INTERNATIONAL COMPUTERS AND TABULATORS LIMITED

Programming Language Division

Fortran Note 23
22/3/66.

Compiler Magnetic Tape Input/Output System

The note describes the system developed in #XFAM for input from, and output to, magnetic tape in subfile format as specified in PDCC/171, issue 2. The document supersedes Fortran Note 17.

Magnetic Tape Input and Output for #XFAM

Introduction: All output from #XFAM is on magnetic tape. Input may be from cards, paper tape or magnetic tape, or from any combination of these (see description of the dynamic allocation system). The Fortran 1V Library must be input from an MLT.

Magnetic Tape Input: Input may be from "simple files" or from "composite files", with the important restriction however that only semi-compiled programs or segments may be held on simple files.
A simple file consists of the following:-

(a) A Header label containing the file name, etc.
(b) TAPEMARK
(c) A semi-compiled program or semi-compiled segments.
(d) TAPEMARK
(e) Trailer label composed as follows:

Word 0 = #40000000
Word 1 = count of number of blocks in file
Words 2, 3 = Zero
Words 4 - 19 = Not used.

A composite file may hold source programs, source segments, semi-compiled programs and semi-compiled segments.

The tape is divided into subfiles each preceded by a subfile sentinel and terminated by end-of-subfile sentinel. At present a subfile may consist either entirely of subfiles (these may be nested to any depth) or entirely of program in one of the forms described above. No two subfiles sentinels on a file may contain the same subfile name.

Since a subfile sentinel contains one indicator recording the nature of its contents (i.e. source, s/c segments, or s/c program), a subfile containing program must contain it in only one of these forms. However this indicator is ignored in the case of subfiles composed of other subfiles; consequently a subfile can contain subfiles holding program material in any or all of the three forms.

A composite file is made up as follows:-

(a) A Header label containing the file name, etc.

(b) Subfiles (nested to any depth)

(c) End of composite file trailer label

A subfile is always preceded by a subfile sentinel having the form:-

Word 0 : #00000006

Words 2-4 : Subfile name (must start with a letter and must contain only letters, digits, spaces and hyphers)

Word 12 : B2F4 for source program or segments
A200 for consolidated semi-compiled program
A300 for semi-compiled segments
C100 for composite subfile

Word 14 : Maximum block size
(21 for source; 20 for semi-compiled).

Words 1,5 - 11, 13, 15- 19 : Not used at present

A subfile is always terminated by an end of subfile sentinel having the form:-

Word 0 : #40000000

Word 1 : Count of data blocks in subfile (excluding sentinels)

Words 2-3 : Zero

Words 4-19 : Not used.

An end of composite file trailer label is made up as follows:-

Word 0 : #00000007

Word 1-19 : Not used

Note : Each of the three types of block described above is preceded by a TAPEMARK.

Source and s/c record format

1) The maximum length of a semi-compiled record is 20 words. This is in the form of a simple "card image".

2) The maximum length of a source record is 21 words. The first word contains a count of the actual number of words in the record (including the first word). The other words are in the form of a simple "card image" of the source statement, though possibly containing fewer characters than a card.

Opening and positioning of magnetic tapes for input

This is described fully in connection with the "READ FRØM" statement of the dynamic allocation system. In all cases the tape is positioned ready to read the first data record.

Input of magnetic tape records

The record is initially read into a 21-word area called BUFF. Then, if it is source (this information is taken from the last subfile sentinel) the appropriate number of words are moved into CIMAGE starting of course at the second word of BUFF. If it is semi-compiled the appropriate number of words is moved into CIMAGE starting at the first word of BUFF.

Detection of a TAPEMARK is taken to indicate the end of the file in the case of simple files: The tape is released and reading continues immediately from the slow peripheral.

In the case of a composite file, reading continues until an end of subfile sentinel of the same level as the original subfile sentinel is detected. The tape is NOT released however, but remains positioned after the end of subfile sentinel in case the programmer requests further subfiles from it at a later stage. Reading continues from the slow peripheral meanwhile.

Halts in the magnetic tape input system

There are three possible halts. Each of these causes the same message to be output on both the console typewriter and on the listing peripheral

(a) Halted: ILLEGAL SENTINEL

This arises if a TAPEMARK is detected on a composite file, followed by a block other than a subfile sentinel, an end-of-subfile sentinel, or an end of composite file trailer label.

The compilation can be continued by typing 'GO' in which case reading continues as though no irregularity had been detected (i.e. ignoring the illegal sentinel)

(b) Halted : SUBFILE NOT FOUND

This arises if the request subfile is found to be not on the tape. The halt will so occur if the programmer has used a READ FROM of the type READ FRØM (MT,. Subfile Name), and the subfile is not between the point at which the tape was positioned and the end of file.

If required, compilation can be continued by typing GØ. This will cause reading from the slow peripheral to continue, so enabling the programmer to feed in another READ FRØM if he wishes.

(c) Halted : NO TAPE ALLOTTED

This arise if a READ FRØM (MT,. Subfile Name) is used, but no tape is currently under program control.

If GØ is typed, reading continues from the slow peripheral enabling the operator to read in another READ FRØM message if he wishes.

Listing in the Magnetic Tape Input System

Whenever reading takes place from a subfile, the contents are preceded on the listing (if listing is taking place) by the line

SUBFILE (Subfile Name)

Any other subfile detected within the main subfile are similarly listed. Also all end-of-subfile sentinels detected are recorded in the listing by the line

END OF SUBFILE

The abnormal halts, ILLEGAL SENTINEL, SUBFILE NOT FOUND, and NO TAPE ALLOWED are also recorded in the listing; these are described more fully in a separate section.

Magnetic Tape Output

All output in # XFAM is on magnetic tape. However there are several alternative types of magnetic tape output, which can be selected by preceding the program description by an appropriate "SEND TØ" statement.

The "SEND TØ"statement

The various possible SEND to statements can be classed under three main types:

Type 1 : SEND TØ (MT,'File Name'(G))

This would cause the output to be written as a simple file to a tape which is already named as indicated and whose generation number is G. G may be zero or omitted, in which case the generation number is not checked by Executive.

Type 2 (a) (SEND TØ statement omitted)
(b) SEND TØ (MT)
(c) SEND TØ (MT,'File name'(G), R)

Statements of this type cause the output to be written to a tape which is previously scratch. In cases (a) and (b) a retention period of 999 days is assumed. In case (c) R is the retention period and is compulsory unless it is required to write to a pre-named tape. In cases (a) and (b) the file name is taken from the following PRØGRAM or SEGMENTS statement. In case (c) it is taken to be as stated, the generation number (G) being optional.

Type 3 SEND TØ (MT,'File name'(G).'Subfile name')

This would cause the output to be written as a subfile (having the name specified) added to the end of an existing composite file. The generation number (G) of the composite file, need not be specified.

Treatment of SEND TØ by the compiler

When a SEND TØ statement is detected (or if it is absent) the compiler sets up a common area MFIL2 as follows:-

All three types:

Words 0 - 2	: File Name
Word 3	: Generation Number (zero if unspecified)
Word 4	: Type (i.e. 1,2 or 3)
Word 8	: Not used at present
Word 11	: Retention period (type 2 only)

For type 3, additional details are included:-

Words 5 - 7	: Subfile Name
Word 9	: A200 if consolidation required A300 if SEGMENTS only.

This information is not used further by the compiler until completion is complete.

If the output is 'Segments' only a no-consolidation switch is also set.

Summary of Output Operations

Initial Allocation

The routine STØUT is called soon after entering the compiler. This allocates a scratch tape and zeroises word 5 in TAPER.

Use of Scratch Tape

The compiler continues outputting to the scratch tape until either (a) errors are found in the input or (b) a FINISH is detected.

In case (a) the outputting of blocks in discontinued, and the scratch tape is released by calling the routine FERRR (from segment U)

Action on detecting a FINISH

1. If in error mode : Any peripherals still allocated are released and the compiler halts ZZ

2. If there are no errors, but no consolidation is required: The compiler enters a routine called TSØØ (from segment A). This terminates the scratch tape with two Tape Marks and rewinds it; the final output tape is then allocated and positioned ready for writing. The routine ENOUT finally copies the scratch tape to the final output tape, after which any remaining peripherals are released and the compiler halts EC

3. No errors; consolidation required: The compiler calls LIBSH which causes the necessary library routines to be found from an MLT and written to the scratch tape. If, after this, blank cues remain the compiler halts after printing a list of routines still needed. If all cues are satisfied the scratch tape is terminated and rewound, and the final output tape is allocated and positioned for writing. The request slip, loader, and consolidated leader are then written to the final output tape. The routine ENØUT then copies the contents of the scratch tape across, all remaining peripherals are released and the compiler halts EC.

P. Girad