Title
A DATA LINK BETWEEN ONE LARGE AND SEVERAL SMALL COMPUTER

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SUMMARY
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SUMMARY

The data link described in this paper provides communication between a CDC-6600 and several small remote computers used on-line in high-energy physics experiments. Raw data from the experiment is sent to the 6600 for analysis, and results are returned to the small computer enabling the physicist to alter experimental parameters.

The design of the data link is complicated by several characteristics of the 6600: it cannot be interrupted; and, since it is used primarily for batch processing, permanent assignment of a PP (peripheral processor of the 6600) would result in unacceptable system degredation. The link must therefore appear to the 6600 as much like a standard job in the batch process as possible. To facilitate this, a preliminary exchange of signals takes place before a PP is committed to the data transfer. This consists of Status Words from the small computer to the 6600, and Function Words from the 6600 to the small computer. These words may be interpreted by synchronizers at each end of the line, or passed on to the computer.

For example, the first Status Word from the small computer is interpreted by the 6600 synchronizer, which signals the 6600 operator to load the FORTRAN program which will analyze the data. The operator, via push buttons on the 6600 synchronizer, returns a Function Word to the small computer to inform it whether the 6600 can accept the link. The small computer then tells the 6600 "I want to input 3000 words." Once the FORTRAN program is loaded, the 6600 will interpret this Status Word and returns a "go ahead" Function Word. The small computer then replies "I'm ready" and begins sending data. During the time between responses in this conversation, the PP is free to work on other programs, returning periodically to see if an answer has been returned. Once the data flow has started, however, it will continue uninterrupted.

A similar conversation at a "lower" level is used for error checking between the synchronizers. Each word (Data, Function, or Status) received by a synchronizer is echoed back to the transmitter, where it is compared with the word originally sent. If the comparison fails, the transmitter sends an error signal instructing the receiver to forget the last word received. Although this system results in the data rate being limited by the length of the lines, close to 100% error correction is possible and synchronization of the two computers is provided

so that one cannot "flood" the other with data.

There are 13 parallel lines connecting the synchronizers, 12 of which carry the data and Function or Status words. The 13th line indicates whether a word is data or Function/Status. Since at least one of the 13 lines always carries a signal, there is always a positive indication of the reception of a word.

Because a lost error signal cannot itself be recovered, its reliability is increased (at the expense of longer transmission time) by sending a pulse train of 16 cycles, rather than a single pulse as for the data. A "Finished" signal, sent at the end of transmission, and a reset signal are handled the same way. The pulse trains are sent over the same 13 lines, but at twice the amplitude so they will not be mistaken for data.

The data link can be thought of as a vehicle which establishes communication between the program in the small computer and the FORTRAN program in the CDC-6600. On this level, many interesting procedures can be designed by the experimenter. Data records can be arranged to serve as a list of instructions to the FORTRAN program, which enables the experimenter to modify certain aspects of this analysis during the experiment. In a similar way the FORTRAN program can be instructed to send a certain selection of analysis results back for display or print-out at the small computer.