THE REAL PROBLEM WITH USING AN ARRAY PROCESSOR

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Recently developed $40,000 array processors possess computational power comparable to large, multi-million-dollar computers. In an attempt to realize this potential, we purchased an array processor (AP) from the largest AP manufacturer, interfaced the AP to a popular mini-computer (from the largest mini-computer manufacturer), added a full complement of host memory, a fast disc, and selected what we believe to be the best operating system for supporting a dozen doctoral candidates doing research in Geophysics and Electrical Engineering.

The AP manufacturer supplied Fortran callable subroutines for nearly all vector operations, and for such standardized computations as matrix inversion and Fourier transforms. Performance data for our system using this software appear in the figure; times are shown for vector multiplication (VMUL), vector initialization (VCLR), Fourier transforms (FFT), and data transfer (DATA) as a function of vector length N.

"... and in 1/10,000th of a second, it can compound the programmer's error 87,500 times!"

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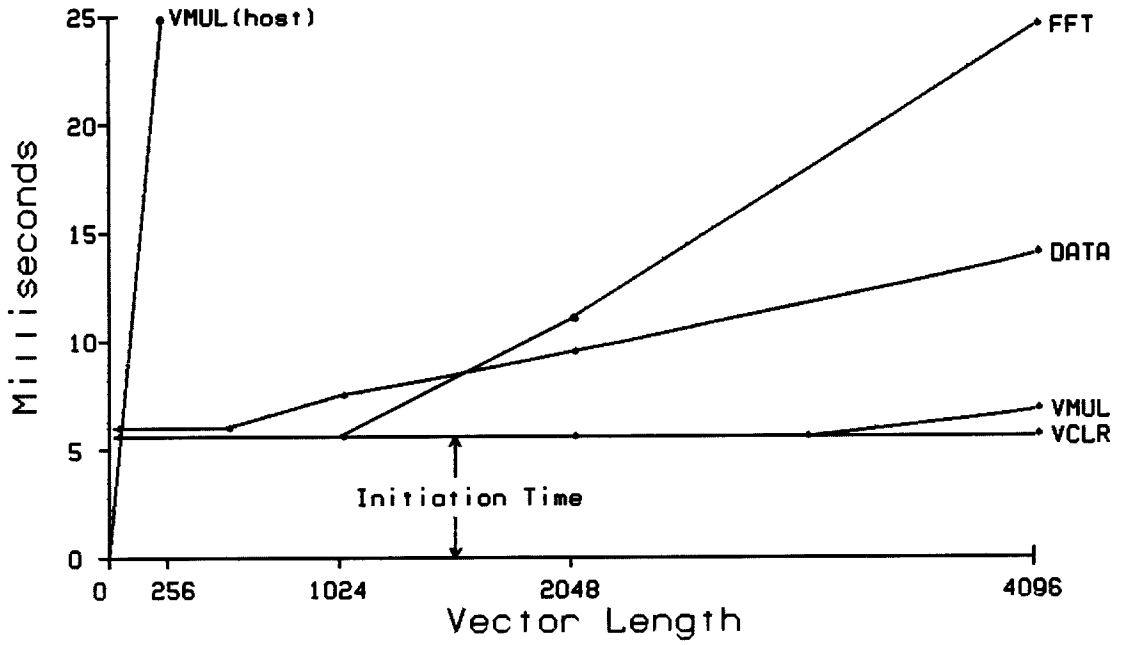

Note that the crossover between host and AP vector multiply occurs near N = 60. Our AP can hold a 90x90 matrix. Thus, manipulating columns of a matrix in the AP is only marginally faster than in our host (and additional AP memory would provide little improvement).

Conventional wisdom has held that array processors tend to be input output limited. For most matrix problems and many vector problems, however, the real limitation lies in the time required for the host to initiate the next AP program. This limit makes few tasks besides Fourier transforms look attractive. As a consequence, despite diligent efforts at applying this system to projects in our laboratory, we have yet to exceed ninety seconds of AP useage per day.

This initiation-time problem is so serious we have also considered writing our own micro-coded programs for the AP. Writing horizontal micro-code, though, is so much more difficult than writing assembly language programs that we have yet to find any tasks which are in sufficient demand to justify the effort required.

Our results are consistent with measurements made at other installations. Therefore, if the research potential of array processors is to be realized either the host computer must be dedicated to serving the AP, or the AP's software and interface hardware must be improved beyond what is available as of January, 1978.

Note added March 15, 1978: We have not yet evaluated the "vector function chainer" software which was recently released by FPS.