for FORTRAN 82.)

11. The following points were made in connection with section 6 of N387.

- (i) Some of the guidelines for assessment echoed requirements in section 5 and had already been discussed.
- (ii) For FORTRAN, 6a, 6b, 6c and 6h were probably most relevant.
- (iii) On 6c (arbitrary limitations and unexplained irregularities) it was accepted that FORTRAN 77 does not accord with this. The irregularities could be justified by appeal to "other requirements" such as upward compatibility and the need to protect the massive investment in existing programs, but there are so many instances that to justify each separately would greatly increase the size of the text.
- (iv) It was remarked on 6i (action of all-correct programs defined) that when stated as absolutely as this it was impossible to achieve.
- (v) It was remarked that one criterion was not included, i.e. that a program text should be easy to type-set and print by non-specialist printers, to aid documentation and portability. FORTRAN did not accord with such a criterion because of its special uses of columns 1-6.

12. It was generally felt that sections 5 and 6 of N387 were useful and stimulating even though some items could not or should not be applied to FORTRAN, and others, however desirable, were not achievable, at least with the present state of the art. On behalf of the U.K. it was remarked that many of the points raised had already come up in internal BSI discussions and the difficulty of achieving some of the listed aims was recognised; nevertheless they were felt to be things which should always be kept in mind and striven towards.
13. The Swedish delegation suggested that FORTRAN (and COBOL) should be required to be implemented in such a way that READ/WRITE can be done using the ISO standards 1001.2 (tape labels and file formats) and 646 (character sets and coding). There followed a somewhat inconclusive technical discussion but the general opinion of the X3J3 members was that these matters were the responsibility of the operating system.
14. On the development of the next standard Mrs Adams said that the rough schedule mapped out was that X3J3 would discuss the philosophy of the new revision during 1978 and particular proposals for revision items during 1979, the remainder of the time until the target date of 1982 for the publication of the new revision being taken up with writing and the comment periods. It was stressed that this was only tentative and that overlap between the "philosophy" and "construct", periods was quite possible. Comments from outside the U.S.A. would be very welcome immediately and at any time during the period. Various X3J3 members stressed that the more comments there were the better.
15. The group agreed that whatever the outcome of discussion on the proposed procedures for international standards generally, the proposed procedure should apply to FORTRAN. (In fact the proposed procedure was agreed at the plenary session on Thursday 17 November.) In particular there should be an ad hoc meeting of experts of all interested countries in late 1978 or early 1979, when X3J3 would have formulated some ideas about the new revision to present to the meeting, but work would not be so advanced that those from other countries would not be able to influence development significantly. This would be the culmination of a series of X3j3 meetings at which there would be "special interest days" on e.g. databases, industrial processes, and large-scale processing. For the international meeting, the east coast of the U.S.A., The Netherlands, U.K. and Sweden were mentioned as possible venues.
16. A sheet was distributed, written by an X3J3 member, indicating areas in which X3J3 might work. It was stressed that this did not represent fixed policy of X3J3 and was circulated only to indicate the general lines along which the committee was thinking. This indicated general philosophical considerations to be taken into account (portability, regularity/modularity, the size of the language, compatibility with FORTRAN 77, efficiency, detailed meaning/definition/ semantics) and categories of possible changes (program form, control/flow constructs, data types/storage/expressions, input-output, environmental interface, semantics/definition/portability).
17. Comments were called for on possible lines of approach to FORTRAN 82, and the following points were made.
 - (i) One could try to produce a compact language, with a set of standard extensions.
 - (ii) A variation to (i) would be to keep FORTRAN 77 as the base.
 - (iii) The revision should concentrate on improving the human usability of the language and on the things which FORTRAN does well, simplifying rather than producing further extensions.

- (iv) A precedent had been set for deletion and further candidates were the remaining (FORMAT) uses of Hollerith strings, arithmetic IF, assigned GOTO, statement functions.
- (v) An alternative would be to retain such features but announce that they would be deleted in the following revision.
- (vi) New features were needed as well as e.g. extensions for real-time and database work, e.g. internal procedures and a CASE construct.
- (vii) The DO loop should be made more structured and readable, at least with an ENDDO analogous to ENDIF, perhaps with a flexible STEP (from, by, to..) WHILE.... DO.... UNTIL.... ENDDO construct in which all but DO and ENDDO were optional.
- (viii) Consideration should be given to matters like character sets, length of identifiers, significant blanks, layout conventions, needs of terminal users, etc.

18. I was tremendously impressed by the keenness of the X3J3 members to have as many ideas and opinions as possible from other countries. I strongly urge that the following actions be taken:

- (a) BSI issues an immediate invitation to ANSI and ISO to hold the late 1978/early 1979 ad hoc SC5 expert group meeting on FORTRAN in the U.K.
- (b) A U.K. experts group on FORTRAN, under David Muxworthy and based on the BCS specialist group and DPS/13, be set up to formulate proposals for and coordinate U.K. views on FORTRAN 82 up to and including, and possibly after, the SC5 ad hoc group meeting mentioned in (a).

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Brian Meek

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