PLATFORM WARS: MACINTOSH-BASED DIGITIZATION SYSTEMS

O. L. Krivanek & J. A. Hunt, Gatan Research & Development

Improvements over the past few years in essentially all modern operating systems coupled with the blurring of the boundaries between mainframes, workstations, and personal computers make the choice of platform often one of personal preference other than of necessity. A decade ago there were very distinct differences between the features offered by IBM PC and clones, the Apple Macintosh, and UNIX workstations. These differences included price, processing performance, OS features, look and feel, graphical capabilities, memory and disk limitations, networking capabilities, ease-of-use, system stability, development tools, etc. Since then many of these distinguishing differences have evaporated making platform selection a more subtle issue, but also much less important. However, there are still a great many users that tend to make such decisions based on their "religious" preference of platform rather than based on objective information.

How does one choose the appropriate platform for image acquisition and processing? The question should first be: "What software packages do what is needed?" From this list the choice of platform can be narrowed. The next questions should then be: "What else is to be done with the system?", "What other systems will communicate with this platform?", "What kind of maintenance will the system need and who will do it?", "What platforms are the users comfortable with and how much time will it take to train the users to begin to use the system?".

The Macintosh has several image acquisition and processing packages available that cover the entire range of image processing and analysis needs. NIH Image (National Institutes of Health) is a good general purpose microscopy image processor (IP) that supports light and other microscopies where images are acquired through TV cameras or scanners. It also has the advantage of being free of charge. IDT makes a high-end, general purpose IP that has excellent scripting capabilities and analysis routines. Photoshop (Adobe) is good for acquiring and processing scanned or other images with limited dynamic range. DigitalMicrograph (Gatan) is a high-end IP that is tailored to electron microscope (EM) image acquisition and processing, allows data processing in floating-point resolution (desirable for high-quality data that is attainable in the EM), computer control of the EM and detectors, user scriptability, etc. These packages have other important features, and there are other excellent Macintosh IP software packages, but we of course can not mention them all here.

In the 1980's and even up until the mid-1990's, Macintosh programmers have had one extremely important advantage over PC programmers called "flat memory space". This feature allowed Macintosh programmers to use large amounts of memory in a very simple way. PC programmers had to resort to complicated methods to effectively use memory greater than 64K at a time and, before Windows 3.0, more than 640K total. Because the scientific community often requires processing data of several megabytes or more, the Macintosh became a natural choice of personal and laboratory computer for many scientists. For instance, image processing is a very memory intensive practice. A very basic IP system today may require only 16 MB of RAM, whereas more state-of-the-art systems may require 128 MB or more. The Macintosh (and workstations) handle arrays of memory approaching these sizes easily. However, software written for Windows 3.x (before Win32s) cannot address arrays of greater than 64K in a straightforward manner. The increase in complexity impacted the quality and capability of most PC based image processing packages. These limitations have been removed in Windows NT and 95 but some manufacturers have not yet managed to purge their software of this older "16-bit" code.

Since its inception, the Macintosh users and developers have enjoyed a well defined set of graphical user interface (GUI) guidelines. This feature has allowed Macintosh software to be easy to use, because most Macintosh programs have common elements that work in similar ways - thus requiring the user to learn less about each application. It has also allowed Macintosh applications to work and share data together more easily than its Windows and UNIX counterparts. Strict GUI guidelines are now also available for Windows *(3.0+/NT/95)* but UNIX platforms still have several GUI variants. Macintosh programmers have also had the luxury of being able to access all hardware through a unified series of OS calls. The PC and UNIX worlds have been fragmented from the very beginning making these machines often difficult for the user to setup and difficult for the application programmer to support. This is the case for all types of hardware from printers to video cards to network access. The situation has been mitigated for the PC platform with recent improvements in OS technology (i.e., plug-and-play approaches), but the Macintosh still has fewer variations for programmers to consider. The Macintosh has long been considered the easiest platform to setup, use, and maintain.

The Macintosh has featured flat memory space, well defined GUI standards, and common access to peripherals such as display models and printers for such a long time - much longer than other platforms. Thus there is a very mature base of quality image processing, image manipulation, and image analysis software available for the Macintosh. The Macintosh integrates easily with the other platforms via seamless networking with most Network Operating Systems (NOS) and the ability to exchange portable disk media.

All the major OS and computer hardware manufacturers, including Apple, have been systematically correcting weaknesses in their platforms. Apple has made two major changes to its hardware recently. The most important change has been adopting the PowerPC RISC processor which has given the Macintosh a much needed increase in speed. The PowerPC 604 chip set used in the most recent Macintosh computers compares favorably with the P5 & P6 generation processors used in the most recent PC computers, particularly for floating point calculations. The second important hardware change has been moving to the PCI bus which allows manufacturers to design cards that operate on both the Macintosh and the PC. This has brought down the price and increased the availability of interface cards such as graphics accelerators and frame grabbers, particularly for the Macintosh. Apple will soon be releasing an important improvement to their OS called "Copland" which will significantly improve the Macintosh OS speed, the look and feel of the interface, and provide better multitasking capabilities.

Macintosh clones have now become important choices both in terms of price and performance. Power Computing currently makes the fastest single processor personal computers of any manufacturer. Daystar makes multiprocessor Macintosh clones that exceed 600 million floating-point operations per second. The PREP platform that IBM will be offering in the near future will allow a single machine to run UNIX (AIX), Windows NT/95, OS/2, and the Macintosh OS. The PREP strategy further blurs the distinctions between platforms further emphasizing that platforms are becoming less important than the software products themselves. Nevertheless, the Macintosh remains an excellent platform for image processing and analysis because of its mature base of IP packages, ease of use, ease of administration, ease of networking with other platforms, OS features, and high processing performance. ■

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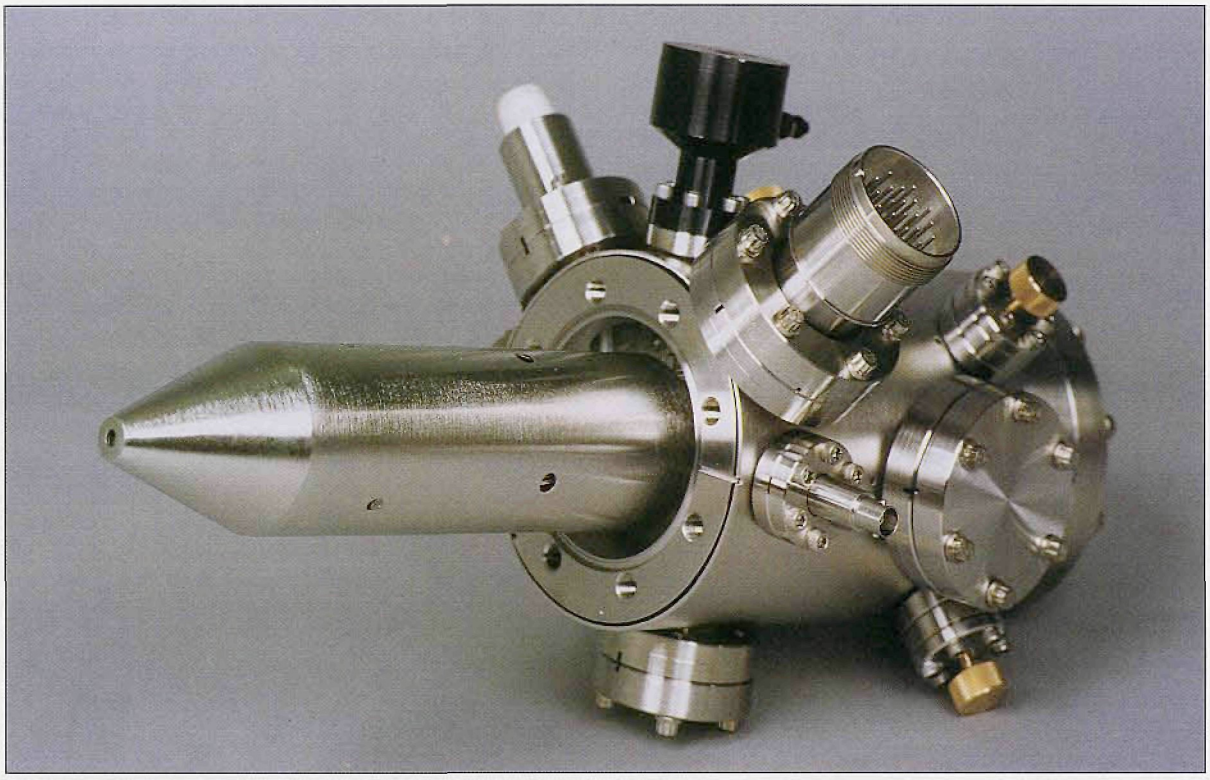

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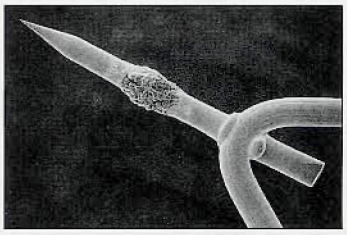

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