Table 1: *Results of* UNIX *benchmarks for the* AT&T UNIX PC *and some comparison machines.*

Machine	UNIX version	System time in seconds Pipe real	user	system	System Call real	user	system	Function Call real
VAX-11/780	4.1 BSD	3.2	0.1	1.2	4.8	1.4	4.0	1.0
AT&T UNIX PC	System V	4.2	0.0	1.6	8.1	0.2	7.5	0.7
IBM PC XT	PC/IX	16.6	0.1	7.6	39.8	2.9	35.6	4.7
TRS-80 16B	XENIX	8.0	0.1	3.4	15.0	1.5	12.7	1.4

		Sieve real	user	system	Write real	Read real	Shell real	user	system	Loop real	user	system
VAX-11/780	4.1 BSD	1.7	1.5	0.1	2.0	8.0	3.3	0.3	1.3	2.6	2.5	0.1
AT&T UNIX PC	System V	2.4	2.1	0.0	3.9	11.6	5.1	0.2	1.2	6.8	6.2	0.1
IBM PC XT	PC/IX	8.2	7.8	0.3	11.6	20.7	8.5	1.1	3.2	32.2	31.5	0.3
TRS-80 16B	XENIX	6.0	4.8	0.3	8.0	22.0	18.0	0.4	2.6	14.0	12.5	0.5

and others who purchase the UNIX utilities package, which includes traditional UNIX text-processing tools as well as the C compiler and library, will find the 10-megabyte hard disk an extremely tight squeeze and should consider the 20-megabyte drive instead. (The disk-formatting routine provides for a 40-megabyte drive.)

The single floppy-disk drive can be used in a number of ways. In AT&T-formatted mode, it gives a 320K-byte "mountable file system." A mountable file system is UNIX terminology for a collection of files and directories that can be "mounted" at any directory branch on the hierarchical UNIX file-system tree, although the usual practice is to mount them at the top or "root" directory to prevent confusion.

The floppy can also be used to make backups of the hard disk in any of several ways: as a structured file system, using ordinary copy commands, or in tar or cpio program formats. Tar, or "tape archive," is a traditional backup program on older systems, while cpio stands for "copy in/out," which is more widely used on UNIX System V systems. UNIX PC users do not need to know these commands; the System Administration menu takes care of such details.

Table 2: *Results for the multitasking* UNIX *benchmark with a variable number of processes.*

Machine	UNIX version	System elapsed (real) time in seconds Number of concurrent processes 1	2	3	4	5	6
VAX-11/780	4.1 BSD	4.3	5.5	7.8	9.0	11.0	13.8
AT&T UNIX PC	System V	6.3	8.7	12.7	19.2	22.8	29.8
TRS-80 16B	XENIX	20.0	24.5	33.0	56.5	1:10.5	1:39.3
IBM PC XT	PC/IX	10.6	23.4	42.8	1:14.1	1:24.2	2:10.7

System Configuration

VAX-11/780	4-megabyte RAM, two 256-megabyte disks
AT&T UNIX PC	1-megabyte RAM, one 10-megabyte disk
IBM PC XT	512K-byte RAM, one 10-megabyte disk
TRS-80 16B	384K-byte RAM, one 15-megabyte disk

(Note: All figures for tables 1 and 2, except those for the AT&T UNIX PC, are taken from "Benchmarking UNIX Systems" by David F. Hinnant, August 1984 BYTE, page 132. See the "At a Glance" box for details.)

AT&T has provided a feature that is almost a must in today's MS-DOS–dominated market, that is, the ability to read MS-DOS–formatted floppies. Since this computer is 68000-based, it will not run MS-DOS, which is tied to the Intel 8088/8086 chips. However, MS-DOS data files, word-processing document files, and program source can all be transferred to the UNIX PC via special disk-read routines.

Unfortunately, though, I was not happy with the software provided for reading MS-DOS disks. Since MS-DOS floppies are formatted differently from the standard AT&T UNIX PC format (360K instead of 320K), the nor-

(continued)

AT A GLANCE

Name
AT&T UNIX PC

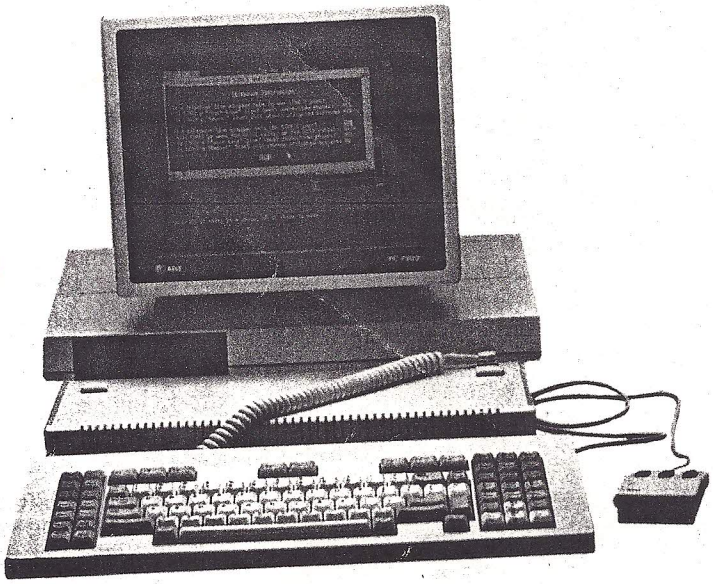
Company
AT&T Information Systems
National Sales Center
111 Westwood Place, Suite 300
Brentwood, TN 37027
(800) 247-1212

Components
Processor: Motorola 32-/16-bit 68010
10-MHz clock speed
Main memory: 512 bytes RAM, expandable to 2 megabytes on-board; 16K bytes EPROM start-up program
Virtual memory: Custom memory-management hardware and Winchester disk allow a memory address space of 4 megabytes
Display: 12-inch green-on-black; 348- by 720-pixel bit-mapped graphics capability
Keyboard: 103 keys; 8 function keys, numeric keypad, and 14 multifunction word-processing keys
Disk storage: Double-sided 5¼-inch floppy stores 320K bytes in AT&T format, 360K bytes in MS-DOS format; Winchester hard disk, in 10-, 20-, and 40-megabyte options
Ports: Standard RS-232C port configured as DTE (data terminal equipment), Centronics-compatible parallel port, three modular phone jacks

Software
UNIX System V, version 2 operating system, window manager, phone manager, word processor, spreadsheet, and business graphics package

Miscellaneous
Clock/calendar, three-button mouse, three expansion slots, built-in 300/1200-bps modem

Price
$5095 with 10-megabyte hard disk, 512K bytes RAM (UNIX $495 extra); $6590 with UNIX, 20-megabyte hard disk, and 1 megabyte of RAM (includes 512K-byte expansion card)



About the Benchmarks

User time is the amount of time a process spent executing nonprivileged instructions (e.g., arithmetic calculations, sorting, searching, calling user-level functions, and so forth).

System time is the time a process spent executing privileged (kernel) commands (i.e., system calls) plus some system-level overhead (e.g., context switching between processes).

The elapsed time is just that. And it is often not the sum of the user and system times. The majority of missing time is spent waiting for I/O operations to complete, waiting for a signal from another process, sleeping, or being swapped out on disk while another program is running. Note that the UNIX operating system utility /bin/time *filename* counts real time in even second increments and user time in tenth-of-a-second increments. This accounts for some of the apparent inconsistencies in the benchmark timings.

The Pipe benchmark is a measurement of how long it takes to set up a pipe (an I/O channel that is written into by one program and read by another) and pass 0.5 megabyte of data through it.

The System Call benchmark repeatedly queries (25,000 times) the operating system concerning its process identity with the getpid( ) system call. As the program doesn't do much other than system calls, the elapsed time is important here. System time and user time are not very significant in this test.

The Function Call benchmark consists of running two programs, one that uses a function call to accomplish a goal and one that doesn't use the function call for the same goal. The user time of the program not using the function is subtracted from the user time of the program using the function. The difference is function call overhead.

The Sieve benchmark is a test of compiler efficiency and processor throughput and is the time required for one pass through the Sieve of Eratosthenes prime-number generator. System overhead is not very significant in this benchmark.

The Disk Write and Read benchmarks test the random-access disk implementation. Disk Write creates, opens, and writes a 256- by 512-byte file. The Read benchmark reads this file and then removes it.

The Shell benchmark invokes six background processes. The shell statement wait causes the shell script to pause until all background processes have terminated. Note that invoking tst.sh more than six times may not be possible on some systems if a per-user process limit is defined.

The Loop benchmark tests long integer arithmetic and is almost totally processor-bound.

For more information on benchmarking UNIX systems, see "Benchmarking UNIX Systems" by David F. Hinnant, August 1984 BYTE, page 132.