AT&T 3B2 Family

MANAGEMENT SUMMARY

UPDATE: *Since the last update of this report, AT&T has redefined its strategy for marketing its 3B2 product line. The company's new focus is on data networking—the integration of its products into existing computing environments to act as the fulcrum that allows everything to work together. Old products are receiving renewed emphasis; new products, particularly the 3B2/500 and 3B2/600, have been introduced to substantiate this new marketing thrust. The new direction may be AT&T's last chance to become successful in the computing industry.*

AT&T's entrance into the general data processing market in early 1984 was somewhat akin to a lone traveller's attempting to join a large entourage on a train that had already left the station. By the time the straggler was able to jump aboard, the passengers already on board—IBM and Digital Equipment Corporation most prominent among them—not only had taken many of the seats, but had also established the trip itinerary. However, still intent on getting a comfortable seat on a vehicle bound for glory, AT&T has switched trains and now sees its ticket to success in data networking, the company's name for departmental computing.

Putting metaphors aside, AT&T has had an extremely difficult time selling its computers. The company's Data Systems Division, the merger of AT&T Information Systems and AT&T Communications, has suffered tremendous losses, and if it were not for the financial resources of the rest of the corporation, AT&T probably would have left the computer business already. These troubles do not stem from anything inherently wrong with the company's product line, except that the systems offer little more than what is available on other generic-type systems crowding the market. Rather, AT&T's troubles hail from within the organization. The company's evolution from telecommunications to computer company has been hindered by AT&T's cumbersome size, employees' resistant attitudes

The 3B2 Family models are desktop multiuser supermicros suitable for use as departmental processors in large corporate computing environments. The systems run the UNIX System V operating system, developed by AT&T. A variety of networking products is available to provide communications among 3B2 systems and other vendors' system which do and do not run the UNIX operating system.

MODELS: 3B2/310, 3B2/400, 3B2/500, and 3B2/600.
MEMORY: 1MB to 16MB.
DISK CAPACITY: 30MB to 14.7GB.
WORKSTATIONS: Up to 65 typical.
PRICE: $12,900 to $46,500 (base system prices).

CHARACTERISTICS

VENDOR: AT&T Data Systems, 295 N. Maple Ave., Basking Ridge, New Jersey 07920. Telephone (201) 221-2000.

CANADIAN ADDRESS: AT&T Canada, Inc., 1500 Don Mills Road, Suite 500, Don Mills, Ontario, Canada M3B 3K4. Telephone (416) 449-4300.

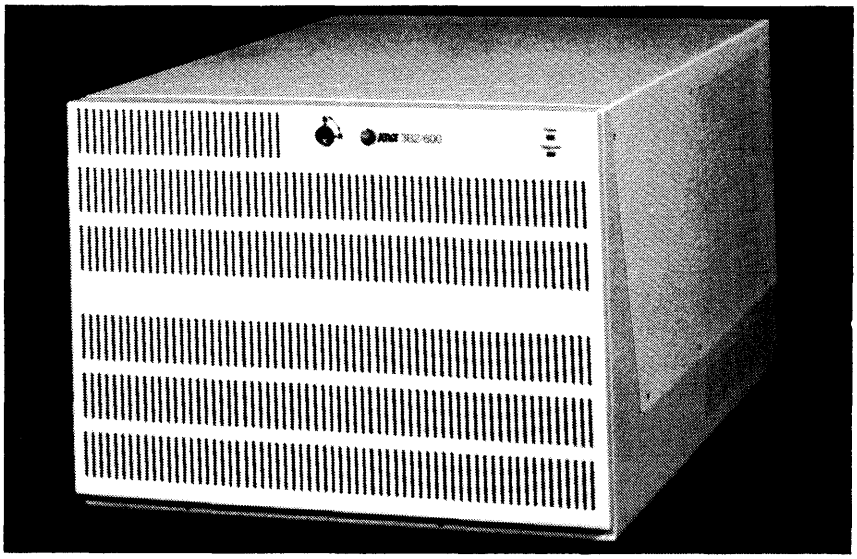
DATA FORMAT

BASIC UNIT: 32-bit word. Data types include bytes (8-bit) and halfwords (16-bits).

INTERNAL CODE: ASCII.

MAIN STORAGE

Main memory on the 3B2 Family is dual-ported, allowing the CPU to use one port, while the I/O bus and the DMA controller share the other port. The CPU and I/O may



AT&T's 3B2/600 supermicrocomputer supports up to 64 active users and runs AT&T's UNIX System V operating system. The 3B2/600 is targeted for use as a departmental processor in large corporate environments.

AT&T 3B2 Family

CHART A. SYSTEM COMPARISON

MODEL	3B2/310	3B2/400	3B2/500	3B2/600
SYSTEM CHARACTERISTICS				
Date of introduction	October 1985	June 1985	September 1987	March 1987
Date of first delivery	—	June 1985	—	—
Microprocessor type	WE 32100	WE 32100	WE 32100	WE 32100
Microprocessor cycle time	10MHz	10MHz	—	18MHz
Operating system	UNIX System V Release 2.0.5, 3.0, or 3.1	UNIX System V Release 2.0.5, 3.0, or 3.1	UNIX System V Release 3.1.1	UNIX System V Release 3.1.1
Upgradable from	3B2/300	Not applicable	—	Not applicable
Upgradable to	Not applicable	Not applicable	—	Not applicable
Number of serial/parallel I/O ports	18/4 or 34 serial	46/11 or 90 serial	22/5 or 50 serial	46/11 or 90 serial
Number of expansion slots	4	11	5	11
MEMORY				
Minimum capacity (bytes)	1M	1M	4M	4M
Maximum capacity (bytes)	4M	4M	8M	16M
DISK STORAGE				
Minimum capacity (bytes)	30M	30M	147M	294M
Maximum capacity (bytes)	14.45G	14.5G	14.5G	14.6G
NUMBER OF WORKSTATIONS	Up to 34 (14 active)	90 (25 active)	50 (25-40 active)	90 (25-64 active)
COMMUNICATIONS PROTOCOLS	Async, 3BNet, Ethernet, TTY, ISN, PC Interface, StarLAN, SNA/3270, BSC/3270, X.25, TCP/IP, BSC 2780/3780, LU6.2	Async, 3BNet, Ethernet, TTY, ISN, PC Interface, StarLAN, SNA/3270, BSC/3270, X.25, TCP/IP, BSC 2780/3780, LU6.2	Async, 3BNet, Ethernet, TTY, ISN, PC Interface, StarLAN, SNA/3270, BSC/3270, X.25, TCP/IP, BSC 2780/3780, LU6.2	Async, 3BNet, Ethernet, TTY, ISN, PC Interface, StarLAN, SNA/3270, BSC/3270, X.25, TCP/IP, BSC 2780/3780, LU6.2

Note: A dash (—) in a column indicates that the information is unavailable from the vendor.

toward change, and a lack of a definitive marketing focus required in an extremely competitive market.

AT&T's most recently defined strategy is to build on its strong presence as a telephone company within the corporate marketplace and to offer networking solutions that integrate voice and data communications. AT&T is intent on earning a large share of this more narrowly defined market, which has not yet been fully tapped by the larger vendors. The three objectives of this strategy are to sustain the company's long-distance network and the design, manufacture, and sale of telephone equipment; to build upon the company's strength in networking and extend it from voice to data; and to establish a presence in international markets.

In addition, capitalizing on its presence within large corporations, AT&T is targeting the departmental processing market. Sales of standalone systems for use by smaller businesses have been turned over to the company's VARs.

The 3B2 systems' role in this strategy is to serve as departmental processors at the center of a three-tier networking strategy, connecting PCs and workstations in the bottom tier to a centralized IBM mainframe at the top. In the middle, the 3B2 can be equipped with communications facilities to provide access to data on multiple systems; transfer data and files between users; and allow sharing of resources such as disks, tape drives, and printers. The new strategy targets systems at large corporate environments that are moving away from a centralized computing environment toward departmental computing.

The 3B2 product line includes the 3B2/310, 3B2/400, 3B2/500, and the 3B2/600. Introduced in March 1987, the

access memory simultaneously, improving system performance. The Dual Port Memory (DPRAM) Controller arbitrates between main memory requests from the CPU and I/O.

Main memory utilizes 256K-bit DRAM chips, which are surface mounted on memory array boards that plug into I/O slots on the system backplane. The 3B2/310 and 400 have two dedicated memory slots that accommodate 1MB or 2MB memory boards, for a maximum of 4MB of main memory. The 3B2/500 has two dedicated memory slots that accomodate 2MB or 4MB memory boards for a maximum of 8MB of main memory. The 3B2/600 has four dedicated memory slots (in addition to the 12 I/O slots) that accommodate 2MB or 4MB memory boards, for a maximum of 16MB of main memory

Memory boards for the 3B2/310 and 400 provide byte parity for memory protection; errors are detected but not corrected. Memory boards for the 3B2/500 and 3B2/600 provide Error Correction Code (ECC), which detects and corrects single-bit errors. Double-bit errors are logged into the system error log file.

Minimum memory required for the UNIX System V Kernel and drivers on the 3B2 Family is about 300KB.

PROCESSING COMPONENTS

All 3B2 models utilize the CMOS-based, AT&T proprietary WE 32100 microprocessor as the CPU. The WE 32100 includes a 32-bit internal data path and 32-bit address bus. Operations are 8, 16, or 32 bits. The fetch controller includes an 8-byte instruction queue and 32-bit-wide Address Arithmetic Unit (AAU). The system includes nine all-user-accessible, general-purpose registers. Seven all-user-accessible registers are dedicated to the CPU. The systems support 15 interrupt levels and 18 addressing modes.

All 3B2 models include a AT&T WE 32106 Math Acceleration Unit (MAU) for floating-point operations. The MAU

AT&T 3B2 Family

3B2/600 improved upon its predecessors in the 3B2 product line by offering higher performance, greater memory and disk storage capacity, and improved data throughput compared to the lower end systems. A processor upgrade is available for the 3B2/600 to increase processing performance by up to 50 percent. At the same time the 3B2/600 was announced, prices were lowered on the 310 and 400 to make them more price competitive with comparable systems on the market. A Small Computer Systems Interface (SCSI) host adapter and SCSI-based peripherals were made available for all the models, increasing potential disk storage capacity to just over 6.5GB from 432MB on the 3B2/310 and to just over 6.6GB from 720GB on the 3B2/400 (disk storage potential was expanded even further in September with the introduction of higher capacity SCSI-based disk drives). The SCSI-based tape drive announced in March supports a storage capacity of 60MB, compared to 23MB of storage on the previously supported tape drive. User support and connectivity were doubled on all models through the Enhanced Ports (EPORTS) card, which offers twice as many RS-232-C ports as the previous I/O Ports card. AT&T also announced office communications software that allows the 3B2s to coexist in IBM, Digital Equipment, and Wang environments.

AT&T further defined its data networking strategy in September 1987 with the introduction of additional systems—including the 3B2/500—designed for small, intermediate, and large work groups. The 3B2/500, which supports up to 40 active users, fills the price performance niche that existed between the 3B2/400 and 600. The 3B2/500 offers twice the CPU performance and memory capacity as the 3B2/400. A multiprocessor enhancement is available which expands the 3B2/500's power by 50 percent. Also in September, AT&T announced the 147MB and 300MB SCSI-based disk drives, which can be used to double disk storage capacity previously available on each of the 3B2 models. Each model can now support up to 14.4GB external disk storage in addition to internal disk storage. Two additional tape drives were made available: a quarter-inch cartridge tape drive with a 120MB storage capacity and a 9-track reel-to-reel tape drive with a backup capacity of 145MB. Enhancements were also made to AT&T's communications and networking products.

In September, AT&T also announced the 6386 WorkGroup System (WGS), based on the Intel 30386 microprocessor, and the multiprocessor 3B4000 superminicomputer, designed for transaction processing, decision support, and general-purpose computing. These systems are not covered in this report.

COMPETITIVE POSITION

When AT&T entered the computer business in 1984, it did so at a very good time; there was an industry-wide attitude of plenty and an optimistic notion that everyone could be successful. There was also widespread interest in integrating communications with computers; hence, it was a prime opportunity for AT&T to establish a foothold in the market. Unfortunately, at that time, AT&T did not yet have its

features single 32-bit, double 64-bit, and double-extended 80-bit precision. Operations performed by the MAU include add, subtract, multiply, divide, modulo, negate, absolute, square root, compare, move, round, and convert.

The Memory Management Unit (MMU), based on the AT&T WE 32101, translates virtual addresses into physical addresses, and vice versa, off-loading this function from the CPU. Standard memory management on the 3B2/310 and 400 is swapping; demand paging is optional. The 3B2/500 and 600 support demand paging. All 3B2 models support 4GB of both virtual and physical address space.

All 3B2 CPUs include 256 bytes of 64-by-32 bit instruction cache memory. The 3B2/600 is also equipped with 6KB of Virtual Cache (VCache), which improves system performance by reducing data and instruction retrieval time. VCache is composed of 2KB of data cache and 4KB of instruction cache. VCache is optional on the 3B2/500.

The 3B2/500 and 600 support an optional multiprocessor enhancement, which consists of a CPU, MMU, and MAU, each with the same features as the system's resident components. This enhancement improves system performance by up to 50 percent. The 3B2/500 must be equipped with VCache to support the multiprocessor enhancement.

CPU clock speed is 10MHz on the 3B2/310 and 400, and 18MHz on the 3B2/600. AT&T Bell Labs rates the 310 and 400 at 1.12 MIPS, while the 3B2/600 is rated at 2.6 MIPS. When configured with the multiprocessor enhancement option, the 3B2/600 performs at 4 MIPS.

INPUT/OUTPUT CONTROL

The I/O bus controls all peripheral interfaces on the 3B2 systems. This asynchronous, multiplexed I/O bus has a 16-bit data path and a 24-bit address path. The I/O bus supports both 8-bit and 16-bit programmed and intelligent peripherals.

I/O access to main memory is monitored by the DPDRAM controller, which also monitors CPU access to main memory. The DPDRAM controller supports four basic modes, listed here in order of their priority (assigned by the bus arbiter): refresh; I/O access of main memory by a feature card or by the integral DMA controller; CPU access of main memory; and CPU access of I/O in which the CPU reaches across the main memory to communicate directly with feature cards or with the system-board-resident DMA controller.

The DMA controller features four independent DMA channels and provides service for the disk and diskette controllers and the transmit ports of the dual asynchronous serial RS-232-C ports. To support the integral controllers and ports, the DMA controller accepts DMA requests, acquires the bus, and generates a DPDRAM address and appropriate peripheral bus signals to accomplish the transfer. All data transfers between the DMA controller and main memory or the CPU are eight bits wide.

On the 3B2/310 and 400 the I/O bus transfers data at 1MB to 2MB per second. The 3B2/600 uses the Enhanced I/O Bus (EIO), which provides a transfer rate of up to 4MB per second. The 3B2/500's bus supports a 12MB per second data transfer rate.

Each 3B2 model's system board includes two integral serial ports, which, for optimum system performance, should be used for the console terminal and a dial-in line or device that

AT&T 3B2 Family

CHART B. DISK/DISKETTE DEVICES

MODEL	36.6MB	85.9MB	1MB	DM/94E
Type	Winchester	Winchester	Diskette-96	—
Size (inches)	5¼	5¼	5¼	5¼
Number of surfaces	3	5	2	—
Formatted capacity per drive (bytes)	30M	72M	1M	94M
Interface/controller	ST-506	ST-506	Integral (TM-100)	ESDI
Number of drives per interface/controller	2	2	1	4
Average access time	45 ms	35 ms	90 ms	—
Data transfer rate	5M bps	5M bps	250K bps	—
Sectors/tracks per surface	18	18	80	—
Bytes per sector/track	512/sector	512/sector	6K	512/sector

Note: A dash (—) in a column indicates that the information is unavailable from the vendor.

CHART B. DISK/DISKETTE DEVICES (Continued)

MODEL	DM/135E	DM/147E	DM/300E
Type	—	—	—
Size (inches)	5¼	5¼	5¼
Number of surfaces	—	—	—
Formatted capacity per drive (bytes)	135M	147M	300M
Interface/controller	ESDI	ESDI	ESDI
Number of drives per interface/controller	4	4	4
Average access time	—	—	—
Data transfer rate	—	—	—
Sectors/tracks per surface	—	—	—
Bytes per sector/track	512/sector	—	—
Comments			

Note: A dash (—) in a column indicates that the information is unavailable from the vendor.

organization in place to sell computers. Communications personnel were asked to change gears and sell computers, but they were not given enough time or training to retool their thinking. The UNIX operating system, developed by AT&T, had not yet been recognized as the industry standard that it is today, and its applications base was not large enough to immediately attract a large number of users. Then came 1985 and the well-chronicled industry slump. Like a lumbering dinosaur of ages past, AT&T Information Systems shivered during the change in industry climate. If it were not for the body fat provided by the rest of the corporation, this division could well have become a fossil.

But it seems to take more than a deep chill—meteors perhaps?—to kill off an industry giant. While smaller, more nimble companies closed their doors, AT&T went through the necessary layoffs and in-house consolidations to carry it through to 1987, where once again, the company is presented with a viable opportunity—in departmental processing—to become a successful vendor of computer products. But it must move quickly and decisively—before IBM's 9370 and other vendors' multiuser 80386-based supermicros sweep the market—and begin spreading some success stories to convince prospective customers that AT&T is here to stay.

Already firmly established as a telecommunications provider to the corporate marketplace, AT&T is in a very strategic position to also sell its computers to the same users. AT&T needs to infiltrate corporate commercial computing from its specialized communications control niche just as Digital Equipment entered this market from the engineering/scientific applications niche and expanded

is not often used. These ports run through the main DMA controller, which causes a CPU interrupt for every character entered on the port.

The 3B2/310 has four available I/O slots for expansion options. Using I/O Ports cards, the 310 supports up to 18 serial and 4 parallel devices. Using Enhanced Ports Boards (EPORTS), the 310 supports a total of 34 serial connections.

The 3B2/400 has 11 available I/O slots for expansion options. Using I/O Ports cards, the 400 supports up to 46 serial and 11 parallel devices. Using EPORTS, the system supports up to 90 serial devices.

The 3B2/500 has 5 available I/O slots. Using I/O ports, the 500 supports up to 22 serial and 5 parallel ports. Using EPORTS, the system supports up to 50 serial ports.

The 3B2/600 has 11 available I/O slots. Using I/O ports the 600 supports up to 46 serial and 11 parallel devices. Using EPORTS the system supports up to 90 serial devices.

I/O Ports cards offer four serial ports and one parallel port. The built-in Intel 80186 microprocessor off-loads character processing from the CPU and supports transmission speeds of 19.2K bps. EPORTS support eight synchronous serial ports conforming to the RS-232-C standard, data transmission and reception up to 38.4K bps, and X-on/X-off software flow control. EPORTS are also based on the 80186 microprocessor and support all serial devices currently supported by I/O Ports cards. Each feature card requires one slot on the I/O backplane.

All 3B2 systems support up to two SCSI host adapters. Each SCSI host adapter provides an SCSI bus which supports up to eight SCSI controllers. One of these controllers is on the host adapter and provides the interface between the SCSI bus and the system. The seven remaining controller taps are

AT&T 3B2 Family

into use for commercial applications. AT&T must convince users that it too is ambidexterous enough to support both telecommunications and computing needs.

AT&T's primary competition in this market comes from Digital Equipment, which has already captured the lion's share of the supermicro and minicomputer marketplace with its MicroVAX II, VAX-II, and successor VAX 8000 systems. Both vendors pursue similar strategies, positioning their products as departmental systems linked to IBM mainframes.

The MicroVAX II can be considered a competitor to all 3B2 models, but especially to the 3B2/400. Based on its feature set and configurability, Digital Equipment is not yet shipping a product directly comparable to the 3B2/600. The forthcoming MicroVAX 3000s, will address this performance gap.

From a pure performance viewpoint, the 3B2s offer more power than the MicroVAX II. The 1.1-MIPS ratings of the 3B2/310 and 400 are slightly higher than the 0.9-MIPS rating of the MicroVAX II. The 3B2/500 is rated at 2.1 MIPS, which can be increased to 4.0 MIPS with optional VCache and Multiprocessor Enhancement. The 3B2/600 is rated at 2.6 MIPS, which can be increased to 4.0 MIPS by adding the Multiprocessor Enhancement. Other advantages that the 3B2s have over the MicroVAX II are greater disk storage capacity (over 14.5GB on the 3B2/400 versus 1.8GB on the MicroVAX II) and user support (up to 64 active users on the 3B2/600 versus up to 48 on the MicroVAX II).

In some cases, support for UNIX as the primary operating system is another advantage that 3B2s have over the MicroVAX II. Many vendors, including Digital Equipment, now offer systems that run UNIX or a UNIX derivative. The UNIX applications base is growing as software houses recognize the operating system's potential as an industry standard. Also, the 3B2s run UNIX System V, the most popular version. Digital Equipment's version of UNIX, Ultrix-32, is based on the Berkeley 4.2 variant and does not incorporate all features of UNIX System V.

Customers who choose UNIX over a proprietary operating system have much wider latitude in making future purchases of computer systems from other vendors. Buying from a vendor like Digital Equipment, that has a largely proprietary product line, limits those choices to the vendor's product line and locks the user into that vendor's way of computing. Flexibility of choice should be a primary consideration where a user has many budgetary restrictions and needs to shop around to get the most for his or her money. A proprietary systems vendor with a captive market has much more power to demand higher prices on its systems. Digital Equipment has been doing this for the past few months, raising prices on systems and software that are high in demand. Digital Equipment's restrictions on licensing its architectures to third-party peripheral vendors also keep users tied into the company's higher-priced peripheral product line. The 3B2s' use of the industry-standard SCSI

available to support up to seven SCSI-based storage peripherals. The 3B2/500, 600, and some configurations of the 3B2/400 come equipped with one host adapter. On the 3B2/500 and 600, three of the controller taps are taken up by the adapter and the internal disk and tape controllers. The SCSI host adapter is optional on the 3B2/310 and on certain configurations of the 3B2/400.

CONFIGURATION RULES

The 3B2/310 is available in three packaged configurations: 3B2/310 Solution Packages A2, B2, and F2. Each configuration includes a WE 32100 system board and cabinet, a WE 32106 MAU, a 720KB diskette drive, four available expansion slots, and four 14-inch shielded cables/connectors. The configurations also include 1MB or 2MB of memory, a 30MB or 72MB disk drive, and an I/O Ports or EPORTS card.

The 3B2/400 is available in five packaged configurations: 3B2/400 Solution Packages A2, C2, D2, R2, and Q2. Each configuration includes a WE 32100 system board, cabinet, WE 32106 MAU, a 720KB diskette drive, 11 available expansion slots, and six 14-inch shielded cables/connectors. The configurations also include 1MB or 2MB of memory, a 30MB or 72MB disk drive, a 23MB or 60MB cartridge tape drive, and one I/O Ports or EPORTS card. Packages Q2 and R2 also include the SCSI host adapter card.

The 3B2/310 and 400 are also available as preconfigured StarLAN PC Servers, allowing the systems to act as resource servers for file and peripheral sharing in an AT&T STARLAN NETWORK.

The 310 StarLAN PC Server, based on the 3B2/310 F2, includes 2MB of memory; a 72MB disk drive; one EPORTS card; UNIX System V Release 3; a 3B2 Network Access Unit (NAU); the 3B2 DOS Server Program; the 3B2 Network Program Package; and the 3B2 Network Support Utilities, Release 1.

The 400 StarLAN PC Server, based on the 3B2/400 R2, is similar to the 310 StarLAN PC Server except that it includes 4MB of memory, two 72MB disk drives, a 60MB cartridge tape drive, and a SCSI host adapter.

The 3B2/500 includes the WE 32100 system board and cabinet, the WE 32106 MAU, 4MB of memory, one 720MB diskette drive, a 147MB disk drive, one 60MB cartridge tape drive, one EPORTS card, one SCSI host adapter card, and various cables.

The 3B2/600 is available in one configuration, the Solution Package A, which includes the WE 32100 system board and cabinet, the WE 32106 MAU, 4MB of memory, one 720MB diskette drive, two 147MB disk drives, one 60MB cartridge tape drive, three EPORTS cards, one SCSI host adapter card, two 7-foot cables, two 14-foot cables, two 25-foot cables, two 50-foot cables, and 10 connectors.

INPUT/OUTPUT UNITS

See Chart B for disk and diskette devices, Chart C for workstations, and Chart D for printers.

The most significant disk drives available are the Disk Module (DM)/94E, DM/135E, DM/147E, and DM/300E disk drives because they are supported by the SCSI host adapter. These drives are connected to a 3B2 via the disk controller module (DCM/4E), which supports up to four disk drives. Each 3B2 supports up to two SCSI host adapters, each of which supports up to seven DCM/4Es, making it

AT&T 3B2 Family

CHART C. WORKSTATIONS

MODEL	Dataspeed 4418	Dataspeed 4425	Dot-mapped Display 5620	510 A/D
DISPLAY PARAMETERS				
Max. chars./screen	1,920 x 3,168	1,920 x 3,168	800 x 1,024 resolution	1,920 (A); 3,168 (D)
Buffer capacity	3 pages	3 pages	256KB or 1MB	1 page (A); 2 pages (D)
Screen size (lines x chars.)	24 x 80 or 132	24 x 80 or 132	70 x 88	24 x 80 (A & D); 24 x 132 (D)
Tilt/swivel screen	Tilt standard	Tilt standard	Not applicable	—
Symbol formation	5 x 7/7 x 9 dot matrix	5 x 7/7 x 9 dot matrix	Bit-mapped	7 x 9/9 x 11 (A); 6 x 10/8 x 12 (D)
Character phosphor	Amber, white, or green	White or amber	Green	Green
Total colors/no. simult. displayed	Not applicable	Not applicable	Not applicable	Not applicable
KEYBOARD PARAMETERS				
Style	IBM 3278	Typewriter	Typewriter	Typewriter
Character/code set	128 ASCII	128 ASCII	ANSI 3.64	—
Detachable	Yes	Yes	Yes	Yes
Program function keys	24 functions	38/19 (option)	8 standard	96 w/cartridge (A); 24 (D)
TERMINAL INTERFACE	RS-232-C	RS-232-C	RS-232-C	RS-232-C (A & D); parallel or DCP (D)
COMMENTS	Optional integrated auto dial modem	Optional integrated auto dial modem; VT-100 compatible		Integrated voice/data, handset, speaker-phone, modem; 510A for analog, 510D for digital

Note: A dash (—) in a column indicates that the information is unavailable from the vendor.

CHART C. WORKSTATIONS (Continued)

MODEL	610 BCT	615 MT	620 MTG
DISPLAY PARAMETERS			
Max. chars./screen	1,920 or 3,168	1,920 or 3,168	1,920 or 3,168
Buffer capacity	1 page	1 page	1 page
Screen size (lines x chars.)	24 x 80 or 132	24 x 80 or 132	24 x 80 or 132
Tilt/swivel screen	Tilt/swivel	Tilt/swivel	Tilt/swivel
Symbol formation	5 x 7/7 x 9	5 x 7/7 x 9	6 x 8 in 8 x 17 (bit-mapped)
Character phosphor	Green, amber, or white	Green or amber	Green or amber
Total colors/no. simult. displayed	Not applicable	Not applicable	Not applicable
KEYBOARD PARAMETERS			
Style	Typewriter	Typewriter or UNIX PC style	Typewriter or UNIX PC style
Character/code set	ASCII/ANSI 3.64	ANSI 3.64	ANSI 3.64
Detachable	Yes	Yes	Yes
Program function keys	16 programmable, 6 fixed	36 programmable	36 programmable
TERMINAL INTERFACE	RS-232-C	—	—
COMMENTS		Multitasking terminal capability with up to 3 terminals. Modem cards optional. AT&T 513 BCT/System 75 compatible. Emulates DEC VT220.	Supports up to 6 windows. Emulates Tektronix 4010 and 4014 protocols. Supports Graph station graphics software, optional mouse, and modem.

Note: A dash (—) in a column indicates that the information is unavailable from the vendor.

peripheral interface provides users with a much wider vendor and product base from which to choose when it comes to expanding system capacity.

In comparing system price and price/performance, the 3B2s offer notable advantages over the MicroVAX II. A 3B2/400 Configuration R2 equipped with 2MB of memory, 144MB of disk storage, a 60MB tape drive, a 720MB diskette drive, a SCSI Host Adapter card, an EPORTS card with eight serial ports, a dot matrix printer, the UNIX operating system, and eight terminals is priced at $33,905

possible to attach 14 DCM/4Es per system. Two of the fourteencontrollers are devoted to supporting tape drives, leaving twelve to support disk drives, for a maximum external storage capacity of 14.4GB when attaching DM/300E disk drives. (This is in addition to internal disk capacity of 72MB on the 3B2/310, 144MB on the 3B2/400, 147MB on the 3B2/500, and 294MB on the 3B2/600.) The DCM/4E, packaged in a single cabinet, houses one Enhanced Small Device Interface (ESDI) bridge controller which provides the connection between the SCSI bus and the ESDI on the disk drives.

The TM/60S and TM/120S are the SCSI-based tape drives supported by the 3B2. Both tape drives use ¼-inch, nine-

AT&T 3B2 Family

CHART D. PRINTERS

MODEL	455	457	458	470	471/476	475
Type	Daisywheel	Daisywheel	Daisywheel	Dot matrix	Dot matrix	Dot matrix
Speed	55 cps	45 cps	45 cps	120 cps	120 cps	120 cps
Bidirectional printing	Yes	Yes	Yes	Yes	Yes	Yes
Paper size	Up to 15 in.	4 to 16.7 in.	4 to 16.7 in.	4.5 to 11 in.	4.25 to 15.5 in.	4.5 to 11 in.
Character formation	Full	Full	Full	8 x 9 dot matrix	8 x 9 dot matrix	8 x 9 dot matrix
Horizontal character spacing (char./inch)	10, 12, 15	10, 12, 15	10, 12, 15	5-17	5-17	5-17
Vertical line spacing (char./inch)	6/8	6/8	6/8	6/8	6/8	6/8
Character set	ASCII 96	ASCII	ASCII	ASCII 128	ASCII 128	ASCII 128
Controller/Interface	RS-232-C, Centronics parallel	Centronics parallel	RS-232-C	Centronics parallel	Centronics parallel (471), RS-232-C (476)	RS-232-C
No. of printers per controller/ interface	1	1	1	1	1	1
Printer dimensions, in. (h x w x d)	7.13 x 24.5 x 15.5	5.2 x 21.6 x 12.9	5.2 x 21.6 x 12.9	5.35 x 15.6 x 11.22	5.35 x 19.8 x 11.22	5.35 x 15.6 x 11.22
Graphics capability	Yes	No	No	Yes	Yes	Yes

CHART D. PRINTERS (Continued)

MODEL	477	478	479	495	5310	5320
Type	Dot matrix	Dot matrix	Dot matrix	Laser	Dot matrix	Dot matrix
Speed	288 cps draft	50/200	50/200	10 ppm	200 cps	200 cps
Bidirectional printing	Yes	Yes	Yes	No	Yes	Yes
Paper size	4 to 16 in.	3 to 9.5 in.	3 to 15 in.	8.5 x 14 and 8.5 x 11 in.	3 to 9.5 in.	3 to 15 in.
Character formation	12 x 24, 18 x 24, 36 x 24	Up to 145	Up to 240	300 x 300 dpi	9 x 7 dot-matrix	9 x 7 dot-matrix
Horizontal character spacing (char./inch)	10 to 20, proportional	5 to 18.2	5 to 18.2	10, 12, 16.7, proportional	5 to 16.5	5 to 16.5
Vertical line spacing (char./inch)	3, 4, 6, 8, programmable	2, 3, 4, 6, 8, 12	2, 3, 4, 6, 8, 12	3, 4, 6, 8, programmable	2, 3, 4, 6, 8, 10, 12	2, 3, 4, 6, 8, 10, 12
Character set	ASCII	ASCII	ASCII	Variable	ASCII	ASCII
Controller/Interface	Centronics parallel, RS-232	Centronics parallel	Centronics parallel	IBM/Centronics parallel, RS-232	Serial RS-232	Serial RS-232
No. of printers per controller/ interface	1	1	1	1	1	1
Printer dimensions, in. (h x w x d)	6.4 x 22.4 x 15.3	5.5 x 16 x 14.4	5.5 x 21 x 14.4	15.2 x 17.7 x 19.1	5.5 x 16 x 20.1	6 x 19.5 x 21.5
Graphics capability	Yes	Yes	Yes	Yes	Yes	Yes

($4,238 per user or $30,822 per MIPS). A similarly equipped MicroVAX II is priced at $44,375 ($5,547 per user or $49,305 per MIPS).

For many users, this price disparity could be a primary consideration in buying from AT&T rather than Digital Equipment. However, this is more true among smaller businesses—which AT&T is no longer directly targeting—that have less to spend on computer equipment than does a large corporation. The larger corporations tend to look to a vendor's reputation for service and stability and to consider the vendor's higher prices as simply the price they must pay for a secure investment. Digital Equipment has this reputation and can command higher prices. AT&T does not and cannot, at least in the corporate market. In going head-to-head with Digital Equipment in the corporate market, AT&T has chosen a tough competitor, and offering systems at lower prices is simply not enough to attract a large corporate user base. The company must also strive to do as well as, or perhaps better than, Digital Equipment both in marketing its systems and in offering better supporting products, including peripherals, applications, operating system enhancements, service and support, product upgrades, upward migration paths, communications, and connectivity.

AT&T has only a couple of years to prove itself by accomplishing what it took Digital Equipment over 10 years to

track tape cartridges with a 60MB and 120MB storage capacity, respectively. The tape drives record in NR2 serial serpentine mode, in QIC-24 format, at 90 inches per second in streaming mode. The data transfer rate is 90K bps. The TM/120S can read tapes that have been recorded on the TM/60S. Also available for use on the 3B2s is a ½-inch, nine-track tape drive which accommodates tape reels of various sizes. This drive has a 40MB capacity and records in NRZI mode at 100 inches per second while streaming. The data transfer rate is 160K bps.

Expansion modules are available for adding storage to the 3B2s. Four expansion modules are available: the SCSI-based XM/405S and XM/900S, the XM Solution Package A, and XM Solution Package C. Up to three 5¼-inch peripherals may be housed in each XM; a maximum of two may be removable.

The XM/405S houses a single bridge controller and three 135MB drives for a total of 405MB of disk storage. The XM/900S houses a bridge controller and three 300MB disk drives for a totat of 900MB of disk storage. Seven such units can be installed per SCSI host adapter and can be used in combination with the DCM/4E, DM/94E, and DM/135E, as well as the 60MB tape drive.

The basic XM Solution Packages A and C include the XM cabinet, internal power supply, internal cabling, an integral 23MB formatted tape drive, and a dual device controller which supports one tape drive and one diskette drive. A 30MB or 72MB disk drive can be added to Solution Package A. Solution Package C includes an installed 72MB fixed disk drive in addition to the basic package.

AT&T 3B2 Family

do—infiltrate a market held by another vendor, which in Digital Equipment's case was IBM. If the next two years don't bring profits high enough to justify AT&T's investments in computer technology, the company may again have to scale down its efforts, perhaps redefine its strategy one more time, or base its efforts on a more viable product, such as the recently announced 80386-based supermicro. AT&T might do better to rely less on products based on its proprietary WE 32100 microprocessor and move toward 80386-based products that promise more recognition and acceptability.

ADVANTAGES AND RESTRICTIONS

Though the 3B2 product line is technologically unextraordinary, the systems do offer many of the same advantages as the other contenders in the supermicro market; though these features don't give the company an extreme edge over the competition, the omission of such features would put the systems at a disadvantage.

Running UNIX System V as its operating system is the single most important advantage of the 3B2 systems, and a large part of AT&T's strategy for marketing the system. Though the UNIX applications base is still small, compared to those of proprietary operating systems from Digital Equipment and IBM, acceptance of UNIX and its attendant applications base continues to grow. UNIX System V is recognized as a standard for operating systems within the industry, and even the major system vendors have recognized its significance by offering UNIX derivatives that run on the same computers as proprietary operating systems.

Even more important, AT&T has been involved in projects with other vendors to integrate UNIX System V with its derivatives. Most notable is the alliance with Microsoft Corp. to merge UNIX System V with Microsoft's Xenix (the most popular UNIX System V derivative on the market). The resulting system will be tailored for use with the Intel 80386 microprocessor and will run applications software written for both UNIX and Xenix. Though this does not immediately or directly benefit the 3B2, a large amount of software will become readily available for use on the 6386 WGS, which already runs UNIX applications concurrently with MS-DOS applications. A strong AT&T supermicro which captures a share of the 80386-based systems market will help to ensure future sales of the 3B2s if the 3B2s provide a migrations path up from the 6386 WGS, or if users look to purchase the 3B2s as network servers and departmental resource processors to tie their PCs and supermicros together.

The other alliance aimed at increasing the popularity of UNIX is the agreement with Sun Microsystems, Inc. to enhance Berkeley UNIX Version 4.2 to make it more compatible and, hence, less competitive with UNIX System V. As UNIX System V becomes a more standardized, unified product, software houses will write more applications software for its use, attracting more users into the AT&T sphere.

COMMUNICATIONS

3B2 networking and communications hardware enable the 3B2 to serve as a gateway to mainframes, MS-DOS-based PCs, and other departmental processors, and to provide services over local area networks (LANs), public packet networks, and IBM systems.

The *Intelligent Serial Controller (ISC)* card provides gateway communications to an IBM host environment and to X.25 networks. The integrated Intel 80186 processor, in conjunction with downloaded software, supports BSC, SNA/SDLC, and X.25 protocols. Running in conjunction with AT&T Emulator+ software packages, the ISC also offers BSC/RJE, SNA/3270, and BSC/3270 connectivity for two to four simultaneous users. The ISC provides two serial ports (one operates up to 19.2K bps, the other up to 9.6K bps), 128KB of RAM, and NRZ/NRZI data encode/decode; it supports a maximum of 20 sessions with data transfer rates up to 19.2K bps. The ISC works with X.25 Network Interface Software's ancillary Packet Assembler/Disassembler (PAD), which executes as firmware on the ISC board.

An *Autodial Modem* feature, along with a basic networking utility, allows the 3B2 Family to be connected to other systems running the UNIX operating system over a standard telephone network. The Autodial Modem unit is externally attached to the computer through a standard RS-232-C port. (No expansion port feature card is required.) Automatic dial/answer facilities are provided at data rates from 300 to 1200 baud.

The *3BNet Network Interface Card* provides Ethernet protocol processing for the 3BNet LAN, the Ethernet version of PC Interface, and the TCP/IP interface. 3BNet is a high-speed, Ethernet-based LAN that employs Carrier-Sense Multiple Access/Collision Detection (CSMA/CD). It transfers data at 10M bps over coaxial cable and uses an 80186 microprocessor-based interface to accept all protocol, flow control, and maintenance overhead downloaded from the attached computers. 3BNet provides for file transfers between computers, remote execution of commands and programs, and electronic mail. 3BNet also provides the ability to write applications that use Ethernet as a network communications facility to provide interprocess communications; the ability to select packet sizes up to 1500 bytes on the system; and the ability to monitor and configure the network from a single terminal. 3BNet kits include the Network Interface card, cables, and transceivers; they are available for installing 3BNet over varying cable distances.

The *Information Systems Network (ISN)* is AT&T's proprietary LAN for building complexes and campuses. It permits networking of 3B superminis and 3B2 systems with computers from other manufacturers. ISN is based on a short, centralized bus structure incorporating attributes of star networks, distributed buses, and distributed token rings. ISN components include a packet controller, a control console for system initialization and administration, and concentrators. ISN can use both fiber optic and four twisted-pair copper wire distribution cables. It can also be interconnected with AT&T's Systems 75 and 85 PBXs. ISN can be integrated with single StarLAN Networks or bridge together multiple StarLAN Networks, providing access to ISN services.

The *StarLAN Network Network Access Unit (NAU)* is the circuit card which enables a 3B2 function in a StarLAN Network. The NAU is standard on preconfigured 310 and 400 StarLAN PC Servers (see the "Configuration Rules" section of this report). Other StarLAN components include the *Network Interface Unit (NIU)* and the *Network Exten-*

AT&T 3B2 Family

The 3B2s also support the SCSI host adapter, enabling the systems to connect industry-standard peripheral devices, thus increasing customers' range of options in selecting add-on storage devices. The use of SCSI-based peripherals by supermicros and minis is becoming very common; the absence of the SCSI would surely be considered as much a drawback as its presence is an advantage.

The SCSI is a standard feature on the 3B2/500 and 600 and on some configurations of the 3B2/400. On remaining configurations of the 3B2/400 and the 3B2/310, the interface is optional. AT&T also offers its own SCSI-based disk and tape drives for use on the 3B2 systems. The interface supports an external disk capacity of 14.4GB on all four models.

Although there are no direct hardware upgrades within the 3B2 Family or to the 3B minicomputers, the 3B2 systems do offer object code compatibility with the 3B5 and 3B15 computers which also run UNIX System V. Processing performance can be increased by up to 50 percent on the 3B2/500 and 600 by adding the Multiprocessor Enhancement, based on the same chip set as the system's existing microprocessor. This enhancement allows users to increase system performance by a sizable increment and still use the same system box and peripherals. A Migration Package is available for upgrading the 3B2/300 (no longer marketed) to the 3B2/310, allowing users to increase the processing capacity of the system while also protecting their investment in the system hardware.

The 3B2 Family supports extensive networking and connectivity products, substantiating AT&T's efforts to market the systems as departmental and workgroup processors which can coexist in IBM and Digital Equipment environments. These connectivity products enable a 3B2 to serve as a gateway to mainframes, to act as a resource processor for networked PCs, and to communicate with other departmental systems within a corporate-wide network. The systems support both de facto and established communications protocols, including IBM SNA/SDLC, BSC, and RJE/BSC. Emulation software is available which allows the 3B2s to emulate a variety of IBM terminal devices and to tranfer files to and from IBM hosts. Through terminal emulation, the 3B2 provides a gateway to the host so that end users not directly connected to the host can access host system data for use in their own applications.

AT&T's STARLAN NETWORK interconnects from 2 to 30 simultaneously active workstations, allowing users to communicate freely with one another and to share peripherals and data. Furthermore, AT&T offers 3B2 models preconfigured to function as servers in a STARLAN NETWORK, removing the burden of configuration from the user.

AT&T's voice and LAN products are based on the Premises Distribution System (PDS) which provides a complete corporate wiring scheme using a fiber optic backbone, twisted pair distribution, and cross connect hardware. AT&T's Information Systems Network (ISN), integrated

sion Unit (NEU). **The NIU interfaces two asynchronous serial devices, such as printers, terminals (at speeds up to 19.2K bps), modems, and host computers to the network. The NEU interconnects daisy-chained workstations and/or individually connected workstations as far as 800 feet away. The *Network Repeater Unit (NRU)* expands the distances between devices connected to a StarLAN Network. It can increase the distance between NEUs from 10 to 800 feet. NRUs can also be used to connect multiple NEUs, increasing the diameter of the entire network up to 8,000 feet. The NRU can be used to improve signal quality in an electrically noisy environment.**

The *General Purpose Interface Bus (GPIB)-3B2* is a single-width IEEE-488 intelligent feature card manufactured, marketed, and sold through National Instruments Company of Austin, Texas. This card includes an 80186 processor and 128KB of memory and transfers data at 790KB per second. It provides the 3B2 with realtime testing, measurement, and control capabilities for laboratory and factory automation environments.

The *AT&T Dataphone II 740 Acculink Multiplexer* integrates data, voice, and other high-speed inputs for high-volume transmission over Accunet T.1.5 services or other communications facilities. The 740 combines 128 input channels into a single digital stream. Each data channel can be programmed for a wide variety of data rates, starting at 300 bps and reaching as high as 1.31M bps.

SOFTWARE

AT&T offers a range of software products, both proprietary and developed by third parties. Products developed by other vendors and discussed in the following section are all available directly from AT&T.

OPERATING SYSTEM: *UNIX System V* (Releases 2.0.5, 3.1, and 3.1.1), the operating system for the 3B2 Family, is a general-purpose, multiuser, multitasking, interactive operating system. UNIX System V for the 3B2 Family consists of a core package that incorporates the system kernel; standard device drivers; and basic commands for shell programming, directory and file management, system administration, user environment, status request, and special-purpose functions (comparing, searching, sorting, and counting data).

As indicated above, UNIX System V is available in various releases. Release 2.0.5, supported by the 3B2/310 and 400, is the maintenance release for earlier swapped-base versions of 3B2 software, including software written for and under all Release 2 versions of UNIX, except Release 2.1. Under swapping, a computer must load an entire software program into its memory before running it. When running more than one program at a time, the computer often has to swap the programs back and forth between its memory and the virtual memory on the disk.

UNIX System V Release 3.1, supported by the 3B2/310 and 400, is the latest version of UNIX System V Release 3.0, which improves upon previous versions by offering Remote File Sharing (RFS), Mandatory and Advisory File and Record Locking, and shared libraries. Release 3.1 is designed for customers who want to run demand paging versions of UNIX software, and for customers committed to networking. Under demand paging, the computer loads only a portion (called a page) of the program into memory. As a result, the computer memory can accommodate more programs in memory at a single time. Users experience faster response times and can run programs larger (up to 1.99GB) than the computer's memory.

AT&T 3B2 Family

AT&T's voice and LAN products are based on the Premises Distribution System (PDS) which provides a complete corporate wiring scheme using a fiber optic backbone, twisted pair distribution, and cross connect hardware. AT&T's Information Systems Network (ISN), integrated with PDS, provides the backbone network for terminal-to-host and host-to-host connectivity in buildings and large campuses. ISN can bridge StarLAN Networks located in different areas of the organization—spanning up to several miles—providing all workstations with access to ISN host systems and systems in other networks. ISN also supports the upper layers of Digital Equipment's DECnet protocols, allowing 3B2s to route and interconnect with Digital Equipment's Ethernet LANs. The capability to connect with Digital Equipment's systems will help AT&T to infiltrate corporate environments where Digital Equipment's systems have already been implemented as departmental processors. ISN also connects more than 100 kinds of voice and data equipment, providing for communications support in a multivendor environment and taking advantage of a customer's investment in computer hardware and peripherals.

Ethernet is not part of AT&T's strategic wiring scheme, since it uses coaxial cable rather than fiber or twisted pair. However, AT&T's communications strategy supports Ethernet to allow the 3B2s to participate in Ethernet environments, protecting a customer's investment in existing equipment and providing for high-volume file transfers among a number of systems. Ethernet-supported products available from AT&T include 3BNet, PC Interface, and TCP/IP.

3BNet provides local area networking of groups of 3B2 systems and AT&T PC 6300s and compatibles within corporate departments and workgroups. 3BNet's higher level protocols do not conform to industry standards, as does TCP/IP, but 3BNet is less expensive than TCP/IP. PC Interface allows the 3B2 to be networked with, and act as a server to, MS-DOS-based PCs interconnected via an Ethernet LAN, protecting users' investments in already installed Ethernet cable. TCP/IP provides higher level capabilities such as electronic mail, remote command execution, and file transfer. Support for TCP/IP allows the 3B2s to participate in many government and university networks.

By supporting X.25, which has been accepted as an industry standard, the 3B2s can communicate over a public packet network with other X.25 network systems, including systems from other vendors. Support for X.25 provides for wide area network connectivity and makes the 3B2s suitable for use in international computing environments, one of AT&T's target markets.

All 3B2 models also support the AT&T LU6.2 Facility, AT&T's implementation of IBM Advanced Program-to-Program Communications, an enhancement of IBM Systems Network Architecture (SNA). The LU6.2 Facility allows applications programs on the 3B2 to communicate with partner programs on an LU6.2 peer or host system. LU6.2 systems can communicate directly with each other **grams in memory at a single time. Users experience faster response times and can run programs larger (up to 1.99GB) than the computer's memory.**

UNIX System V Release 3.1.1, a version of 3.1, is designed for use with the 3B2/500 and 3B2/600 and is able to support this model's unique hardware features such as VCache, main memory ECC, and the CPU's 18MHz clock. Release 3.1.1 includes SCSI utilities and is available on cartridge tape. The following table indicates which key features are supported by each of the three releases.

	Rel. 2.0.5	Rel. 3.1	Rel. 3.1.1
Networking			
StarLAN		X	X
TCP/IP*	X	X	X
X.25*	X	X	X
3BNet*	X	X	X
PC Interface	X	X	X
Memory Management			
Demand Paging		X	X
Virtual Swapping	X		
Mass Storage			
SCSI-based peripherals	X	X	X
XM expansion modules	X	X	X
Features			
Remote Management		X	X
Shared Libraries		X	X
File and Record Locking:			
Mandatory		X	X
Advisory	X	X	X
Windowing	**X	X	X
3B2 Models supported			
3B2/310	X	X	
3B2/400	X	X	
3B2/500			X
3B2/600			X

**As of July 1987, does not support the Streams implementation.*
***With optional windowing driver software.*

Chart E. Features of UNIX System V Releases 2.0.5, 3.1, and 3.1.1

The Streams option, provided with Release 3.1 and later versions, allows users to share applications software among different points of the network without regard to network protocol or hardware. On most operating systems, a program must be produced for each network supported. Problems arise when changes occur in any of the several layers of protocol translations; changes in one layer may require the rewriting of network software. Streams breaks this process down into a series of small, reusable modules, one for each step in the protocol translation process. Networks are connected by putting these modules together like building blocks. When a protocol changes, one module is exchanged for another module without having to rewrite the entire program.

For details on UNIX System V, refer to the "Operating Systems" section of the "AT&T 3B Computer Family" report and to the "AT&T Information Systems UNIX System V" report in *Datapro Reports on Minicomputers.*

DATABASE MANAGEMENT SYSTEM (DMBS): Several DBMS products are available from AT&T for 3B2 computers, including standard and relational packages. Packages include *dBASE II*, developed by Ashton-Tate, Inc.; *AT&T INGRES/CS* (a compatible subset of the Ingres DBMS originally developed by Relational Technology, Inc.); *INFORMIX*, from Relational Database Systems, Inc.; *ORACLE*, from Oracle Corp.; and *UNIFY*, from Unify Corp.

AT&T 3B2 Family

without host intervention, which is easier and more economical than the host controlling communications between systems. Support for LU6.2 makes the 3B2s suitable for use in SNA-based departmental environments. The AT&T Application Program Interface (API) allows programmers to write C programs that emulate a 3270 host session to an IBM host, thus increasing the ability to implement the 3B2 as a departmental processor in an IBM mainframe environment.

The UNIX to UNIX Copy (uucp) facility in each computer's UNIX operating system permits communications with both AT&T UNIX System V and non-AT&T UNIX operating systems (for example, those running a version of UNIX based on the University of California at Berkeley implementation). This facility gives users access to applications data without requiring that their systems run the particular version of UNIX for which the application was written.

AT&T also offers Document Exchange, which provides system gateways to IBM DISOSS and PROFS, Wang OIS/VS, MS-DOS-based PCs, and AT&T's own electronic mail systems. This package allows the 3B2s to integrate into an existing IBM, Wang, AT&T, or multivendor environment, while providing for the 3B2 users' choice of a preferred word processing or office automation system. This capability is especially important in competing with the widely installed IBM System/36 in departmental and office environments; the System/36 has facilities available to it for downloading DISOSS and PROFS from a mainframe host.

As part of its marketing push behind the UNIX operating system and its computer systems, AT&T provides extensive training for AT&T employees, users, and licensees of the UNIX System V operating system. Management courses are also available. Training is available in the form of classroom seminars, hands-on classes, and self-paced videotape and interactive videodisk courses. AT&T's approach is to develop training programs concurrently with product development so that installation and maintenance courses are ready when the products are announced. There are 5 national training centers, 14 regional training centers, and over 10 satellite training centers. A Datapro editor visited one of the national training centers, the Corporate Education Center in Hopewell, NJ, and was suitably impressed with the facilities and course offerings and materials. AT&T's dedication to user and employee training in UNIX System V and the C programming language is evidence of AT&T's commitment to marketing UNIX System V to the end user. The company is banking on the continued success of the operating system as much as it is hoping for the eventual success of the 3B2 systems.

It is curious that in spite of the extensive training available to the Data Systems Division, many of the restrictions pertaining to the 3B2 concern AT&T's ability to sell and support the products. The merger of the sales and support staffs from the company's Information Systems and long-distance units required dramatic layoffs, which reduced the overhead and bulk of the company but also reduced the

LANGUAGES: Languages available for the 3B2 Family include the C language; Basic; Fortran 77; RM/Cobol; RM/Cobol Runtime; Pascal; UX Software, Inc's UX-Basic+; Micro Focus Level II Cobol and Level II Cobol/Enhanced Technology (ET); and Software Ireland Ltd's Unibol. AT&T Integrated Compiler Products (ICP) is a collection of language processors that are driven by a front end centered around a common code generator. The processor share common routine libraries and develop and maintain programs through the use of a common debugger. ICP includes compilers for Basic, Fortran, Cobol, and Pascal.

Several programming tools and utilities are available, including AT&T Advanced Programming Utilities (APU), AT&T C Programming Language Utilities (CPLU), and AT&T C Programmer's Productivity Tools (CPPT); Micro Focus Animator, Forms-2, Runtime ET, and ET Sourcewriter; and VISUAL Menu.

COMMUNICATIONS: Communications software products focus on supporting existing industry protocols for connectivity to both PCs and mainframes, as well as to other 3B2 and 3B superminicomputers. Communications software products include both emulation and networking packages.

***SNA/3270 Emulator* provides interactive communications between the 3B2 and any IBM host system supporting SNA/SDLC protocol. This package emulates 3274 SNA/SDLC Control Unit, Physical Unit Type 2 support. Terminal emulation includes the IBM 3278 SNA/SDLC Display Station (Models 2 and 5), Logical Unit (LU) Types 1 and 3, and 3279 Models S2A and S2B.**

***BSC/3270 Emulator* provides interactive communications between a 3B2 and any IBM host system supporting bisynchronous communications protocols. It enables a 3B2 to emulate a 3274 Control Unit Model 51C. Terminal emulation includes the 3278 Display Station Model 2, LU Types 1, 2, and 3; and the 3287 printer. The BSC/3270 Emulator is transparent to IBM TSO/SPF, VM/CMS, CICS, IMS, and VTAM.**

The *3270 Application Program Interface (API)* consists of a library of access routines that allow a C language program to interface directly to an IBM host computer. The program appears to the host as if someone were sitting at a 3278 Display Station and keying in responses. Large volumes of data can be processed via computer programs without operator intervention. API supports both SNA/3270 Emulator and BSC/3270 Emulator.

***BSC/RJE Emulator* allows a 3B2 to emulate an IBM 2780 data transmissions, a 3780 data communications terminal, and HASP workstations.**

The UNIX System V *Basic Networking Utility* with the *UNIX-to-UNIX Copy Facility (cu/uucp)* provides remote login and file transfer capabilities among 3B2 and 3B superminicomputers, as well as computers from other vendors. It is packaged with each 3B2 computer and may be ordered by users who do not already have it.

The 3B2 Family also supports *PC Interface*, a hardware/software link that interconnects 3B2 computers to PCs running the MS-DOS operating system. The PC Interface allows multiple PCs to share files and peripherals on a central 3B2 running UNIX System V. Files can be transferred back and forth from PCs to 3B2 systems. The PC Interface supports two types of media to interconnect PCs and 3B2s: RS-232 media operating at speeds up to 9.6K bps and Ethernet at 10M bps.

AT&T 3B2 Family

company's talent and demoralized many of the employees. The resulting sales force, hailing mainly from the AT&T Communications division, was turned loose to sell computers, as well as long-distance services and telecommunications equipment. Prospective customers have complained that the sales reps don't know data processing or the AT&T computer systems well enough to understand the customers' computing needs. A complaint has also been voiced that the service force is not well equipped to maintain and service the systems. This may be a reputation resulting from problems experienced immediately after the in-house consolidation, and it appears that the company is trying to rid itself of this image through heavy marketing and internal use of its educational offerings.

In spite of negative perceptions of AT&T's service and support, the 52 3B2 users who responded to the 1987 Datapro Computer Users Survey indicated otherwise. Users rated vendors on a scale of one to four (one being Poor and four being Excellent) in several categories regarding vendor support. On the average, for support of the 3B2 systems, AT&T rated 3.41 for responsiveness of vendor maintenance; 3.44 for effectiveness of vendor maintenance; and 3.23 for troubleshooting (this last rating received special mention in this year's "U.S. User Rating of Minicomputers and Supermicros" report in *Datapro Reports on Minicomputers*). It is ironic that, in spite of AT&T's extensive educational program, the average response for user education was lower—2.84—than any of the other categories pertaining to vendor maintenance and support. (To put this in perspective compared to the other 19 vendors rated, 7 vendors scored lower than AT&T on user education, and 13 vendors scored higher.)

Datapro concludes that AT&T has recognized its weaknesses in support, maintenance, and education and has taken steps to improve these services, enabling it to compete more effectively with vendors like IBM and Digital Equipment that are already highly regarded as service providers. Not only must AT&T improve its service offerings, though; it must also strongly market a new image as a better educator and service provider.

USER REACTION

By telephone we contacted a number of 3B2 users who had responded to our 1987 Computer Users Survey. The first respondent with whom we spoke is the data systems analyst for a school district coordination office in New York state. The office uses two 3B2/300s, which were installed in December of 1985. (Though AT&T no longer markets the Model 300, the previous entry-point model to the 3B2 line, many of the user's comments regarding the system are still applicable and reflect opinion voiced elsewhere.)

While considering the purchase of a new system, the user had limited his investigation to systems from IBM and AT&T because of vendor reputation and his own time restrictions. He looked at the IBM PC but selected the 3B2/300 because it offered multiuser support while being

PC Interface software provides transparent sharing of files resident on 3B2s by personal computers running MS-DOS; transparent printer spooling, through which a PC user can obtain output from a printer on the 3B2; and, in conjunction with UNIX System V, control over user access privileges.

The *LU6.2 Facility* is a UNIX System V-based software development tool that provides direct communication between any 3B2 and LU6.2-compatible systems in an SNA environment. This facility is AT&T's implementation of LU6.2 and PU2.1, which IBM also calls Advanced Program-to-Program Communications (APPC). It enables both peer-to-peer, i.e., nonhost directed, and application-to-application communications in multivendor environments.

***3BNet* provides a user-level command interface to an Ethernet network. 3BNet requires the 3BNet Network Interface card and standard Ethernet transceiver and drop cable.**

Adhering to CCITT and ISO standards, *X.25 Network Interface 3B2 Software* provides a packet layer interface to an X.25 network. Processor-to-processor communications are supported through a public packet network or direct connection. This package is authorized for use with AT&T ACCUNET Packet Service USA and GTE's TELENET public data networks.

The *PAD* allows a 3B2 to packetize information from asynchronous terminal devices and send it through an X.25 network. This gives asynchronous terminals high-speed access to files, databases, and other services on remote computers.

***AT&T Enhanced Transmission Control Protocol/Internet Protocol (TCP/IP) WIN/3B Interface* provides applications protocols including mail, remote login, and file transfer. An Ethernet LAN and X.25 implementation are available and can be internetworked. TCP/IP represents the standard protocol set specified by the U.S. Department of Defense for use over all federal government computers. The AT&T version was ported to the 3B computer line by the Wollongong Group.**

APPLICATIONS: Both proprietary and third-party applications are available for the 3B2 Family, including general business, data management, spreadsheets, word processing, and office automation and productivity. Vertical industry packages for doctors and hospitals are also available. Graphics packages include Sound Presentation, GSS-Chart, GSS-Plottalk, GSS-Drivers, and GSS-Toolkit.

Two office communications software packages are also available. *AT&T Document Exchange* provides an electronic mail system that facilitates communications between IBM's Document Content Architecture (DCA) and Document Composition Format (DCF), Wang's Standard Word Processing, Software Systems' MultiMate, final form ASCII, and UNIX NROFF. *AT&T Office TeleSystem (OTS)* integrates voice and data communications into a system that provides messaging, AT&T Mail Communications, PC file transfer, terminal independence, and application registration.

The *AT&T Computer Software Guide* lists available software for the AT&T 3B2, as well as the 3B superminis and PCs.

OPERATING ENVIRONMENT

The 3B2/310 system cabinet is 3.6 inches high, 22 inches wide, and 17 inches deep; basic configurations weigh about

AT&T 3B2 Family

within his price range. He also liked the power and expandability of the system and the migration path to the larger AT&T 3B5. The similarities between the 3B2/300 and 3B5 would obviate the need to retrain users in the event of a migration to the larger machine.

The user did not like the long shipping delay after ordering the system, he believed such delays to be characteristic of AT&T today. AT&T suggested that he begin dealing with a VAR to avoid future delays, and he has done so in purchasing a printer and an AT&T PC 6300 Plus. The user stated that he doesn't think AT&T has gotten its act together yet, and that parts of the company don't know what the other parts are doing. However, he considers this to be a problem in dealing with any big company.

The user would like AT&T to offer more software for the 3B2s, especially for office automation, word processing, and graphics. He also finds currently available software to be rather expensive.

When asked if he would recommend a 3B2 to a prospective user, he said yes, if the system could run the applications software the buyer wanted to use. He also said that many other school districts using a 3B2 were happy with the system. He believes that the 3B2s offer a lot of power just beginning to be tapped by the software that is coming on the market; and he really appreciates AT&T's close work with software houses to help provide this software. He found that AT&T closely coordinates the use of the software and hardware and doesn't try to blame a software developer if a problem develops with the hardware.

We also interviewed the records supervisor of a police department in Kentucky. The department uses a 3B2/400 for scheduling, administration, and inventory as well as for running law enforcement software. At the time of purchase the department had also considered an IBM System/36, a Digital Equipment MicroVAX II, and a system from Hewlett-Packard, which the user could no longer identify. He would have preferred that the department purchase the MicroVAX II because it ran a particular software package that he wanted to use. However, the 3B2/400 was selected for him for political reasons beyond his control. Because of this choice, it has been necessary to develop software for the system. He said that purchasing the MicroVAX II would have saved a lot of time but probably not any money.

This user likes UNIX System V and the flexibility it offers, though he does find software development a bit cumbersome and he wishes that there were more packaged software available.

He claims that the 3B2/400 offers plenty of expansion capability, and he doesn't foresee growth beyond the system's capacity within the next 10 years. He says the hardware is very good and that AT&T provides very good

30 pounds. The 3B2/310 can be positioned either horizontally or vertically; when horizontally positioned, it can support an external load up to 60 pounds. The 3B2/310 requires standard power of 115 VAC/220-240 V, 4 amp/2 amp, at 60 Hz. Power consumption is less than 230 watts. Operating temperatures range from 40 degrees Fahrenheit to 100 degrees Fahrenheit at 20 percent to 80 percent relative humidity, noncondensing. Heat dissipation is less than 200 watts.

The 3B2/400 is 7.2 inches high, 22 inches wide, and 17 inches deep. The 3B2/400 weighs 60 pounds and requires the same operating temperature and power parameters as the 3B2/310. Power consumption for the 3B2/400 is less than 540 watts. Heat dissipation is less than 370 watts.

The 3B2/500 is 7.6 inches high, 18 inches wide, and 22 inches deep. It features an autoranging power supply.
The 3B2/600 is 12.6 inches high, 16.9 inches wide, and 24.6 inches deep. It weighs 82 pounds. The 3B2/600 requires standard power ranging from 100/120V, 15 amp to 200/240V, 8 amp, at 50-60 Hz. Power consumption is less than 1,300 watts. Heat dissipation is 3,000 Btu per hour, 900 watts.

SUPPORT SERVICES

DOCUMENTATION: Standard user documentation includes the *3B2 Computer Model 310, Model 400,* or *Model 600 Owner/Operator Manual*; the *3B2 Computer Model 310, Model 400,* or *Model 600 UNIX System V User Guide and Essential Utilities Reference Manual*; and an *Update Manual.* Also, *Documentation Roadmap, Release Notes, User Reference Manual, System Administration Reference Manual, Programmer Reference Manual,* and *Security Administration Utilities Guide* are all standard. Other available documentation includes *AT&T Information Systems Architecture manual* and the *AT&T Computer Software Guide.*

TRAINING/EDUCATION: AT&T provides hardware and software training at national and regional education centers. The company also provides on-premises training in complex software packages. Videotaped courses are also available.

MAINTENANCE: AT&T offers tailored maintenance agreements for 3B2 computer systems. The agreements include combinations of toll-free hot line assistance for hardware and software and on-site service by field service technicians.

In some cases, hot line service can include remote diagnostics services. For those problems that cannot be resolved by telephone, a systems technician will be dispatched to the user's site.

On-site service options include:

- **Business day service, AT&T's standard maintenance agreement, which provides coverage from 8 a.m. to 5 p.m. Monday through Friday. Response time is four hours if the user is experiencing a major failure with a totally inoperable system or loss of more than 25 percent of the system's peripherals. A 24-hour response time is guaranteed for minor failures.**

- **Around-the-clock service, which extends coverage to 24 hours a day, 7 days a week, including holidays. Response times are the same as for business day service contracts.**

AT&T 3B2 Family

service. He would recommend the 3B2/400 to a prospective buyer as long as the system runs the software the user wants.

Other users we contacted responded similarly: they like the multiuser, multitasking capabilities of UNIX System V and the reliability of the 3B2; however, they wish there were more applications software available for the UNIX operating system. Also, one user found it a drawback that each system located at a branch site required a system administrator. Datapro asked if he was aware of AT&T's 3B2 Remote Management package that provides for administration and maintenance operations to be performed on a 3B2 from a remote location, eliminating the need for on-site administration. He was not familiar with this package, announced in March 1987, which indicates that AT&T is not ensuring that all critical information filters down to the end user.

The following chart shows how the 52 3B2 users who replied to our Computer Users Survey rate the 3B2 product line. Responses came from users of the 3B2/300, the 3B2/310, and the 3B2/400. The 3B2/500 and 3B2/600 were not available at the time the survey was conducted.

	Excellent	Good	Fair	Poor	WA*
Ease of operation	18	22	11	0	3.14
Reliability of system	24	22	2	0	3.46
Reliability of peripherals	26	25	0	0	3.51
Maintenance service:					
Responsiveness	27	16	5	1	3.41
Effectiveness	26	18	3	1	3.44
Technical support:					
Troubleshooting	22	21	8	1	3.23
Education	9	24	15	1	2.84
Documentation	9	21	18	3	2.71
Manufacturer's software:					
Operating system	20	28	3	0	3.33
Compilers & assemblers	14	25	6	0	3.18
Application programs	8	24	11	3	2.80
Ease of programming	13	27	9	0	3.08
Ease of conversion	10	26	11	0	2.98
Overall satisfaction	13	34	5	0	3.15

*Weighted Average on a scale of 4.0 for Excellent.

Complete results of this survey are available in the "User Ratings of Minicomputers and Supermicros" report in *Datapro Reports on Minicomputers.* □

- **Dedicated service, which allows customers to have technicians on-site for one, two, or three shifts a day for five, six, or seven days a week.**

- **Per-occurrence service on a time-and-materials basis. Coverage is for 24 hours a day, 7 days a week. Response times are on a best-efforts basis, but targeted toward 4 hours for major failure and 24 hours for minor failure. Per-occurrence customers have lower dispatch priority than maintenance contract customers.**

AT&T also offers software-only services. Options include:

- **Hot line assistance, 8 a.m. to 5 p.m. Monday through Friday in all time zones.**

- **Hot line assistance plus on-site visits by technicians, 8 a.m. to 5 p.m. Monday through Friday.**

- **Hot line assistance plus on-site visits by technicians 24 hours a day, seven days a week, including holidays.**

- **Hot line assistance plus on-site technicians' visits charged on a noncontract, per-occurrence, time-and-materials basis.**

The AT&T 3B2 Remote Management Package allows administrations and maintenance operations to be performed from a remote location. This package includes software utilities and four features grouped together in the Alarm Interface Circuit (AIC) card. An AT&T Auto Dial Modem Package is required to utilize the remote console. A commercial alarm system is required to generate remote alarm signals.

The 3B2 system has a 90-day warranty for both software and hardware; during that period, customers receive business day service and hot line assistance.

PRICING

POLICY: The 3B2 Family is available for purchase or lease. Financing is also available from AT&T Credit Corporation. A volume discount for the system is also available. List prices for the system are quoted in the EQUIPMENT PRICES information following. The price for software is a onetime use license fee. Maintenance fees for both purchase and lease options are available on either a month-to-month or annual contract basis. Separate price schedules for spares and growth, software licensing, and fee schedules are also available.

AT&T 3B2 Family

EQUIPMENT PRICES

		Purchase Price ($)	Monthly Maint. ($)
3B2/310 Packages			
3B2/310-A2	Package includes 3B2/310 system unit with MAU, 2 RS-232-C serial ports, I/O expansion ports card (4 RS-232-C serial, 1 parallel ports), 1MB memory board, 30MB disk, 720KB diskette, Unix System V, and 4 RS-232-C terminal cables	12,900	75.00
3B2/310-B2	Package includes 3B2/310 system unit with 2 RS-232-C serial ports, I/O expansion ports card (4 RS-232-C serial, 1 parallel), 1MB memory board, 72MB hard disk, Unix System V, and 4 RS-232-C terminal cables	13,200	—
3B2/310-F2	Same as 3B2/310-B2 but includes 2MB memory board and 1 EPORTS board (no I/O Ports board)	15,100	—
3B2/400 Packages			
3B2/400-A2	Package includes 3B2/400 system with, MAU, I/O expansion ports card, 1MB memory board, 30MB hard disk drive, 720KB floppy disk drive, 23MB cartridge tape drive, 6 RS-232-C cables, and Unix System V	18,100	79.00
3B2/400-C2	Package includes 3B2/400 system with MAU, 1 EPORTS card, 2MB memory board, 2 30MB hard disk drives, 720KB floppy disk drive, 23MB cartridge tape backup unit, 6 RS-232-C cables, and Unix System V	23,300	83.00
3B2/400-D2	Same as 3B2/400-C2 but includes 2 72MB disks (no 30MB disk)	27,500	142.00
3B2/400-Q2	Same as 3B2/400-C2 but includes a 60MB tape drive (no 23MB tape drive), and an SCSI host adapter card	23,000	—
3B2/400-R2	Same as 3B2/400-Q2 but includes 2 72MB disks	26,500	—
3B2/500 Packages			
3B2/500	Package includes 3B2/500 system unit with MAU, 4MB of memory, 720KB diskette drive, a 147MB disk drives, 1 EPORTS cards, 60MB tape drive, SCSI host adapter, Unix System V	28,000	—
3B2/600 Packages			
3B2/600-A	Package includes 3B2/600 system unit with MAU, 4MB of memory, 720KB diskette drive, 2 147MB disk drives, 3 EPORTS cards, 60MB tape drive, SCSI host adapter, 8 cables, Unix System V	46,500	—
STARLAN PC SERVERS			
—	Model 310 based on 3B2/310 F2, includes 2MB of memory, a 72MB disk drive, one EPORTS card, Unix System V, NAU, DOS Server Program, Network Program Package, Network Support Utilities	16,600	—
—	Model 400 based on 3B2/400 R2, similar to 310 StarLan PC Server bu includes 4MB of memory, 2 72MB disk drives, a 60MB cartridge tape drive, and an SCSI host adapter	29,500	—
CPU OPTIONS			
73254	3B2/300 to 310 Migration Kit without MAU	2,190	—
73255	3B2/300 to 310 Migration Kit with MAU	3,790	—
—	3B2/600 Multiprocessor Enhancement	3,500	—
—	3B2/500 Multiprocessor Enhancement	4,500	—
—	Virtual Cache (VCache)	1,500	—
MEMORY OPTIONS			
73201	1MB expansion memory	1,600	—
73241	2MB expansion memory for 3B2/400	2,400	—
73272	2MB expansion ECC memory for 3B2/500 and 600	3,000	—
73273	4MB expansion ECC memory for 3B2/500 and 600	5,000	—
INPUT/OUTPUT OPTIONS			
73202	I/O expansion card	660	—
73271	EPORTS card	1,320	—
MASS STORAGE			
73213	XM Package C includes 72MB disk drive and 23MB tape drive	9,695	—
73215	XM diskette drive	660	—
73216	XM 30MB disk drive may be added to XM package on 3B2/310	2,950	—
73217	XM 72MB disk drive may be added to XM package on 3B2/310	3,950	—
73238	30MB disk drive for 3B2/400 internal use	2,950	—

A dash (—) in a column indicates that information was unavailable from vendor.

AT&T 3B2 Family

		Purchase Price ($)	Monthly Maint. ($)
MASS STORAGE (Continued)			
73240	72MB disk drive for 3B2/400 internal use	3,950	—
73258	23MB tape drive	2,595	—
73263	SCSI Host Adapter	2,000	—
36201	DM/94E 94MB SCSI-based disk drive	5,400	—
36202	DM/135E 135MB SCSI-based disk drive	7,300	—
—	DM/147E 147MB SCSI-based disk drive	5,900	—
—	DM/300E 300MB SCSI-based disk drive	9,750	—
3620-010	DCM/4E disk controller module that controls up to four disk modules	1,300	—
3621-010	XM/405S 405MB expansion module	20,700	—
3631-101	TM/60S 60MB streaming cartridge tape drive	2,595	—
—	TM/120S 120MB streaming cartridge tape drive	3,250	—
3630-010	49MB 9-track 1600 bpi SCSI-based tape drive	12,000	—
—	9-track 6250 bpi tape drive	21,500	—
PRINTERS			
3330-455	Daisywheel; 455 wide, 55 cps, 132 columns, 4 maximum paper parts; for departmental word processing applications	1,870	—
3330-457	Daisywheel; 457 wide, 45 cps, 132 columns, 5 maximum paper parts; for word processing printer applications	625	—
3330-458	Daisywheel; 458 wide, 45 cps, 132 columns, 5 maximum paper parts; for word processing printer applications	550	—
3330-470	Impact dot-matrix; 470 std., 120 cps, 80 columns, 4 maximum paper parts; for personal printer applications	545	—
3330-471	Impact dot-matrix; 471 wide, 120 cps, 132 columns, 4 maximum paper parts; for personal printer applications	425	—
3330-475	Impact dot matrix; 475 std., 120 cps, 80 columns, 4 maximum paper parts; for personal printer applications	595	—
3330-476	Impact dot-matrix; 476 wide, 120 cps, 132 columns, 4 maximum paper parts; for personal printer applications	845	—
3330-477	Impact dot matrix printer, 288 cps, 132 columns, 5 paper parts, 7 colors,	1,695	—
3330-478	Impact dot-matrix; 478 std. (near-letter-quality), 200 cps, 80 columns, 6 maximum paper parts; business printer/forms tear off	1,034	—
3330-479	Impact dot-matrix; 479 wide (near-letter-quality), 200 cps, 132 columns, 6 maximum paper parts; business printer/spreadsheets	1,244	—
3331-495	495 laser printer, 10ppm, 300 x 300 dpi	3,595	—
3353-010	Impact dot-matrix; 5310 std., 200 cps, 80 columns, 6 maximum paper parts; business printer/forms tear off	1,349	—
3353-020	Impact dot-matrix; 5320 wide; 200 cps, 132 columns, 6 maximum paper parts; business printer/integrated, modem available	1,659	—
3330-435	435 plotter (six-pen plotter only); 1 maximum paper part; six-color quality charts and graphics	1,895	—
3330-102	Line printer; Dataspeed Model 102, 300 lpm, 80 columns, 6 maximum paper parts; heavy duty roll paper	3,935	—
3330-154	Line printer; Dataspeed Model 154, 300 lpm, 80 columns, 6 maximum paper parts; heavy duty forms printer	3,370	—
3330-202	Line printer; Dataspeed Model 202, 300 lpm, 132 columns, 6 maximum paper parts; one sheet at a time	4,240	—
3330-204	445 line printer; 300 cps, 132 columns, 6 maximum paper parts; batch processing	6,850	—
3330-253	Forms access line printer; 300 lpm, 80 columns, 6 maximum paper parts; last form tear-off	3,750	—
3330-201	460 high-speed dot-matrix printer; 200 lpm, 132 columns, 6 maximum paper parts; medium duty wide platen	4,115	—
3330-447	447 line printer; high-volume computer output	10,995	—
WORKSTATIONS			
3356-1MB	5620 dot-mapped display with 1MB memory	5,000	33.00
3344-180	Dataspeed 4418 terminal	1,065	18.75
3344-250	Dataspeed 4425 terminal	1,295	16.50
—	610 Business Communications Terminal (BCT) complete package	875	—
3344-610	610 BCT controller/base	505	4.00
33410	610 BCT 12-inch monitor (green or amber)	230	4.25
—	615 Multitasking Terminal (MT) complete package	945	—
33410-615	615 MT controller/base	575	5.00
33415	615 MT 14-inch monitor (amber or green)	230	4.25
—	620 Multitasking Graphics Terminal (MTG) complete package	1,295	—
3344-620	620 MGT controller/base	800	10.25
33411	620 MGT 14-inch monitor	355	4.40
33401	98-key keyboard for 610 BCT, 615 MT, and 620 MGT	140	.75
33402	103-key keyboard for 610 BCT, 615 MT, and 620 MGT	140	.75
33561	513 BCT/System 75 emulation cartridge	125	.75
33456	VT220 emulation cartridge	125	.75
33403	VT220 emulation keyboard	175	1.00
33430	300/1200 dialer modem card	325	3.25
33465	Limited distance modem card	100	.75
33460	Autodialer card	285	2.75
33450	Mouse	165	1.00

A dash (—) in a column indicates that information was unavailable from vendor.

AT&T 3B2 Family

		Purchase Price ($)	Monthly Maint. ($)
COMMUNICATIONS/NETWORKING OPTIONS			
73203	3B2/300 3BNet Network Interface feature. Includes network interface card, network interface label, ground clip, three screws, block label, nylon cable clamp	1,500	—
73204	Same as 73203, plus 10-meter drop cable and transceiver	2,000	—
73205	Same as 73204, but with 30-meter cable	2,155	—
73206	Same as 73204, but with 50-meter cable	2,340	—
73210	Autodial modem	695	—
—	Network Repeater Unit (NRU)	895	—
—	Dataphone II 740 Acculink Multiplexer, lowest price	15,000	—
—	Dataphone II 740 Acculing Multiplexer, average price	52,000	—
—	Information Systems Network (ISN) remote concentrator	7,500	—
—	ISN fiber extenders	7,000	—
2614-300P	3B2 Network Adapter Unit	950	—

SOFTWARE PRICES

The list price for software includes a one-time license fee. A dash (—) in the order number column indicates that the order number has not been supplied by the vendor.

		List Price ($)
OPERATING SYSTEMS		
The Unix System V operating system is bundled with the 3B2 Family.		
1041-030	Unix System V Rel. 3.0; includes binary software and documentation; right- to-use, not purchase	800
1041-031	3B2 Remote File Sharing Utilities	500
1041-205	Unix System V Rel. 2.0.5 upgrade for 3B2/300; right-to-use, not purchase	500
1041-206	Unix System V Rel. 2.0.5 upgrade for 310/400; right-to-use, not purchase	500
—	Unix System V Rel. 3.0 to 3.1 upgrade	300
—	Unix System V Rel. 2.0 to 3.1 upgrade	800
DATABASE MANAGEMENT SYSTEMS		
1041-L00	dBase II	1,200
1041-L01	Ingres/CS	2,000
1041-L06	Unify	1,995
1041-L10	Informix	1,600
LANGUAGES		
1041-A01	Unix C programming language	340
1041-C02	Unix Fortran	275
1041-B00	Unix Basic Language	300
1041-B10	UX-Basic+	975
1041-D00	RM/Cobol	1,500
1041-D01	RM/Cobol RT	300
1041-D03	Pascal	340
1041-D10	Level II Cobol	1,600
1041-D11	Micro Focus Level II E/T	2000
1041-D31	Unibol	2,400
1041-A02	AT&T Advanced Programming Utilities	500
—	C Programming Language Utilities for 3B2/310 and 400	750
—	C Programming Language Utilities for 3B2/600	1,300
COMMUNICATIONS		
1040-001	3B2 3BNet	400
1040-010	3B2 PC Interface	100
1040-015	3B2 SNA/3270 Emulator	700
1040-017	3B2 3270 API	150
1040-018	SNA/RJE Emulator	900
1041-032	3B2 Networking Support Utilities	200
—	AT&T LU6.2 Facility	3,000
—	3B2 Remote Management Package	900
—	ISN Starkeeper I Network Management System	12,000
—	ISN connectivity software for DECnet upper layer protocols	5,000
—	ISN software driver for DEC VAX/VMS hosts	2,500
—	ISN HDLC protocols software on the Synchronous Interface Module	1,200
—	Enhanced TCP/IP WIN/3B Interface, binary code	4,995
1040-S02P	3B2 DOS Server Program	664
1040-S01P	3B2 Network Program Package	377

A dash (—) in a column indicates that information was unavailable from vendor.

AT&T 3B2 Family

OFFICE AUTOMATION

		List Price ($)
1042-OTS	Office TeleSystem (OTS)	3,000
—	AT&T Document Exchange base system software	6,000
—	Document Exchange Utilities	3,000
—	Document Exchange Translators (each)	3,500
—	Document Exchange IBM PROFS Bridge	4,000
—	Document Exchange IBM DISOSS Bridge	3,000
—	Document Exchange Wang VS Bridge	3,000
—	Document Exchange Wang OIS Bridge	3,000
—	Document Exchange PC Access	85

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