

AT&T 3B Computer Family

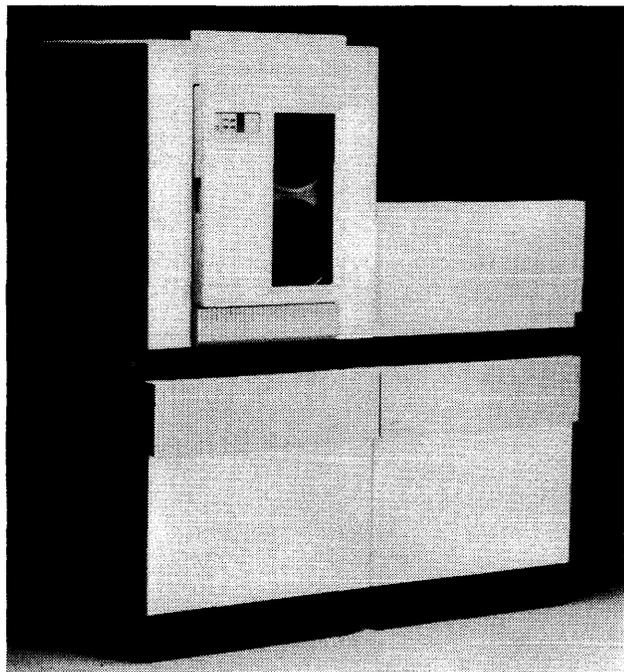
MANAGEMENT SUMMARY

UPDATE: *In the past year, AT&T has enhanced the 3B computer family by adding two new models—Model 401 for the 3B5 series and Model 401 for the 3B15 family. In addition, performance has been increased on all 3B models. A new terminal has also been added, as well new communications capabilities.*

The 3B5/401 basic core unit is packaged in a single basic cabinet, and contains the basic control unit (BCU), the 10MHz, WE 32100-based central controller, 8KB of cache memory, an integrated disk file controller, a storage module drive controller (SMDC), a 2MB main memory board, and a math accelerator unit (MAU). The system supports up to 48 concurrent users and performs at a rate of 1.1 million instructions per second (MIPS). The BCU provides five physical I/O slots.

The 3B15/401 shares the same core package as the 3B5/401, but uses a 14MHz WE 32100 microprocessor and offers 16KB of cache memory. According to AT&T, the 3B15/401 offers a 25 percent increase in performance over the 3B5/401 and performs at an increased speed of 1.6 million MIPS. The 3B15/401 supports up to 60 concurrent users.

Both the 3B5 and 3B15 Models 401 support only the 2MB memory boards for a maximum of 16MB of memory. Both systems support up to 2.2GB of disk storage. ➤



The 3B15, comprising Models 101, 201, 301, and 401, is the mid-range system in AT&T's 3B Computer family. The 3B15 supports up to 60 simultaneously active users. It runs under Release 2.1 of Unix System V, which provides demand paged memory management and record/file locking.

AT&T's 3B 32-bit superminicomputer family is comprised of the low-end 3B5, mid-range 3B15, and high-end 3B20 groupings. The 3B models are designed for engineering and scientific environments, as well as the office environment. All systems support versions of AT&T's Unix operating system.

MODELS: 3B5/101, 201, 301, and 401; 3B15/101, 201, 301, and 401; 3B20S and 3B20A.

MEMORY: 2MB to 16MB.

DISK CAPACITY: 40MB to 8.8GB.

WORKSTATIONS: Up to 256 (100-150 concurrently active).

PRICE: \$34,500 to \$340,000 (core system prices).

CHARACTERISTICS

MANUFACTURER: AT&T Information Systems, 1 Speedwell Avenue, Morristown, NJ 07690. Telephone (201) 898-2000.

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

DATA FORMATS

BASIC UNIT: 32-bit word.

FIXED-POINT OPERANDS: On 3B20 systems, integers can be 8 bits, 16 bits, 32 bits, or 64 bits. All have the same format; the high-order bit is used as the sign. On 3B5 and 3B15 systems, data are read or written in word (32-bit), halfword (16-bit), or byte (8-bit) lengths. Bytes and halfwords are automatically expanded to 32-bit words for processing.

FLOATING-POINT OPERANDS: The 3B20 systems accommodate both single-precision (4-byte) and double-precision (8-byte) formats; in both formats, the high-order bit is the sign. Single-precision fractions are 23 bits long and the exponent is 8 bits long; double-precision fractions are 52 bits in length, with the exponent 11 bits long. Optional with the 3B20S and 3B20A computers is a Floating Point Accelerator that, according to AT&T, increases floating-point performance by a factor of three.

The 3B5/201, 3B5/301, and all 3B15 models include the WE 32106 Math Accelerator Unit (MAU), which provides floating-point capabilities; the unit is optional on the 3B5/101. The WE 32106 MAU is compatible with the proposed IEEE Standard for Binary Floating Point Arithmetic, Draft 10.0. The MAU provides single (32-bit), double (64-bit), and double-extended (80-bit) precision. It provides the following functions: add, subtract, multiply, divide, remainder, negate, absolute value, square root, compare, move, and rounding to integral value.

INSTRUCTIONS: The 3B20 computers employ 13 instruction types: arithmetic; function call; dual serial channel I/O; special I/O; field; serial channel I/O; jump; logical; miscel- ➤

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CHART A. SYSTEM COMPARISON

MODEL	3B5/101	3B5/201	3B5/301	3B5/401	3B15/101
SYSTEM CHARACTERISTICS					
Date of introduction	June 1985	June 1985	June 1985	1986	June 1985
Date of first delivery	October 1985	October 1985	October 1985	1986	December 1985
Operating system	Unix System V, Release 2.0	Unix System V, Release 2.0	Unix System V, Release 2.0	Unix System V, Release 2	Unix System V, Release 2.1
Upgradable from	Not applicable	Not applicable	Not applicable	Not applicable	3B5/101
Upgradable to	3B15/101	3B15/201	3B15/301	3B15/401	Not applicable
MIPS	0.8-1.1	1.1	1.1	1.1	1.6
Relative performance (based on a rating of the 3B20S at 1.0)	0.65	0.65	0.65	0.65	0.91
MEMORY					
Minimum capacity, bytes	2M	2M	2M	2M	2M
Maximum capacity, bytes	8M	16M	16M	16M	8M
Type	DRAM	DRAM	DRAM	DRAM	DRAM
Cache memory	8KB	8KB	8KB	8KB	16KB
Cycle time, nanoseconds	125	125	125	125	125
Bytes fetched per cycle	—	—	—	—	—
INPUT/OUTPUT CONTROL					
Number of channels	16	16	16	16	16
High-speed buses	3	3	3	3	3
Low-speed buses	None	None	None	None	None
MINIMUM DISK STORAGE					
	40MB	40MB	134MB	40MB	40MB
MAXIMUM DISK STORAGE					
	1.1GB	2.2GB	2.2GB	2.2GB	1.1GB
NUMBER OF WORKSTATIONS					
	128 (32 concurrently active)	128 (48 concurrently active)	128 (48 concurrently active)	128 (40 concurrently active)	128 (60 concurrently active)
COMMUNICATIONS PROTOCOLS					
	Async, sync, BSC/3270, SNA/3270, TTY, RJE, 3BNet, Ethernet, ISN, X.25	Async, sync, BSC/3270, SNA/3270, TTY, RJE, 3BNet, Ethernet, ISN, X.25	Async, sync, BSC/3270, SNA/3270, TTY, RJE, 3BNet, Ethernet, ISN, X.25	Async, sync, BSC/3270, SNA/3270, TTY, RJE, 3BNet, Ethernet, ISN, X.25	Async, sync, BSC/3270, SNA/3270, TTY, RJE, 3BNet, Ethernet, ISN, X.25

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

➤ The 3B5/401 and 3B15/401 configurations are contained in a 61 by 30 by 36 inch basic cabinet. This first (or basic) cabinet can house up to four disk drives. A second, or growth, cabinet is optional and can house the cooling unit and a combination of either one tape drive or two Lark disk drives. The growth cabinet, combined with the basic cabinet, provides 15 physical (12 addressable) I/O slots and three additional SMDCs.

In addition to the introduction of two new systems, AT&T has increased the performance rate of the 3B systems to 1.1 MIPS on the 3B5 models 201, 301, and 401, and to 1.6 MIPS on all models of the 3B15.

The 610 BCT terminal, a general-purpose, ANSI 3.64-based terminal, has been added to the 3B system offerings. The terminal features a 27-line screen with an 80- or 132-column display and a bidirectional printer port. The 610 BCT offers a 103- or 98-key keyboard with 16 program-mable function keys and an RS-232-C interface that transmits at rates between 110 bps and 19.2K bps.

Several communications products have been added to the 3B systems. These include the 6500 Multifunction Communication System that allows the 3B systems to interface and manipulate data on four host systems simultaneously; the Unified Messaging Manager and Unified Messaging Link that provide various messaging services; and the AT&T X.25 Network Interface that allows connection to public packet switched networks or another processor.

The four 3B5 models employ 10MHz WE 32100 CPUs; each CPU has a WE 32106 MAU. The 3B5/101 is available with a 7.2MHz WE 32000 CPU, as well as with the 10MHz ➤

➤ laneous; maintenance channel; PSI-ACHI; special; and floating-point.

The instructions for the 3B5 and 3B15 systems are divided into the following functional groups:

- Data Transfer instructions, which copy data to and from registers and memory.
- Arithmetic instructions, which perform arithmetic operations on one, two, or three operands.
- Logical instructions, which perform a logical operation on one, two, or three rotate, and logical shift (left or right).

The 3B5 systems also use unique instructions. Program control instructions (branch, jump, return) provide different levels of execution privilege by allowing alteration in the sequence in which instructions are executed. Priority interrupt and exception handling instructions permit the processor to establish an environment in which other processes can take control of the microprocessor. Memory management instructions provide relocation and protection capabilities.

INTERNAL CODE: ASCII for text-oriented data; binary for calculations.

MAIN STORAGE

TYPE: Dynamic Random Access Memory (DRAM).

CYCLE TIME: Refer to Chart A for the cycle times on the various 3B models.

CAPACITY: Main memory capacities on the 3B Computers range from 2MB to 16MB and is provided on either 1MB or 2MB boards; 2MB boards must be used to provide the maximum of 16MB of memory. Refer to Chart A for the memory capacities of specific models. ➤

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CHART A. SYSTEM COMPARISON (Continued)

MODEL	3B15/201	3B15/301	3B15/401	3B20S	3B20A
SYSTEM CHARACTERISTICS					
Date of introduction	June 1985	June 1985	1986	March 1984	March 1984
Date of first delivery	December 1985	December 1985	1986	March 1984	March 1984
Operating system	Unix System V, Release 2.1	Unix System V, Release 2.1			
Upgradable from	3B5/201	3B5/301	3B5/401	Not applicable	3B20S
Upgradable to	Not applicable	Not applicable	Not applicable	3B20A	Not applicable
MIPS	1.6	1.6	1.6	1.0	1.5-1.8
Relative performance (based on a rating of the 3B20S at 1.0)	0.91	0.91	0.91	1.0	1.5-1.8
MEMORY					
Minimum capacity, bytes	2M	2M	2M	2M	2M (each CPU)
Maximum capacity, bytes	16M	16M	16M	16M	16M (each CPU)
Type	DRAM	DRAM	DRAM	DRAM	DRAM
Cache memory	16KB	16KB	16KB	16KB	16KB (each CPU)
Cycle time, nanoseconds	125	125	125	400	400
Bytes fetched per cycle	—	—	—	4	4
INPUT/OUTPUT CONTROL					
Number of channels	16	16	16	—	—
High-speed buses	3	3	3	—	—
Low-speed buses	None	None	None	—	—
MINIMUM DISK STORAGE					
	40MB	134MB	40MB	256MB	256MB
MAXIMUM DISK STORAGE					
	2.2GB	2.2GB	2.2GB	8.8GB	8.8GB
NUMBER OF WORKSTATIONS					
	128 (60 concurrently active)	128 (60 concurrently active)	128 (60 concurrently active)	256 (100-150 con- currently active)	256 (100-150 con- currently active)
COMMUNICATIONS PROTOCOLS					
	Async, sync, BSC/ 3270, SNA/3270, TTY, RJE, 3BNet, Ethernet, ISN, X.25	Async, sync, BSC/ 3270, SNA/3270, TTY, RJE, 3BNet, Ethernet, ISN, X.25	Async, sync, BSC/ 3270, SNA/3270, TTY, RJE, 3BNet, Ethernet, ISN, X.25	Async, sync, X.25, HDLC, RJE, 3BNet, Hyperchannel, Ether- net, ISN, DDCMP	Async, sync, X.25, HDLC, RJE, 3BNet, Hyperchannel, Ether- net, ISN, DDCMP

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

➤ WE 32100. AT&T quotes MIPS rates of 0.8 to 1.1 MIPS (depending upon the processor) for Model 101, and 1.1 for Models 201, 301, and 401. All models feature an 8KB cache memory. The 3B5 systems run under AT&T's Unix System V, Release 2.0.

Model 101 supports up to 32 simultaneous users, while the 201, 301, and 401 support up to 48. The maximum number of terminals that can be physically connected to any of the models is 128. In addition, a high-speed memory controller and disk file controller subsystem are included that reportedly boost system performance and increase disk I/O.

The 3B5/101 supports up to 8MB of main memory; the 3B5/201, 301, and 401 provide up to 16MB. Each core system comes with 2MB of main memory, expandable in 1MB or 2MB increments (except in the Model 401, which supports only 2MB boards).

All four 3B5 models support 134MB and 279MB fixed disk drives, and a 40MB fixed/removable drive. Model 101 permits attachment of up to four disk drives in any combination, for a maximum of 1.1GB of auxiliary storage. Models 201, 301, and 401 support up to eight drives, to a maximum of 2.2GB. Each model supports up to four single-density or dual-density tape drives.

Like the 3B15, the 3B5 plugs into a standard office electrical outlet. The cabinets are the same dimensions as those for the 3B15.

Each 3B5 model can be converted to its counterpart 3B15 model with a hardware/software migration kit consisting of ➤

➤ The main memory unit on the 3B20S and 3B20A consists of the memory controller and from 2 to 16MB of memory per CPU. For the 3B20A, duplicate copies of main memory are maintained in each of the system's dual processors; the maximum amount of addressable memory is 16MB. The duplicate copies of memory increase the memory bandwidth by allowing each processor to read memory simultaneously.

CHECKING: In 3B20 systems, each 32-bit word in main storage is divided into four 8-bit bytes; each byte has an associated parity bit. The four parity bits are modified, and, combined with four additional Hamming bits, make up a modified 8-bit form of the Hamming code. During memory read operations, the main store controller uses this code to check for and correct all single bit errors and to identify double and detectable multibit errors. During each memory refresh cycle (every 8 microseconds), the main store is checked for bad parity. If bad parity is detected, an error signal is generated to the central processor.

In 3B5 and 3B15 systems, Hamming codes are used for double-bit error detection and single-bit error correction.

STORAGE PROTECTION: The 3B20 computers use a 24-bit virtual address and support a segmented-paged memory management scheme.

In the 3B5 computers, which use a swapping scheme, memory management logic divides memory into 512- or 2048-byte pages. The 3B5 systems are also equipped with read and write protection of system and user files.

The 3B15 provides demand paged memory management through the WE 32101 Memory Management Unit (MMU), a 32-bit bus-structured device providing logical-to-physical address translation, memory organization, control, and access protection. The MMU maps virtual memory addresses to physical memory addresses through, allowing up to 4GB each of virtual and physical address space. The MMU also accommodates demand segmented virtual mem- ➤

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CHART B. MASS STORAGE

MODEL	48MB	160MB	300MB	340MB	675MB
Type	Fixed/removable	Fixed	Removable	Fixed	Fixed
Controller model	IDFC/SMDC	IDFC/SMDC	DFC	IDFC/SMDC (3B5 & 3B15); DFC (3B20)	DFC
Drives per subsystem/controller	2 per SMDC, 4 per IDFC	2 per SMDC, 4 per IDFC	8	2 per SMDC, 4 per IDFC; 8 per DFC	8
Formatted capacity per drive, megabytes	20/20	134	256	279	550
Number of usable surfaces	4	10	19	12	20
Number of sectors or tracks per surface	—	—	823 tracks	711 tracks	823 tracks
Bytes per sector or track	512/sector	512/sector	512/sector	512/sector	512/sector
Average seek time	35 ms	30 ms	30 ms	20 ms	25 ms
Average rotational/relay time	8.5 ms	8.3 ms	8.3 ms	8.3 ms	8.3 ms
Average access time	43.5 ms	38.3 ms	38.3 ms	28.3 ms	33.3 ms
Data transfer rate	1.2MB/sec.	1.2MB/sec.	1.2MB/sec.	1.2MB/sec.	1.2MB/sec.
Supported by system models	3B5/101, 3B5/201, 3B15/101, 3B15/201	All 3B5 and 3B15	3B20S/3B20A	All	3B20S/3B20A

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

▷ two replacement circuit packs for the central controller and cache and Unix System V, Release 2.1.

Conversion from a 3B5 to a 3B15 reportedly requires little or no change in application programs. AT&T states, however, that large and complex multitasking applications may experience some correctable timing differences, due to the faster run time of the 3B15. AT&T states that the 3B5 and 3B15 are object-code compatible with the company's 3B2 supermicrocomputers (covered in a separate report in this volume of DATAPRO REPORTS ON MINICOMPUTERS) and source-code compatible with the 3B20 supermini systems.

The 3B15 Computer is based on AT&T's proprietary WE 32100 microprocessor. The WE 32100, which features a full 32-bit address path and data bus, is the more powerful successor to the older WE 32000. The 3B15 CPU employs a 14MHz WE 32100, and includes an MAU based on AT&T's WE 32106 chip. The MAU reportedly provides a 137-fold performance increase for math-intensive applications.

A total of four models of the 3B15 are available: 101, 201, 301, and 401. Each model can reportedly deliver up to 45 percent greater performance than a comparable 3B5 model, with processor power up to 1.6 MIPS.

The 3B15 runs Unix System V, Release 2.1, providing support for demand paged memory management (as opposed to the swapping method supported in Release 2.0, which runs on the 3B5 computers), mandatory record/file locking, simplified system administration (menu driven), and enhanced file hardening with dynamic bad block handling. (The version of Unix System V running on the 3B20S and 3B20A incorporates the features of Release 2.1, except for simplified administration.)

The 3B15/101 supports up to 8MB of ECC dynamic random access memory (DRAM), while Models 201, 301, and 401 accommodate up to 16MB. Each core system provides 2MB of main memory, which can be expanded in 2MB increments. All models have a 16KB cache memory.

All models of the 3B15 support 40MB fixed/removable and 134MB and 279MB fixed disk drives. Up to four drives can

▷ ory systems. The MMU offers four types of access protection—execute only, read/execute, read/write/execute, and no access—at each of four execution levels (kernel, executive, supervisor, and user).

RESERVED STORAGE: The minimum reserved storage in 3B5 and 3B15 systems is 512KB for the Unix kernel and drivers; disk buffer cache requires an additional 512KB to 1MB.

CACHE MEMORY: The 3B5 computers all feature a standard 8KB cache; a 16KB cache is standard on the 3B15. The 3B20S has a 16KB cache memory; the 3B20A provides 16KB of cache in each processor. The 16KB cache on the 3B20 computers is divided into two 8KB units: one for standard memory cache and the other for a subroutine return stack. (Unix applications typically consist of many subroutine calls, so the 3B20 cache is optimized for the Unix environment.)

CENTRAL PROCESSOR

GENERAL: All 3B20 processors employ the bit-slice-based 3B20S processor in various permutations. The central processor (also called the central control) of the 3B20 computers comprises the following subunits:

- The microcontroller, which provides sequencing and control of the instructions executed from control storage.
- Control storage, a microprogrammed processor with 10KB of microstore.
- Main store update unit, controlling access to the main store. This bidirectional unit receives main store access requests and controls the order in which the requesting units receive access to main storage.
- Cache store, which comprises the cache controller and cache memory and allows bypassing of the main store for frequently used memory locations.
- Data manipulation unit, which includes the arithmetic logic unit and general registers for the central control.
- Special registers used by hardware and software for special functions, such as maintenance access, self-checking, time-of-day clock, and interrupt source register.
- Store data controller, store address controller, and store address translator, which maintain control of virtual memory addressing and of all data and address transfers in and out of central control.

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▷ be configured on Model 101, for 1.1GB of storage; up to eight drives can be attached to Models 201, 301, and 401, for maximum storage of 2.2GB.

Up to 128 workstations can be connected to 3B15 computers; up to 48 can be simultaneously active on Model 101, and up to 60 on Models 201 and 301. Each 3B15 model permits attachment of up to four tape drives, either single-density 1600 bpi or dual-density 1600/6250 bpi.

A basic 3B15/101 provides five I/O, two general-purpose, and four memory card slots, along with mounting space for two 40MB fixed/removable disk drives. The 3B15/201, 3B15/301, and 3B15/401 provide 12 I/O, four general-purpose, and eight memory card slots, with mounting space for two disk drives in any combination permissible on the specific model. A card cage providing space for 14 more feature cards can be added to all three models.

According to AT&T, the 3B15 needs no special power equipment; it plugs into a standard office electrical outlet and requires 117 VAC, 20 amp of current, typically consuming 1.36 kilowatts.

The basic cabinet of the 3B15/101 and 201 measures 31¼ inches high, 30 inches wide, and 31¼ inches deep; vertical and horizontal growth cabinets can be added. The 3B15/301 comes in a single cabinet 67½ inches high, 31¼ inches wide, and 28 inches deep. A growth cabinet of the same dimensions can be added. The 3B15/401 is housed in a basic cabinet and optional growth cabinet configuration, with each cabinet measuring 61 inches high, 31 inches wide, and 36 inches deep.

In communications, the Host Connectivity products, for AT&T/IBM networking on 3B5 and 3B15 computers, include the Communication Processor—a hardware product—and three software packages: SNA/3270 Emulator+, BSC/3270 Emulator+, and 3270 Application Program Interface. The X.25, TCP/IP, and DMI communications products are also supported on the 3B systems.

The Communication Processor provides support for multiple 3B computers. It is a node on an AT&T 3BNet network, and links the 3Bs on the network to IBM hosts for 3270 emulation services. The intelligent Communication Processor manages protocol conversions between the asynchronous 3B computer environment and the IBM SNA/SDLC continuum; it is available in both local and remote versions.

AT&T SNA/3270 Emulator+ allows an ASCII terminal user to access an SNA network and use the resources available to a 3278 display station user. AT&T BSC/3270 Emulator+ is functionally the same as the SNA/3270 emulator, except it emulates bisynchronous protocol. Both emulators use the interface between the IOA (Input/Output Accelerator) and SDLI (Synchronous Data Link Interface) on 3B5 and 3B15 computers.

AT&T 3270 Application Program Interface (API) provides virtual terminal facilities, allowing the user of an ASCII ▷

▶ • Maintenance channel interface, which provides the diagnostic processor with maintenance and recovery access to the central control.

• Power converters, which convert DC power from the power conditioning cabinet to the logic levels required in the central control.

• Power control and monitor, which provides for display of power and alarm states, out-of-service requests, and command of control unit power.

The 3B20 central control interfaces with the main store and direct memory access unit through internal processor buses.

The 3B20S and 3B20A CPUs are powered from batteries continually charged through the AC source. During a power outage, the batteries can power the CPU, DMA controllers, I/O and peripheral controllers, Disk File Controllers, memory subsystem, and DC disk drives; only tape drives and AC disk drives will go down.

The processors used in the 3B5 and 3B15 computers are based on AT&T's WE 32100 microprocessor, which features 32-bit data and address buses. The clock rate for the central control processor is 10MHz in the 3B5 and 14MHz in the 3B15 systems. (The 3B5/101 is available with either the 10MHz WE 32100 or a 7.2MHz version of the older WE 32000.)

The WE 32100-based CPUs include sixteen 32-bit registers; an Address Arithmetic Unit (AAU); a 33-bit Arithmetic Logic Unit (ALU); a 32-bit barrel switch; 170 opcodes implemented in on-chip Programmable Logic Array (PLA), a procedure linkage facility, built-in system call instructions, process switch instructions for Unix and C operations, and a macro ROM for executing operating system instructions and microsequences; a 12-byte instruction queue; a Program Counter (PC) and internal registers; a Process Status Word (PSW); and a parity tree. The WE 32106 MAU is standard on all WE 32100-based CPUs. The 3B15 CPU also includes the WE 32101 MMU.

The processor in each 3B5 and 3B15 system performs address and data calculations independently. The 32-bit CBUS carries the results of data manipulation, while the 32-bit ABUS handles instruction stream and memory board operand accesses. Data is passed between the ABUS and the CBUS over a 32-bit bidirectional bus multiplexer. The CPU's address bus can access 4GB of virtual memory to address main memory or feature cards. In addition to the address and data buses, the processor also has an 18-bit status bus.

Each 3B5 model can be upgraded to its 3B15 counterpart through a hardware/software migration kit consisting of two replacement circuit packs for the central controller and cache, and Unix System V, Release 2.1, which runs on the 3B15.

CONTROL STORAGE: The 3B20 central control contains a microprogrammed control storage processor with 10KB of microstore, of which 2KB is read-only memory (ROM) containing a series of microinstructions that directs such system activities as booting.

REGISTERS: The 3B20 computers employ 12 general-purpose registers. The WE 32100 microprocessor in the 3B5 and 3B15 CPUs has sixteen 32-bit registers: nine general-purpose and seven special-purpose. (A register is "general-purpose" in that it can be referenced in all possible addressing modes.) Three registers are privileged.

ADDRESSING: The 3B20 computers use eight address modes: six memory modes, immediate mode, and register ▶

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CHART C. WORKSTATIONS

MODEL	4410	4418	4425	5620	BCT 513	610 BCT
DISPLAY PARAMETERS						
Max. chars./screen	1,920 or 3,168	1,920 or 3,168	1,920 or 3,168	800 x 1,024 resolution	1,920	—
Buffer capacity	1 page	1 page	9600 characters	256KB or 1MB	1 page	—
Screen size (lines x chars.)	24 x 80 or 132	24 x 80 or 132	24 x 80 or 132	70 x 88	24 x 80	27 x 80 or 132
Tilt/swivel screen	Tilt standard	Tilt standard	Tilt standard	Not applicable	Tilt standard	Yes
Symbol formation	7 x 9 or 5 x 7 dot-matrix	7 x 9 or 5 x 7 dot-matrix	7 x 9 or 5 x 7 dot-matrix	Not applicable	7 x 11 dot-matrix	—
Character phosphor	White, green, or amber	Amber or green	White or amber	Green	White	Amber, green, or white
Total colors/no. simult. displayed	Not applicable	Not applicable	Not applicable	—	Not applicable	Not applicable
KEYBOARD PARAMETERS						
Style	Typewriter	Typewriter	Typewriter	Typewriter	Typewriter	Typewriter
Character/code set	128 ASCII or 96 line-drawing/graphics	128 ASCII, line-drawing/graphics, others	128 ASCII, special character sets	ANSI 3.64	128 ASCII, special character sets	—
Detachable	Yes	Yes	Yes	Yes	Yes	Yes
Program function keys	8	8	38	8 standard	8	16 prog.; 31 dedicated
TERMINAL INTERFACE	RS-232-C	RS-232-C	RS-232-C	RS-232-C	RS-232-C	RS-232-C
Comments	Integrated auto dial modem available	Integrated auto dial modem available; 3278-like keyboard	Integrated auto dial modem available; allows up to 4 windows	Dot-mapped display (DMD) terminal		

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

➤ terminal to access 3270 applications on a mainframe through a C-language-callable interface. The API can be used with both the SNA/3270 and BSC/3270 Emulator+ products.

The AT&T 435 Plotter, designed for color graphics, uses the HPGL graphics protocol. The 435 has a six-pen carousel that can plot on 8½-by-11 inch or 11-by-17 inch paper or on 8½-by-11 inch glossy presentation paper and transparency film. The 435 Plotter is compatible with software from Graphics Software Systems.

The high end of the 3B family is the 3B20 series, comprising the 3B20S and 3B20A. These systems are designed for high-volume applications, and are compatible at the source-code level with the 3B5 and 3B15 computers. All 3B20s employ the bit-slice-based 3B20S processor in various permutations. CPU functions on the 3B20S are handled through the Central Control complex. The Central Control handles logic, control, and arithmetic processes, and provides virtual addressing. Main memory on the 3B20S computer ranges from 2MB to 16MB; it can be expanded in 2MB increments. Main memory is complemented by a 16KB cache memory. The 3B20S can support up to 8.8GB of online disk storage. Up to 256 terminals can be configured; from 100 to 150 can be simultaneously active, depending upon the application.

The 3B20A is a symmetrical multiprocessor version of the 3B20S; it offers from 1.5 to 1.8 times the performance of the single-processor system. The 3B20A comprises the 3B20S and an attached processor unit; the two units process in parallel. Both the primary and the attached processors perform operating system calls. Both execute scheduling routines from a single job queue. Input/output functions are handled by the primary processor, however, and both processors execute different jobs. The 3B20A supports from 2MB to 16MB of main memory in each

➤ mode. The 3B5 and 3B15 processors recognize commonly used address modes—absolute, displacement (or offset) from a register's contents, immediate, and register—as well as a special (expanded operand type) mode.

INTERRUPTS: 3B20 computers recognize 32 interrupt levels. The 3B5 and 3B15 computers have 15 hardware interrupt levels.

OPERATING ENVIRONMENT: A 3B20S configuration with three cabinets, one disk drive, console printer, and operator terminal occupies a minimum of 31 square feet of floor space. It requires 208 VAC single-phase, 208 VAC three-phase, and 120 VAC, single-phase. Operating temperatures range from 32 degrees Fahrenheit to 122 degrees Fahrenheit at 20 percent to 80 percent relative humidity. Heat dissipation is 14K Btu per hour. The 3B20A has the same power requirements and range of operating temperatures. However, the 3B20A (four cabinets, one disk drive, console printer, and operator terminal) takes up a minimum of 36 square feet of floor space and has a heat dissipation rate of 18.5K Btu per hour. No water cooling is required, and an uninterruptible power system (UPS) is optionally available. According to AT&T, the 3B20 systems do not require special air-conditioning or raised floors.

Models 101 and 201 of the 3B5 and 3B15 are modular and have several cabinets. The basic system cabinet for each is 31¼ inches high, 30 inches wide, and 31¼ inches deep and weighs 400 pounds. A horizontal expansion cabinet of the same height and depth, but with a width of 31 inches, is also available; it weighs 250 pounds. The basic system cabinet takes up 12.6 square feet of floor space; the system and horizontal cabinets combined occupy 21.6 square feet of space. A vertical expansion cabinet for disk drives, which can be placed on top of the system or horizontal cabinet, is 19 inches high, 31 inches wide, and 31¼ inches deep; it weighs 225 pounds. A tape drive cabinet can also be positioned on top of a system or horizontal cabinet; it is 38 inches high, 30 inches wide, and 31¼ inches deep, and weighs 225 pounds.

➤ Model 301 of the 3B5 and 3B15 is housed in a cabinet 67.5 inches high, 31¼ inches wide, and 28 inches deep, weighing 750 pounds. A 550-pound growth cabinet of the same dimensions can be added.

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CHART D. PRINTERS

MODEL	5310	5320	470	475
Type	Dot-matrix	Dot-matrix	Dot-matrix	Dot-matrix
Speed	200 cps	200 cps	120 cps	120 cps
Bidirectional printing	Yes	Yes	Yes	Yes
Paper size	Up to 9.5 in. wide	Up to 17 in. wide	Up to 10 in. wide	Up to 10 in. wide
Character formation	7 x 9 dot-matrix	7 x 9 dot-matrix	9 x 9 dot-matrix	9 x 9 dot-matrix
Horizontal character spacing (char./inch)	Variable	Variable	Variable	Variable
Vertical line spacing (char./inch)	Variable	Variable	Variable	Variable
Character set	96 ASCII plus APL	96 ASCII plus APL	ASCII plus AT&T proprietary	ASCII or AT&T proprietary
Controller/Interface	RS-232-C, EIA CCITT	RS-232-C, EIA CCITT	Centronics parallel	RS-232-C
No. of printers per controller/interface	—	—	—	—
Printer dimensions, in. (h x w x d)	5.5 x 16 x 14.4	5.5 x 21.2 x 14.4	5.4 x 15.7 x 11.3	5.4 x 15.7 x 11.3
Graphics capability	Yes	Yes	Yes	Yes
Comments	Various submodels available	Various submodels available		

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

CHART D. PRINTERS (Continued)

MODEL	476	447	447X
Type	Dot-matrix	Band	Band
Speed	120 cps	600 lpm	1,000 lpm
Bidirectional printing	Yes	Not applicable	Not applicable
Paper size	—	Up to 16 in.	Up to 16 in.
Character formation	9 x 9 dot-matrix	Full	Full
Horizontal character spacing (char./inch)	Variable	Variable	Variable
Vertical line spacing (char./inch)	Variable	Variable	Variable
Character set	ASCII or AT&T proprietary	Full ASCII	Full ASCII
Controller/Interface	RS-232-C	Dataproducts L.C. or RS-232-C	Dataproducts L.C. or RS-232-C
No. of printers per controller/interface	—	—	—
Printer dimensions, in. (h x w x d)	—	15 x 30.3 x 25.2	15 x 30.3 x 25.2
Graphics capability	Yes	No	No

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

➤ processor. The 3B20A supports the same amount of disk and the same number of workstations as the single-processor system. The 3B20A is available as a separate system or as an upgrade for the 3B20S. According to AT&T, the 3B20S and 3B20A are designed for applications such as office services, software development, and manufacturing.

In addition to the Host Connectivity facilities, AT&T offers two other products designed to connect the 3B computers to both AT&T systems and those from other vendors—3BNet and Information Systems Network (ISN).

3BNet is a high-speed local area network that provides file-transfer facilities for 3B5, 3B15, and 3B20A/S systems operating within an area of over 540 yards (500 meters). The network operates at a transmission rate of 10M bits per second over coaxial cable and is intelligent, using WE 32000 microprocessor-based interfaces to deload all protocol, flow control, and maintenance overhead from attached host computers. 3BNet is Ethernet-compatible, permitting connection of 3B systems to computers and peripherals supporting the Ethernet standard. 3BNet employs the Carrier Sense Multiple Access/Collision Detection (CSMA/CD) communications scheme. It operates in conjunction with a package of network services contained in the Unix operating systems, allowing users to move data among machines and set network security. The 3BNet network allows configuration of up to 100 nodes.

➤ Model 401 of the 3B5 and 3B15 utilize the basic cabinet and an optional growth cabinet. The basic cabinet is 61 inches high, 31 inches wide, and 36 inches deep, and weighs 750 pounds.

Power requirements for the 3B5 and 3B15 computers are 117 VAC, 20 amp (multiple feeder), 60 Hz; typical system power consumption is 1.36 kilowatts. The 3B5 and 3B15 systems operate at temperatures ranging from 40 degrees Fahrenheit to 100 degrees Fahrenheit at 20 percent to 80 percent relative humidity, noncondensing. Heat dissipation for typical 3B5 and 3B15 configurations is 5K Btu per hour.

INPUT/OUTPUT CONTROL

The 3B20 systems employ parallel processing, using micro-processor-controlled Input/Output Processors and Disk File Controllers to transfer data through the Direct Memory Access Controller (DMAC) to or from main storage, bypassing the CPU. Each I/O Processor (IOP) and Disk File Controller (DFC) acts as a front-end processor. Up to four fully equipped IOPs can be accommodated on a 3B20 computer; each IOP can handle up to 16 peripheral controllers. An IOP consists of a basic input/output processor (BIOP) and a growth input/output processor (GIOP). An IOP can be located in the processor input/output cabinet, the tape and growth cabinet, or a system expansion cabinet. In the 3B20A, an IOP can also be located in the second processor I/O cabinet. Up to four DFCs can be accommodated on each 3B20 computer; each DFC can handle eight disk drives. (For further discussion of the DFC, refer to the CONFIGURATION RULES section of this report.)

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CHART E. MAGNETIC TAPE EQUIPMENT

MODEL	—	1600	6250IN/1	6250IN/2
TYPE	Reel-to-Reel	Reel-to-Reel	Streaming	Streaming
FORMAT				
Number of tracks	9	9	9	9
Recording density, bits per inch	1600	1600	1600/6250	1600/6250
Recording mode	—	PE	PE/GCR	PE/GCR
CHARACTERISTICS				
Controller model	Local bus adapter	UN52 C.P.	UN145 C.P.	UN138, UN139 C.P.
Drives per controller	4	4	2	2
Storage capacity, bytes	40M	38M-40M	100M	100M
Tape speed, inches per second	25	125	25	25/75
Data transfer rate, units per second	—	200KB	244KB	40KB
Streaming technology	Yes	No	Yes	Yes
Start/stop mode; speed	Not applicable	Not applicable	Yes	Yes
Switch selectable	No	—	—	—

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

➤ Information Systems Network (ISN) is AT&T Information Systems' proprietary local area network for building complexes and campuses; it permits networking of 3B systems and computers from other manufacturers. ISN is based on a short, centralized bus architecture incorporating attributes of star networks, distributed buses, and distributed token rings.

As previously mentioned, the 3B5, 3B15, and 3B20S and 3B20A all run AT&T's Unix System V, a general-purpose, multiuser, multitasking, interactive operating system. The two major components of Unix System V are the file system and the shell, or command language. The Unix System V file system consists of a uniform set of directories and files arranged in a tree-like structure. The shell is the user/system interface program that interprets command links input by the user from a terminal. The shell is not only an interactive command language, but also a full programming language.

Unix System V includes support for C, the high-level programming language in which the operating system and most of its subsystems are written. Also provided are facilities for development, diagnostics, system administration, and system services, along with text processing tools.

Languages available for the 3B computer family include C, Basic, and Pascal. The 3B20 systems support Cobol, while the 3B5 and 3B15 also support RM/Cobol. Among applications offered directly by AT&T are those for academic instruction, courseware development, communications management control, service operation management, time clock data collection and reporting, and retail management. A variety of commercial applications from third-party vendors are offered through AT&T's Independent Software Vendor program. Details on available software products are provided in the *AT&T Computer Software Guide*, published twice a year.

COMPETITIVE POSITION

AT&T's introduction of Models 3B5/401 and 3B15/401 strengthens its goal of providing computers that can be easily migrated up to a larger system offering higher perfor-

➤ The 3B20S and 3B20A (where I/O is handled by the primary 3B20S processor) each have up to two DMACs, featuring two DMA channels per controller and eight I/O devices per DMA channel. According to AT&T, the distributed I/O architecture of the 3B20 systems permits incremental growth in bandwidth from 1MB per second to 4MB per second.

The 3B20S and 3B20A incorporate a distributed architecture that enhances I/O control by permitting partial failures. For example, if a peripheral device such as a DFC or IOP fails on a system with multiple devices, the system can continue to operate, provided that the failed unit is not the primary (bootstrap) unit. The 3B20S and 3B20A also permit disks to be dual-ported.

On 3B5 and 3B15 systems, the local bus provides the interconnection for the various subsystems. During local bus transactions, one device acts as the bus "master" and another device as the "slave." The central control provides centralized arbitration so that multiple "masters" may exist. Possible masters include the Central Control, the memory controller, a disk or tape controller, an Input/Output Accelerator (IOA), or the 3BNet Network Interface CPU (NICPU). Once a master is granted permission by the arbiter, it may address any board on the bus as a slave. The master may then write or read data to or from the internal locations on the slave. The local bus supports byte, half-word, and word data transactions; parity is carried over all local bus addresses and data.

Input/output activities are accelerated through IOAs. The IOA is a WE 32000 microprocessor-based intelligent peripheral controller that features 256KB of RAM and 96KB of CPROM. It is designed to control a number of peripheral interfaces, including the Asynchronous Data Link Interface (ADLI), Synchronous Data Link Interface (SDLI), Synchronous/ Asynchronous Data Link Interface (SADLI), and Teletype Terminal Interface (TTI).

CONFIGURATION RULES

GENERAL: The 3B20S and 3B20A are each available in single core systems. The core configuration for each includes one (3B20S) or two (3B20A) CPUs, 2MB of main memory, one I/O processor and channel, a disk controller, an operator console, and read-only console printer. To the core system must be added options for additional memory, tape drives, disk drives and cabling, printers, co-location cabling, networking features, and communications interfaces.

➤ The 3B5/101 is available with either a 7.2MHz WE 32000 or a 10MHz WE 32100 processor with WE 32106 MAU. In ➤

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▷ mance. The Models 3B5/401 and 3B15/401 add two more models to AT&T's 3B mid-range systems, and are suitable for front office, as well as back office and computer center environments. The 3B5 and 3B15 Models 301 and 201 are also designed for the same environmental use; Models 101 are entry-level models and are more suitable for front office use that does not require a large number of users.

AT&T feels that with the 1.6 MIPS provided by the 3B15 models, it will be able to compete more effectively for applications requiring superminicomputer performance. Designed as departmental systems, and being used for software development, engineering and scientific environment, or office automation, the 3B systems support a range of user-defined applications.

With the AT&T 3B systems offering scientific as well as general business and office automation capabilities, they come up against competition from a variety of sources that include Data General, Digital Equipment Corporation, Concurrent Computer Corporation, IBM, and Prime. Each of these vendors offers a system that is comparable in some respect to the AT&T 3B systems, and each offers a version of Unix. These vendors offer a wider range of systems, providing a greater software-compatible growth path than the 3B systems. However, the new AT&T 401 models show AT&T's future commitment towards eventually providing an equally wide range of systems.

To be more specific, the 3B5/101 entry-level system could be compared to the Data General MV/4000. The 3B5/101 operates at a MIPS rating of 1.1, has a maximum main storage capacity of 8MB, a disk storage capacity of 1.1GB, offers 8KB of cache memory, and supports 32 active users (128 ports). The MV/4000 offers a lower MIPS rating of 0.6, the same main storage capacity, more disk storage capacity at 9.4GB, no cache memory, and supports 64 users. The 3B5/101 holds a definite advantage as it uses the same cabinet as the 3B15/101 and can be easily field upgraded to the 3B15/101, offering 1.6 MIPS of processing power. Although the MV/4000 is software compatible with all high-end members of the Data General Eclipse MV family, the box must be swapped for upgrading.

The AT&T 3B15/401 mid-range system would be in the same competitive range as the Digital Equipment Corporation VAX 8300. Both systems are used in the scientific and general business environments. They also both offer a 1.6 MIPS performance rating. The 3B15/401 provides more main storage with 16MB versus the VAX's 14MB, more cache memory of 16KB versus the VAX's 8KB, and more disk storage at 2.2GB versus the VAX's 1.8GB. The VAX 8300 does top the 3B15/401 by support of 64 typical users versus the 60 active users supported on the 3B15/401.

The AT&T 3B20 systems, with their faster distributed I/O architecture, are designed for large office applications such as data base management systems, software development, large networking gateways, or as a shared life server for distributed systems. The 3B20A is a dual processor version of the 3B20S. Although the 3B20 systems compete with a variety of vendors, a major competitor to be considered ▷

▶ either case, the core system includes a CPU, system cabinet, dual maintenance port function, 8KB cache memory, two RS-232-C ports for console and maintenance, main memory controller, one 2MB main memory board, Integrated Disk File Controller (IDFC), Storage Module Drive Controller (SMDC), basic control unit, and Unix System V. The basic control unit can accommodate three additional memory boards, five additional I/O boards, and an additional SMDC. Two 40MB fixed/removable disk drives can be configured in the processor cabinet. The aforementioned components are included in the core package of the 3B15/101, whose central control includes a 10MHz WE 32100 CPU with WE 32106 MAU. (Cache memory on the 3B15/101 is 16KB.)

The 3B5/201 core system centers around a 10MHz WE 32100 CPU with MAU, while the 3B15/201 incorporates a 14MHz CPU, also with MAU. Components of both core systems include a basic processor cabinet, a vertical growth cabinet, dual maintenance port function, 8KB (3B5) or 16KB (3B15) cache, two RS-232-C control ports, main memory controller, two 1MB memory boards or one 2MB memory board, IDFC, SMDC, basic control unit, growth control unit, and Unix System V. The 3B5/201 core includes Unix System V, Release 2.0, while the core for the 3B15/201 includes Unix System V, Release 2.1. The basic control unit and growth control unit combined provide 15 physical I/O slots and room for six additional memory boards, additional SMDCs, and a 3BNet interface. The vertical growth cabinet can accommodate two 40MB fixed/removable disk drives, two 134MB and 279MB fixed disk drives in any combination, or one 40MB drive and either a 134MB or a 279MB drive.

The 3B5/301 and 3B15/301 core systems pack the same components as the respective 201 cores into a single 67½ by 31¼ by 28 inch basic processor cabinet with cooling fans. The basic cabinet can hold two fixed disk drives and a 9-track tape drive.

The 3B5/401 basic core package contains the basic cabinet, basic control unit, the 10MHz WE 32100-based central controller, 8KB of cache memory, an IDFC, an SMDC, a 2MB main memory board, an MAU, and the main memory controller (MASC). The B15/401 uses the same core package as the 3B5/401, but provides a 14MHz WE 32100 microprocessor and 16KB of cache memory. The 3B5/401 and 3B15/401 configurations are contained in a 61 by 30 by 36 inch basic cabinet. This first (or basic) cabinet can also house any of the following combinations: four hard disk drives (279MB or 134MB), three hard disk drives (279 or 234MB) and one Lark disk drive (40MB), or two hard disk drives (279 or 134MB) and two Lark disk drives. A second, or growth, cabinet is optional and can house the cooling unit, ELBU, and a combination of either one tape drive or two Lark disk drives.

The 3B5 and 3B15 permit attachment of a chassis, in an expansion cabinet, providing 14 additional I/O slots; each feature card requires one slot.

WORKSTATIONS: The 3B20 computers can support up to 256 workstations; 100 to 150 can be concurrently active, depending upon the application. Up to 128 workstations can be attached to any of the 3B5 and 3B15 systems, although the number of concurrently active users varies. The 3B5/101 supports up to 32 simultaneous users, while the 3B5/201, 3B5/301, and 3B15/101 support up to 48 each. Up to 60 users can be concurrently active on the 3B15/201, 3B15/301, and 3B15/401.

DISK STORAGE: The 3B20 computers all support up to 8.8GB of online disk storage. The Disk File Controller (DFC) in the 3B20S and 3B20A provides an interface for up to eight 256MB, 279MB, or 550MB disk drives through ▶

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➤ would be, of course, IBM with its 4300 systems. Another significant vendor in this arena would be Honeywell with its DPS 6/95 and 6/98 dual processor systems.

The AT&T 3B20A is comparable in many specification areas with the DPS 6/95-2. As mentioned, both are dual processor systems, both are 32-bit systems designed for the office or engineering environment, both support 16MB of memory per processor, and both offer a 1.8 MIPS performance rating. The 3B20A tops the 6/95-2 with 16KB of cache memory and 8.8GB of disk storage, versus 8KB and 6.6GB, respectively, on the DPS 6/95-2. Both systems are comparable in their workstation support, and both are high-end systems in their respective system families; however, the DPS 6/95-2 does have one more system above it for upgradability. Both systems also offer effective communications capabilities. However, the Honeywell DPS 6/95-2 offers the LU 6.2 peer-to-peer communications protocol, which is becoming an industry standard and necessity; the AT&T systems do not as yet support this facility.

ADVANTAGES AND RESTRICTIONS

In addition to AT&T adding two more systems to the 3B family, providing a wider system range, a significant plus factor is the increase in performance that has been allotted to the 3B5 and 3B15 systems. The 3B5/101, /201, /301, and /401 all offer a 1.1 MIPS rating; previously it was 1.0. The 3B15/101, /201, /301, and /401 have been increased from 1.4 MIPS to 1.6MIPS. According to AT&T, the 3B15 systems actually offer a 25 percent greater performance than the 3B5 systems. AT&T attributes this increase in performance on the 3B15 to the 14MHz WE 32100 processor, a larger and faster cache memory, a faster clock speed, the dual WE 32101 memory management unit, and the Unix System V Release 2.1 Demand Paging Operating System.

AT&T's overall plan with the 3B systems is for each model of a series to be easily upgraded to its respective counterpart in the next series up the ladder. They have followed through on this strategy with the introduction of the 3B5/401, which, like other members of the 3B5 series, is supplied in the same model array and cabinetry as its counterpart in the 3B15 series, allowing for an easy field upgrade. This migration path is designed to protect the customer's software investment and to provide strong communications capabilities. There is no direct hardware upgrade path from the 3B5 and 3B15 to the more configurable 3B20s; however, source-code compatibility between the 3B15 and 3B20 groups affords users a measure of protection for their applications investments.

The Unix operating system supported by the AT&T 3B systems strengthens the family. The Unix operating system provides the software developer with an effective array of commands for successful software development. The Unix System V Release 2.1 supporting demand paging and record/file locking adds additional enhancements to the 3B15 computer line. The demand paging feature on the 3B15 provides greater system efficiency for high-through-

➤ dual serial channels in the DMA unit. The DFC can be located in the processor and input/output cabinet, the tape and growth cabinet, or system expansion cabinets.

All 3B5 and 3B15 models support 134MB and 279MB fixed disk drives and a 40MB fixed/removable drive. The 3B5/101 and 3B15/101 permit attachment of up to four disk drives in any combination, for a maximum of 1.1GB of auxiliary storage. The 3B5 and 3B15 Models 201, 301, and 401 support up to eight drives, to a maximum of 2.2GB. A Storage Module Drive Controller is required for each additional two disk drives; an additional Integrated Disk File Controller (IDFC) is required for a system with more than four drives. (Each IDFC supports two SMDCs.)

(Note: The unformatted capacities of the aforementioned 40MB, 134MB, 256MB, 279MB, and 550MB disk drives are 48MB, 160MB, 300MB, 340MB, and 675MB, respectively.)

MAGNETIC TAPE: The 3B20S and 3B20A computers support the UN52, a high-speed tape controller for use with 1600 bpi magnetic tape drives. Up to four drives can be controlled through two tape formatters. The 3B20S and 3B20A also support the UN138 and UN139 controller and Tape Input/Output Processor (TIOP). Two 6250 bpi tape transports can be supported by the 3B20S and 3B20A.

Each 3B5 and 3B15 model can accommodate up to four 9-track tape drives. Two types of drives are available: single-density 1600 bpi or dual-density 1600/6250 bpi. Both tape drives can be controlled by an Intelligent Tape Controller (ITC) or high-speed accelerated tape controller (ATC); one ITC supports 25 ips, while an optional one supports 75 ips.

PRINTERS: The 3B20S and 3B20A support up to two line printers through each TN85 data long lines printer interface, which permits maximum circuit pack throughput of 2,000 lpm (with 132-character lines). RS-232-C interfacing is available through the TN4 asynchronous controller.

MASS STORAGE

For information on available mass storage devices, refer to Chart B.

INPUT/OUTPUT UNITS

See Chart C for workstations, Chart D for printers, and Chart E for magnetic tape equipment.

The 3B5 and 3B15 computers support the AT&T 435 Plotter, designed for color graphics. Using the HPGL graphics protocol, the 435 has a six-pen carousel that can plot on 8½-by-11 inch or 11-by-17 inch paper or on 8½-by-11 inch glossy presentation paper and transparency film. The plotter employs an RS-232-C interface and is compatible with software from Graphics Software Systems.

Also supported by the 3B5 and 3B15 are two daisywheel printers: the 55-cps Model 455 and the 46-cps Model 458/457.

COMMUNICATIONS CONTROL

GENERAL: Communications control on the 3B20 systems is provided by the following devices:

The *TN4 Eight-Channel Asynchronous Data Link Controller* provides data communications between 3B20S and 3B20A computers and asynchronous serial communication channels through the RS-232-C interface. It provides the capabilities of the TN74, but at a lower cost. ➤

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► put applications. The Unix enhancements also endow System V with features previously found only in the Berkeley 4.2 version of Unix, and, thus, move Unix System V beyond commercial computing, giving it entree into the technical and research areas, where Berkeley 4.2 has been dominant.

Unix System V provides object-code compatibility among the 3B5 and 3B15 supermini systems and the 3B2 supermicro grouping, permitting users to port applications with little conversion as they move upward in system power. There is also source-code compatibility among the 3B5/15 and 3B20 systems; while conversion is rendered more complex than if the systems were object-code compatible, users at least need not rewrite applications completely when moving from the bottom to the top of the line.

In the matter of communications, AT&T's Host Connectivity products provide the requisite SNA communications capabilities for the 3B5 and 3B15 systems, and make them more credible competitors in the market for department-level processors. The new 6500 system that allows interfacing to four different hosts simultaneously is an added plus. This system provides four-window terminals that allows manipulation of data on all four host systems.

The 3B computers exhibit significant strengths for networking and distributed processing, implemented in a variety of ways. The AT&T X.25 Network Interface provides effective connection to a public packet switched network, or to another processor through point-to-point, dial-up, or dedicated connection. The UUCP (Unix to Unix Copy) facility in each computer's Unix operating system permits communications with both AT&T Unix and non-AT&T Unix systems (for example, those running a version of Unix based on the University of California at Berkeley implementation). The Information Systems Network links 3B computer systems to non-AT&T systems (Digital Equipment Corporation VAX systems, for example) running Unix System V; it also supports protocol converters for SNA/SDLC communications. The 3BNet LAN provides local interconnection for a group of 3B systems.

USER REACTION

We received no responses for 3B computer systems in our 1986 Datapro Computer Users Survey. As a matter of policy, AT&T Information Systems does not divulge data about its customers. Thus, AT&T-IS declined to provide us with a list of users from whom we could obtain assessments of the 3B systems. □

► The *TN74 Two-Channel Asynchronous Data Link Controller* permits communications between the computer and a variety of asynchronous serial communications channels through the EIA RS-232-C interface. The asynchronous channels can be connected to asynchronous terminals or computers locally or remotely through modems. Speeds up to 9600 bps can be achieved for local operation with terminals or computers. The TN74 features program-controlled options; the user can specify the data rate, data format, parity generation and detection, and character input and output processing options. The option processing tasks are

performed by the peripheral controller to relieve the processor.

The *UN56 Eight-Port Automatic Call Unit Interface* is a circuit-pack peripheral controller. Each port provides an optically isolated EIA RS-366 standard interface for controlling 801CR-type Data Auxiliary Sets (DASs). The UN56 provides dialout capability for eight data sets where one ACU is dedicated to controlling one data set. Up to 96 data sets can be obtained with one eight-port ACU using expansion hardware. Dialout activities may proceed in any order, but not simultaneously.

The *TN82 X.25 Level 2 Synchronous Data Link Interface*, a one-channel device, can provide one RS-232-C interface running at 9600 baud or one CCITT V.35 interface running at 56K bps. The X.25 Level 2 is implemented by the peripheral controller to free CPU time.

The *TN75 X.25 Level 2 Synchronous Data Link Interface*, a two-channel device, is arranged for full-duplex, private line, or dial backup operation. It provides two independent X.25 Level 2 channels. It can operate at 9600 bps full-duplex; in a typical configuration, one channel would operate at 9600 bps or two would operate at 4800 bps. The X.25 Level 2 is implemented by the peripheral controller to free CPU time.

The *UN141 X.25 Level 2 Synchronous Data Link Interface* is an eight-channel device providing essentially the same capabilities as the TN75. In the UN141, however, the hardware Level 2 interface is implemented in silicon. All channels can be set for 19.2K bps full-duplex; a burst of throughput, however, can cause the aggregate data rate per channel to become 9600 bps.

The *UN49 High-Speed Network Interface* allows 3B20S and 3B20A computers to communicate with other computer systems through a Network Systems Corporation Hyperchannel adapter network. A Hyperchannel network consists of adapters that interface computers and peripheral control units from various manufacturers to coaxial cable data trunks. In addition, the 3B20S and 3B20A support RJE protocols.

In 3B5 systems, communications control for peripheral interfaces is provided by the *Input/Output Accelerator (IOA)*, the WE 32000 microprocessor-based intelligent peripheral controller. The IOA supports a Virtual Protocol Machine/Common Synchronous Interface (VPM/CSI) implementation. In this environment, scripts using VPM primitives are downloaded and run on the IOA to provide protocol processing while Unix/VPM drivers supply the user interface. Drivers and scripts supporting the following hardware and protocols are available under Unix System V, Release 1: Unix character processing through both the Teletype Terminal Interface (TTI) and the Asynchronous Data Link Interface (ADLI), and RJE processing through the Synchronous Data Link Interface (SDLI). IOA firmware also provides support for an AT&T Teletype Model 5620 Dot Mapped Display (DMD) terminal through the ADLI or the IOA's on-board serial data port. As an alternative to the DMD, the IOA's on-board serial port can accommodate a high-speed asynchronous printer.

The *Synchronous/Asynchronous Data Link (SADL) Interface* provides eight serial, asynchronous or synchronous full-duplex channels with programmable data rates from 300 to 19.2K bits per second (bps) in async mode and 300 to 64K bps in sync mode. Synchronous communications require appropriate software to support the protocols. An IOA is required.

The *Asynchronous Data Link Interface (ADLI)* provides eight RS-232-C serial ports, which operate at speeds from 300 to 9600 bps; two ports may be configured for 801 ►

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► **Automatic Call Units (ACUs).** Unix character processing support is provided for the unaccelerated (CPU-controlled) ADLI using the standard Unix TTY driver, as well as for the IOA-controlled accelerated ADLI under the VPM environment.

The *Synchronous Data Link Interface (SDLI)* provides an eight-port interface for full-duplex synchronous data communications at up to 9600 bps using RS-232-C or RS-449 signal levels. This board is used in the IOA/VPM environment with drivers and scripts provided to support the RJE synchronous protocol.

The 3B5, 3B15, 3B20A, and 3B20S can be connected to *3BNet*, a high-speed local area network that provides a file-transfer network for systems operating within an area of over 540 yards (500 meters). The network operates at a transmission rate of 10M bits per second over coaxial cable. The network is intelligent, using WE 32000 microprocessor-based interfaces to deload all protocol, flow control, and maintenance overhead from attached host computers. The 3BNet is Ethernet-compatible, permitting connection of 3Bs to computers and peripherals supporting the Ethernet standard. The network allows users to select packet sizes (up to 4096 bytes on the 3B20S, the 3B20A, and the 3B5s). It also provides centralized administration with automatic backup, so users can monitor and configure the network from a single terminal. The 3BNet operates in conjunction with a package of network services contained in the 3Bs' Unix operating systems, allowing users to move data among machines and set network security.

The 3BNet protocol is a higher level Ethernet protocol that automatically constructs and processes packet header information. 3BNet hardware comprises the interconnect medium (IM), network interface (NI), transceiver, and transceiver power supply. Each host computer or peripheral device connects to the network through a network interface. The network interface is an intelligent link between the interconnect medium and the associated peripheral/computer device. The interconnect medium is a coaxial cable interconnecting all network interfaces through transceivers. A transceiver is placed in the coaxial cable at each point of connection to a network interface. Transceiver power is supplied through the host computer/peripheral device from a transceiver power supply on the 3B20S, 3B20A, and 3B5 series computers.

A maximum of 100 transceivers can be handled on the network, allowing up to 100 nodes for interconnection of Unix-based host computers or Ethernet-compatible peripheral devices. Up to 30 nodes can be 3B20S, 3B20A, or 3B5 systems; the rest can be AT&T's 3B2/300 supermicros. The 3BNet is a structured network in which one 3B20S, 3B20A, or 3B5 host computer node is defined as the master node, that is, the hub that handles administrative and security processes for the network.

Communication over the common interconnection medium is controlled through the Carrier Sense Multiple Access/Collision Detection (CSMA/CD) scheme. The 3BNet LAN also includes a software component that provides a user-level interface to the network, maintenance capabilities, network administration, and security features.

Information Systems Network (ISN) is AT&T Information Systems' proprietary local area network for building complexes and campuses; it permits networking of 3B family systems and computers from other manufacturers. ISN is based on a short, centralized bus architecture incorporating attributes of star networks, distributed buses, and distributed token rings.

The components of ISN include a packet controller that contains a high-speed, hardware-based packet switch for

virtual circuit data transport, features an 8.64M bps bus transmission speed, and serves up to 1,920 ports; a control console for system initialization and administration; and concentrators that statistically multiplex up to 40 EIA device ports to the packet controller through an optical fiber pair with an 8.64M bps transmission rate.

The ISN can use both fiber-optic and four-twisted-pair copper wire distribution cables. The copper wires link terminals or host computers, AT&T personal computers, and similar devices directly to the packet controller or to concentrators. The optical fibers form the backbone of the system, carrying multiplexed data between packet controllers and host computers, between packet controllers and concentrators, and among multiple packet controllers. ISN supports multiplexed fiber-optic interfaces to Digital Equipment Corporation VAX systems running under Unix System V. It can also be interconnected to AT&T's System 75 and System 85 PBXs.

A member of AT&T's Host Connectivity product family for AT&T/IBM networking, the *Communication Processor* provides support for multiple 3B computers. It is a node on an AT&T 3BNet network, and links the 3Bs on the network to IBM hosts for 3270 emulation services. Employing its own processor, disk drive, memory, special feature cards, and operating system, the Communication Processor manages protocol conversions between the asynchronous 3B computer environment and the IBM SNA/SDLC continuum. Two models of the Communication Processor are available. Model 1 emulates a channel or local connection to the IBM host; Model 2, designed for remote applications, emulates a 3270-type cluster controller.

Also available for AT&T/IBM networking environments is the *E4540 Information Display System*. The E4540 product group includes terminals compatible with IBM's 3278-2, 3278-5, 3178, and 3279-S2A (color) displays. The displays connect to remote controllers compatible with IBM 3276 and 3274 C-type controllers, supporting SNA/SDLC and BSC protocols and allowing attachment of up to 32 devices. (A Local Channel Controller for direct connection to IBM systems is also available.)

The *6500 Multifunction Communication System* provides simultaneous access to multihost systems and multitasking windows. All windows are active, allowing the user to view and work with four files at the same time. This can be accomplished with four different 3270 or asynchronous hosts, or with multiple sessions in a single host.

The *6544 Multifunction Communication Controller* is the heart of the 6500 Multifunction Communication System and contains a main processor module, a diskette drive for loading software, and 12 expansion module slots.

The *6500 Synchronous Host Module* provides up to three synchronous host ports and supports high data rates of 64,000 bps for SNA and 19,200 bps for BSC.

The *6500 Synchronous Device Interface Module* allows attachment of up to 16 synchronous displays, printers, and PCs via twisted-pair wire. Two modules may be installed to support up to 32 devices.

The *6500 Asynchronous Host/Protocol Conversion Module* provides for connections of up to eight asynchronous hosts or display terminals. Protocol conversion allows asynchronous terminals to access synchronous hosts (optional software required). The ports operate at up to 19,200 bps, although the aggregate speed for the entire module is 48,000 bps.

The *X.25 Interface Module* provides one port for IBM-compatible hosts supporting Network Control Program ►

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- Packet Switched Interface (NPSI) protocols. The connector can be optioned for either EIA RS-232-C for data rates up to 19,200 bps, or CCITT V.35 at 48,000, 56,000, or 64,000 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*, the operating system for the 3B20S, 3B20A, 3B5, and 3B15 computers, is a general-purpose, multiuser, multitasking, interactive operating system. The two major components of Unix System V are the file system and the shell, or command language.

The file system consists of a uniform set of directories and files arranged in a tree-like structure. Some features of the file structure are:

- Consistent naming conventions; file names can be fully qualified or relative to any directory in the file system hierarchy.
- Mountable and demountable file systems and volumes.
- File linking across directories.
- Automatic file space allocation and deallocation transparent to users.
- Flexible directory and file protection modes that allow all combinations of read, write, and execute access.
- Facilities for uniformly creating, accessing, moving, and processing files, directories, or sets thereof.
- Uniform device input/output handling among terminals, disk files, and main memory. Each physical input/output device, from interactive terminals to main memory, is treated like a file.

Unix System V supports file systems with 512- or 2048-byte blocks and 512- or 2048-byte buffers for enhanced file system throughput in operations requiring a large number of reads and writes.

The shell is the user/system interface program that interprets command links input by the user from a terminal. The Unix system shell is not only an interactive command language, but also a full programming language. It can be used to create scripts, which establish the operating environment by defining the variables and the conditional and interactive constructs under which commands and shell programs are executed. Through the shell, users can add to and change the environment according to specific individual and group requirements, adapting the operating system to varied and unique applications without resorting to compiled programs. The Unix Operating System typically runs unattended.

Other features of Unix System V include support for the C language; protection for disk file systems; access to the facilities of other (host) computer systems; development, diagnostics, system administration, system services, and text processing tools.

The 3B5 computers run Unix System V, Release 2.0, which supports swapping as a memory access method; an entire program must be loaded into memory before it can run. Unix System V, Release 2.1 runs on the 3B15; it supports demand paged memory management, in which portions of a program can be loaded into memory and executed. Release 2.1 also features mandatory record/file locking, enhanced file hard-

ening with dynamic bad block handling, and simplified system administration. The version of Unix System V running on the 3B20S and 3B20A incorporates all features of Release 2.1, except for simplified administration.

DATA BASE MANAGEMENT SYSTEM: Several standard relational DBMS products are available for the 3B5 and 3B15 systems through AT&T. Those include Ashton-Tate's *dBase II*; *AT&T Ingres*, a version of the Ingres DBMS originally developed by Relational Technology, Inc. (also available for the 3B20s); *Informix*, from Relational Database Systems, Inc.; *File-it!*, an Informix-compatible file manager for personal record keeping; *Unify*, a relational data base management system from Unify Corporation; and *Oracle*, from Oracle Corporation.

LANGUAGES: Languages available for the 3B computer family include C language, Basic, and Pascal. The 3B20 systems support Cobol, while the 3B5 and 3B15 also support RM/Cobol.

COMMUNICATIONS: For the 3B5 and 3B15, AT&T offers *Host Connectivity* software products for AT&T/IBM networking. The three members of the family are SNA/3270 Emulator+, BSC/3270 Emulator+, and 3270 Application Program Interface.

AT&T SNA/3270 Emulator+ allows an ASCII terminal user to access an SNA network and use the resources available to a 3278 display station user. The package emulates a remote 3274 cluster controller Model 51C, 3278 information display stations Model 2, and 3287 printers. *AT&T BSC/3270 Emulator+* is functionally the same as the SNA/3270 emulator, except it emulates bisynchronous protocol for the same devices in the 3270 family. Both emulators use the interface between the IOA (Input/Output Accelerator) and SDLI (Synchronous Data Link Interface) on 3B5 and 3B15 computers.

AT&T 3270 Application Program Interface (API) provides virtual terminal facilities, allowing the user of an ASCII terminal to access 3270 applications on a mainframe through a C-language-callable interface. The API appears to the mainframe as a 3278 display station. The 3270 API does not interface at the protocol level, so there is no SNA or BSC protocol-specific code; thus, the API can be used with both the SNA/3270 and BSC/3270 Emulator+ products.

AT&T also provides the *Unified Messaging Products* that include the Unified Messaging Manager and the Unified Messaging Link. These products provide the foundation for tying together telecommunications switches (such as AT&T System 75, System 85, and Dimension systems); text services and applications that reside on AT&T's processors; services that reside on computers using Unix System V, Release 2; and the AT&T Mail Network Service.

The *X.25 Network Interface* is a data transport package allowing a host processor to connect to a public packet switched network or another processor through a point-to-point, dial-up, or dedicated connection.

TCP/IP WIN+/3B Interface is a suite of application protocols for high-level networking services such as electronic mail, remote login, and file transfer between AT&T computers and other superminicomputers.

UTILITIES: Unix System V utilities are bundled with the core system. The following types of standard utilities are provided:

- System administration—for file system maintenance, measurement, and scheduling.
- Shell programming—to aid users in creating shell programs using Unix system commands, especially programs ►

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▶ that run in multiple Unix machine environments (for example, a shell program that allows the user to perform specific functions based on the type of processor in the system).

- Directory and file management—to provide single-step file and directory manipulation capabilities.
- User environment—to enhance the user interface to the Unix system environment and provide access to commands for controlling command priority and changing environmental variables, among others.
- Editing—providing both screen and text editors based on a consistent set of commands designed for use by both inexperienced and expert users.
- Calculator—to let the user employ the mathematical capabilities of the Unix operating system. The principal feature is an interactive processor for a language that resembles the C language but provides precision arithmetic.

Also available for the 3B5 and 3B15 computers is the *Software Generation System (SGS)*, a package of tools used to create and test programs for WE 32100 series microprocessors. The SGS includes 11 utilities that can perform the following functions, among others: check the contents of an object file; convert WE 32100 processor object files from one host machine format to another; compress object files by removing duplicate structure and union descriptors; disassemble object files to allow assembly-level debugging; dump selected parts of the named object files; generate an ordered listing of object files suitable for link editing in one pass; and perform symbolic debugging on C language code. Because the SGS operates under Unix System V, it can use features of the Unix system shell.

Available for the 3B20 systems is *S Software*. Integrated with Unix System V, S Software provides a language and system for analytical computing, data analysis, graphics, and data management.

All 3B computers support the *Unix-to-Unix Copy (UUCP)* utility of Unix System V. UUCP is a software-to-software facility that provides the capability to copy and send files from a resident 3B20 or 3B5 system to a remote Unix system.

Also available for the 3B5 and 3B15 computers are two special development packages. *C Programming Language Utilities, Issue 3* comprises a C compiler and associated programming tools for producing and debugging code. It provides IEEE P754 Draft 10 floating-point support, automatically making use of the WE 32106 MAU. *CFP+ Programming Language Utilities, Issue 1*, also comprising a C compiler and tools, works with the MAU to increase floating point performance to a reported maximum of 225K Whetstones per second.

System V Verification Suite (SVVS) is a set of test programs allowing hardware and software vendors to verify that System V ports conform to the AT&T System V Interface Definition (SVID). SVID is the specification for an operating system environment allowing applications software to be written independent of any particular computer hardware.

OFFICE AUTOMATION: Third-party office products like Handle, Q-Office, and Prevail are available for AT&T's 3B computer family through the company's Independent Software Vendor program.

APPLICATIONS: Among applications offered directly by AT&T are those for academic instruction, courseware development, communications management control, service operation management, time clock data collection and reporting,

retail management, and electronic publishing. A variety of commercial applications from third-party vendors are offered through AT&T's Independent Software Vendor program. Details on available software products are provided in the *AT&T Computer Software Guide*, published twice a year.

PRICING

POLICY: The 3B computers are available for purchase or lease. Volume discounts for all systems are available. List prices for all systems are quoted in the EQUIPMENT PRICES information following. The purchase price for software includes a onetime use license fee. Maintenance fees are provided on a monthly basis. Separate price schedules for spares and growth, software licensing, and fee schedules are also available.

Financing for the AT&T systems are also available through the AT&T Credit Corporation. Several financial options are available.

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

Hot line service can include remote diagnostics services in some cases. Calls will be accepted from any of a customer's employees; 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.
- Around-the-clock service, which extends coverage to 24 hours a day, seven days a week, including holidays.
- 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.

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 3B systems have 90-day warranties; during that period, customers receive Business day service and hot line assistance.

TRAINING: AT&T provides hardware and software training at national and regional centers. The company also provides on-premises training in complex software packages. These training courses are in areas that include data communications, data base management, PC training, programming tools, screen management, and spreadsheet.

TYPICAL CONFIGURATIONS: The following tables show typical 3B computer configurations. ▶

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▶ **AT&T 3B5/301:**

3B5/301 Core System; includes:	\$44,500
10MHz WE 32100 CPU with WE 32106 Math Acceleration Unit, 8KB cache memory	
Dual maintenance ports	
Two RS-232-C ports for maintenance and console	
Main memory controller	
2MB main memory board	
Integrated Disk File Controller	
Storage Module Drive Controller	
Unix System V operating system	
Cabinet	
Basic Control Unit	
Growth Control Unit	
160MB fixed disk drive	14,000
High-speed 1600 bpi tape drive and controller	14,000
Model 475 120-cps dot-matrix printer	593
Input/Output Accelerator	5,000
8-channel asynchronous interface	2,250
Eight Dataspeed 4410 terminals	7,560
TOTAL PURCHASE PRICE:	\$87,903

AT&T 3B15/201:

3B15/201 Core System; includes:	\$ 64,500
14MHz WE 32100 CPU with WE 32106 Math Acceleration Unit, 16KB cache memory	
Dual maintenance ports	
Two RS-232-C ports for maintenance and console	
Main memory controller	
2MB main memory board	
Integrated Disk File Controller	

Storage Module Drive Controller	
Unix System V operating system	
Basic processor cabinet	
Basic Control Unit	
Vertical growth cabinet	
Growth Control Unit	
2MB add-on main memory board	7,000
Two 340MB fixed disk drives	36,500
High-speed 1600 bpi tape drive and controller	14,000
Three Model 475 120-cps dot-matrix printers	1,779
Input/Output Accelerator	5,000
Three 8-channel asynchronous interfaces	6,750
24 Dataspeed 4410 terminals	22,680
TOTAL PURCHASE PRICE:	\$158,209

AT&T 3B20S:

3B20S Core System; includes:	\$139,000
CPU with 8KB cache memory	
2MB main memory	
Input/Output Processor and channel Disk File Controller	
Operator console and read-only console printer	
Unix System V operating system	
Two 2MB add-on memory boards	15,000
1600 bpi tape drive and formatter	23,250
Tape controller	5,000
Two 675MB single-port fixed disk drives	64,000
1,000-lpm band printer	14,995
Five 8-channel asynchronous communications controllers	20,000
48 Dataspeed 4410 terminals	45,360
TOTAL PURCHASE PRICE:	\$326,605

EQUIPMENT PRICES

		Purchase Price (\$)	Monthly Maint.* (\$)
CORE SYSTEMS			
3B5			
7350-101	3B5/101 core system; includes 7.2MHz WE 32000 CPU, 8KB cache, system cabinet, dual maintenance port function, two RS-232-C ports for console and maintenance, main memory controller, 2MB main memory board, Integrated Disk File Controller, Storage Module Drive Controller, basic control unit, and Unix System V	34,500	**
73609	10MHz WE 32100 CPU with Math Accelerator Unit (for 3B5/101)	5,000	**
7350-201	3B5/201 core system; includes CPU with Math Acceleration Unit, 8KB cache, dual maintenance port function, two RS-232-C ports for console and maintenance, main memory controller, one 2MB or two 1MB main memory boards, Integrated Disk File Controller, Storage Module Drive Controller, basic processor cabinet, vertical growth cabinet, basic control unit, growth control unit, and Unix System V	44,500	**
7350-301	3B5/301 core system; includes CPU with Math Acceleration Unit, 8KB cache, dual maintenance port function, two RS-232-C ports for console and maintenance, main memory controller, one 2MB or two 1MB main memory boards, Integrated Disk File Controller, Storage Module Drive Controller, basic processor cabinet, basic control unit, growth control unit, cooling fans, and Unix System V	44,500	**
7350-401	3B5/401 core system; includes CPU with Math Acceleration Unit, 8KB cache, two RS-232-C ports for console and maintenance, main memory controller, one 2MB memory board, Integrated Disk File Controller, Storage Module Drive Controller, basic processor cabinet, basic control unit, and Unix System V	37,500	**

NA—Not applicable.

NC—No charge.

**3B20D maintenance prices given are national averages; prices will vary depending on geographic location.

AT&T 3B Computer Family

		Purchase Price (\$)	Monthly Maint.* (\$)
▶ 3B15			
7355-101	3B15/101 core system; includes CPU with Math Acceleration Unit, 16KB cache, system cabinet, dual maintenance port function, two RS-232-C ports for console and maintenance, main memory controller, 2MB main memory board, Integrated Disk File Controller, Storage Module Drive Controller, basic control unit, and Unix System V	54,500	208.00
7355-201	3B15/201 core system; includes CPU with Math Acceleration Unit, 16KB cache, dual maintenance port function, two RS-232-C ports for console and maintenance, main memory controller, one 2MB or two 1MB main memory boards, Integrated Disk File Controller, Storage Module Drive Controller, basic processor cabinet, vertical growth cabinet, basic control unit, growth control unit, and Unix System V	64,500	208.00
7355-301	3B15/301 core system; includes CPU with Math Acceleration Unit, 16KB cache, dual maintenance port function, two RS-232-C ports for console and maintenance, main memory controller, one 2MB or two 1MB main memory boards, Integrated Disk File Controller, Storage Module Drive Controller, basic processor cabinet, basic control unit, growth control unit, cooling fans, and Unix System V	64,500	208.00
7355-401	3B15/401 core system; includes CPU with Math Acceleration Unit, 16KB cache, two RS-232-C ports for system console and maintenance, Central and Control Support, main memory controller, one 2MB memory board, Integrated Disk File Controller, Storage Module Drive Controller, Basic Control Unit, basic cabinet, Unix System V, Release 2.1 Demand Paging	57,500	**
3B20			
7420-240	3B20S core system; includes two CPUs, 2MB main memory, I/O processor and channel, disk controller, operator console and read-only console printer, and Unix System V	139,000	**
7420-260	3B20S preattached processor core system; same as 7420-240, but includes only one processor and expansion cabinet for second processor	159,000	**
7420-280	3B20A core system; includes CPU, 2MB main memory, I/O processor and channel, disk controller, operator console and read-only console printer, and Unix System V	194,000	**
MIGRATION KITS			
73650	3B5 to 3B15 migration kit	20,000	4.00
CPU OPTIONS			
3B5 and 3B15			
73686	Cache pack	4,800	**
3B20S/A			
74203	Floating-point unit (UN140)	9,500	**
74204	DMA-1 controller (UN46)	5,500	**
74205	Dual serial channel pack (UN9)	2,900	**
74206	Power module (495FA)	1,000	**
74210	Attached processor upgrade with cabinet	95,000	**
74211	Attached processor upgrade, CPU only	80,000	**
MEMORY OPTIONS			
3B5 and 3B15			
73602	1MB memory option (3B5/101)	NC	NC
73603	2MB memory option (3B5/201 and 301)	NC	NC
73604	1MB add-on memory pack	4,900	**
73605	2MB add-on memory pack	7,000	31.00
73684	Main store control for 2MB memory board (growth units)	2,385	
73685	First 2MB memory board (growth units)	7,500	**

NA—Not applicable.

NC—No charge.

**3B20D maintenance prices given are national averages; prices will vary depending on geographic location.

AT&T 3B Computer Family

		Purchase Price (\$)	Monthly Maint.* (\$)
▶ 3B20S/A			
74202	1MB memory board (TN28)	4,900	**
73605	2MB memory board (TN56)	7,000	**

INPUT/OUTPUT OPTIONS

The 3B20S, 3B20A, and 3B20D have optional Input/Output processors (IOPs) that provide common interfaces for peripheral and disk file controllers. The IOP comprises a basic section (BIOP) and a growth section (GIOP). The growth section supports an additional Disk File Controller (DFC). Options vary from package to package. The 3B5 and 3B15 systems have optional I/O Accelerators (IOA).

3B5 and 3B15

73610	I/O Accelerator	5,000	14.00
73611	Asynchronous port for I/O Accelerator	310	NA
73624	Extended Local Bus unit for growth	9,000	**

3B20S/A

74260	Basic IOP (TAG, SEC) and DSCH cable	18,000	**
74261	Basic IOP (PIOC-1)	18,000	**
74262	Growth IOP (TAG, SEC)	3,500	**
74263	Growth IOP (PIOC-1)	3,500	**
74264	Growth IOP controller and power unit	4,000	**

MASS STORAGE**3B5 and 3B15**

73633	Disk File Controller and two Storage Module Drive Controllers	7,000	40.00
73632	Disk File Controller and one Storage Module Drive Controller	5,000	27.50
73631	Storage Module Drive Controller	2,000	12.50
73635	340MB disk drive (279MB formatted)	15,250	113.00
73634	160MB disk drive (134MB formatted)	12,000	93.00
73638	48MB disk drive (40MB formatted)	9,000	213.00
73639	Cable and fan for 48MB disk drive	710	NA
73642	Cartridge for 48MB disk drive	485	**

3B20S/A

74265	Enhanced Disk File Controller and DSCH cable	13,000	**
74266	Disk File Controller (TN68-based) and DSCH cable	14,500	**
74267	Enhanced Disk File Controller upgrade kit	8,200	**
74280	300MB disk drive, single-port	24,000	**
74281	300MB disk drive, dual-port	26,000	**
74282	300MB dual-port upgrade kit	2,500	**
74283	Interlock kit for 300MB drive	295	**
74285	Disk pack for 300MB drive	1,200	**
74286	675MB disk drive, single-port	32,000	**
74287	675MB disk drive, dual-port	34,000	**
74288	675MB dual-port upgrade kit	2,500	**
74300/74302	340MB AC/DC disk drive, single-port	18,250	**
74301/74303	340MB AC/DC disk drive, dual-port	18,250	**
74304	340MB dual-port upgrade kit	2,500	**
74305	Rack mounting for AC drives	1,950	**
74306	Rack mounting for DC drives	1,650	**
74316/74318	Disk package, four 340MB AC drives	69,000	**
74317	Disk package, four 340MB DC drives	69,000	**

MAGNETIC TAPE EQUIPMENT**3B5 and 3B15**

73651	High-performance Integrated Tape Controller	6,500	21.00
73661	1600 bpi tape drive and standard controller	12,000	125.00

NA—Not applicable.

NC—No charge.

**3B20D maintenance prices given are national averages; prices will vary depending on geographic location.

AT&T 3B Computer Family

		Purchase Price (\$)	Monthly Maint.* (\$)
▶ 73662	Additional 1600 bpi tape drive	8,500	104.00
73663	1600 bpi tape drive with high-speed controller	14,000	138.00
73664	First 6250 bpi tape drive, standard speed	21,000	179.00
73665	First high-speed 6250 bpi tape drive	23,000	196.00
73666	Additional 6250 bpi tape drive	17,500	158.00

3B20S/A

74220	1600 bpi primary tape system	23,250	**
74221	1600 bpi add-on tape drive with formatter	19,000	**
74222	1600 bpi add-on tape drive without formatter	14,000	**
74223	1600/6250 bpi primary tape system (3B20S)	35,750	**
74224	1600/6250 bpi primary tape system (3B20A)	35,750	**
74227	1600/6250 bpi add-on tape drive	18,500	**
74229	1600 bpi tape controller	5,000	**

PRINTERS

**	Model 447 600-lpm band printer	10,995	**
**	Model 447X 1,000-lpm band printer	14,995	**
**	Model 470 120-cps dot-matrix printer	545	**
**	Model 475 120-cps dot-matrix printer	593	**
**	Model 476 120- ps dot-matrix printer	845	**
**	Model 5310 200-cps dot-matrix printer	1,285	**
**	Model 5320 200-cps dot-matrix printer	1,580	**

GRAPHICS PLOTTER

**	Model 435 plotter	1,898	**
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WORKSTATIONS

**	4410 terminal	945	**
**	4418 terminal	1,065	**
**	4425 terminal	1,295	**
**	5620 terminal; hardware and software, including 256KB of memory	5,000	**
**	5620 terminal; hardware and software, including 1MB of memory	6,000	**
**	610 BCT terminal	875	**

COMMUNICATIONS/NETWORKING OPTIONS

3B5 and 3B15

73612	8-channel asynchronous interface	2,250	7.00
73613	2-channel auto call interface	260	NA
73614	4-channel synchronous interface	6,200	20.75
73615	Additional 4-channel synchronous interface	335	NA
73616	4-channel Teletype Terminal Interface	5,400	27.00
73617	Additional 4-channel Teletype Terminal Interface	240	NA
73622	4-port synchronous/asynchronous interface	6,500	**
73623	Additional 4-port synchronous/asynchronous interface	310	NA
73624	Extended local bus with 12 I/O slots	9,000	**
73625	8-port Teletype Terminal Interface pack	5,640	33.00
73626	Additional 8 ports for Teletype Terminal Interface pack	480	NA
73618	3BNet interface	6,500	35.50
73619	3BNet transceiver and 10 m cable	50*	2.25
73620	3BNet transceiver and 30 m cable	655	2.25
73621	3BNet transceiver and 50 m cable	840	2.25

NA—Not applicable.

NC—No charge.

**3B20D maintenance prices given are national averages; prices will vary depending on geographic location.

AT&T 3B Computer Family

		Purchase Price (\$)	Monthly Maint.* (\$)
▶ 3B20S/A			
74241	8-channel asynchronous controller (TN4)	4,000	**
74242	2-channel asynchronous controller (TN74)	3,700	**
74243	8-channel automatic call unit (UN56)	2,750	**
74244	2-channel synchronous controller, RS-232-C (TN75)	4,100	**
74245	2-channel synchronous controller, RS-449 (TN75)	4,100	**
74246	1-channel X.25 controller, RS-232-C (TN82)	5,000	**
74247	1-channel X.25 controller, RS-422 (TN82)	5,000	**
74248	8-channel X.25 controller (UN141)	6,500	**
74249	4-channel bisynchronous controller (TN82/UN53)	7,500	**
74215	Interface to NSC Hyperchannel Network	4,300	**
74216	3BNet interface	6,500	**
73619	3BNet transceiver and 10 m cable	500	**
73620	3BNet transceiver and 30 m cable	655	**
73621	3BNet transceiver and 50 m cable	840	**
74217	Datakit interface	9,500	**
**	6544 Multifunction Communication Controller for the 6500 Communications System	7,800	**
**	Synchronous Host Add-on Expansion Module for the 6500 Communications System	2,400	**
**	Synchronous Device Interface Module for the 6500 Communications System	3,920	**
**	6550 Asynchronous Host/Protocol Conversion Module	2,215	**
**	6550 X.25 Interface Module	3,510	**

HARDWARE OPTIONS

3B5 and 3B15

73606	Expansion rack for extended local bus	8,000	29.00
73672	Vertical growth cabinet for two 48MB disk drives (Models 101 and 201)	2,500	NA
73673	Vertical growth cabinet for one 48MB disk drive and one fixed disk drive (Models 101 and 201)	2,500	NA
73674	Vertical growth cabinet for two fixed disk drives (Models 101 and 201)	2,500	NA
73675	Horizontal growth cabinet	3,000	NA
73601	Growth cabinet for Model 301	3,000	NA
73607	Model 301 growth cabinet tape door	1,245	**
73608	Model 301 growth cabinet with door	4,245	**
73695	Growth control unit	7,000	**

3B20S/A

74239	Half-door	1,000	**
74270	Expansion cabinet for I/O Processor or Disk File Controller	3,135	**
74271	Fan and fuse unit (SEC-0)	7,500	**
74272	Fan and fuse unit (TAG-3)	7,500	**
74273	Fan and fuse unit (TAG-3/SEC-4)	7,500	**
74274	Fan and fuse unit (SEC-5)	7,500	**
74310	Expansion cabinet for 340MB disk drives	3,135	**
74390	Earthquake bracing, 3-cabinet system	500	**
74391	Earthquake bracing, additional cabinet	150	**

NA—Not applicable.

NC—No charge.

**3B20D maintenance prices given are national averages; prices will vary depending on geographic location.

SOFTWARE PRICES

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

OPERATING SYSTEMS

The Unix System V operating system is bundled with 3B20S, 3B20A, 3B5, and 3B15 systems; the Unix RTR system for the 3B20D is priced separately. ▶

AT&T 3B Computer Family

		<u>List Price (\$)</u>
▶ 3B5 and 3B15		
1051-005	Unix System V, Release 1 to Release 2 upgrade	1,500
 COMMUNICATIONS		
1050-001	3BNet (3B5 and 3B15)	8,000
 UTILITIES		
1051-A01	C Programming Language Utilities, Issue 3	340
**	Unix System V Verification Suite	29,000 ■