To: WG5
From: Whitman Wright

THE CANADIAN FORTRAN 2000 PRIMITIVE GRAPHICS PROPOSAL

The Canadian proposal is that Fortran 2000 be given a set of primitive capabilities that would permit graphic objects to be placed on a display surface.

Fortran now has very adequate facilities for developing the software required for performing the higher graphic operations such as clipping, scaling,the execution of other transformations, and doing three-dimensional modelling. However, it does not have the facilities for performing the elementary graphic functions such as drawing or picking a point on a display screen. The result is that a program written in Fortran must use non-standard features if it is to perform any graphic operations. Thus, if the program is to be later transferred to another different platform, the graphic part has to be re-written specifically for the new platform.

While this limitation of standard Fortran may not present difficulties for Fortran users having the appropriate resources and technical knowledge, it does present difficulties, often insurmountable, for many Fortran users with fewer resources.

In the past, Fortran has been especially suited for use by scientists and engineers who are experts in their own disciplines first, and programmers only secondly. These people badly need access to convenient computer graphics, not necessarily the powerful computer graphics required by CAD systems or commercial displays, but enough graphics to permit them to develop programs that will produce graphs, figures and diagrams. Even the computational efficiency of certain commercial graphics systems is not required because of the speed of modern CPUs. For example, many programmers and users could live with software clipping in Fortran rather than clipping by hardware or assembler, if the only alternative were non-portable programs.

What is required is access to the very basic graphic primitives in a platform-independent manner. This would permit the computational power of Fortran to be used for the development of specialized in-house programs by scientists and engineers having modest computer expertise. Such programs could be easily moved from one platform to another.

In this proposal, we have avoided, at this time, the exact setting forth of the primitive graphic features which we would like to see contained in Fortran 2000.

These features should be the minimum required to permit a variety of types of graphic displays. Any feature that could be implemented with reasonably efficient software written in present-day Fortran should probably be omitted at this time. For example, no new Fortran features are required to do graphic scaling and panning. Present-day Fortran is very adequate for that purpose. Some of the features that should be provided are as follows:

(1) Turning on and off of the graphics mode.

(2) Some control over the number of pixels to be used horizontally and vertically to represent the display surface, of course subject to the limitations of the graphics hardware in use.

(3) Some control over colour ranges, again subject to hardware limitations.

(4) An ability to draw a point (a pixel) on a selected location on the display surface, using a colour selected from the colour palate in use. Once this capability is available, almost any graphic display can be done using present-day Fortran, although perhaps not as quickly as with specialized graphic systems.

(5) An ability to pick a selected point on a display surface using a pointing device such as a mouse. This would permit drawing and editing directly on the screen.

Some features that would be less essential but nevertheless desirable would be:

(1) The drawing of straight lines between any two points on the display surface. This would permit the Fortran programmer to produce software that would draw a variety of curved and/or broken lines with more efficiency than if only pixels were available.

(2) A minimum set of text fonts with size, colour, location and orientation under the control of the Fortran programmer. This feature would promote speed and simplify programming.

(3) Boundary clipping. This may save the Fortran programmer some trouble.

The objective would not be to provide in Fortran the resources necessary to develop efficient CAD or commercial display systems in a platform-independent manner. The programmers of such systems would be expected to have the technical and other resources to develop such systems for each individual platform intended to be used. The provision of the facilities for developing such systems in platform-independent Fortran could place an unreasonable burden on Fortran compiler writers at this time.

It may be suggested that X-Windows, the various versions of Microsoft Windows such as 3.X, 95 or NT, or the hopefully forthcoming Posix graphic features, will have the effect of making our proposal unnecessary. In practice, at this time and in the foreseeable future, none of these systems has or is likely to have anything at all close to universal acceptance.

Another alternative that may be proposed is a more widespread use of the GKS or PHIGS standards. The GKS standard is now approximately ten years old and substantial differences of opinion between different users seem to be impeding the updating of the Standard. The software necessary to implement the GKS Standard does not appear to be readily available for some important platforms. When it is available, it may be expensive for users with limited resources and it may provide much functionality that is not needed, redundant or even in the way for many users. By contrast, the Fortran code required to exploit the proposed primitive Fortran graphic functions can easily developed, published, and made available to Fortran programmers with limited resources. The required algorithms are generally readily available to programmers having some initiative. Something similar has already been done for certain platform-dependent versions of the programming language Basic. However, the benefits of such work in Basic have been limited because of the platform-dependence problem.

The example of Basic is an interesting one. In spite of their substantial limitations, platform-dependent versions of Basic continue to be used on a substantial scale in scientific and engineering offices because these versions of Basic contain graphic primitives which can be used to good effect by unsophisticated programmers.

I would be pleased to have the opportunity to discuss this proposal with any of the delegates to the present Dresden WG5 meeting on Fortran.

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