J. Griffiths

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FILE MEMO: STRETCH

SUBJECT: Relation of 729 Tape Program to STRETCH Tape Requirements

Stretch encompasses five basic tape applications. They are--

1. Communication with other systems.
2. Communication with card equipment, and printers (including 1000 cpm and 1000 lpm devices.
3. Communication with auxiliary storage tapes and disks.
4. Auxiliary storage for a 10X computer.
5. Auxiliary storage for a 100X computer.

Stretch equipment goals for each of these applications are respectively--

1. A tape unit that will read 7 track (6 data, 1 parity) 1/2 inch, 200 bits per inch tape.
2. A tape unit that operates at 1X speed and can deliver (and accept) 8 bit bytes to (and from) the Exchange. Higher speeds are inefficient, in fact even 1X tapes are too fast for this work. See my memo of 4/30/57 on Card-to-Tape Operations.
3. A tape that can process tape prepared on type 2 equipment. The application does not limit the speed of this tape unit, but Exchange considerations, manufacturing economies, and price structures point to the desirability of the type 2 unit performing the type 3 application as well. See my memo of 5/2/57 on effect of the 729 tape program on the Exchange.
4. A tape unit that operates at 10X speed.
5. A tape unit that operates at 100X speed.

The 729 Model I can handle the three communication applications if it is equipped with a byte converter.

The 729 Model III can handle the 4th application--auxiliary storage for a 10X computer. It would be slow (at 4 to 6X speeds) for this work.

If the 729 Model III is designed to operate at two densities, one of which is 200 bits per inch, then it can handle the third communication application at 1-1/2X speed. The increase in speed over 729 I is an advantage--a small one--, but the cost of this increase is to use a device capable of 4 to 6X speed on a 1-1/2X operation. The same comment applies to any use of a 4 to 6X machine on a 1-1/2X operation. The merit in the two density 729 III exists only for low volume applications where any other method would require purchase of special equipment. For example, in application 1, if the user had no other need for 729 I tapes and prepared only ten tapes a week to ship to another location, then the 2 density 729 III would be desirable.

For STRETCH the 729 III is a misfit. At 4 to 6X speeds it is too fast for communication with card equipment, printers and other systems and slow for role of auxiliary storage in a 10X computer. It is too fast to be serviced competently by the basic Exchange and may be too slow to warrant the cost of servicing it by the 10X Exchange.

Nevertheless, because the 729 III is further advanced than any other in this speed range, it is a serious contender for the role of auxiliary storage for a 10X computer. In this role it should be serviced by the 10X Exchange.

An important feature of lower speed tape units is the automatic changing device. This should be as simple as possible (for the sake of lower cost) and need not have any other functions than unloading one tape and loading the next. Here is a degree of automation that the customer can profitably use. Tape changing is a serious bottleneck and the source of costly human errors in many installations.

If the tape drives to be serviced by the basic Exchange were to have 8 data tracks and 1 parity track, it would not be necessary to fit them with byte converters. Their byte size would match that of the Exchange. Such drives could not perform the communication-with-other systems function unless it were possible to change the number of tracks (cutout certain heads) on programmed instruction from the computer.

The tape speeds mentioned in this memo bear closer definition than they have enjoyed in the past. The speed of 1X refers to the speed of the 727 that delivers 15,000 characters per second. Stretch is designed to contain 8 characters per word. Thus, 1X speed to Stretch is 1,875 words per second or 533 1/3 usec/word. This implies 100X tape should operate at 5 usec/word. Call this definition of 1X speed, Definition A. This is a good definition, because it satisfies the user's realm of thought; he is more interested in characters than bits.

Definition B observes that at 7 bits per character 15,000 characters per second on the 727 is actually 105,000 bits per second. Thus, 1X speed on Stretch is defined as 105,000 bits per second or 9,524 usec per bit. At 72 bits per word, 1X speed means 1458 1/3 words/sec. or 686 usec/word. This implies 100X tape should operate at 6.86 usec/word. This is a good definition for the engineer; he is more interested in total number of bits regardless of their use.

Definition C considers only the data bits. At 6 bits per character and 15,000 characters per second, 1X speed is defined as 90,000 bits per second or 11.111 1/9 usec per bit. At 64 data bits per word, 1X speed means 1406 1/4 words per sec. or 711 1/9 usec per word. This implies 100X tape should operate at 7.11 usec/word.

Definition A has undoubtedly been the most popular one among IBM personnel to date, but more important is the fact that it coincides more closely with the speeds we have announced to non-IBM personnel, namely 100X tape to operate at 4 usec per word. It is in the spirit of this definition that this memo was prepared and the author urges universal adoption of Definition A.

Jack C. Gibson

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JCG/jv