FILE MEMO: SUPERVISORY PROGRAM

SUBJECT: With Respect to the SP Issuing all I-O's

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There are certain advantages in allowing the SP to issue all I-O's, even where multiprogramming is not being done. These are that the SP may take over the job of coping with certain I-O conditions which are not of direct interest to the PP. Thus the SP can handle all I-O rejects, analyze the cause for an Exchange Program check and execute corrective procedures in case of Unit checks.

It is also desirable to allow the PP codes to use symbolic addresses for I-O units and to leave to the SP the burden of associating these addresses with a specific unit on a specific channel. If he wishes to do arithmetic on these symbolic addresses, he may choose numeric symbols or symbols containing numeric parts. It will be necessary for the PP to provide a list of all symbolic unit addresses which could be encountered in the execution of his program. Thus if he writes the symbol T01 but in the course of his program modifies it so that it takes on the values T02 and T03, he must include T02 and T03 in the list. Prior to the execution of a PP, the SP assigns actual channel-unit addresses and associates them with the symbolic addresses provided by the PP, in a table. Prior to the execution of any I-O instruction, the SP does a table look-up on the symbolic address in order to determine the actual address.

In the process of assembly, a "Store Instruction Counter and Branch Disable" instruction will be inserted preceding every I-O instruction. The Branch address will be such as to cause entry into a region of the SP associated with I-O issuing. The SP will use two additional tables in issuing I-O's: an "Occupying Channel" Table and a "Not Yet Issued" Table.

The Occupying Channel Table will require one slot for each I-O channel in the machine, and thus a maximum of 32 slots. A given slot will contain the I-O instruction on which the corresponding channel is currently working. If the channel is free, the entry will contain all zeros. If multiprogramming is being done it will be necessary for the entry also to contain identification of the PP. The I-O instruction in this table will be in "almost machine language" form. The pseudo parts, i.e., the symbolic unit address and PP identification will occupy the first 24 bits of the instruction. This allows 18 bits (3 alpha, 4 numeric) for the unit symbol and 6 bits for PP identification) Thus the maximum table size is 32 full words.

The Not Yet Issued Table is for remembering I-O instructions which cannot be issued when requested by the PP because the channels they use are already busy. The table would contain a maximum of 8 slots for each channel on the machine. For a 32-channel machine this would mean a maximum total of 256 slots. Each slot would be 19 bits long and would thus accommodate the memory location of an I-O instruction. Thus the maximum table size is 76 full words.

The SP will process an I-O request from the PP as follows:

1.   Apply indexing to the symbolic unit address and then do a table look-up on the result in order to obtain the actual channel and unit addresses.

2.   Examine the appropriate slot in the "Occupying Channel" table.

    2.1 If the slot is zero
      a.   Place the "almost machine language" I-O instruction in this slot.
      b.   Construct a LOCATE instruction and a "completely machine language" I-O instruction and execute them.

      c.   Return to the same or a different PP.

    2.2 If the slot is not zero
      a.   Examine in turn each of the 8 slots in the Not Yet Issued table which correspond to the channel in question.
        a.1   If one is found that is zero, place in it the location of the "almost machine language" I-O instruction and return to the same or a different PP.

        a.2   If none is zero, set the Resume Address of the PP equal to the address of the STIC and BR Dis instructions which preceeds the "almost machine language" I-O instruction in the PP. Return to a _different_ PP.

3.   Place the symbolic unit address (contained in the "Occupying Channel" table slot corresponding to the channel which has indicated completion) into the proper PP UNIT ADDR REGISTER. This is a pseudo register which the PP may consult. There is one such pseudo register for each PP.

4.   Examine the slots in the Not Yet Issued Table corresponding to the channel which has just completed.

   4.1   If there are any non zero slots, choose the first and obtain the corresponding I-O instruction. Set this slot in the Not Yet Issued Table to zero. Process the I-O instruction obtained as in 2.1 above, steps a. and b. only.

   4.2   If all slots are zero, set the slot in the "Occupying Channel" table to zero.

5.   Resume the same PP via the tertiary table entry corresponding to successful I-O completion.

Eight slots for each channel were chosen for the Not Yet Issued Table for the following reasons. Eight units is the maximum number that may be attached to any given channel. The only condition under which the 8 slots would be insufficient to remember all I-O instructions that need to be remembered would be if a given PP requested the issuance of an I-O instruction to a given unit without waiting for the completion of the previous I-O instruction issued to that same unit. The procedure outlived above does, however, handle this situation by in effect halting the PP (step 2.2.a.2 above) Therefore, it would be possible to reduce the size of the NYI table by allowing fewer slots per channel. It is desirable, however, to have the same number of slots per channel even where this is unrealistic because of the machine configuration. This is because it enables fast pin-pointing of the information desired without having either to search or to make to another table.

Assuming a 16-channel, 64-unit machine and assuming 4 slots for each channel in the Not-Yet Issued Table, memory space occupied by the SP tables mentioned above would be as follows:

	# bits/entry	# entries	# FW
Symbolic-Actual Unit Table	26	64	26
Occupying Channel Table	64	16	16
Net Yet Issued Table	64	64	64
			106

E. McDonough
Product Planning Representative
Project 7000

EM/jcv