

The Advantages of SAS 6.06 Under OS/2®

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The availability of SAS® under IBM OS/2 provides another alternative for those users seeking work station based solutions for their SAS processing needs. What performance can users expect from OS/2 SAS as compared with PC SAS? How does work station performance compare with IBM mainframes and VAX® minicomputers?

This paper presents the author's experience in working with OS/2 SAS in an environment that includes SAS for the PC, IBM and VAX environments. The discussion includes how well OS/2 SAS interfaces with the OS/2 PCSA® and 3Com® network protocols as well as other OS/2 applications software.

A Beta copy of SAS 6.06 was installed on a GRiD® 386is running IBM OS/2 1.2. The processor is a 25 Megahertz 386 chip with 8 megabytes of RAM memory installed. There is no math coprocessor. All SAS Institute software products were installed on this machine including Base®, SAS/STAT®, SAS/FSP®, SAS/GRAPH®, SAS/ETS®, SAS/ASSIST®, SAS/IML®, SAS/OR®, SAS/ACCESS®, SAS/CONNECT®, SAS/AF®, and SAS/QC®. Compressed SAS/GRAPH maps were also installed. Together, the software required about 65 megabytes of hard disk space.

A benchmark program was created to measure performance of the OS/2 version of SAS. The purpose of the benchmark was to measure whether a desktop work station could perform the work of a VAX minicomputer or an IBM mainframe in a reasonable amount of time. The testing was divided into two components: task completion and task elapsed time. If test results showed that similar performance could be achieved without sacrificing functionality, users would be made aware of another alternative to mainframe and PC SAS processing.

The benchmark used was chosen because it approximated a typical mainframe SAS job. The program reads an external ASCII file containing 2,000 observations and 28 variables. Assignment statements create new variables. Several reports were created using the SORT, FREQ, CONTENTS and TABULATE procedures. Formats and labels were used throughout to make the reports easy to read and interpret.

OS/2 SAS evaluation was performed in an organization which has SAS available on an IBM 3081KX, a VAX cluster consisting of four model 8650's and on about 10 IBM and compatible workstations. This evaluation was inspired in part by one particular work group which is a very intensive user of SAS on the IBM mainframe. This group has been investigating alternatives to the mainframe processing of SAS for several years. New workstations are brought in for testing. SAS is installed and the performance is evaluated. I was able to use some of these machines for running the benchmark SAS program, the results of which are included in this report.

OS/2 1.2 was evaluated because of the multitasking and memory management capabilities of this operating system. The memory requirements of PC SAS are great. For some users large models cannot be calculated under MS DOS®. OS/2 1.2 however, can address up to 16 megabytes of memory. There was also considerable interest among our PC SAS users to learn of any performance advantages of OS/2. UNIX® is another good candidate for SAS workstation processing, but it would

have been more difficult to obtain the hardware for a UNIX based SAS machine in our organization.

In order for the OS/2 version of SAS to be accepted, OS/2 itself needed to be accepted. The GRiD was the first machine in our work area to run OS/2 1.2. It was not clear how this operating system would fit in to the Macintosh®/IBM PC workstation mix in our organization. A great concern was the issue of connectivity. In this environment there is a mixture of 3Com, Appleshare®, Alisashare® and DECNET's PCSA networks to provide mail, file and print services for workstations. In order to succeed, OS/2 needed to prove that it could support the OS/2 versions of either 3Com and PCSA at the same level of functionality and ease of use as the MS DOS products. Additionally, there were questions about OS/2 version 1.2 software: Could this IBM version designed for the IBM PS/2® model computer be successfully installed and operated on a GRiD machine which has a different architecture? If installed would it crash? How difficult would it be to learn this new operating system? Can users do all of their work in OS/2 or must they rely on MS DOS for word processing and spreadsheet software? Is Dynamic Data Exchange (DDE) an effective means of transferring data between other applications and SAS? These were some of the questions that needed to be answered before OS/2 could be accepted as a supported operating system.

The following represents the findings of the OS/2 SAS evaluation.

OS/2 Operating System

OS/2 loaded very easily on the GRiD. The only compatibility issue that presented a problem involved the machine's mouse port. I was not able to address the port either from the installation process or by modifying the CONFIG.SYS file after installation. The problem was resolved by plugging the mouse into the serial port. A serial board was installed as COM2 so that ASYNC communications could be tested.

There was no difference in running OS/2 version 1.2 on the GRiD or on an IBM PS/2. All functionality was the same. SAS loaded without any problems as well. SAS detected the mouse in the serial port. Kermit, WordPerfect®, Excel®, Corel Draw® and WingZ® all loaded and performed as expected. 3Com installed and worked fine. PCSA only provided drivers for OS/2 1.1 which limited its functionality. Printing and file services were available under 3Com but only printing was possible under PCSA. PCSA printing was an awkward two step process which involved changing the default printer on the user's VAX account. A file needed to be created before being printed which made it impossible to print from within an application. In contrast, 3Com supported the printing of text and graphics either from a saved file or from within an application. 3Com's file services supported data transfer from a Macintosh 3Com file server to the OS/2 machine. This was very useful for an on-going project which involved the evaluation of data contained in a Fourth Dimension® data base created on a Macintosh work station. Using 3Com and OS/2 SAS I could link to a 3Com disk containing the exported data on the 3Com network. The ASCII data was read from the network into SAS without needing to copy it to the GRiD. PCSA file services depended on the availability of OS/2 1.2 drivers which were not yet available. A colleague ran SAS with version 1.1 of OS/2 and was able to set up virtual disks, print from within applications and access his VAX account as another disk on the machine. I stopped using PCSA after

installing 3Com. The 1.2 drivers were never made available during the evaluation period.

OS/2 Applications Software

The following is a brief discussion of the OS/2 applications software that were evaluated on the GRID:

Kermit is one of the workstation-to-host communications software supported in our organization. It provides terminal emulation and file transfer services for IBM PC and compatible machines. I tested two versions of Kermit for OS/2. One was a version for the Display Manager and the other an early version written for OS/2 1.0. Both worked satisfactorily supplying both VT100[®] emulation and file transfer capabilities. Neither have Tektronix[®] 4010 or 4014 emulation capability which would enable users to view host-based graphics at their PC. This ability has been part of MS DOS Kermit for several years. Documentation for the Presentation Manager[®] version of Kermit indicates that future releases will support Tektronix standard graphics support.

Microsoft's Excel[®] spreadsheet program for OS/2 was functionally the same as its MS DOS counterpart. No difficulties were encountered in using this software.

WordPerfect[®] for OS/2 was a clone of the MS DOS version 5.0. No attempt was made to rewrite the program for the Presentation Manager. This version did not support a mouse and did not have a graphical user interface. Within these limitations it worked fine but it clearly was not a OS/2 word processor but rather a MS DOS product ported to OS/2.

The Corel Draw[®] graphics package was a beta test version and had limited functionality. The interface was the same as the MS DOS Windows[®] version.

The WingZ[®] spreadsheet software was tested because a colleague purchased a copy for his MS DOS machine. The package contains both DOS and OS/2 versions. No difference in interface or functionality was noted between the two versions.

SAS Display Manager

The SAS Display Manager can be entered from the command line in an OS/2 window or from an applications group menu. SAS provides an installation option to create or add to an applications group menu. This applications group menu is an OS/2 window listing all installed applications software. If these are presentation manager programs, an icon will be displayed next to the program name. Parameters which include working directory, path and file names can all be set in the applications group window. Upon entering the SAS Display Manager, a

pull-down menu (PMENU) user interface appears. Available on the IBM VM/CMS[®] and VAX VMS[®] operating systems, the PMENU system is particularly well implemented in the OS/2 environment. When used with a mouse, PMENUs are a quick and easy way to maneuver around the SAS system. Programs can be brought into the editor, executed and printed without using the keyboard. Another feature of the display manager, first seen in PC SAS, is the extensive help facility and use of windows for filesets, libsets and variable names. Extensive information about SAS data sets and catalogs is available in these windows which are easily accessible by mouse and the PMENU system.

The Help facility, available through the PMENU system, is very good, providing both a description and the syntax of SAS language and procedures. Unfortunately, the PMENU system has no direct way of using built-in context sensitive help. To get help for a specific item the user must switch off the PMENU interface and type "help SAS-keyword" on the command line. The alternative is to wade through layers of interactive help screens to find the item of interest.

The Program Editor looks the same and has the same functionality as in PC SAS. The Spelling Checker is a good idea and can be used for debugging SAS programs within the editor. Unfortunately, functionality is greatly reduced as SAS keywords are not included in the dictionary. For example, LIBNAME, EQ, LE, GE, MAX, PROC, LP, SPARSEDATA and even the word SAS are not recognized by the dictionary. You can spend the time and energy to supplement the dictionary, but users should not be required to load it with SAS keywords. A nice feature of the Program Editor is its ability to read in very large files. I was able to read in a SAS program containing 37,279 lines of data and program statements.

The SAS Display Manager is a highly productive programming environment. Without needing to type commands, the PMENU system can access SAS/ASSIST, the menu driven interface to SAS, PROC SPELL, SAS/FSP, SAS/AF and PROC CATALOG. Users are prompted to fill in the name of a SAS data set or catalog to be viewed. A question mark (?) can be entered which lists all temporary and permanent SAS data sets and catalogs available. Text files such as SAS programs or raw data can also be viewed via the "View file" option. Display Manager windows can be opened for the inclusion of TITLE and FOOTNOTE statements for any procedure; the SAS OPTIONS window can be used as an alternative to the OPTIONS statement to modify options; SAS/GRAPH AXIS, LEGEND, SYMBOL and PATTERN options can all be created in Display Manager windows. Program development time is decreased because LOG, OUTPUT, FSBROWSE, OPTIONS and LIBNAME windows can be used to review intermediate data step results and final output. Using the mouse to delete, copy and paste code within and between SAS programs speeds up code editing and debugging a great deal. Graphics and output created in previous runs can be recalled in the GRAPHICS and OUTPUT MANAGER windows. Output that has been erased from the OUTPUT window is available for review or printing from the Output Manager. Similarly, stored graphs are available in the Graph Manager.

Performance

The following times were recorded for the SAS benchmark program:

Platform	Operating System	SAS Version	Time
GRiD 386is-25	OS/2 1.2	6.06	2 min 53 sec
GRiD 386is-33	OS/2 1.2	6.06	2 min 13 sec
IBM AT with Inboard 386	MS DOS 3.3	6.04	13 min 54 sec
GRiD 386is-25	MS DOS 3.3	6.04	6 min 33 sec
IBM 3081KX	CMS 5.2	6.06	1 min 18 sec
IBM PS/2 model 70-486	OS/2 1.2	6.04	5 min 32 sec
IBM RS6000 model 530	AIX 3.1	6.07	13 sec
VAX 8650/VMS 5.2	VMS 5.3	6.06	3 min 01 sec

Timings were recorded by stopwatch. In all cases the programs were run several times to verify original results. SAS was run in interactive batch mode on each platform. Time recorded for the VAX was the average of several runs as VAX execution time varied from 2 min 44 sec to 3 min 17 sec. User activity load contributed to this time variability.

PC SAS was installed on the GRiD to eliminate any hardware bias and the benchmark was run in OS/2's DOS window. As can be seen in the table, completion time was 6 minutes 33 seconds for PC SAS and 2 minutes 53 seconds for OS/2 SAS. OS/2 SAS runs more than twice as fast on the same machine.

I expected that a PC with a 80486 processor would run SAS quicker than one with a 80386 chip. This was not the case with the IBM PS/2 model 70. The benchmark was twice as slow as the 25 megahertz GRiD machine. Upon testing I found the hard disk access time on the IBM to be 33 milliseconds as compared with 15.4 milliseconds on the GRiD. These results show that SAS performance under OS/2 is more related to hard disk speed rather than processor speed.

Another interesting result was the extremely quick time recorded for the IBM RS6000 machine. It's 13 second processing speed was six times faster than the IBM mainframe.

OS/2 Operating System and SAS

Dynamic data exchange (DDE) worked as documented but with disappointing results. A link was created between an Excel spreadsheet and SAS. The spreadsheet contained input data for SAS processing. The data was successfully piped into SAS but, because of missing cells, the format read the data incorrectly. Empty cells were not recognized by SAS as missing values. This resulted in the next occurrence of data being read as the variable value. Only when a '.' was placed in missing cells were data values read correctly. This method of reading in data was therefore abandoned and the raw data was obtained by exporting a comma delimited file from Excel. This was in turn a problem as it was discovered that SAS did not recognize two consecutive commas (..) as an indicator of missing values. This file was first edited to provide spaces between consecutive commas so SAS could read the data properly.

It was a pleasure and significant productivity gain to be able to use a multitasking environment. Two SAS Display Manager sessions could be opened and code cut and pasted from one program into another. More than one SAS program could run at one time though completion time would decrease in proportion to the number of programs being executed.

It seems clear that OS/2 can be a very easy transition for those who are familiar with MS DOS. Most of the same commands are there plus a

MOVE command which transfers files from one directory to another. Functionality is increased as the mouse and Presentation Manager allow nimble manipulation of files and directories. An attractive feature of OS/2, for those of us who have used MS DOS for a long time, is the ability to delete subdirectories without first erasing all their files. The text editor provided with the operating system is powerful and easy to use. It's a great improvement over EDLIN, the editor supplied with MS DOS. It was often more convenient to modify SAS programs using the OS/2 editor and submit them as batch jobs. Program output is saved as a file by default which could be printed immediately or saved for future review.

The evaluation of PCSA is not complete. There are many promises but presently limited functionality. PCSA is still in a beta stage for OS/2 1.2. When available, it will support the ability to link a user's VAX account as a logical disk and use virtual disks, the same functions available to MS DOS users of PCSA. In addition, users will be able to run programs on OS/2 machines from their VAX accounts. The 3Com network has been used exclusively for printing. When version 1.2 of PCSA becomes available, both networks will be accessible on the same ethernet card.

Discussion

During the testing period I helped a PC SAS user with a PROC GLM application that could not be run on his MS DOS machine. I was able to show that OS/2 SAS could evaluate his complex model where PC SAS could not. Not only does OS/2 SAS execute faster, but it can handle more complex analyses than PC SAS. If you have experience with PC SAS, the OS/2 version is easy to learn as is the OS/2 operating system.

OS/2 can be viewed as a superset of DOS. Many of the same commands are available, plus a few more, like MOVE. There is also the advantage of being able to perform two or more tasks at the same time. A workstation running OS/2 can support standard word processing, spreadsheet and drawing packages without need to rely on MS DOS for these applications.

I also found that the SAS benchmark will run under PC SAS, SAS for AIX, CMS and VMS, demonstrating the portability of SAS code across different platforms.

The Display Manager for version 6.06 enhanced productivity by providing an on-line help, libref and fileref information and windows for browsing or editing SAS data sets.

The additional costs required to run the OS/2 version of SAS are reasonable. As of January 1, 1991, the cost of OS/2 1.2 Standard Edition is \$340 retail. Adding 4 megabytes of memory to a 4 megabyte MS DOS machine costs about \$320. There is a \$100 difference in the cost of licensing the OS/2 SAS Base for 1 to 3 licenses as compared

with PC SAS. The cost difference does increase as the number of licenses grow. As a ball park figure though, it appears that for a one time cost of \$660 and an annual premium of about \$100 per product, PC SAS users can upgrade to OS/2 which enables them to execute their programs more than twice as fast and to create larger, more complex models than before.

It is quite clear from these results that SAS is very I/O bound. This means that as with PC SAS, OS/2 performance is dictated more by hard disk access time than by the processor speed. The IBM PS/2 model 70 with the 486 processor ran the benchmark nearly twice as slowly as the GRiD 25 megahertz 386 machine because the hard disk access time was twice as slow. For best performance, buyers should only consider the purchase of a PC with a 20 millisecond or faster hard disk.

The evaluation also demonstrated the tremendous speed of the IBM RS6000® RISC processor running AIX®, IBM's version of UNIX. These machines are also excellent candidates as SAS machines. The disadvantage with this choice is that it would take longer to learn UNIX than OS/2 for our users with a MS DOS background.

Conclusion

The OS/2 version of SAS performs very well. SAS users who are thinking about running PC SAS on a workstation should also consider the OS/2 version of SAS. It runs twice as fast, can handle more complex analyses than PC SAS and provides an enhanced Display Manager environment for creating SAS applications. OS/2 SAS execution time has been found to compare well with mainframe versions of SAS. OS/2 SAS users have available to them the same spreadsheet and word processing capabilities as are available with MS DOS and can be integrated into a 3Com and PCSA network environment.

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