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FILE MEMO: STRETCH

SUBJECT: The Effect of the 729 Program on the Exchange

The basic medium speed exchange was planned to be used with I/O devices operating at speeds up to 25,000 bytes per second. The impetus to this decision was the fact that the 729 II was to operate at 1 1/2X speeds, i.e. at 22,500 bytes per second. The 22,500 figure was rounded to 25,000 to provide some safety margin.

The decision, however, has been made to not produce the 729 II. Thus, the only tapes in view are the 729 I at 15,000 bytes per sec. and the 729 II at 4 to 6 times 729 I speed. To the Exchange this means that there is no equipment in sight that operates in the 1X to 3X range. In fact, if 729 III achieves 5X speed, then the only thing in the 1X to 5X speed range is the direct access disks which can operate at 4X speed. [1]

Now consider the role of 1X and 4 to 6X tapes in a Stretch system. For a basic input-output tape it is economically more desirable to use 1X tape than 4 to 6X tape, assuming the 4 to 6X tape price may be at least double that of the 1X tape. (See my memo of 4-30-57 on card-to-tape operations.)

If it is desired to load 4 to 6X tape from cards, it is more efficient to first load 1X tape and then transfer to faster tape. [2] The 729 I also plays the role of communications tape. This makes 700-series auxiliary equipment usable for Stretch customers. The 4 to 6X tape will be used for auxiliary storage, e.g. for master files. It competes admirably with the proposed 10X tape as of this date, because its development is considerably more advanced. Should the 10X program fail or be late, the 729 III can perform the auxiliary storage function for a 10X computer. It may be enough for certain customers anyway. Other customers may have reasons for having both 4 to 6X and 10X tapes.

From an engineering point of view, Exchange capacitites are determined by the data-rate of the fastest external unit that it services. This means that the basic Exchange is subject to the limitations of a 25,000 bytes/sec external unit that does not exist and is not even proposed! Further, word assembly by

1 Density of 400 bpi permits this. See San Jose report of December 1956 on Stretch disks.

2 This is true even with a 1000 cpm card-reader.

bytes becomes less and less efficient as the speed of the external unit becomes higher and higher. Present indications imply that above 3X speeds such word assembly is impractical in the Exchange and that at that speed serious curtailment in number of channels would be necessary.

It is proposed, therefore, that the basic exchange be designed to accommodate external units with speeds up to 15,000 bytes per second.

It is proposed that the 10X Exchange be designed to accommodate units in the speed range from 15,000 to 150,000 bytes per second

This proposed relaxation of requirements for the basic Exchange gives it a potential of many more channels that can operate simultaneously. Future expansion is thus assured; more channels mean more of the same hardware (higher price to the customer and profit to IBM) rather than redesign and re-engineering.

The second proposal provides a 10X Exchange to handle 4 to 6X and 10X tapes--units that are in a sense substitutes for one another. Thus, a customer can substitute 10X tapes for 729 III tapes without buying a new Exchange and paying for unused capacity in his basic Exchange. Similarly he does not need to buy a number of 10X tapes to justify having a 10X Exchange; 729 III tapes and direct access disks can use some of this capacity.

There are many choices the physical form of these two Exchanges may take. For the basic Exchange there is the byte crosspoint, shared channel form or the square dimensioned form with no crosspoint switch. (See my memo of 4/24/57 on this topic). For the 10X Exchange higher performance equipment can justify more elaborate buffering, a byte crosspoint is a possibility, and a word crosspoint may be feasible.

As to the capacity of the basic Exchange one would hope that the maximum be set no lower than enough to do simultaneously 3 card-to-tape, 3 tape-to-print, 1 tape-to-punch*, and 2 1X tape-to-10X tape operations. This calls for 12 channels and 18 external units. Six standby units would swell the number of external units to 24. Some 729 I tapes would also be used by the major programs in the machine. These would be low activity tapes where higher speeds are not required but many files are. A conservative estimate here would call for eight tapes and four channels to service them. Thus, the least upper bounds should be 16 channels and 32 external units.

For the capacity of the 10X Exchange one should observe that some external units are communicating with 1X tape, some (the disks) are communicating

* The customer has this facility now at 705 installations using auxiliary equipment.

with low speed (inquiry stations), and some are devoted to the computer processing of one or more major programs. A conservative least upper bound here is 6 channels and 14 external units.

It is probably true that some installations will request more external units. One 705 installation currently has 37 input-output devices. Average number of external units for the larger 705 installations is 24. One would expect a user of a 10X computer to need more units than the user of a 705.

The Sigma installation is not expected to have these external unit requirements. It will need the entire line of input-output equipment but not in the same quantity as the Harvest user. Some Sigma users may be willing to pay a high price in inefficient communication with 100X tape for the sake of not purchasing any units in the 10X range. Combined Sigma - Harvest installations will have heavy external unit requirements.

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