SESSION VI JOINT DEC/MICRO USERS' MEETING

Doris Aaronson and M. Pavel, *Presiders*

Joint DEC and microprocessor users' groups report

DORIS AARONSON and M. PAVEL
New York University, New York, New York 10003

The results of a joint meeting of users of Digital Equipment Corporation (DEC) computers and various microprocessors are reported. The meeting included a review and a discussion of Unix and of recent hardware and software products from DEC.

Part of the joint Digital Equipment Corporation (DEC) and microprocessor user-group meeting was dedicated to the evaluation of the Unix operating system for two reasons. (1) During that past few years, many of the PDP-11 and VAX users have switched from DEC software to Unix, and other DEC users are considering such a switch. (2) Unix has recently become available for use on microcomputers. In addition, the programming language C, closely associated with Unix, is now commercially available (for about \$125) as "tiny-c" for microcomputers such as TRS, Apple II, North Star, KIM, and SYM. Hopefully, this will enable psychologists to do major program development on the larger machines and then to execute their experiments on software-compatible microprocessor substations.

AN OVERVIEW AND EVALUATION OF UNIX

The session started with an overview of Unix, presented by Misha Pavel, chair of the Microprocessor Users' Group. Pavel focused on a number of new and powerful features of Unix for users not already familiar with Unix.

The second part of the session was an evaluation of Unix in the psychology laboratory. This was based on responses to a survey sent to our membership by Doris Aaronson, chair of the DEC Users' Group. The data suggest that users are pleased with Unix's facilities for program development, systems operations, and maintenance, but that they are dissatisfied with some aspects of the "user interface," based on human-factors considerations.

UnixTM is a computer operating system developed by Dennis Ritchie and Kenneth Thompson of Bell Laboratories. Unix is trademarked by Bell Laboratories and is available under license from Western Electric.

PANEL AND AUDIENCE DISCUSSION OF UNIX

In the third part of the session, a panel of experienced Unix programmers discussed the advantages and disadvantages of using Unix for particular tasks important in psychological research. Further, the panel responded to audience questions and comments on the use of the Unix operating system. The panel consisted of Marcia Derr, Sharon Murrell, and Ted Wright from Bell Laboratories at Murray Hill, New Jersey, and Robert Sherak from New York University. The following description is an attempt to summarize the most important points covered in the discussion.

Question: What are the pros and cons of using Unix in psychological research?

Answer: The effective utility of Unix for a particular application depends on a number of variables. Unix is especially useful for software development, data manipulation, and text processing because it has a great degree of flexibility, a large number of software tools and an elegant way of handling information. Each user can easily build a set of his or her own tools to handle rather complex tasks automatically (e.g., stimulus preparation or data analyses). On the other hand, the lack of outside support and systems documentation often requires sufficient in-house programming capabilities for system maintenance. In addition, Unix is not designed to handle real-time applications arising in many psychophysics and cognitive experiments.

Question: Are the features of Unix useful for someone who is skilled in more traditional programming (e.g., assembler)?

Answer: Unix offers a large set of programming tools, takes care of problems of manipulating data structures, and, in general, enables users to accomplish their work without being concerned with too much detail. If the programming task at hand is reasonably simple and the resulting software will undergo only a limited evolution, the advantage of Unix may not be that significant. How-

ever, most programmers will agree that in a research environment it is rare to develop software that is used for only a short period of time and does not require major modifications. An example of a task conveniently accomplished under Unix involves selection of a set of words from a dictionary under a number of simultaneous constraints (number of letters, type of letters, word frequency, etc.). Each of these constraints can be implemented as a small program ("filter") and then applied in sequence to data in a dictionary file. These programs can be easily documented, modified, and used for other tasks involving word selection.

Question: How does one keep track of the various storage devices and file systems that are mounted on the system at a given time?

Answer: Once a device is mounted, it becomes a part of the existing system and there is no special need for the user to remember the details. The same command that is used to mount new devices can be used to remind the user where the devices are actually attached. In addition, the user may define "Shell" variables identifying the directories that are particularly useful and then use these variables for more convenient access.

Question: Is Unix suitable for real-time experimental work?

Answer: The standard versions of Unix are not suitable for real-time application. There are, however, solutions to the problem. The particular solution depends on the requirements for speed. In some laboratories, standard Unix (V6) was modified to remove those functions that interfere with the real-time operation (e.g., line clock, update, etc.). Other laboratories have developed multiprocessor-based satellite systems. There, all the software and stimulus preparation is carried out under Unix. The real-time software is downloaded into smaller satellite CPUs which then take complete control over the experiment. In less time-critical cases, it is possible to install special-purpose system calls and run the experiments with reduced load on the Unix machine.

Question: How do you compare Unix with a DEC system such as RSX-11?

Answer: The DEC system RSX-11 lacks most of the user-oriented features of Unix. The advantage of RSX-11 is in its ability to handle real-time tasks. However, using any standard system for real-time application is risky if one relies on the I/O functions provided by the system. The overhead time for the I/O system calls are usually quite variable, as they depend on the system status at the time of an external event.

CONCLUSION OF PANEL DISCUSSION

Unix is good for stimulus preparation, data analysis, text processing, and many other software functions. In many respects, Unix is clearly superior to other systems. Yet, recently, Unix has been criticized for various aspects of its implementation. Among the criticisms are those concerning names and usage of various commands and the degree to which the system responds to them. There are many problems with these criticisms and with the defense of Unix as it stands. In particular, there is very little systematic empirical evidence directly applicable to the problems at hand. Thus, most of the arguments rest on the opinions of various users and computer scientists. It is simply not known how to compare the importance and effectiveness of various "principles"

in the situation involving an arbitrary user. Incidentally, critics of the system have not been able to propose an alternative command language. And yet, to modify the usage and names of various commands is a relatively easy task to do in Unix.

DEC REPORT

The fourth part of the session consisted of a report on recent hardware and software products from DEC that can facilitate psychological research. This report, by Robert Bickel from the Laboratory Data Products group of the Philadelphia DEC office, included information on DEC hardware that can support Unix and information on DEC software alternatives to the Unix system. The summary that follows is organized into information on (1) large, (2) medium-sized, and (3) small computer systems.

Bickel informed the users that DEC has a Unix group located at its Maynard, Massachusetts, plant. Many employees of this unit prefer Unix to standard DEC software and are quite strong in their preferences. If owners of DEC computers obtain a license to use Unix from Western Electric, the DEC group provides the Unix software at no charge (according to Bickel). Although under consideration, DEC currently has no plans to provide software support for Unix.

Large Computers: The VAX

Vax computers, with the VMS operating system, can now comfortably handle about 60 users in the time-sharing environment. The Unix system generally handles about half this number of users, and it is somewhat slower for many tasks. The VAX/VMS system provides more "help" facilities than Unix, to enable new programmers to learn and to use the system easily. Further, the VAX can communicate with other users via DECnet. DEC has recently developed a new information management system for the VAX under VMS. The system provides modern and powerful data management, security, and graphics. Further, DEC is developing an advanced word processing system to compete favorably with Unix.

A new floating-point microprocessor has been developed for the VAX-11/750 that will speed up data processing and numerical computation. DEC has introduced a "low-end" VAX that uses VLSI technology. It supports the full VMS operating system and is highly reliable. This low-end VAX has about 60% of the power of the VAX-11/780 at a lower cost, about \$90,000, as opposed to \$200,000. Members of the audience asked about DEC's time schedule for marketing the VAX-11/730. Bickel indicated that he had no knowledge of the system.

Medium-Sized Computers: The PDP-11 Series

The PDP-11 group was told by last year's DEC representative that the company was phasing out the 16-bit processor. Apparently, this is not true, according

to Bickel. DEC has recently introduced the PDP-11/24, a Unibus family member, and DEC is now expanding that line. The 11/24 has more main memory than the 11/34 and a faster bus than the 11/23. The 11/24 costs a few thousand dollars more than the 11/23 and requires more expensive peripherals.

DEC has introduced a new CRT terminal with medium-resolution graphics. This can be a useful peripheral for PDP-11 machines. The VT-125 (\$3,800) is based on the VT-100, but it also provides bit-map graphics and allows hard-copy output on a dot-matrix printer. Users can obtain color output for the VT-125 by connecting it to a color monitor. Special-purpose applications can use DEC's microinstruction set, and there is a high-level software package to facilitate programming even further.

Small Computers: The MINK and the Personal Computer

For psychologists who cannot afford larger systems, the MINK can run many types of experiments and

analyze the resultant data. MINK has been enhanced with the VT-125 graphics system and a floating-point module that has markedly improved the computational speed. The single-user operating system includes the "MINK BASIC" programming language, which now runs on hard disks. This combination makes it easy for the new computer user to collect and analyze data. Some users in the audience complained that DEC salespeople had been "pushing" the MINK too hard and had not been willing to listen to objections to its use in laboratory environments that require flexibility and expandability beyond the MINK's capabilities.

Finally, DEC has recently introduced a new line of small, inexpensive "personal computers," based on a Z-84 microprocessor chip connected to a VT-100 visual display. More information on the systems can be obtained by contacting a local "Digital Store."

This user's meeting ended with the wish that the psychologists using these systems could have a super operating system combining the strong features of both Unix and DEC software.