IBM 4300 Series

MANAGEMENT SUMMARY

UPDATE: *Since this report was last updated, IBM has revamped the 4381 grouping, replacing Model Groups 1, 2, and 3 with Model Groups 11, 12, 13, and 14. In addition, the company has increased the memory available on the 4361 and provided that family with enhanced channeling capabilities and peripheral support. A magnetic tape subsystem and a tabletop nonimpact printer have also been debuted. In addition, IBM has raised hardware lease/rental and maintenance prices, as well as software license charges.*

The new 4381 family consists of three uniprocessor models—the entry-level Model Group 11 and the intermediate Model Groups 12 and 13—as well as the high-end Model Group 14 dual processor system. The older members of the 4381 grouping—Model Groups 1, 2, and 3—have been withdrawn from marketing.

The main storage capacities of the new processors range from 4MB to 32MB, depending upon the model. The uniprocessors feature six standard and six optional I/O channels, while the Model Group 14 dual processor has 12 standard and six optional channels. The uniprocessor models have a single high-speed cache buffer between main processor storage and the instruction processor. The dual processor model has one high-speed buffer for each instruction processor. Model Groups 13 and 14 take advantage of a faster chip technology that increases performance and reduces processor cycle time to 56 nanoseconds from the 68-nanosecond speed of Model Groups 11 and 12.

All models include features designed to enhance functionality in engineering/scientific applications. All have 64-bit arithmetic logic units and data paths. Model Groups 12, 13, and 14 include a high-speed hardware multiplier. In addition, engineering/scientific assists on each model reportedly reduce processor busy time by as much as 65 percent for the assisted functions. Among those assists are a Multiply and Add Facility that provides vector/scalar capability for all models; a Square Root Facility for all models; and a Mathematical Function Facility on Model Groups 12, 13,

Features both standard and optional make IBM's seven-model 4300 Series suitable for engineering/scientific applications, as well as for computation-intensive and high-throughput commercial environments. The 4300 Series provides both peripheral and software compatibility with other systems based on IBM's System/370 architecture.

MODELS: 4361 Model Groups 3, 4, and 5; 4381 Model Groups 11, 12, 13, and 14.
MEMORY: 2MB to 32MB.
DISK CAPACITY: 258MB to 5,160GB.
WORKSTATIONS: Up to 1,024.
PRICE: $56,500 to $855,000 (base processor complexes).

CHARACTERISTICS

MANUFACTURER: International Business Machines Corporation, Old Orchard Road, Armonk, New York 10504. Contact your local IBM representative.

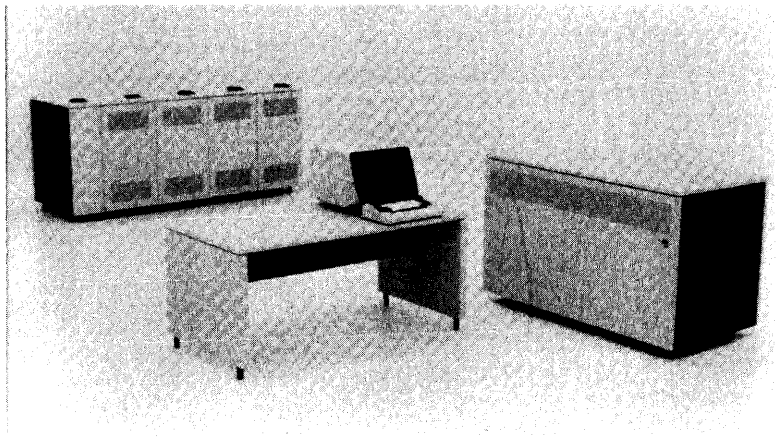
CANADIAN ADDRESS: IBM Canada Ltd., Markham, 3500 Steeles Avenue East, Markham, Ontario, L3R 2Z1 Canada. Telephone (416) 474-2111.

DATA FORMATS

BASIC UNIT: An 8-bit byte. Each byte can represent 1 alphanumeric character, 2 BCD digits, or 8 binary bits. Two consecutive bytes form a "halfword" of 16 bits, while 4 consecutive bytes form a 32-bit "word."

FIXED-POINT OPERANDS: Can range from 1 to 16 bytes (1 to 31 digits plus sign) in decimal mode; 1 halfword (16 bits) or 1 word (32 bits) in binary mode.

FLOATING-POINT OPERANDS: One word, consisting of 24-bit fraction and 7-bit hexadecimal exponent, in "short" format; 2 words, consisting of 56-bit fraction and 7-bit hexadecimal exponent, in "long" format; or 4 words, in "extended precision" format.



IBM's 4361 systems are targeted toward department-level computing functions in engineering/scientific and technical environments. The systems support up to 16MB of main memory and up to three high-speed block multiplexer channels for attachment of Direct Access Storage Devices (DASD) and other high-speed devices. The three 4361 models run in IBM's proprietary DOS/VSE, SSX/VSE, VM, and OS/VS1 operating environments.

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CHART A. SYSTEM COMPARISON

MODEL	4361 Model Group 3	4361 Model Group 4	4361 Model Group 5	4381 Model Group 11
SYSTEM CHARACTERISTICS				
Date of introduction	Sept. 1984	Sept. 1983	Sept. 1983	Feb. 1986
Date of first delivery	Dec. 1984	2nd quarter 1984	1st quarter 1984	May 1986
Operating system	DOS/VSE, SSX/VSE, VM/370, VM/SP, OS/VS1, IX/370	DOS/VSE, SSX/VSE, VM/370, VM/SP, OS/VS1, IX/370	DOS/VSE, SSX/VSE, VM/370, VM/SP, OS/VS1, MVS/370, IX/370	DOS/VSE, OS/VS1, MVS/SP, VM/SP, MVS/XA, VM/XA, IX/370
Upgradable from	Not applicable	4361-3	4361-3/-4	Not applicable
Upgradable to	4361-4/-5	4361-5	Not applicable	4381-12
MIPS	0.38 (approx.)	0.79	1.14	—
Relative performance (based on a rating of the 4381-12 at 1.0)*	—	—	—	0.44-0.60
MEMORY				
Minimum capacity, bytes	2M	2M	2M	4M
Maximum capacity, bytes	4M	16M	16M	16M
Type	MOS	MOS	MOS	MOS
Cache memory	8KB	8KB	16KB	4KB
Cycle time, nanoseconds	—	—	—	—
Bytes fetched per cycle	—	—	—	—
INPUT/OUTPUT CONTROL				
Number of channels	3	6	6	12
High-speed buses	2 opt.	1 std., 4 opt.	2 std., 3 opt.	5 std., 6 opt.
Low-speed buses	1 opt.	1 opt.	1 std.	1 std., 1 opt.
MINIMUM DISK STORAGE	258MB	516MB	516MB	635MB
MAXIMUM DISK STORAGE	262GB	645GB	645GB	1290GB
NUMBER OF WORKSTATIONS	1,024	1,024	1,024	1,024
COMMUNICATIONS PROTOCOLS	Bisync, SDLC, 3270, X.25, SNA, DIA/DCA	Bisync, SDLC, 3270, X.25, SNA, DIA/DCA	Bisync, SDLC, 3270, X.25, SNA, DIA/DCA	Bisync, SDLC, 3270, X.25, SNA, DIA/DCA

Note: A dash (—) in a column indicates that the information is unavailable from the vendor.
**Based on Internal Throughput Rate (ITR)—number of completed jobs or transactions per-processor-busy second.*

and 14 that includes short- and long-precision versions of exponentiation, common logarithm, and natural logarithm.

In the engineering/scientific connection, it must also be noted that an optional software system, the Vector Processing Subsystem/Vector Facility (VPSS/VF), allows users to run application programs developed on IBM's 3838 array processor in System/370-XA (Extended Architecture) mode on the 4381.

The entry-level Model Group 11 is available with main memory ranging from 4MB to 16MB. It employs a 4KB cache. Four 3MB high-speed datastreaming channels are standard.

Model Group 12 supports from 8MB to 32MB of main memory. Four 3MB channels are standard; two more can be added as options. Buffer storage on the Model Group 12 is 32KB.

Model Group 13 has four standard 3MB channels; five more can be added. The system has a 64KB cache memory, and supports from 8MB to 32MB of main storage.

The dual processor 4381 Model Group 14 incorporates two instruction processors operating under a single control program. Each processor has a 64KB cache and has access to a shared central storage and to its own set of channels.

INSTRUCTIONS: 2, 4, or 6 bytes in length, specifying 0, 1, or 2 memory addresses, respectively.

The 4300 Series processors employ the System/370 Universal Instruction Set. The instruction set includes complete arithmetic facilities for processing variable-length decimal and fixed-point binary operands, as well as instructions which handle loading, storing, comparing, branching, shifting, editing, radix conversion, code translation, logical operations, packing, and unpacking. In addition, a group of "privileged instructions," usable only by the operating system, handles input/output and various hardware control functions.

Also standard are some instructions that were optional on some models of the System/370. These include the dynamic address translation instructions of Load Read Address, Reset Reference Bit, Purge Translation Lookaside Buffer, Store Then AND System Mask, and Store Then OR System Mask; the VTAM support instructions of Compare and Swap and Compare Double and Swap; the OS/VS support instructions of Insert PSW Key, Set PSW Key from Address, and Clear I/O; and the extended precision floating-point instructions.

The *High Accuracy Arithmetic Facility (ACRITH)* is standard on all 4361 processors; it comprises a set of subroutines that can be called from VS Fortran or Assembler language programs. ACRITH implements floating-point instructions for the computation of the basic arithmetic operations (add, subtract, multiply, and divide) and the scalar (dot) product with maximum accuracy, providing direct rounding for the short and long floating-point hexadecimal formats. Maximum accuracy is defined as having no floating-point number between the rounded result and the exact result (at infinite precision).

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CHART A. SYSTEM COMPARISON (Continued)

MODEL	4381 Model Group 12	4381 Model Group 13	4381 Model Group 14
SYSTEM CHARACTERISTICS			
Date of introduction	Feb. 1986	Feb. 1986	Feb. 1986
Date of first delivery	April 1986	April 1986	April 1986
Operating system	DOS/VSE, OS/VS1, MVS/SP, VM/SP, MVS/XA, VM/XA, IX/370	DOS/VSE, OS/VS1, MVS/SP, VM/SP, MVS/XA, VM/XA, IX/370	MVS/SP, VM/SP, MVS/XA, VM/XA, IX/370
Upgradable from	4381-11	4381-12	4381-13
Upgradable to	4381-13	4381-14	Not applicable
MIPS	—	—	—
Relative performance (based on a rating of the 4381-12 at 1.0)*	1.0	1.21-1.35	1.65-2.45
MEMORY			
Minimum capacity, bytes	8M	8M	16M
Maximum capacity, bytes	32M	32M	32M
Type	MOS	MOS	MOS
Cache memory	32KB	64KB	64KB per CPU
Cycle time, nanoseconds	—	—	—
Bytes fetched per cycle	—	—	—
INPUT/OUTPUT CONTROL			
Number of channels	12	12	18
High-speed buses	5 std., 6 opt.	5 std., 6 opt.	10 std., 6 opt.
Low-speed buses	1 std., 1 opt.	1 std., 1 opt.	1 std., 1 opt.
MINIMUM DISK STORAGE	635MB	635MB	2.5GB
MAXIMUM DISK STORAGE	1935GB	2903GB	5160GB
NUMBER OF WORKSTATIONS	1,024	1,024	1,024
COMMUNICATIONS PROTOCOLS	Bisync, SDLC, 3270, X.25, SNA, DIA/DCA	Bisync, SDLC, 3270, X.25, SNA, DIA/DCA	Bisync, SDLC, 3270, X.25, SNA, DIA/DCA

Note: A dash (—) in a column indicates that the information is unavailable from the vendor.
**Based on Internal Throughput Rate (ITR)—number of completed jobs or transactions per-processor-busy second.*

The system cannot be partitioned into two distinct uniprocessor systems. Main memory on the system ranges from 16MB to 32MB. Ten 3MB channels are standard; six more can be added as options.

The new 4381 processors are air cooled. IBM states that they all occupy the same floor space and can be installed with or without a raised floor, allowing installation either in data processing centers or in end-user work areas.

According to IBM, the new processors use existing attachment interfaces. All devices attached to a 4381 Model Group 1, 2, or 3 processor can attach to the new models. Any program written to operate in System/370 or System/370-XA mode operates on any 4381 in the appropriate mode, unless it is subject to timing, system facility, or architectural dependencies. The dual processor 4381 Model Group 14 is intended to operate under MVS or VM using multiprocessing with shared real storage in a multitasking/multiprogramming environment. Within that environment, any program written for System/370 or System/370-XA mode operates on the system in the appropriate mode, subject to the aforementioned dependencies. Similarly, any program written for System/360 operates on a 4381 processor in System/370 mode.

For the 4361, IBM has introduced Model N4 of Model Group 4 and Model N5 of Model Group 5, each containing 16MB of main memory; that increases the maximum memory available in either model group from 12MB. The 16MB memory maximum is supported by current releases of VM/SP, VSE/SP in IBM 4361 ECPS/VSE mode, and

The ACRITH Subroutine Library includes complex extensions for the following: standard functions (23 for short and 23 for long format), inclusion of complex zeroes of polynomials with complex coefficients, complex vector and matrix operations, and a linear system solver for complex matrices. Also included are a linear system solver for sparse matrices, a nonlinear system solver for systems of nonlinear equations, and MVS/XA 31-bit-mode support.

The *Floating-Point Accelerator* is optional on the 4361 Model Group 3 and standard on the 4361 Model Groups 4 and 5. The accelerator executes frequently used floating-point multiply instructions in VLSI gate array hardware, instead of in microcode. IBM states that the feature improves the execution of these instructions by a factor of 3 to 8.

The *Engineering/Scientific Assist*, standard on the 4381, is designed to improve the performance of certain mathematical computations, such as matrix inversion, decomposition, and multiplication. Engineering/Scientific Assist reportedly reduces processor busy time by up to 65 percent for assisted functions. It includes a Multiply and Add Facility that provides vector/scalar capability for all models, a Square Root Facility on all models, and a Mathematical Function Facility on Model Groups 12, 13, and 14. The Mathematical Function Facility includes short and long precision versions of exponentiation, common logarithm, and natural logarithm. The Engineering/Scientific Assist is supplied on a microcode diskette and installed as part of the Initial Microcode Load (IML) process.

INTERNAL CODE: EBCDIC (Extended Binary-Coded Decimal Interchange Code).

MAIN STORAGE

TYPE: SAMOS (silicon and aluminum metal oxide semiconductor) process N-channel FET (field effect transistor).

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CHART B. MASS STORAGE

MODEL	3310	3350	3370	3375	3380 Models A4, AA4, B4	3380 Models AD4, BD4	3380 Models AE4, BE4
Type	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
Controller model	Integrated	3830-2 or 3880-1, -2, or -21	3880-1, -2, or -4	3880-1, -2, or -4	3880-2, -3, or -23 (-23 for AA4 and B4 only)	3880-3 or -23	3880-3 or -23
Drives per subsystem/ controller	4	8-32	16-32	16-32	8-16	8-16	8-16
Formatted capacity per drive, megabytes	64.5	317.5 per HDA	571-730	819.7	1260 per HDA	1260 per HDA	2520 per HDA
Number of usable surfaces	—	—	—	—	—	—	—
Number of sectors or tracks per surface	358 tracks	—	—	—	—	—	—
Bytes per sector or track	512/sector	19,069/track	—	—	—	—	—
Average seek time	27 ms	25 ms	19 ms	19 ms	16 ms	15 ms	17 ms
Average rotational/relay time	9.6 ms	8.4 ms	10.1 ms	10.1 ms	8.3 ms	8.3 ms	8.3 ms
Average access time	36.6 ms	33.4 ms	29.1 ms	29.1 ms	24.3 ms	23.3 ms	25.3 ms
Data transfer rate	1.03MB/sec.	1.2MB/sec.	1.86MB/sec.	1.86MB/sec.	3MB/sec.	3MB/sec.	3MB/sec.
Supported by system models	4361	All	All	All	All except 4361-3	All except 4361-3	All except 4361-3
Comments	Model A2 includes 2 drives and supports up to 2 more.	Fixed head models available. Model A2 includes logic and power for up to three B2s or two B2s and one C2.	Model A units include logic and power for up to three B units.	Model A1 includes logic and power for up to three B1s or two B1s and one D1.	Strings headed by Model AA4 can intermix with strings headed by Models AD4 and AE4.	AD4 can control up to three BD4 or BE4 drives.	AE4 can control up to three BD4 or BE4 drives.

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

MVS/SP (on Model Group 5). For support in System/370 mode, VSE/SP version 2.1.1 or later is required.

According to IBM, the additional 4MB provide a base for further application growth and allow more concurrently logged-on interactive users in existing installations under the VM/CMS, VSE/SP, and MVS/TSO (for Model Group 5) environments. The company projects that, in storage-constrained environments, the new memory maximums will allow up to 10 percent faster response time in intensive VM/CMS environments and up to 20 percent more VM/CMS and MVS/TSO users.

IBM has also removed differences in channel configurability between Model Group 4 and Model Group 5 by providing Model Group 4 with an optional second block multiplexer channel, complementing the one already stan-

The SAMOS process relies on silicon or silicon compounds to enhance gate reliability and to control chip surface leakage.

CYCLE TIME: See Chart A.

CAPACITY: Main memory capacity on the 4300 Series ranges from 2MB to 32MB. See Chart A for capacities of specific models.

CHECKING: All data paths between the central processor and main storage are parity-checked by byte. When data is stored, an error-correcting code is substituted for the parity bits. (An 8-bit modified Hamming code is appended to each 8-byte "doubleword" of data.) When the data is retrieved, single-bit errors are detected and corrected automatically, and most multiple-bit errors are detected and signalled so that appropriate program action can be taken.

The 4381 systems provide double-bit error detection and correction when the double-bit error consists of one solid failure and one intermittent failure.

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dard on the system. (Model Group 5 has two BMPX channels as standard features.) A third high-speed BMPX channel is permitted on Model Group 4 for channel-only configurations. Two additional DASD/8809 adapters are available for Model Group 4 for integrated adapter configurations. According to IBM, those extensions to the I/O configuration capabilities of the 4361 Model Group 4 allow attachment of more DASD (disk devices), tapes, graphics display stations, and printing devices to enhance throughput in office, graphics, design and simulation, manufacturing, business planning, network control, commercial data base, and batched output applications.

In addition, IBM 4245 Printer Models D12 (1200 lpm) and D20 (2000 lpm) can now be attached to the Work Station Adapter and to the Display/Printer Adapter on all 4361 model groups. The printers can be attached to either of the adapters as terminal printers or to the Work Station Adapter as system printers. Physical attachment can be by coaxial cable (up to 3,000 meters/9,840 feet) or the IBM Cabling System (up to 600 meters/2,000 feet).

Models A22 and B22 of IBM's 3480 magnetic tape subsystem can now be attached to high-speed block multiplexer channel number 1 on the 4361 Model Group 3, and to high-speed BMPX channel 1, 2, or 3 on Model Groups 4 and 5, when operated in streaming mode. It can also be attached to any block multiplexer channel or high-speed BMPX channel when operated in DC interlock mode.

Also, IBM's 3880 storage control Models 21 and 23 can be attached to high-speed block multiplexer channel 1 or 2 on the 4361 Model Group 5. Model 21, which offers cache storage of 8, 16, 32, 48, or 64 megabytes, combines with the 3350 DASD to form a page/swap subsystem. Model 23, which has two storage directors and provides the same range of cache as Model 21, joins with the 3380 DASD to form a high-performance subsystem for application data.

Although IBM admits that the two 3880 models are intended mainly for large System/370 machines, it claims that the new attachability serves 4361 Model Group 5 installations where the computer is used as a test system; where migration to a 4381, 308X, or 3090 is planned; or where the system shares data with a larger processor and requires or would benefit from attachment of 3880 Model 23.

The IBM 3422 magnetic tape subsystem is a 10½-inch unit that can read or record data at selectable speeds of 1600 and 6250 bits per inch (bpi). It operates at 125 inches per second (ips) and has autothread/autoload capabilities. Data transfer rates are 200KB per second at 1600 bpi and 780KB per second at 6250 bpi. Three options are available: a data-streaming feature that allows a channel transfer rate of either 2MB or 3MB per second; a two-channel switch, which allows the 3422 to be addressed by two separate I/O channels; and a communicator, which connects two control units and allows either controller to address up to 16 tape units.

The 3812 page printer is a tabletop nonimpact page printer that uses Light Emitting Diode (LED) printhead technol-

STORAGE PROTECTION: The Store and Fetch Protection features, which guard against inadvertent overwriting or unauthorized reading of data in specified blocks of storage, are standard in all models.

In the 4381, segment protection is provided in System/370 mode and page protection in System/370-XA mode. All models of the 4381 support system control program use of 2K or 4K storage protect keys when the processor storage is no more than 16MB. Only 4K storage protect keys are supported when processor storage is more than 16MB.

RESERVED STORAGE: The 4361 includes 150K bytes of reloadable control storage which is not available to the user. In addition, approximately 350K bytes of processor storage are occupied by microcode, RAS (reliability, availability, and serviceability) workspace, and system data.

Information is unavailable for reserved storage on the 4381.

CACHE MEMORY: Cache memory, also referred to as buffer storage, is transparent to all programs. Uniprocessor 4381 systems have a single high-speed buffer between the main processor storage and the instruction processor; the dual processor Model Group 14 has one high-speed buffer for each instruction processor. Refer to Chart A for the sizes of the caches on individual machines.

CENTRAL PROCESSORS

GENERAL: The 4300 Series processors are heavily microprogrammed processors that feature LSI technology, one-level addressing facility, virtual storage capability by dynamic addressing, channels with virtual storage, and System/370 Universal Instruction Set. CE maintenance support functions include support processors and remote support facilities. In addition, the following features are standard on all 4300 Series systems: store and fetch storage protection, byte-oriented operands, clock comparator and CPU timer, time-of-day clock, interval timer, control storage, PSW Key handling, control registers, extended precision floating point, machine check handling, and program event recording.

Microcode is loaded through the system diskette drive. The several diskettes supplied with the system contain field engineering diagnostics, basic system features, and optional system features selected by the user. The system diskette facility also allows storage of failure data from the 4300 Series processors. This data can be subsequently analyzed by field engineering for maintenance purposes.

The no-charge Problem Analysis Feature allows 4381 users to identify valid hardware problems as the cause of system interruptions. Screen-prompted instructions lead the user through the steps required to solve the problem. Using the Remote Support Facility, service information can be sent to and received from IBM Field Engineering. The Remote Operator Console Facility (ROCF) is used to run a subset of Problem Analysis from the user installation.

The 4361 comes equipped with a Problem Finder Facility, a hardware diagnostic tool invoked by the customer. Detailed information on machine failures, suspected hardware problem sources, and the need for a service call are communicated to the customer.

Also available for the 4361 is an optional Auto Start feature that provides for preprogrammed and remote system power-on. With this feature, the system can be automatically powered on at a predetermined time and day of the week, or it can be started up remotely via the ROCF. The 4361 processors also include a programmable power-off function as a standard feature.

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CHART C. WORKSTATIONS

MODEL	3178	3179	3180	3278
DISPLAY PARAMETERS				
Max. chars./screen	1,920	1,920	1,920 to 3,564	960 to 3,564
Buffer capacity	—	—	—	—
Screen size (lines x chars.)	24 x 80	24 x 80	24 x 80 to 27 x 132	12 x 80 to 27 x 132
Tilt/swivel screen	Standard	Standard	Standard	No
Symbol formation	7 x 14 dot-matrix	7 x 14 dot-matrix	8 x 11 to 8 x 8 dot-matrix	7 x 12 or 7 x 14 dot-matrix
Character phosphor	—	Green (monochrome mode)	—	—
Total colors/no. simult. displayed	None	7 displayed	None	None
KEYBOARD PARAMETERS				
Style	75-key data entry or 85-key typewriter	Typewriter	Data entry or typewriter	Data entry or typewriter
Character/code set	94	94	—	94
Detachable	Yes	Yes	Yes	Yes
Program function keys	10 or 24	24	24	12
TERMINAL INTERFACE	Display/Printer Adapter, Work Station Adapter	Display/Printer Adapter, Work Station Adapter	Display/Printer Adapter, Work Station Adapter	Display/Printer Adapter, Work Station Adapter

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

CHART C. WORKSTATIONS (Continued)

MODEL	3290	6580	8775
DISPLAY PARAMETERS			
Max. chars./screen	9,920	6,600	2,560 or 3,440
Buffer capacity	24K characters	128KB (RAM)	—
Screen size (lines x chars.)	62 x 160	25 x 80 or 66 x 100	12, 24, 32, or 43 x 80
Tilt/swivel screen	Tilt standard	Standard	—
Symbol formation	5 x 8 char. matrix	8 x 16 dot-matrix	9 x 16 or 9 x 12 dot-matrix
Character phosphor	Orange	—	—
Total colors/no. simult. displayed	None	Not applicable	Not applicable
KEYBOARD PARAMETERS			
Style	Typewriter	Typewriter	Typewriter
Character/code set	—	96 (92 opt.)	75 or 94 EBCDIC
Detachable	Yes	Yes	Yes
Program function keys	24	Yes	10, 12, or 24
TERMINAL INTERFACE	3274 Control Unit	Display/Printer Adapter, Work Station Adapter, 3274 Control Unit	3705 or 3725 Communications Controller

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

ogy. The 3812 has no moving parts. It delivers letter-quality print, text, and all-points-addressable graphics at speeds up to 12 pages per minute. It has a print resolution of 240 by 240 dots per inch and supports merged text and graphics printing. The 3812 can be connected to VM hosts through an IBM 3705 or 3725 communications controller or through the Communications Adapter of the 4361 processor, using an RS-232-C bisync line, the 3812's bisynchronous communications feature, and a support program called Pageprinter VM Support.

On the price front, IBM has increased monthly lease/rental charges for most machines, including features and Requests for Price Quotation (RPQs), by approximately 8 percent. Minimum maintenance charges, additional maintenance and additional monthly maintenance charge rates, monthly use charge rates, warranty option charges, and central facility maintenance service monthly charges have also been increased by the same percentage for selected machines, features, and RPQs. IBM National Service Divi-

The 4381 features an 8-byte (64-bit)-wide data flow within the processor, as well as an 8-byte-wide data flow among the processor, storage, and channels. Data flow within the 4361 ranges from 4 to 8 bytes wide.

On the 4361, the mode of operation is selected at initial program load (IPL) time; on the 4381, at initial microcode load (IML) time. One operating mode is the Extended Control Program Support (ECPS:VSE) mode, which utilizes the extensive microcoding facilities of the 4300 to reduce DOS/VSE or SSX/VSE overhead and improve system throughput. Another operating mode, 370 mode, has three options on the 4361. On the 4361, the Basic Control (BC) option provides for execution of System/360 programs, the Extended Control (EC) option provides for execution of programs that require dynamic address translation facilities, and the ECPS:VM/370 option provides improved system performance with VM/370.

Two modes of operation are supported on the 4381: 370 mode and 370-XA mode. When the 4381 is operating in 370 mode, support is provided by MVS/SP-JES2 or MVS/SP-JES3, VM/SP, DOS/VSE with VSE/AF, and OS/VS1 with Basic Programming Extensions. When operating in

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CHART D. PRINTERS

MODEL	3203 Model 5	3262 Models 1 & 3	3262 Models 11 & 13	3268 Models 2 & 2C	3287 Models 1, 1C, 2, 2C
Type	Train	Band	Band	Matrix	Matrix
Speed	1200 lpm	650 lpm (48-char. set)	325 (48-char. set)	340 cps	80/120 cps
Bidirectional printing	Not applicable	Not applicable	Not applicable	Yes	Yes
Paper size	3.5-20 in.	3.5-16 in.	3.5-16 in.	16 in.	3-15 in.
Character formation	Full	Full	Full	Dot-matrix	Dot-matrix
Horizontal character spacing (char./inch)	10	10	10	10 or 16.7	10
Vertical line spacing (lines/inch)	6 or 8	3, 4, 6 or 8 (Mod. 1); 6 or 8 (Mod. 3)	3, 4, 6, or 8 (Mod. 11); 6 or 8 (Mod. 13)	3, 4, 6, or 8	6 or 8
Character set	48	48, 64, 96, or 128	48, 64, 96, or 128	48, 64, 96, or 128	EBCDIC, ASCII
Controller/Interface	Integrated	Integrated	Integrated	Integrated	Integrated
No. of printers per controller/ interface	Varies with available channel position	2 on Mod. 1; varies on Mod. 3	2 on Mod. 11; varies on Mod. 13	1	2-3
Printer dimensions, in. (h x w x d)	—	—	—	—	—
Graphics capability	No	No	No	Yes	Yes
Comments		4361 only	4361 only	Model 2C has color print capability.	Models 1C & 2C have color print capability.

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

CHART D. PRINTERS (Continued)

MODEL	3812	3820	4245 Models 12 & D12	4245 Models 20 & D20	4248 Model 1
Type	Nonimpact (LED)	Laser	Band	Band	Band
Speed	12 ppm	20 ppm	1200 (48-char. set)	2000 (48-char. set)	2000 to 3600 lpm
Bidirectional printing	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Paper size	—	Up to 14 in. long	3.5 to 22 in. wide	3.5 to 22 in. wide	3.5 to 22 in. wide
Character formation	Electrophotographic	Laser	Full	Full	Full
Horizontal character spacing (lines/inch)	Variable	Variable	10	10	10
Vertical line spacing (lines/inch)	Variable	Variable	6 or 8	6 or 8	6 or 8
Character set	Variable fonts	Variable fonts	48-124	48-124	48, 50, 63, 94, or 124
Controller/Interface	3705 or 3725 Comm. Controller	3705 or 3725 Comm. Controller, or 4361 ICA	Integrated	Integrated	—
No. of printers per controller/ interface	—	—	—	—	—
Printer dimensions, in. (h x w x d)	15 x 27 x 19	47 x 60 x 26.5	—	—	—
Graphics capability	240 x 240 dots/in.	240 x 240 dots/in.	No	No	—
Comments		Remote printer under MVS; direct attachment under VSE			Attachment to byte multiplexer channel not recommended.

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

sion hourly (per-call) service rates have been increased by approximately 15 percent. The company has also increased monthly license charges, initial license charges, and one-time charges for the basic license and Distributed Systems License Option (DSLO) of selected licensed programs.

All 4300 Series processors offer full System/370 compatibility. They can operate in System/370-compatible mode or in an extended control program (ECPS) mode; the 4381 processors, as mentioned previously, can operate in System/370-XA mode, which provides compatibility with larger systems. ECPS mode is designed to take full advantage of the extensive microcoding available in these machines to reduce operating system overhead and improve system throughput.

According to IBM, the 4361 processors are particularly suited for commercial, office, and interactive problem solving, and for engineering/scientific applications. The

370-XA mode, the 4381 will support MVS/SP-JES2 and MVS/SP-JES3 and the VM/XA Migration Aid. The Start Interpretive Execution (SIE) assist reportedly provides improved performance for V=R preferred guests under the Virtual Machine/Extended Architecture (VM/XA) Systems Facility.

With ECPS:VSE, a reduction of up to 20 percent of total CPU time has been measured by IBM when compared with the same version of DOS/VSE running in a typical DB/DC environment without ECPS:VSE. Likewise, with ECPS:VS1, a reduction of up to 7 percent of CPU busy time for the OS/VS1 supervisor has been measured by IBM when compared to the same version of OS/VS1 without ECPS:VS1. With ECPS:VM/370, a reduction of up to 84 percent of CPU busy time for the VM/370 control program has been measured by IBM when compared to the same version of VM/370 running without ECPS:VM/370.

The 4361 employs three independent processors: the instruction processor, the input/output processor, and the service processor. The instruction processor includes a high-speed cache buffer, a three-port local store, high-speed instruction processing, a 370 instruction buffer, a floating-

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CHART E. MAGNETIC TAPE EQUIPMENT

MODEL	3420 Model 3	3420 Model 5	3420 Model 7	3420 Models 4, 6, & 8	3422	3410/3411 Model 1
TYPE	Cartridge	Cartridge	Cartridge	Cartridge	Reel-to-reel	Reel-to-reel
FORMAT						
Number of tracks	7; 9	7; 9	7; 9	9	—	7; 9
Recording density, bits per inch	556/800; 1600/800	556/800; 1600/800	556/800; 1600/800	1600/6250	1600/6250	200/556/800; 1600/800
Recording mode	NRZI; PE/NRZI	NRZI; PE/NRZI	NRZI; PE/NRZI	PE/GCR	—	NRZI; PE/NRZI
CHARACTERISTICS						
Controller model	3803	3803	3803	3803	3422	3411
Drives per controller	1-16	1-8	1-8	1-8	8 (16 w/2-channel switch)	1-6
Storage capacity, bytes	—	—	—	—	—	—
Tape speed, inches per second	75	125	200	75; 125; 200	125	12.5
Data transfer rate, units per second	41.7KB/60KB; 120KB/60KB	69.5KB/100KB; 200KB/100KB	111KB/160KB; 320KB/160KB	120KB/470KB; 200KB/780KB; 320KB/1.25MB	200KB/700KB	2.5KB/6.9KB/ 10KB; 20KB/10KB
Streaming technology	No	No	No	No	No	No
Start/stop mode; speed	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Switch selectable	Yes	Yes	Yes	Yes	Yes	Yes
COMMENTS					Model A1 can control up to 7 Model B1 drives	

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

CHART E. MAGNETIC TAPE EQUIPMENT (Continued)

MODEL	3410/3411 Model 2	3410/3411 Model 3	3430	3480	8809
TYPE	Reel-to-Reel	Reel-to-Reel	Reel-to-Reel	Cartridge	Cartridge
FORMAT					
Number of tracks	7; 9	7; 9	9	18	9
Recording density, bits per inch	200/556/800; 1600/800	200/556/800; 1600/800	1600/6250	38K	1600
Recording mode	NRZI; PE/NRZI	NRZI; PE/NRZI	PE	—	PE
CHARACTERISTICS					
Controller model	3411	3411	3430	A22	8809
Drives per controller	1-16	1-6	1-4	1-8	1-6
Storage capacity, bytes	—	—	—	200MB	—
Tape speed, inches per second	25	50	50	79	100
Data transfer rate, units per second	5KB/13.9KB/20KB; 40KB/20KB	10KB/27.8KB/40KB; 80KB/40KB	80KB or 312KB	3MB	20KB or 160KB
Streaming technology	No	No	No	Yes	Yes
Start/stop mode; speed	Not applicable	Not applicable	Not applicable	—	12.5 ips
Switch selectable	Yes	Yes	Yes	Yes	Yes
COMMENTS					Supported on 4361 only.

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

4361 incorporates separate instruction and I/O processing units to enhance system throughput. The 4361 Model Group 3 can have up to three optional I/O channels. The Model Group 4 comes equipped with one standard channel, with five additional channels available as options. On the Model Group 5, three I/O channels are standard and an additional three are optional. The 4361 Model Group 3 can be field upgraded to a Model Group 4 or 5, and the Model Group 4 can be upgraded to a Model Group 5.

All 4361 models support the Work Station Adapter (WSA) and the Serial OEM Interface (SOEMI), both of which increase the flexibility of 4361 configurations. The WSA, optional on all models, permits direct attachment of up to 32 peripheral devices and intelligent workstations through the 3299 Terminal Multiplexer. The SOEMI, which is standard on all 4361 Display/Printer Adapters and Work Station Adapters, permits the connection of OEM devices

point multiply unit, an arithmetic and logic unit, a function control element, and control storage. The Input/Output Processor includes a separate channel processor for independent I/O processing, a data mover buffer, and channels for control unit attachment and integrated I/O adapters. The service processor includes the Problem Finder Facility for detecting and recording recoverable errors, the Remote Operator Console Facility (ROCF), the Remote Service Facility for problem diagnosis performed away from the 4361, and controls for dual diskette drives and system console attachment.

The 4381 consists of four separate functional units: a memory subsystem, an instruction processing unit, a channel subsystem, and a maintenance subsystem. The memory subsystem features main storage, a high-speed buffer, a swap buffer, and a memory control unit. The instruction processing unit includes a shifter (to and from memory), a storage address register, an arithmetic logic unit, local storage, control storage, and an instruction buffer; it also includes a high-speed hardware multiplier in 4381 Model Groups 12, 13, and 14. The channel subsystem includes

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from various manufacturers, including equipment for such applications as robotics, process control, and voice response/recognition. The 4361 processors also include Auto Start and Programmable Power-Off features.

The 4300 Series processors allow attachment of most peripheral devices supported by IBM's System/370 and 303X, 308X, and 3090 Series computers, including 3310 (4361 only), 3350, 3370, 3375, and 3380 Direct Access Storage Devices; the 3830 and 3880 Storage Control Devices; the 3410/3411, 3420, 3430, 3480, and 8809 (4361 only) Magnetic Tape Units; and the 4245, 4248, and 3820 Printers.

All 4300 Series processors require a 3278-2A or 3205 display console as an operator console. Up to three additional consoles or 3287 Printers (for a total of four devices) can be attached to the 4381 processors. The Display/Printer Adapter on the 4361 processors can accommodate as many as 15 additional display units or printers. With the optional Work Station Adapter, the 4361 can support up to 40 devices: eight on the Display/Printer Adapter and 32 on the Work Station Adapter.

The principal operating systems available for the 4300 Series processors include DOS/VS Extended (DOS/VSE), SSX/VSE, OS/VS1, Virtual Machine Facility/370 (VM/370), VM/System Product (VM/SP), MVS, and MVS/XA. IX/370, a Unix guest system, is also available.

DOS/VSE is a major expansion of DOS/VS, incorporating functional and I/O support. However, DOS/VSE provides only limited multiprogramming capabilities without the DOS/VSE Advanced Function product, an independently priced adjunct that allows the DOS/VSE user to employ up to 12 partitions and also makes it possible to incorporate many of the new program products available with the system.

SSX/VSE (Small Systems Executive/VSE) is a pregenerated, preconfigured subset of DOS/VSE designed for users with limited data processing skills. SSX/VSE supports batch or interactive applications on 4361 processors operating in standalone or distributed environments.

OS/VS1 provides support for the 4361 and 4381 processors in System/370 mode. Although IBM plans no further releases of OS/VS1, that system is highly compatible with the MVS operating system used on large systems. OS/VS1 performs job management, task management, data management, and recovery management routines, as well as I/O load balancing.

With VM/370, the 4300 user can operate in mixed-mode environments where Conversational Monitor System (CMS) interactive computing is combined with a guest System Control Program (DOS/VSE or OS/VS1) on the 4300 processors. VM/System Product (VM/SP) contains all functions available in the VM/Basic System Extensions and VM/System Extensions program products, which extend the system control program of VM/370. Those exten-

channel data buffers, a channel operation unit, and standard and optional channels. The maintenance subsystem includes a service processor, a service panel, a power-up microprocessor, a direct console attachment, diskette drives, a modem (which connects to the Remote Operator Console Facility and the Remote Service Facility), a direct instruction processor link, and a channel link for operator consoles.

The dual processor 4381 Model Group 14 incorporates standard 4381 processor features. It does, however, employ two integrated instruction processors under a single control program. Each processor has access to a shared central storage facility. Each processor also has its own set of channels. The 4381 Model Group 14 cannot be partitioned into two distinct uniprocessor systems.

The 4381 Model Groups 13 and 14 take advantage of a faster chip technology to reduce processor cycle time; the cycle times of those machines are 56 nanoseconds, compared to the 68-nanosecond times of Model Groups 11 and 12. Otherwise, all four systems are architecturally similar.

CONTROL STORAGE: Control storage on the 4361 consists of 16K bytes.

The 4381 processors utilize reloadable control storage (RCS) to hold the microcode which controls their operations. The RCS is composed of 18K-bit SAMOS-process N-channel FET chips; however, the amount of control storage has not been specified by IBM.

REGISTERS: Information unavailable from the vendor.

ADDRESSING: Three types of addresses are recognized: absolute, real, and logical. In all 4300 Series processors, a one-level addressing facility provides for improved virtual storage control by DOS/VSE.

The dynamic address translation facility, standard in all models, is the mechanism that translates the virtual storage addresses contained in instructions into real main storage addresses as each instruction is executed. All models can address a virtual storage space of 16,777,216 bytes.

Translation between the virtual and real addresses is accomplished by a hardware-implemented table-lookup procedure that accesses tables in main storage which are created and maintained by the operating system. The translation process is sped up by a group of high-speed registers (translation lookaside buffer) which hold recently referenced virtual storage addresses and their real storage equivalents.

Model Groups 11, 12, and 13 of the 4381 support system control programs with either 2K or 4K virtual page sizes. However, only half of the high-speed buffer is employed when 2K virtual pages are used. The 4381 Model Group 14 dual processor system supports only 4K virtual pages.

INTERRUPTS: Classes of interrupts include I/O, external, program, supervisor call, machine check, and restart. Classes of interrupts are distinguished by the storage locations at which the old program status word (PSW) is stored and from which the new PSW is fetched.

OPERATING ENVIRONMENT: The 4381 processors are air cooled. The system footprint for all models is 14.33 square feet; including service clearances, the space required is 125.61 square feet. Power consumption on the uniprocessor models is 4.27 kVA at 50 Hz; on the dual processor Model Group 14 it is 7.2 kVA at 50 Hz. Heat output on uniprocessor 4381s is 13,650 Btus per hour; Model Group 14 puts out 22,500 Btus per hour.

The 4361 systems require an operating temperature of 50 to 90 degrees Fahrenheit (10 to 32 degrees Celsius). Power consumption is 2.6 kVA.

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sions are intended to make VM/370 and CMS more flexible and productive, and to increase the number of devices supported. VM/SP supports the Structured Query Language/Data System (SQL/DS) data base management system, and provides native support for Systems Network Architecture (SNA) products.

MVS support is provided on the 4361 and 4381 processors. MVS with Processor Support 2 provides the required basic SCP code. MVS/SP-Job Entry Subsystems 2 and 3 (JES2 and JES3) are separately priced products that provide major extensions and enhancements to the MVS Base Control Program plus JES2 and JES3, respectively.

MVS/XA is supported only on the 4381 processors and includes two programs: MVS/SP and the Data Facility Product. MVS/XA allows address space sizes to be expanded up to 2GB.

Interactive Executive for System/370 (IX/370) is an implementation of AT&T's Unix System V. A multiuser, multitasking system, it runs as a guest under VM/SP, with or without the VM/SP High Performance Option. IX/370 includes the Bourne Shell command language and provides virtual address space of 8MB for each user.

IBM offers a wide range of data communications products for the 4300 Series for systems interconnection, multisystem networking, and distributed processing. The Customer Information Control System/VS (CICS/VS) is a general-purpose data communications monitor for terminal-oriented transaction processing environments; it is available for both the DOS/VS and OS/VS operating environments.

Multiregion Operation (MRO) allows multiple connected CICS/VS regions to run within a system while sharing terminals, transactions, and other resources. In addition, the Intersystem Communications (ISC) facility provides the capability for connecting CICS/VS systems through ACF/VTAM or ACF/TCAM so that a transaction running in one system can access files and DL/1 data bases, initiate transactions, queue messages, or communicate directly with another transaction running in a connected CICS/VS system.

Advanced Communications Function/Virtual Telecommunications Access Method (ACF/VTAM) is the base for the major IBM communication subsystems. It runs under MVS/XA, MVS/370, and VSE, and provides an "operating system" for the network. Its functions are the same as those of a host operating system in terms of resource sharing and logical handling of user requests. ACF/VTAM allows creation of networks with multiple 4300, System/370, 303X, 308X, and 3090 processors.

COMPETITIVE POSITION

With the 4300 Series, IBM has a formidable supermini product line which runs the gamut from department-level processors to systems with near-mainframe power and configurability.

INPUT OUTPUT CONTROL

In addition to the I/O channels described below, the 4361 processors can be equipped with integrated I/O adapters. A *Display/Printer Adapter (DPA)* is standard on all 4361 models. The DPA is used for attaching the required 3205 or 3278-2A Display Console and up to 15 additional devices (seven when the Work Station Adapter, or WSA, is installed). The DPA and WSA support the attachment of the IBM Personal Computer, 3270 PC, 6580 Displaywriter, and, with the Serial OEM Interface, various OEM devices.

The *Work Station Adapter (WSA)* is available as an option for the 4361 processors. The WSA supports up to 32 devices and workstations via the 3299 Terminal Multiplexer. When the WSA is installed, the number of available ports on the DPA is reduced to 8. Each group of 8 ports requires one 3299 Model 1.

Both the DPA and WSA include the *Serial OEM Interface (SOEMI)* feature, which provides support for various devices for scientific and engineering applications. The DPA supports up to two OEM adapters with an aggregate data rate of up to 17K bytes per second inbound or 30K bytes per second outbound. The WSA supports up to four OEM adapters with an aggregate data rate of 22K bytes per second inbound and 45K bytes per second outbound.

A software product, SOEMI Access Method, establishes the necessary protocols for communication between an application program running on the 4361 and the storage spaces in an OEM subsystem. It provides subroutines that can be called from application programs through VM and VSE subroutine linkage conventions.

Also available is the optional *DASD/8809 Adapter*, which permits the direct attachment of 3310 or 3370 Direct Access Storage Devices and 8809 Magnetic Tape Units. The 4361 Model Group 3 supports two DASD/8809 Adapters. The first one allows attachment of up to four strings of 3310 and 3370 DASD. The second allows the attachment of either the DASD or up to six 8809 tape units. The second DASD/8809 Adapter is mutually exclusive with the High-Speed Block Multiplexer Channel.

Model Groups 4 and 5 have four possible maximum configurations: four DASD/8809 Adapters; two DASD/8809 Adapters and one High-Speed Block Multiplexer Channel; one DASD/8809 Adapter and two High-Speed Block Multiplexer Channels; or three High-Speed Block Multiplexer Channels. The DASD/8809 Adapters operate at up to 1.86 megabytes per second.

The 4361 processors also include an integrated operator control panel that allows attachment of the 3205 color display console or of the 3278-2A display console. This panel provides the capability to power on/power off and initial microcode load (IML) the 4361 processor; it also provides processor status indicators.

The *4361 Model Group 3* can have a maximum of three I/O Channels: one byte multiplexer channel, one block multiplexer channel, and one High-Speed Block Multiplexer Channel.

The 5248 Byte Multiplexer Channel operates at up to 36K bytes per second in single-byte mode and at up to 500K bytes per second in burst mode. The 5248 provides eight control unit positions and up to 36 subchannels, four of which are shared subchannels with up to 16 devices each. The number of subchannels is reduced by one if the Communications Adapter is installed. In addition, each communications line reduces by one the number of subchannels available.

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IBM is touting the lower half of the line—the 4361 systems—as a set of departmental systems for engineering/scientific and technical environments. The company claims that the 4361 systems can serve with equal facility as servers for intelligent workstations, as applications processors, and as hosts or remote nodes in distributed networks.

Certainly, IBM is providing the tools to suit the 4361 systems for engineering/scientific tasks. The ACRITH facility, standard on each processor, endows the 4361 with strong computational capabilities. Moreover, the large amount of disk storage available through the 3380 Extended Capability disk drives (Models AE4 and BE4) provides the systems with facilities for storing the large data bases involved in engineering/scientific and technical applications. The extension of main storage to 16MB on 4361 Model Groups 4 and 5 endows them with greater power for complex, memory-dependent applications. In addition, the SOEMI attachment capability of the 4361 allows these systems to connect specialized equipment for process control, data collection, and other specialized technical functions. (Third-party vendors currently offer a number of SOEMI-attachable devices.)

At the upper end of the family, IBM's realignment of the 4381 grouping is a fascinating development. First, it increases the power of the 4381 systems up to 40 percent—a necessity, in that IBM's principal rivals in the computation-intensive supermini market, Digital Equipment Corporation and Data General, have recently debuted powerful high-end systems. DG added the Eclipse MV/20000 in both single (Model 1) and dyadic processor (Model 2) configurations, while Digital brought out the uniprocessor VAX 8650 and 8300, and the top-of-the-line VAX 8800, a dual processor model.

Secondly, the announcement has intensified the MIPS war, that is, the debate about the proper basis for performance comparisons among systems. DG rates the MV/20000 Model 2 at 10 MIPS; Digital's VAX 8800, up to 12 times as powerful as the 1.06-MIPS VAX-11/780, comes in at about 12.7 MIPS. IBM announced the new 4381 machines without supplying MIPS ratings, because the company does not accept the validity of such measurements; immediately, analysts rushed to provide estimates. For instance, if the Model Group 14 is 40 percent more powerful than the 5.13-MIPS Model Group 3, it rates at about 7.2 MIPS—lower than either of its rival systems.

IBM held a special session to dispute such comparison-mongering, claiming, with much justification, that MIPS is a spurious guide to actual performance. The company asserts that the number of instructions used in a single operation depends on the architecture of the system, the amount of microcode in the system, and other factors. Thus, three machines could take the same amount of time to do the same amount of work, although one could use two instructions, one could use five, and the other could use 10. The end would be exactly the same; only the means would differ.

The 1421 Block Multiplexer Channel can accommodate a data transfer rate of up to 1.25 million bytes per second. The 1431 High-Speed Block Multiplexer Channel can handle a data transfer rate of up to 1.86 million bytes per second, permitting attachment of high-speed peripheral devices such as the 3350, 3370, and 3375 DASD via control units. Each of the block multiplexer channels for the 4361 Model Group 3 provides eight control unit positions and can be configured with up to 128 nonshared subchannels and up to 16 shared subchannels, each with devices in multiples of eight. (The maximum number of devices is 128.) The high-speed block multiplexer channel and the second DASD Adapter are mutually exclusive.

The *4361 Model Groups 4 and 5* come standard with one and two block multiplexer channels, respectively. The block multiplexer channel operates at up to 1.25 megabytes per second for the attachment of tape units, system printers, and displays. A byte multiplexer channel is optional on Model Group 4 and standard on Model Group 5, and operates at up to 36K bytes per second in byte mode and 500K bytes per second in burst mode. It is used primarily for the attachment of unbuffered card readers and MICR and OCR devices.

The High-Speed Block Multiplexer Channels include support for the 3880/3380, 337X, and 3350 Direct Access Storage Devices. The data transfer rate is up to 3.0 megabytes per second; Model Groups 4 and 5 each support up to three of these channels.

The *4381 Model Groups 11, 12, and 13* come equipped with six channels: five block multiplexer and one byte multiplexer. Four of the block multiplexer channels have data rates of up to 3.0 megabytes per second in datastreaming mode. The fifth block multiplexer channel has a data rate of up to 2.0 megabytes per second; this channel may alternatively be selected as a byte multiplexer channel. An additional group of 6 block multiplexer channels may be installed as an option, increasing maximum aggregate data rates to 22 megabytes per second on Model Group 11, 24 megabytes per second on Model Group 12, and 30 megabytes per second on Model Group 13. On Model Group 11, the optional channels consist of two 2-megabyte and four 1-megabyte datastreaming block multiplexer channels. On Model Group 12, the optional channels are two 3-megabyte and four 1-megabyte; on Model Group 13, users can add five 3-megabyte channels and one 1-megabyte channel.

A Channel-to-Channel Adapter (feature 1850) allows the interconnection of two channels, which may be on a 4341, 4381, System/360, or System/370. Only one of the interconnected processors needs to be equipped with this feature.

The *4381 Model Group 14* comes with 12 standard channels: two byte multiplexer channels and ten 3-megabyte-per-second high-speed block multiplexer channels. Two of the standard block multiplexer channels can be configured as byte multiplexer channels, for a system total of four byte multiplexer channels. Six additional block multiplexer channels can be configured with the 4381 Model Group 14—each with a data transfer rate of 3 megabytes per second.

The channels on each processor of a 4381 Model Group 14 with 12 channels can provide an instantaneous aggregate data rate of 15 megabytes per second for an aggregate data rate of 30 megabytes per second. The channels on each processor of a 4381 Model Group 14 with 18 channels can provide an instantaneous processor data rate of 24 megabytes per second, for a system aggregate data rate of 48 megabytes per second.

Up to sixteen 3-megabyte-per-second datastreaming channels can be configured on the 4381 Model Group 14 to support advanced peripherals, such as the 3380 Direct

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IBM argues that the only meaningful test of relative power is to measure performance in a specific environment according to controlled benchmarks. For example, long-precision floating-point operations reportedly comprise two thirds of computation-intensive work. To gauge the performance of systems designed for intensive computation, IBM says, one should measure long-precision floating-point performance according to the LINPACK, NASTRAN, or other controlled benchmark. LINPACK is a dense system of linear equations in Fortran; it is controlled by Argonne National Laboratories. NASTRAN, controlled by MacNeal-Schwendler Corporation, is a series of finite element structural analysis algorithms. The frequently used Whetstone benchmark, IBM claims, is unreliable because it exists in different versions.

IBM points out that DG's MV/20000 Model 2 and Digital's VAX 8800 appear to outperform the 4381-14 in long-precision Whetstone operations; however, according to the LINPACK and NASTRAN gauges, the 4381-14 beats both of its rivals handily in long-precision floating-point operations. Thus, by more objective standards than the misleading MIPS ratings, the IBM system seems to deliver better peformance in the computation-intensive arena for which it is intended.

That apparent superiority in certain operations, of course, does not mean that the 4381-14, and the other 4300s for that matter, are objectively better than their rivals. Other factors must be taken into account. For example, the base processor complex of the 4381 Model Group 14 is more expensive than that of either major rival; whether the system delivers qualitatively better price/performance than its competitors the buyer must judge, according to his or her needs. (One way to compare would be to give a program run daily to each vendor under consideration, and to see how it runs on that vendor's system.)

ADVANTAGES AND RESTRICTIONS

In IBM's 4300 Series, the advantages far outweigh the restrictions. On the negative side, the hardware upgrade path within the family is somewhat limited. Users can upgrade within groupings, but not between them. For example, one can upgrade from a 4361 Model Group 4 to a 4361 Model Group 5, but not from a 4361 Model Group 5 to a 4381 Model Group 11.

However, the 4300 systems support most of the same DASD mass storage devices and other peripherals, so users converting from one 4300 grouping to another can, in most cases, transport peripherals from older to newer systems. Speaking of peripherals, it must be noted that the amounts of storage provided by the 3380 Extended Capability drives and even by standard DASD drives give the 4300 systems an advantage over competitive systems; few supermini vendors provide storage devices even approaching IBM's DASD subsystems in capacity. In addition, all systems in the 4300 Series incorporate System/370 architecture and can run System/370 software—features which provide application compatibility not only within the 4300 family, but also between the 4300 Series and the 308X and 3090 Access Storage Device subsystem and the 3480 magnetic tape subsystem.

The 3088 Multisystem Channel Communication Unit is a standalone I/O Control Unit that provides channel-to-channel communication facilities for multiple IBM 303X, 308X, 3090, 4361, 4341, or 4381 processors. The 3088 permits interconnection of four to eight processor channels. The channel interfaces can be configured with 32 or 64 contiguous unit addresses that provide the function of a Channel-to-Channel Adapter. From 126 to 252 logical Channel-to-Channel Adapter links are provided. The 3088 requires one control unit position on each processor channel to which it is attached. One unshared subchannel is required on each attached channel for each unit address.

All 4300 processors can support the *Device Attachment Control Unit (DACU)*, an option that permits configuration of high-performance, non-IBM input/output devices on IBM 4300 block multiplexer channels. The DACU provides simulated direct memory access (DMA) transfers to and from host main storage; such transfers are buffered in DACU storage. The DACU supports both RS-232-C and Digital Equipment Corporation Unibus interfaces.

CONFIGURATION RULES

GENERAL: A Model 3205 or 3278 2A display console is required for all 4300 models. IBM recommends that a 3205 console on the 4381 use a separate operator control panel supplied with the processor; the 3278 should be equipped with a keyboard and an integrated operator control panel.

For detailed information on channel configurability, see the INPUT/OUTPUT CONTROL and COMMUNICATIONS CONTROL sections of this report.

WORKSTATIONS: The 4300 Series systems can support up to 1,024 terminals. Numerous IBM display devices can be connected to a 4300 system in remote and/or local configurations.

DISK STORAGE: The 4300 Series Systems all support 3350, 3370, 3375, and 3380 DASD mass storage devices; the 4361 also supports the 3310 DASD. The number of DASD devices supported by a 4300 System depends upon the number of high-speed channels configured.

MAGNETIC TAPE: The 4300 systems support 3420 cartridge tape drives; 3410/3411, 3422, and 3430 reel-to-reel tape drives; and the 3480 (cartridge) streaming tape drive; the 4361 also supports the 8809 (reel-to-reel) streaming tape drive.

PRINTERS: The 4300 systems support printers ranging from dot-matrix devices with speeds of 80/120 characters per second to train and band printers with speeds up to 2000 lines per minute. The systems can also support nonimpact printers with speeds up to 20 pages per minute.

On the Display/Printer Adapter of the 4361, no more than two 4245 Model D12, 3262, or 3289 printers, and no more than one 4245 Model D20 can be configured. The 3262 and 3289 can be configured as system printers only.

MASS STORAGE

For information on mass storage devices available on the 4300 Series, refer to Chart B.

INPUT/OUTPUT DEVICES

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

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systems; this compatibility is obviously advantageous to users contemplating migration to larger systems. Moreover, some IBM PC systems can run 370 software, providing a compatible operating and application environment from desktop microcomputers to large mainframes.

IBM also continues to extend the configurability of the 4300 systems. For example, the 4361s can now support the 3480 tape drive, which provides them with high-speed streaming backup. Also, the increase in the number of channels available for the 4361 Model Group 4 permits new options for configuring a range of I/O devices.

On the design side, IBM is consciously trying to reduce the size of the 4300 systems, particularly at the lower end of the line. The 4361 Model Group 3, for example, incorporates a good deal more on-board technology than was previously available for 4300 systems. This reduction in components not only leads to lower maintenance costs, but also makes the 4361 systems more suitable as office-installable, department-level systems. To be truly officeworthy, however, the 4361 systems will require internal Winchester storage (a feature not currently available).

USER REACTION

Datapro's 1985 Computer Users Survey drew responses from 61 users of the 4361 and 92 users of the 4381. The 4361s had an averaged installed life of 8.3 months, while the average installed time of the 4381s was 6.9 months. Of the 4361s, 67.2 percent had been purchased, 4.9 percent rented from IBM, and 27.9 percent leased from a third party; corresponding purchase, rental, and lease figures for the 4381 were 50 percent, 14.1 percent, and 35.9 percent, respectively.

The responses yielded some interesting information about the relative sizes of system configurations. Of the 4361 systems, 78.3 percent were configured with between 1.2GB and 10GB of disk storage; 66.7 percent of the 4381s had disk storage in the same range. An additional 26.4 percent of the 4381s had over 10GB of disk, while none of the 4361s went that high. For local workstations, 20 percent of the 4361s had over 60, while 55.6 percent of the 4381s had over 60. For remote workstations, only 6.6 percent of the 4361s had over 60, while 46.7 percent of the 4381s had over 60.

Although IBM frequently emphasizes the engineering/scientific capabilities of the 4361 and the 4381, the respondents' application uses reflected more of a commercial bent. For instance, 90.2 percent of the 4361 users cited accounting/billing as a principal application; other popular ones were payroll/personnel (72.1 percent), order processing/inventory (60.7 percent), sales/distribution (49.2 percent), purchasing (47.5 percent), and manufacturing (45.9 percent). Only 16.4 and 13.1 percent of the 4361 users cited engineering/scientific and mathematics/statistics, respectively, as principal applications.

Similarly, the 4381 users cited accounting/billing (82.6 percent), payroll/personnel (61.9 percent), order processing/inventory (52.2 percent), purchasing (46.7 percent),

OTHER PERIPHERALS: The 4300 Series systems also support MICR and OCR devices. Speeds on the MICR devices range from 500 to 2,400 documents per minute, with the number of stackers ranging from 6 to 36; document sizes accommodated range from 2.5 to 4.17 inches wide and from 4.85 to 8.75 inches long. Speeds on the supported OCR equipment range from 96 to 665 documents per minute, with each reader accommodating 2 or 3 stackers. Document size ranges from 2.25 to 9 inches in width and from 3 to 14 inches in length.

A specialized device, the *3814 Switching Management System*, is designed to aid in the management of complex EDP configurations by providing centralized control of control-unit switching. The 3814 uses an integrated microcode-driven processor and features password authorization, stored configurations, and self-diagnostic functions. An optional software facility, the Multi-System Configuration Manager (MSCM), works in conjunction with the 3814's System Attachment Feature in the MVS operating environment to provide centralized control from a single terminal for up to sixty-four 3814 devices.

COMMUNICATIONS CONTROL

The principal communications control unit for the 4361 is the Integrated Communications Adapter, described below. The programmable 3705-80 Communications Controller, also described below, is the prime communications device for the 4381. It can also serve as an alternative to the Communications Adapter when more than eight lines must be connected to a 4361. Loop Adapters are also available for the 4361. The 4300 systems also support the 3725 Communications Controller.

The *4361 Communications Adapter* is optional on all 4361 model groups. It allows direct attachment of up to eight BSC, start/stop, or SDLC communications lines in any combination. (At any given time, the "any combination" may be two of the three available types.) The aggregate data rate capacity may not exceed 64,000 bits per second. For seven of the eight lines, the data rate per line may not exceed 9600 bps. The eighth line may be a BSC or SDLC high-speed line with a data rate of up to 56,000 bps, operating concurrently with other lines provided that the data rate limitations are not exceeded. The adapter operates with start/stop and BSC lines in 2703 compatibility mode. SDLC is supported only by ACF/VTAME operating under DOS/VSE or by ACF/VTAME operating under VM/370 with DOS/VSE running as a guest. The communications adapter provides auto answer, auto poll operation, multipoint station functions, EBCDIC transparent mode for BSC only, and EBCDIC/ASCII code for BSC only.

The eight lines attached to the communications adapter may have the following optional features in addition to the high-speed line feature (4720) already mentioned: up to eight line features without internal clock for attachment to external modems with (4695) or without (4696) clock (data circuit-terminating equipment); up to eight line features with integrated 1200 bps modems; up to eight line features with local attachments (4801); up to eight line features with digital data service adapters (5650); and auto call unit interfaces for up to two of the installed lines (1020).

Certain configuration parameters for each line may be specified from the display console keyboard. Those parameters include select standby, half-speed operation for synchronous lines only (for both clocked and nonclocked modems which have this capability), NRZI mode in SDLC mode, write interrupt (start/stop line), read interrupt (start/stop line), unit exception suppression (start/stop line), error index byte mode (BSC line), and ASCII code instead of EBCDIC (BSC line).

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and sales/distribution (34.8 percent) as primary applications. Engineering/scientific applications were cited as primary by 18.5 percent of the 4381 respondents; mathematics/statistics captured 9.8 percent.

Cobol was by far the most popular programming language, cited by 76.7 percent of the 4361 users and 68.5 percent of the 4381 respondents. In-house personnel were cited as the greatest single source of application programs; 94.6 percent of 4361 users and 94.8 percent of 4381 users employed in-house development.

A data base management system was used on 55.9 percent of the 4361 systems and on 62.9 percent of the 4381s. A communications monitor was employed on 65.5 percent of the 4361s and on 84.1 percent of the 4381s. Of the 4361 users, only 14.8 percent had established an information center; 40.2 percent of the 4381 respondents had established such a facility.

The following table shows the 4361 users' ratings of their systems.

	Excellent	Good	Fair	Poor	WA*
Ease of operation	12	41	5	0	3.1
Reliability of system	46	11	1	0	3.8
Reliability of peripherals	36	22	0	0	3.6
Maintenance service:					
Responsiveness	35	22	3	0	3.5
Effectiveness	32	25	3	0	3.5
Technical support:					
Troubleshooting	15	39	6	0	3.2
Education	9	38	10	1	2.9
Documentation	9	35	14	0	2.9
Manufacturers software:					
Operating system	11	46	1	0	3.2
Compiler & assemblers	13	44	1	0	3.2
Application programs	3	31	14	2	2.7
Ease of programming	6	37	15	0	2.8
Ease of conversion	9	27	15	3	2.8
Overall satisfaction	10	44	4	0	3.1

*Weighted Average on a scale of 4.0 for Excellent.

The 4381 users' ratings of their systems are contained in the following table.

	Excellent	Good	Fair	Poor	WA*
Ease of operation	29	54	4	0	3.3
Reliability of system	70	17	0	0	3.8
Reliability of peripherals	42	40	4	0	3.4
Maintenance service:					
Responsiveness	55	35	2	0	3.6
Effectiveness	54	35	2	0	3.6
Technical support:					
Troubleshooting	40	41	10	1	3.3
Education	26	52	12	1	3.1
Documentation	27	39	25	1	3.0
Manufacturers software:					
Operating system	30	55	3	4	3.2
Compiler & assemblers	37	49	3	3	3.3
Application programs	11	40	21	2	2.8
Ease of programming	16	52	17	4	2.9
Ease of conversion	19	40	20	7	2.8
Overall satisfaction	24	64	1	2	3.2

*Weighted Average on a scale of 4.0 for Excellent.

Certain configuration parameters can be selected at installation time and set by the IBM Customer Engineer. Those parameters include duplex instead of half-duplex connection (two-way alternate data flow transmission), switched network facility instead of nonswitched lines for external modems, new sync for BSC or SDLC in multipoint primary station function only, connect data set to line or data terminal ready procedure, and selection of WE202 or V.23 answer tone frequencies for 1200 bps integrated modems with automatic answering.

The 4361 has an attachment capability for intelligent workstations. The IBM Displaywriter, IBM Personal Computer, and the 3270 Personal Computer Attachment are supported by one of the following: the Integrated Communications Adapter, the 3274 control unit, the Display/Printer Adapter, the Work Station Adapter, or the 4994 or 7171 ASCII Device Attachment Control Unit.

The 4361 Communications Adapter supports communications with virtually all of the current IBM terminals, systems, and communications controllers in one or more of the three transmission modes: SDLC, BSC, or start/stop.

***4361 Loop Adapters* provide the capability to attach certain terminals and control units to a 4361 Model Group 4 or Model Group 5, either directly or via a data link. Loop Adapter 1 (feature 4830) and Loop Adapter 2 (4831) permit direct attachment. The Data Link Adapter (4840) provides remote attachment capabilities for 3843 Loop Control Units. Each Data Link Adapter can be used as a point-to-point or multipoint connection to attach up to four 3843 Loop Control Units. The Loop Adapters are available on a Request for Price Quotation (RPQ) basis only.**

Various display devices and printers can be connected to directly attached loops at 9600 bps or to data link attached loops at 2400, 4800, or 9600 bps. In addition, the 8775 and the 3274 control unit and associated terminals can also be attached at 38,400 bps. Up to 80 terminals can be connected to a 4361 via the Loop or Data Link Adapters.

Cable length for directly attached loops can be up to 1.25 miles (2,000 meters) when operating at 38,400 bps or two miles (3,200 meters) when operating at up to 9600 bps. Data link attached loops can be up to two cable miles in length. The 4361 supports one Loop Adapter 1, one Loop Adapter 2, and up to two Data Link Adapters.

The *3705-80 Communications Controller* is a programmable front-end network processor that can be connected to either a byte or block multiplexer channel on a 4361 or 4381 processor.

The 3705-80 series consists of Models 81, 82, and 83. The 3705-80 has 256K bytes of storage and supports 4, 10, or 16 communications lines. The 3705-80 can be used as a front-end communications processor or as a remote concentrator linked to a local 3705-II controller (a widely installed device no longer in new production).

When connected to a host IBM processor, a 3705-80 can use either the Network Control Program (NCP) or the 2701/2/3 Emulation Program. NCP/VS, for virtual environments, includes all of the facilities of the original NCP and also has the Partitioned Emulation Program Extension (PEP) capability, which permits operation in the NCP mode and Emulation mode concurrently.

The 3705-80 controller is supported under the VTAM, TCAM, and BTAM access methods. The Advanced Communications Function for NCP, ACF/NCP/VS (and related Systems Support Programs), adds capabilities for multiple-processor environments. An X.25 NCP Packet Switching Interface is now available for use with ACF/NCP/VS. To

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Citing additional points about their systems, 91.9 percent of the 4361 respondents and 95.5 percent of the 4381 users gave "good" or "excellent" ratings to the systems' expandability; 88.3 percent of the 4361 users and 98.8 percent of the 4381 users praised their systems for their power and energy efficiency. On the negative side, 46.6 percent of the 4361 respondents and 39.2 percent of the 4381 users gave only "fair" or "poor" ratings to the efficacy of available productivity aids in keeping programming costs low.

All of the 4361 users said that their systems did what they had expected them to do; 96.7 percent of the 4381 users said the same. When asked if they would recommend the system to another user, 96.7 percent of the 4361 users said that they would; 97.8 percent of the 4381 users said that they would recommend that system.

To gain additional insight into the users' experiences with the 4300 Series, we talked to four survey respondents by telephone in March 1986.

The first user interviewed was affiliated with an insurance concern in the Midwest. His company used a 4381 Model Group 2, to which it had upgraded from a 4341. The company converted because it needed to go to the MVS/XA environment for virtual memory, and required a processor that could support it. "The speed was there with the 4341," he said, "but not the virtual support." Although his organization had also looked at the 4381 Model Group 3, it rejected the larger system because it was more than was necessary, and was not economically justifiable at the time of purchase. The conversion from the 4341 to the 4381, he said, had gone very easily.

Citing the best features of his system, the first user stressed reliability: "It doesn't break down." The CPU, he said, had only gone out once, and that was due to a power failure. He said that IBM's service is "right on the spot"; responses to service requests are always good for CPU and disk problems, although they sometimes lag for tape and printer problems, which, he admitted, he viewed as less crucial.

He also characterized the 4381-2 as "just about the ideal machine" for a shop the size of his, which uses six application programmers, three system programmers, and eight analysts. Most program development is done in-house; 90 percent of the work is done online, with only backups and reports done in batch mode at night.

The first user leveled only one critical remark at his 4381. He said that I/O Control Program (IOCP) generation is a separate step from the SYSGEN process, and had to be performed each time a SYSGEN was done. He felt that the two processes should be integrated.

This user said that he thought his next step would be to move to a 4381 Model Group 14; he said he anticipated that the conversion would pose no problems, involving only a SYSGEN that would take about a month. When asked what advice he would give to prospective users, he said that, much as he liked his system, he would advise that they buy a 4381 Model Group 13, which is a newer machine.

utilize ACF/NCP/VS, the Advanced Communication Function for VTAM and TCAM is required. ACF/VTAM supports CICS/VS, IMS/VS, Power/VS, JES1/RES, JES2/RJE, TSO, VSPC, SSS, and BTP user programs. ACF/TCAM supports CICS/VS, TSO, SSS, and user programs.

The *3725 Communications Controller* consists of a central control unit that operates under control of the Advanced Communications Function (ACF)/Network Control Program, Emulator Program, or Partitioned Emulator Program. Main storage up to 1 or 2 megabytes is available, depending on the model. It can be attached to either byte or block multiplexer or selector channels on the host processor. Up to six channel adapters are available. Two adapters are standard in the base frame and four can be added via the 3726 Expansion Unit. With the optional two-processor switch feature, connection can be made to a maximum of eight processors, six of which can operate concurrently. The Maintenance and Operator Subsystem allows for host-independent maintenance. Communications scanners and line interfaces are provided by a transmission subsystem. The scanners are microprocessor-based and can control eight Line Interface Couplers with up to 32 lines. The 3727 Operator Console provides an operator interface to the Maintenance and Operator Subsystem of the 3725.

The 3725 supports X.25, X.21, and V.35 attachment and line speeds ranging from 50 bits per second to 256K bits per second.

Two 3725 models are available. Model 1 consists of the 3725 Communication Controller and the 3726 Communication Controller Expansion. Up to 256 full-duplex or half-duplex lines may be attached with Model 1. Model 2 allows for attachment of up to 80 full-duplex or half-duplex lines. Model 2 is field-upgradable to Model 1.

The *4994 ASCII Device Attachment Control Unit* comprises 3 models: the A Model supports up to 16 devices, the B Model supports up to 32 devices, and the C Model supports up to 48 devices. In conjunction with its program offering support, Host Loaded Yale ASCII Communications System, the 4994 allows the attachment of ASCII devices to a 4361 or 4381 running VM/CMS. ASCII terminals appear to the host as IBM 3277 terminals. In order to be supported, devices must perform clear screen or clear to end of screen, provide absolute cursor positioning, and allow characters written to the screen to replace, not overstrike (except APL). Features provided include full-duplex operation between the 4994 and the terminals, type-ahead capability from the terminal, and normal keyboard functions. Physical connection is made via EIA RS-232-C or 20 ma current loop.

The *7171 ASCII Device Attachment Control Unit* is similar to the 4994, but supports a maximum of 64 ASCII devices. The 7171 attaches to a 4300 Series block multiplexer channel and appears to the host as one or two 3274 Model D control units. Supported devices must feature point-to-point connection, 7-bit ASCII code, full-duplex character mode transmission, absolute cursor positioning, and the ability to clear the screen. Data can be transmitted at up to 19,200 bits per second.

The *Remote Operator Console Facility (ROCF)*, an extension of the 4300 Remote Support Facility, is designed to facilitate dial-up and initialization of a remote 4300 Series processor from a real or emulated 3275 Model 2 Display Station at the host site. A network can include a 4300 Series processor with ROCF installed and an IBM System/370, 303X, 308X, 3090, or 4300 Series host processor running either of two software products that provide 3275 emulation: the MVS/Operator Communications Control Facility (MVS/OCCF) or the VM/Pass-Through Facility. MVS/OCCF is designed to operate on any IBM host com-

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The second user we interviewed represented an educational organization in the Southeast. His organization uses a 4361 Model Group 4, which it had chosen over a Digital Equipment Corporation VAX system because IBM had delivered a better last-minute proposal for a more cost-effective system. He noted that his organization had and still has a VAX system.

This user said that of all aspects of his 4361, he was most impressed with IBM's service. He said that he had previously had problems with Digital Equipment's area service; IBM, however, is right in town, so he gets a fast response to problem reports. He did say that he felt IBM should reduce the cost of the 4361-4; he thought it was high-priced, even with an educational discount. However, it was worth the price overall, he felt. He also said that he had made a mistake in going with the DOS operating environment instead of OS. The software he needs is only available for OS, so he must do a conversion every time he gets a new package.

Commenting on the growth path offered by the 4361, the second user said that he anticipates upgrading to the 4361-5 in the near future, for his Model Group 4 system is running out of space. He said he figures that the upgrade will be good for at least two years; after that, the next step will be adding storage. Because he is only using four 3370 disk drives currently, however, he did not see storage as a problem area. He also said that when the upgrade from Model Group 4 to Model Group 5 occurs, he will convert the data from the organization's VAX system to the IBM machine; he saw that as no problem, saying it would only take a few days to figure out how to do it.

When asked what advice he would give a prospective user of the 4361-4, the second user said, "Go with it."

The third user we spoke to had a 4381 Model Group 2; he was affiliated with a county government in the Southwest. He had been a Burroughs user, but had chosen the 4381 over a system from the 900 Series for two main reasons—better service and closer compatibility with neighboring administrations. He said that he had become dissatisfied with Burroughs' local support; he characterized the vendor's maintenance as "atrocious," saying he had had to wait up to two weeks for a part. Also, he said that he had expressed interest in purchasing two B 6900 systems, but had not been taken seriously. On a pragmatic level, it made sense to go with the IBM system, because both the state highway department and the city which contains 85 percent of the population of his county are IBM users; it makes it easier to cross-domain the three authorities for civil administration, vehicle registration, and other purposes.

He was very pleased with his 4381, saying that he got 99.6 percent uptime. He singled out the system's software diagnostics facilities for praise; the CPU had failed only twice, he said, and each time the diagnostic facilities had been able to give the number of the part that needed to be replaced.

puter that supports MVS/SP, while the VM/Pass-Through Facility requires the VM/SP program product. No software support is required if a real 3275 Model 2 Display Station is available at the host site or if both the host and the remote systems are 4361 processors. Microcode performs 3725 emulation in the host 4361.

The following 4300 system operations can be performed from the host site: initial microcode load (IML), initial program load (IPL), reset, restart, compare/trace, and alter/display. Power-on for the remote 4300 processor must be performed at the remote site. A password verification function is provided to help protect against unauthorized access to the remote 4300 system. ROCF supports bisynchronous communications at 1200 bits per second.

After a remote 4300 is initialized from the host, communications control should continue through the existing network facilities of the host processor. ROCF is not designed to perform interactive jobs. On a 4361 system, ROCF suppresses the activities of all devices attached to the Display/Printer Adapter. When MVS/OCCF is used to initialize a remote 4381 MVS or DOS/VSE system, continued control can be provided by MVS/OCCF in conjunction with the Network Communications Control Facility. After a remote 4381 VM system has been initialized, continued control can be provided by the Programmable Operator Facility of VM/SP.

SOFTWARE

Any program written for an IBM System/370 computer operates on a 4300 Series processor in System/370 mode, provided that it is not time-dependent; does not require the presence of facilities, such as storage size, I/O equipment, and optional features, when the facilities are not included in the configuration; does not require the absence of system facilities, such as interruptions and operation codes, when the facilities are included in the 4300 processor; and does not depend on results or functions which IBM specifies to be unpredictable or model-dependent.

Any program written for a System/360 will operate on a 4300 Series processor in System/370 mode, provided that it follows the above rules and does not depend on functions that differ between the System/360 and System/370.

OPERATING SYSTEMS: The 4300 Series processors are supported by DOS/VSE (a significant expansion of DOS/VS), SSX/VSE (a subset of DOS/VSE), VM/370, OS/VS1, MVS, and MVS/XA (on the 4381 only).

***DOS/VSE* is a disk-resident operating system designed to control system resources and job processing; it is a prerequisite for VSE-related program products.**

DOS/VSE is enhanced by the VSE/Advanced Functions (VSE/AF) and VSE System Product (VSE/SP) programs, which provide functional and performance-related capabilities. Both programs provide support for 4K pages in S/370 mode supervisor, allowing VSE to run as a VM guest using virtual address space extensions on IBM processors, such as the 4381 Model Group 14, which only support 4K pages. The 4K paging capabilities allow these two programs to use the full cache storage on IBM 4381 processors. Both programs also support the remote auto start/programmable power-off features of the IBM 4361.

VSE Performance Tool (VSE/PT) is a software system monitor for measuring and evaluating the performance of a DOS/VSE system.

DOS/VSE supports 4300 processors operating in System/370 or ECPS:VSE mode. The components of DOS/VSE are stored in DASD-resident system libraries

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Because the current system "just keeps on growing," this user anticipated an upgrade to a 4381 Model Group 14, and, in the late 1980s or early 1990s, to a 3090; he felt that application portability would be provided through the MVS/XA operating environment.

The fourth user represented a public utility in the far Pacific Northwest. He said that his organization had chosen its 4361 Model Group 5 over smaller members of the 4341 grouping both because it would better handle the CPU load that the company's work required and because it had integrated adapters that obviated the need to buy data communications equipment at additional cost.

He said that the system delivers "a lot of performance for your money." His system runs under two operating environments: VM/SP for engineering and DOS/VSE under VM/SP for general-purpose applications. He said, however, that he had not intially been aware of the CPU resources eaten up by VM. He also said that he would like to see IBM provide more integrated communications adapter ports than the eight currently available; that way, users could avoid having to multidrop devices.

The fourth user said that he found IBM's local hardware and software support to be only fair in relation to that he had received in another area of the country; he did say, however, that it is good for the current location, which is remote. He also remarked that he felt the 4361 provided a good upgrade path to the 4381, permitting software portability to the larger system in case of a conversion. □

and can be loaded into main storage when needed. The functions of DOS/VSE include initial program load, resource management, job control, linkage editing, paging management, library management, data management, system-to-operator communication, system utilities, system serviceability, and debugging aids.

***Small Systems Executive/VSE (SSX/VSE)*, a subset of DOS/VSE, is a pregenerated, preconfigured operating system designed for use by personnel with limited data processing skills. SSX/VSE supports batch, interactive, and online applications on 4361 processors operating in standalone or distributed environments. Prompts and procedures are provided to aid in installation, operation, program development, and service-related activities. According to IBM, a standalone SSX/VSE system can be installed in two hours or less. SSX/VSE is a complete, self-contained operating system with no prerequisite software. It is ready for use immediately after installation.**

SSX/VSE consists of components unique to SSX/VSE and components based on DOS/VSE. Unique functions of SSX/VSE include: 1) system installation and initialization; 2) system administration and operation functions, including library maintenance support, program development support, data set management support, CICS/VS table maintenance, and system operation support tasks, such as job creation and submission, backup, and recovery; 3) a problem determination aid; 4) an application installation interface that aids in adapting applications programs to SSX/VSE; and 5) a network installation interface that allows the integration of SSX/VSE into an SNA cross domain environment.

***VM/370* is an operating environment that manages a computer system's facilities in such a way that each user has use of the functional equivalent of a dedicated computer system. The four main components of VM/370 are Control Program (CP), Conversational Monitor System (CMS), Remote Spooling Communication Subsystem (RSCS), and Interactive Problem Control System (IPCS).**

The Control Program makes all system resources (processor time, real storage, and I/O devices) available to many users at the same time. CP enables multiple independent virtual machines to run concurrently under control of different operating systems or different releases of the same operating system. The Conversational Monitor System (CMS) creates and maintains source programs, supports a wide range of compilers, provides testing and debugging functions, and allows for time-sharing in either a distributed system or centralized environment. The Remote Spooling Communication Subsystem (RSCS) transfers unit record files between virtual machines and remote stations connected via BSC switched or nonswitched lines. The Interactive Problem Control System (IPCS) is intended to aid systems programmers in managing and resolving programming problems by reducing the need for using hardcopy documentation.

***VM/System Product (VM/SP)* contains all functions available in the VM/Basic System Extensions and VM/System Extensions program products, which extend the system control program of VM/370. These Extensions are intended to make VM/370 and the Conversational Monitor System (CMS) more flexible and productive and increase the number of devices supported. VM/SP provides the following functions as well: dynamic SCP transition with an IPL, interuser communications capability, CMS full-screen 3270 editor, additional CMS functions and productivity aids, a command retrieve capability, a trace table recording facility, and support for Structured Query Language/Data System (SQL/DS).**

VM/SP provides native support for Systems Network Architecture (SNA) products. When used in conjunction with Advanced Communications Function/VTAM (ACF/VTAM), Network Communications Control Facility (NCCF), and Remote Spooling Communications Subsystem Networking, VM/SP allows an installation to take full advantage of the features of SNA. The VM/Group Control System within VM/SP allows ACF/VTAM and associated communications network management products to operate on VM/SP without a guest operating system.

Adjunct products include VM/SP High Performance Option (HPO) and VM/XA System Facility. VM/SP HPO provides a range of performance, operational, and reliability, availability, and serviceability (RAS) features.

VM/XA, for MVS, VSE, or VS1 users who need to migrate to the MVS/XA operating system, extends the range of MVS/XA environments supported by VM; it emphasizes guest production, migration, testing, and maintenance, and provides increased flexibility for guest systems. Among its features, VM/XA allows development, testing, and execution of VM and MVS applications supported by the Conversational Monitor System (CMS). An associated product, VM/XA Realtime Monitor/Systems Facility (VM/XA RTM/SF) is a comprehensive systems monitoring aid that can be used to help detect and diagnose problems, analyze system performance, and provide operators with an awareness of machine operations.

There are two specialized versions of VM/SP: VM/SP Entry and VM/SP System Base. VM/SP Entry, which runs on all 4361 systems and on uniprocessor 4381 systems, provides an interactive, load-and-go system for selected configurations. According to IBM, VM/SP Entry includes the full CMS facilities of VM/SP, and is intended to meet the needs of entry-level VM users running CMS-only applications on uniprocessor systems in departmental environments.

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VM/SP System Base comprises VM/SP and 12 other individual programs; it is the successor to IBM's Engineering/Scientific Support System. Structured to meet the needs of a range of business professionals, including engineers, VM/SP System Base provides an integrated load-and-go system that provides facilities for design and presentation graphics, analysis/simulation, interactive and personal computing, and administration.

Both VM/SP Entry and VM/SP System Base have full-screen, menu-driven facilities. Each requires at least 4 megabytes of real storage, two actuators (addresses) of 3370 or 3380 DASD space, one 3410/11, 3420, or 8809 tape drive, a system console, a terminal, and a printer.

Another product, VM/SP System Offering, contains VM/SP and a set of optional feature programs for functions such as application development, communications, and data base management.

OS/VS1 provides support for the 4361 and 4381 processors in System/370 mode. IBM plans no further releases of OS/VS1. However, OS/VS1 is highly compatible with MVS, used on large systems. The four major functions of the control program routines of OS/VS1 are: job management through operator commands and job control statements; task management, which monitors and controls the entire system; data management, which controls all operations associated with input and output devices; and recovery management, which attempts to overcome the effects of a processor, channel, or I/O device malfunction. Additional features of OS/VS1 include automatic partition redefinition, dynamic dispatching or time slicing, concatenated procedure libraries, and I/O load balancing.

MVS is supported on the 4361 Model Group 5 and on 4381 processors. These processors can utilize either of two MVS/System Products, MVS/SP-JES2 or MVS/SP-JES3. MVS with Processor Support 2 provides the required basic SCP code. MVS/SP-JES2 and MVS/SP-JES3 are separately priced products that provide major extensions and enhancements to the MVS Base Control Program plus JES2 and JES3, respectively. The MVS/System Products replace the earlier MVS/System Extensions product and serve as the base for future enhancements to MVS, JES2, and JES3. MVS features include the System Resource Manager (SRM), which provides optimum system resource use; the Virtual Input/Output Facility (VIO), which stores temporary data in a buffer; and the Job Entry Subsystem (JES2 or JES3), which reduces restart and rerun costs.

MVS/SP-JES2 provides input/output spooling for local and remote unit record devices and class scheduling of batch jobs. It uses principles of HASP, and supports Time Sharing Option (TSO) batch job submission and Remote Job Entry (RJE) facilities. In the MVS/XA environment, MVS/SP-JES2 provides virtual storage constraint relief (VSCR) by using the 31-bit addressing and extended private virtual storage capabilities of that operating system. Other facilities include spool restructure and constraint removal, spool offloading, and RAS features.

Among other capabilities, MVS/SP-JES3 allows an installation to couple independent processors together through channel-to-channel adapters and shared DASD, providing a single system image. Like JES2, JES3 exploits the 31-bit addressing capabilities of the System/370 extended architecture to provide virtual storage constraint relief in MVS/XA environments. It also provides trace facilities and job networking features.

RMF (Resource Measurement Facility) is a centralized management tool for MVS users which monitors system activity to collect performance and capacity planning data. It can be used either dynamically by displaying selected real-time activity reports, or statistically by recording in SMF data sets for postprocessing. RMF measures the following activities: processor usage, address space usage, channel activity, device activity and contention, detailed I/O queueing for logical control unit groups, detailed system paging, detailed system workload, and page/swap data sets.

MVS/XA (MVS/Extended Architecture) is supported only by the 4381 processors. MVS/XA allows address space sizes beyond the 16-megabyte maximum of MVS/370. The address space sizes can be expanded up to 2000 megabytes, and there can be 32,000 such address spaces simultaneously active. MVS/XA consists of two programs: MVS/SP and the Data Facility Product. The Data Facility Product provides data management, device support, program library management, and utility functions.

In the process of converting to MVS/XA, the VM/XA Systems Facility permits other operating systems to run with the 370-XA (Extended Architecture) microcode as VM guest operating systems in both uniprocessor and dyadic processor environments. (Such support is also available for VSE and OS/VS1.)

The VM/XA Systems Facility supports guest production and migration, allowing the migrating customer to continue production with the current operating system (MVS, VSE, VS1) while installing and testing MVS/XA. Full CMS support can be obtained by running VM/SP or VM/SP HPO as a guest of the VM/XA Systems Facility. (The CMS component of the Systems Facility is supported only for installation and maintenance.)

The VM/XA Systems Facility can exploit the full dyadic capabilities of the dual-processor 4381 Model Group 14, allowing guest systems that support dyadics, such as MVS/XA or VM/SP HPO, to run simultaneously on both instruction processors in full dyadic mode. This facility is intended to balance workloads and resource use between the two processors.

IBM Interactive Executive for System/370 (IX/370) is IBM's implementation of AT&T's Unix System V. It is a multiuser, multitasking system that runs as a guest under VM/SP Release 3.0 or later, with or without the VM/SP High-Performance Option (Release 3.4 or later). IX/370 includes the Bourne Shell command language and provides virtual address space of 8 megabytes for each user, a hierarchical file system, extended file and logical record locking, and programming tools, including F77 Fortran with Ratfor dialogue and a C compiler and runtime libraries. Another feature is multiple IX/370 system support, which allows several IX/370 systems to co-reside on the same processor either by running in several different virtual machines or by running several images of IX/370 in a single virtual machine. IX/370 supports IBM and other full-duplex ASCII terminals; 327X terminals, however, are not supported as user terminals. IBM PCs, PC XTs, and PC ATs running PC/IX or Xenix can function as workstations for systems running IX/370.

DATA BASE MANAGEMENT SYSTEM: DBMS products for the 4300 Series include the following:

Database 2 (DB2) is a relational product designed to take advantage of the facilities provided by the MVS/370 and MVS/XA operating systems. It permits multiple users to concurrently access and change data within the same DB2 table. Among the features of DB2 is sequential prefetch, which allows data base records to be buffered in anticipation of a subsequent request for them; this feature reportedly improves performance for most processes which scan the data base in physical record sequence.

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Other features of DB2 include application plan segmentation, which allows a DB2 application plan to contain the code supporting every SQL statement in the program; support for multiple temporary files, which permits temporary files used internally by DB2 to be allocated from a pool of VSAM data sets; support for MVS Data Facility Hierarchical Support Manager (DFHSM), allowing DFHSM to manage volumes on which DB2 data resides, thus allowing DB2 logs and image copies to be automatically migrated and recalled; and the Double-Byte Character Set (DBCS), supporting any two-byte code representation.

DB2 also provides full recovery capabilities in case of system, storage media, or application program failure. A Selective Trace/Performance Instrumentation feature combines the accounting, statistics, and serviceability tracing functions of DB2 into a single instrumentation facility that can be controlled by commands.

Data Language/1 (DL/1) is available for both DOS/VSE and SSX/VSE environments. It provides sequential, indexed sequential, indexed direct, and direct access to data. Each data base structure and organization is described in a central data base description (DBD), allowing changes to be made once, instead of in every program using the data base. DL/1 also includes a High-Level Programming Interface (HLPI) to assist Cobol and PL/1 programmers.

Information Management System/VS Data Base Facility (IMS/VS-DB) executes as an application program under OS/VS1, MVS/370, and MVS/XA; it provides an interface between user application programs and data bases. It links data bases through logical relationships by creating networks and inverted files to meet the requirements of complex applications, allowing existing data to be accessed in new ways by new applications. According to IBM, IMS/VS-DB is particularly applicable for operational applications with large transaction volumes and critical response-time requirements in MVS environments.

SQL/Data System (SQL/DS) is a full-scale relational data base management system with integrated query and report writing facilities; it is intended for use with DOS/VSE, SSX/VSE, and VM/SP systems. SQL/DS includes the Structured Query Language (SQL) and an online help facility, and is designed to address analytical environments, such as planning and prototyping, for which data structure and application requirements change frequently. Among its capabilities, SQL/DS provides blocking of data by application programs to improve performance in multiuser mode, offers an accounting facility for VM and VSE, and allows users to choose between two levels of read locking for their applications.

SQL/DS offers a number of data security and integrity options. The product allows an installation to take advantage of most available DASD backup and restore facilities for data base archive and restore procedures; the product supports log recovery during the user restore process to reapply all data base updates made after the data base archive. A log archiving feature allows only the SQL/DS log, instead of the entire data base, to be archived. A directory verification option provides early detection of data base errors during SQL/DS shutdown processing. Selective log processing allows SQL/DS to bypass selected portions of the SQL/DS log, allowing an installation to avoid corrupted portions of a data base or to ignore data base update transactions that should not be processed.

LANGUAGES: Languages available for the 4300 Series include Pascal/VS, Fortran, Basic, VS APL, PL/1, Cobol, and RPG II.

COMMUNICATIONS: IBM offers a wide range of data communications products for systems interconnection, multisystem networking, and distributed processing.

The *Advanced Communications Function/Virtual Telecommunications Access Method (ACF/VTAM)* is the base for the major IBM communication subsystems. It runs under MVS/XA, MVS/370, and VSE, and provides an "operating system" for the network. Its functions are the same as those of a host operating system in terms of resource sharing and logical handling of user requests. ACF/VTAM allows creation of networks with multiple 4300, System/370, 303X, 308X, and 3090 processors. Under MVS/XA, ACF/VTAM provides virtual storage constraint relief by supporting 31-bit addressing; in MVS/XA and MVS/370 environments, ACF/VTAM provides integrated encrypt/decrypt capabilities. Under VSE, this product supports the extended virtual and real storage capabilities of VSE Advanced Functions, and uses the 4K paging capability of VSE Advanced Functions when executing in System/370 or VM mode.

The *Customer Information Control System/VS (CICS/VS)* is a general-purpose data communications monitor for terminal-oriented transaction processing environments. CICS/VS, available for both the DOS/VS and OS/VS operating environments, interfaces between user-written application programs and transaction processing access methods (BTAM, VTAM, TCAM, ACF/VTAM, ACF/TCAM) data base managers (DL/1 DOS/VS, SQL/DS in DOS/VS, IMS/VS/DB, and DB2 in MVS). The user can generate a CICS/VS system configuration applicable to specific needs and define the environment in which the system is to execute.

Multiregion Operation (MRO) allows multiple connected CICS/VS regions to run within a system (partitions in DOS/VSE and address spaces in OS/VS2) while sharing terminals, transactions, and other resources. In addition, the Intersystem Communications (ISC) facility provides the capability for connecting CICS/VS systems through ACF/VTAM or ACF/TCAM so that a transaction running in one system can access files and DL/1 data bases, initiate transactions, queue messages, or communicate directly with another transaction running in a connected CICS/VS system.

The *File Transfer Program for VM* is an SNA-based facility that enables a VM installation to transfer or extend files between File Transfer Program network nodes without the aid of a spooling subsystem. It provides high-performance data transmission, file handling, and checkpoint-restart facilities. By supporting the native VM SNA environment, it complements the cross-systems bulk data transfer capabilities of File Transfer Program for MVS and VSE.

File Transfer Program for VM offers transmission functions for CMS files and VSAM data sets. A programmable interface allows the user to access other, not directly supported, file organizations for remote data transmission.

UTILITIES: Utility and special functions for the 4300 Series systems are handled both through intrinsic operating system capabilities and through specialized software products supplied with the operating systems.

Operating system utility functions include, among others: device configuration tasks, such as tape and DASD initialization; copying and restoring of DASD volumes; and functional recovery routines for system components.

The specialized adjuncts to the operating systems are discussed in the following paragraphs.

To assist the DOS/VSE user in improving productivity, IBM offers the *VSE/ICCF* program product, which is the successor to the DOS/VS ETSS-II (Entry Time-Sharing System) field-developed product. VSE/ICCF is an integrated system of productivity tools for program development, program maintenance, editing, documentation, security, and coordination.

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In the *System Installation Productivity Options/Extended (System IPO/E)*, the IPO concept has been extended to facilitate the installation, management, and use of 4300 Series software products. IPO/E consists of a base set of integrated program products pregenerated, preconfigured, and pretested with the latest service levels preapplied, and ready to use in specific operating environments.

The *Time-Sharing Option (TSO)* is a full-function time-sharing system that provides interactive computing through the following functions: maintenance of system libraries, catalogs, and procedure libraries; application development and maintenance of existing applications; and creation, maintenance, and control of development support libraries and production libraries. TSO Extensions (TSO/E) provides all of the functions of TSO and includes the following enhancements: virtual storage constraint relief for MVS/XA installations, with savings between 155K and 350K bytes; selection at logon of region sizes consistent with MVS/XA capabilities; simplification of the process of sending data between nodes in a network; performance improvements in the area of sending work from the foreground to the batch stream for execution; and display of information about a command during command entry. Under MVS/XA, TSO/E also provides support for testing a program located in addresses above 16 megabytes.

The *Data Base Edit Facility (DBEdit)* is a data maintenance tool that allows users to add, delete, update, and display records in relational data base tables. DBEdit takes advantage of the catalog facilities of DB2 in the MVS environment and of SQL/DS in the VM/SP environment.

The *Fortran Utilities for VM/370* program offering provides a set of Fortran-compatible system functions for programmers writing Fortran programs for the Conversational Monitor System (CMS) of VM/370. The subroutines can execute with other programs written in either Fortran 77 or Fortran 66.

OFFICE AUTOMATION: IBM offers several host-based office applications, described in the following paragraphs.

Advanced Text Management System III (ATMS III) provides facilities for entry, editing, and management of textual material. It runs under DOS/VSE, OS/VS1, and MVS/XA.

Storage and Information Retrieval System (Stairs) provides facilities for storage and contextual retrieval of large amounts of text, as well as for creation of Stairs data bases from machine-readable formats. It runs under DOS/VSE, OS/VS1, and MVS/XA.

Two products which can be installed and used in conjunction are *Document Composition Facility (DCF)* and *Document Library Facility (DLF)*. DCF provides for markup, full-page composition, and printing of text documents on remote or local system printers. DLF is a data repository that can store input from numerous sources, including text prepared on interactive systems using a submit-to-batch facility, text prepared by ATMS and other text processors, and input to or from application programs. The products can run under MVS, MVS/XA, DOS/VSE, and OS/VS1.

Distributed Office Support System/370 (DISOSS/370) is an office system support product that provides electronic mail and document processing facilities. It runs in MVS/VSE and DOS/VSE environments under the CICS/VS general-purpose data communications monitor.

The *Document Interchange Facility* comprises two complementary program products. Document Interchange Facility/Central executes in the host computer and processes requests from distributed system users to file documents in the Document Library Facility, format them through the Document Composition Facility, and retrieve them from the library. Document Interchange Facility/Distributed executes in the distributed system, preparing user requests to file, format, and retrieve documents, and sending those requests to the host for processing. The Document Interchange Facility runs in both DOS/VSE and MVS/XA environments.

Professional Office System (PROFS) is a program product designed to help professionals and support personnel control job-related information. It provides facilities for document entry, processing, and distribution within a single system or across multiple systems; calendar management; and other end-user services, such as conference room scheduling and electronic messaging. PROFS runs in the VM/SP environment. The system permits interchange of both revisable-form and final-form documents with DISOSS users. PROFS notes can be sent to DISOSS users. Through the system's integrated interface to DisplayWrite/370 VM/SP, PROFS supports IBM's Document Content Architecture (DCA).

DisplayWrite/370 provides word processing functions for professional end users. It includes a full-screen text editor/formatter that provides basic and advanced text functions for creation and revision of documents. Document printing is supported by creating print data streams. The product provides multilanguage support for automatic hyphenation, spelling verification and correction assistance, and a grade-level analyzer and synonym support for English.

DisplayWrite/370 processes both revisable-form and final-form text documents, which can be exchanged between IBM office systems products and applications supporting the Document Content Architecture. DisplayWrite/370 operates under the control of MVS/SP (MVS/370 or MVS/XA) or VSE and CICS/VS, or as a VM/SP application. Either an IBM 3270 information display or an IBM 3270-PC display terminal can be used as an input device.

DisplayWrite/370 includes an application programming interface and can be invoked by any CICS/OS/VS or CICS/DOS/VS application that provides the appropriate interface and maintains a document library.

APPLICATIONS: A broad range of commercial, scientific/engineering, and technical applications is available for 4300 systems both from IBM and from third-party vendors.

One noteworthy aid is the *VM/SP End User Software Support System (VM/SP ES³)*, a family of software offerings that provide general business, office, and engineering/scientific application solutions. Within this product, the user has the option of choosing either VM/SP-Entry or VM/SP-System Base. (For details on those products, refer to the OPERATING SYSTEMS section of this report.) Eight optional packages offer application solutions.

Two separate products complement VM/SP ES³. The ES³ Productivity Facility (PF) is a full-screen, menu-driven facility that provides an online introduction to supported applications, menus to help navigate to the applications, and online help screens. It can be tailored by the user to reflect a specific VM/SP application environment. VM/Remote System Programming (VM/RSP) allows a customer with only system administrator skills to install, operate, administer, and service a VM/SP ES³ system. The product includes a single, toll-free interface to IBM for technical support of VM/SP ES³.

The *Vector Processing Subsystem/Vector Facility (VPSS/VF)* allows users to run application programs developed on IBM's 3838 array processor in System/370-XA (Extended Architecture) mode on the 4381. It yields results mathematically equivalent to those achieved on the native

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3838. This facility requires no modification to standard application code. VPSS/VF requires three separately available software facilities: VPSS/XA, VS Fortran Version 2 Library, and Engineering and Scientific Subroutine Library.

PRICING

POLICY: The 4361 and 4381 are available for purchase or monthly rental only. The standard rental contract includes equipment maintenance and entitles the customer to unlimited usage each month. The purchase option accrual equals 40 percent of the monthly charge up to 50 percent of the purchase price. Some peripherals and other devices for the 4300 Series are available for purchase, lease, and rent.

The Agreement for Lease or Rental of IBM Machines provides users with a single contract on which they can specify mixtures of rental and leased equipment, each with various terms. CPUs rented under the plan can be terminated or downgraded on 90 days' notice, and all other rented equipment can be terminated or downgraded on 30 days' notice. Base terms and extension terms are specified for each piece of equipment obtained through a leasing agreement. The basic lease term is two years, followed by one-year extension terms.

Volume discounts are given for purchase of multiple 4300 systems; discounts vary from one system grouping to another.

IBM 4300 Series users receive the basic DOS/VSE, OS/VS1, VM/370, or MVS system control programs at no additional cost. All other IBM software, including the DOS/VS Advanced Functions and the SSX/VSE and IX/370 operating systems, is priced separately. In addition, basic monthly charges have been established for maintenance of the IBM system control programs and other licensed program products.

Charges for most software products are based on a continuous monthly charge. A onetime license fee is available for SSX/VSE, IX/370, and selected programs. Users who have multiple systems controlled from a central site can pay the Basic License Fee for the central site and the Distributed Systems License Option (DSLO) fee for all other locations. Central Service, including the IBM Support Center, is provided through the customer location designated for the Basic License.

SUPPORT: For purchased or rented systems, the IBM 4300 Series is under maintenance group D. The minimum period of maintenance service is 9 consecutive hours between 7 a.m. and 6 p.m., Monday through Friday. Charges for maintenance coverage outside this period are based upon the following percentages of the minimum monthly maintenance charge (MMC) added to the MMC:

	Consecutive Hours				
	*9	12	16	20	24
Monday-Friday (until 8 a.m. Saturday)	10	12	14	16	18
Saturday (until 8 a.m. Sunday)	4	5	7	8	9
Sunday (until 8 a.m. Monday)	4	7	9	11	12

**Outside of the hours 7 a.m. to 6 p.m.*

For users without a maintenance contract, the 4300 Series is maintained under per-call class 3. Under this class, the per-call charge during regular hours is $150 per hour, and during off hours the charge is $173 per hour.

For software, local programming support is available on two levels. The Monthly Licensed Program Support Charge provides local support for a single licensed program. The Monthly Multiple Licensed Program Support Charge provides local support for multiple copies of a program. The multiple copies can be installed at more than one customer location, but the local support is performed at one designated location. Local program support for Class 1 SCPs is offered on the same two levels.

An alternative to contracted software maintenance is per-call service, charged to the applicable hourly rate. Program service/programming assistance costs $182 per hour during regular hours and $209 per hour at other times. The initial and prime interface for software problems and their solution is the IBM Support Center, described below.

The centralized IBM Support Center provides 24-hour, seven-day customer access by telephone (an 800 number is provided). It utilizes the Software Support Facility data base, which incorporates every problem encountered and resolved (or unresolved) by the central support group. The customer is assisted in making out any APAR (program problem report) and gets advice on temporary fixes or bypasses.

RETAIN is a data base which serves as the heart of service support. It is available to 4300 customers as an online service. It is scanned for existing solutions to a problem as it occurs. RETAIN is also used as a place to store solutions to new problems so that others will not rediscover the same problems. If the Support Center cannot resolve a problem, the customer is put in touch with the Change Team Support Specialist, who is directly familiar with the section of coding relating to the problem being reported. If, after working with this individual, the user finds that the problem still cannot be resolved, the PSR (Program Support Representative) from the customer's local office is dispatched to assist. Under the support plan, many of the facilities that were previously provided by IBM support personnel at no charge have become billable activities.

TRAINING: IBM offers a range of technically and conceptually oriented training programs covering a variety of subjects, from large-system operating environments to information systems use and management. Educational methods include classroom instruction, self-study, program offerings (computer-based training products running on the 4300 Series and other systems), and technical update videotapes. Courses are usually given at IBM Education Centers nationwide; some are held at IBM branch offices and, by special arrangement, at user sites.

For the 4300 systems, IBM offers a range of systems, applications, and operations courses for DOS/VSE/SSX, OS/VS1, MVS, and VM environments; courses on communications systems, data base management systems, and distributed processing, among other subjects, are also offered. IBM also makes available the 4300 Operator Training Series, a multimedia, self-study curriculum for system operations.

TYPICAL CONFIGURATIONS: Sample configurations for IBM 4300 Series systems are shown below. Complete equipment and software prices follow these configurations.

4361 MODEL GROUP 5:

4361 Model L5 processor with 4MB of main memory and one I/O channel	$184,200
Two 3278-2A operator consoles with keyboards	6,828
3310 DASD Model A2 with Model B2 attached (258MB)	21,690
Four 8809 magnetic tape units	45,140

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Two 650 lpm 3262 Model 1 printers	30,080
3274 Model 31A communications controller	16,650
Workstation adapter	918
16 3178 Model C10 display stations	26,560
TOTAL PURCHASE PRICE:	$332,066

4381 MODEL GROUP 14:

4381 Model Q14 dual processor system with 24MB of main memory and 12 I/O channels	$ 795,000
Two 3205 color display consoles	5,790
3287 Model 2 console printer	5,150
3380 Model A4 DASD with two Model B4s attached (7.5GB)	206,560
3880 Model 2 storage control	60,270
Eight 3420 Model 6 magnetic tape units	143,360
3803 Model 2 tape control	27,550
Three 4245 Model 20 2000 lpm printers	105,000
Two 3274 Model 31A communications controllers	33,300
Six workstation adapters	5,508
64 3178 Model C10 display stations	106,240
TOTAL PURCHASE PRICE:	$1,493,728

EQUIPMENT PRICES

		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly 2-Year Lease Charge* ($)
PROCESSORS AND UPGRADES					
4361 K3	Processor with 2,097,152 bytes of main memory and 8K-byte buffer	56,500	318.00	4,075	NA
4361 L3	Same as 4361 K3, but with 4,194,304 bytes of main memory	71,500	374.00	5,355	NA
4361 K4	Processor with 2,097,152 bytes of main memory and 8K-byte buffer	126,900	529.00	9,820	NA
4361 L4	Same as 4361 K4, but with 4,194,304 bytes of main memory	141,900	585.00	11,100	NA
4361 LK4	Same as 4361 K4, but with 6,291,456 bytes of main memory	161,900	641.00	12,380	NA
4361 M4	Same as 4361 K4, but with 8,388,608 bytes of main memory	176,900	697.00	13,660	NA
4361 ML4	Same as 4361 K4, but with 12,852,912 bytes of main memory	206,900	809.00	16,220	NA
4361 N4	Same as 4361 K4, but with 16,777,216 bytes of main memory	242,200	921.00	19,200	NA
4361 K5	Processor with 2,097,152 bytes of main memory and 16K-byte buffer	169,200	637.00	13,050	NA
4361 L5	Same as K5, but with 4,194,304 bytes of main memory	184,200	693.00	14,330	NA
4361 LK5	Same as K5, but with 6,291,456 bytes of main memory	199,200	749.00	15,610	NA
4361 M5	Same as K5, but with 8,388,608 bytes of main memory	214,200	805.00	16,890	NA
4361 ML5	Same as K5, but with 12,582,912 bytes of main memory	244,200	917.00	19,450	NA
4361 N5	Same as 4361 K5, but with 16,777,216 bytes of main memory	279,700	1,030.00	22,430	NA
4381 L11	Processor with 4,194,304 bytes of main memory and 4K-byte buffer	185,000	450.00	18,780	NA
4381 M11	Same as L11, but with 8,388,608 bytes of main memory	215,000	503.00	21,630	NA
4381 P11	Same as L11, but with 16,777,216 bytes of main memory	275,000	609.00	27,330	NA
4381 M12	Processor with 8,388,608 bytes of main memory and 32K-byte buffer	330,000	550.00	38,510	NA
4381 P12	Same as M12, but with 16,777,216 bytes of main memory	390,000	656.00	44,210	NA
4381 Q12	Same as M12, but with 25,165,824 bytes of main memory	450,000	762.00	49,910	NA
4381 R12	Same as M12, but with 33,554,432 bytes of main memory	510,000	868.00	55,610	NA
4381 M13	Processor with 8,388,608 bytes of main memory and 64K-byte buffer	440,000	640.00	43,825	NA
4381 P13	Same as M13, but with 16,777,216 bytes of main memory	500,000	746.00	49,525	NA
4381 Q13	Same as M13, but with 25,165,824 bytes of main memory	560,000	852.00	55,225	NA
4381 R13	Same as M13, but with 33,554,432 bytes of main memory	620,000	958.00	60,925	NA
4381 P14	Dual processor system with 16,777,216 bytes of main memory and 64K-byte buffer per processor	735,000	740.00	75,125	NA
4381 Q14	Same as P14, but with 25,165,824 bytes of main memory	795,000	846.00	80,825	NA
4381 R14	Same as P14, but with 33,554,432 bytes of main memory	855,000	952.00	86,525	NA
System upgrades:					
	4361 K3 to 4361 L3	15,000	NA	NA	NA
	4361 K3 to 4361 K4**	58,560	NA	NA	NA
	4361 K3 to 4361 L4**	73,560	NA	NA	NA
	4361 K3 to 4361 LK4**	93,560	NA	NA	NA
	4361 K3 to 4361 M4**	108,560	NA	NA	NA
	4361 K3 to 4361 ML4**	138,560	NA	NA	NA
	4361 K3 to 4361 N4**	174,060	NA	NA	NA

**Rental/lease prices include equipment maintenance.*
***Standard 4361 Model Group 4 or 5 features that are optional on the 4361 Model Group 3 must already be installed.*
NC—No charge.
NA—Not applicable.

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	Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly 2-Year Lease Charge* ($)
System upgrades: (Continued)				
4361 L3 to 4361 L4**	58,560	NA	NA	NA
4361 L3 to 4361 LK4**	78,560	NA	NA	NA
4361 L3 to 4361 M4**	93,560	NA	NA	NA
4361 L3 to 4361 ML4**	123,560	NA	NA	NA
4361 L3 to 4361 N4**	159,060	NA	NA	NA
4361 K3 to 4361 K5**	98,195	NA	NA	NA
4361 K3 to 4361 L5**	113,195	NA	NA	NA
4361 K3 to 4361 LK5**	128,195	NA	NA	NA
4361 K3 to 4361 M5**	143,195	NA	NA	NA
4361 K3 to 4361 ML5**	173,195	NA	NA	NA
4361 K3 to 4361 N5; requires 1100 floating-point multiply accelerator, 1421 block multiplexer channel, and 5248 Byte Multiplexer Channel	208,695	NA	NA	NA
4361 L3 to 4361 L5**	98,195	NA	NA	NA
4361 L3 to 4361 LK5**	113,195	NA	NA	NA
4361 L3 to 4361 M5**	128,195	NA	NA	NA
4361 L3 to 4361 ML5**	158,195	NA	NA	NA
4361 L3 to 4361 N5; same prerequisites as K3-to-N5 upgrade	193,695	NA	NA	NA
4361 K4 to 4361 L4	15,000	NA	NA	NA
4361 K4 to 4361 LK4	35,000	NA	NA	NA
4361 K4 to 4361 M4	50,000	NA	NA	NA
4361 K4 to 4361 ML4	80,000	NA	NA	NA
4361 K4 to 4361 N4	115,500	NA	NA	NA
4361 L4 to 4361 LK4	20,000	NA	NA	NA
4361 L4 to 4361 M4	35,000	NA	NA	NA
4361 L4 to 4361 ML4	65,000	NA	NA	NA
4361 L4 to 4361 N4	100,500	NA	NA	NA
4361 LK4 to 4361 M4	15,000	NA	NA	NA
4361 LK4 to 4361 ML4	45,000	NA	NA	NA
4361 LK4 to 4361 N4	80,500	NA	NA	NA
4361 M4 to 4361 ML4	30,000	NA	NA	NA
4361 ML4 to 4361 N4	35,500	NA	NA	NA
4361 K4 to 4361 K5	39,635	NA	NA	NA
4361 K4 to 4361 L5	54,635	NA	NA	NA
4361 K4 to 4361 LK5	69,635	NA	NA	NA
4361 K4 to 4361 M5	84,635	NA	NA	NA
4361 K4 to 4361 ML5	114,635	NA	NA	NA
4361 K4 to 4361 N5	150,135	NA	NA	NA
4361 L4 to 4361 L5	39,635	NA	NA	NA
4361 L4 to 4361 LK5	54,635	NA	NA	NA
4361 L4 to 4361 M5	69,635	NA	NA	NA
4361 L4 to 4361 ML5	99,635	NA	NA	NA
4361 L4 to 4361 N5; includes 1421 block mulitplexer channel #2 and 5532 additional power interfaces; does not include 5248 Byte Multiplexer Channel	135,135	NA	NA	NA
4361 LK4 to 4361 LK5	34,635	NA	NA	NA
4361 LK4 to 4361 M5	49,635	NA	NA	NA
4361 LK4 to 4361 ML5	79,635	NA	NA	NA
4361 LK4 to 4361 N5; includes/excludes same prerequisites as L4-to-N5 upgrade	115,135	NA	NA	NA
4361 M4 to 4361 M5	34,635	NA	NA	NA
4361 M4 to 4361 ML5	64,635	NA	NA	NA
4361 M4 to 4361 N5; includes/excludes same prerequisites as L4-to-N5 upgrade	100,135	NA	NA	NA
4361 ML4 to 4361 ML5	34,635	NA	NA	NA
4361 ML4 to 4361 N5; includes/excludes same prerequisites as L4-to-N5 upgrade	70,135	NA	NA	NA
4361 N4 to 4361 N5; includes/excludes same prerequisites as L4-to-N5 upgrade	34,635	NA	NA	NA
4361 K5 to 4361 L5	15,000	NA	NA	NA
4361 K5 to 4361 LK5	30,000	NA	NA	NA

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NC—No charge.
NA—Not applicable.

IBM 4300 Series

	Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly 2-Year Lease Charge* ($)
System upgrades: (Continued)				
4361 K5 to 4361 M5	45,000	NA	NA	NA
4361 K5 to 4361 ML5	75,000	NA	NA	NA
4361 K5 to 4361 N5	110,500	NA	NA	NA
4361 L5 to 4361 LK5	15,000	NA	NA	NA
4361 L5 to 4361 M5	30,000	NA	NA	NA
4361 L5 to 4361 ML5	60,000	NA	NA	NA
4361 L5 to 4361 N5	95,500	NA	NA	NA
4361 LK5 to 4361 M5	15,000	NA	NA	NA
4361 LK5 to 4361 ML5	45,000	NA	NA	NA
4361 LK5 to 4361 N5	80,500	NA	NA	NA
4361 M5 to 4361 ML5	30,000	NA	NA	NA
4361 M5 to 4361 N5	65,500	NA	NA	NA
4361 ML5 to 4361 N5	35,500	NA	NA	NA
4381 L11 to 4381 M11	30,000	NA	NA	NA
4381 L11 to 4381 P11	90,000	NA	NA	NA
4381 L11 to 4381 M12	145,000	NA	NA	NA
4381 L11 to 4381 P12	205,000	NA	NA	NA
4381 L11 to 4381 Q12	265,000	NA	NA	NA
4381 L11 to 4381 R12	325,000	NA	NA	NA
4381 M11 to 4381 P11	60,000	NA	NA	NA
4381 M11 to 4381 M12	115,000	NA	NA	NA
4381 M11 to 4381 P12	175,000	NA	NA	NA
4381 M11 to 4381 Q12	235,000	NA	NA	NA
4381 M11 to 4381 R12	295,000	NA	NA	NA
4381 P11 to 4381 P12	115,000	NA	NA	NA
4381 P11 to 4381 Q12	175,000	NA	NA	NA
4381 P11 to 4381 R12	235,000	NA	NA	NA
4381 M12 to 4381 P12	60,000	NA	NA	NA
4381 M12 to 4381 Q12	120,000	NA	NA	NA
4381 M12 to 4381 R12	180,000	NA	NA	NA
4381 M12 to 4381 M13	110,000	NA	NA	NA
4381 M12 to 4381 P13	170,000	NA	NA	NA
4381 M12 to 4381 Q13	230,000	NA	NA	NA
4381 M12 to 4381 R13	290,000	NA	NA	NA
4381 P12 to 4381 Q12	60,000	NA	NA	NA
4381 P12 to 4381 R12	120,000	NA	NA	NA
4381 P12 to 4381 P13	110,000	NA	NA	NA
4381 P12 to 4381 Q13	170,000	NA	NA	NA
4381 P12 to 4381 R13	230,000	NA	NA	NA
4381 Q12 to 4381 R12	60,000	NA	NA	NA
4381 Q12 to 4381 Q13	110,000	NA	NA	NA
4381 Q12 to 4381 R13	170,000	NA	NA	NA
4381 R12 to 4381 R13	110,000	NA	NA	NA
4381 M13 to 4381 P13	60,000	NA	NA	NA
4381 M13 to 4381 Q13	120,000	NA	NA	NA
4381 M13 to 4381 R13	180,000	NA	NA	NA
4381 M13 to 4381 P14 with feature 1870	259,420	NA	NA	NA
4381 M13 to 4381 P14 without feature 1870	295,000	NA	NA	NA
4381 M13 to 4381 Q14 with feature 1870	319,420	NA	NA	NA
4381 M13 to 4381 Q14 without feature 1870	355,000	NA	NA	NA
4381 M13 to 4381 R14 with feature 1870	379,420	NA	NA	NA
4381 M13 to 4381 R14 without feature 1870	415,000	NA	NA	NA
4381 P13 to 4381 Q13	60,000	NA	NA	NA
4381 P13 to 4381 R13	120,000	NA	NA	NA
4381 P13 to 4381 P14 with feature 1870	199,420	NA	NA	NA
4381 P13 to 4381 P14 without feature 1870	235,000	NA	NA	NA

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NA—Not applicable.

IBM 4300 Series

		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly 2-Year Lease Charge* ($)
System upgrades: (Continued)					
	4381 P13 to 4381 Q14 with feature 1870	259,420	NA	NA	NA
	4381 P13 to 4381 Q14 without feature 1870	295,000	NA	NA	NA
	4381 P13 to 4381 R14 with feature 1870	319,420	NA	NA	NA
	4381 P13 to 4381 R14 without feature 1870	355,000	NA	NA	NA
	4381 Q13 to 4381 R13	60,000	NA	NA	NA
	4381 Q13 to 4381 Q14 with feature 1870	199,420	NA	NA	NA
	4381 Q13 to 4381 Q14 without feature 1870	235,000	NA	NA	NA
	4381 Q13 to 4381 R14 with feature 1870	259,420	NA	NA	NA
	4381 Q13 to 4381 R14 without feature 1870	295,000	NA	NA	NA
	4381 R13 to 4381 R14 with feature 1870	199,420	NA	NA	NA
	4381 R13 to 4381 R14 without feature 1870	235,000	NA	NA	NA
PROCESSOR FEATURES AND CHANNELS					
Many of the features listed below include microcode as well as hardware. Microcode is supplied on diskettes.					
Features for the 4361:					
1100	Floating-Point Multiply Accelerator (standard on Model Groups 4 and 5)	8,500	21.00	559	NA
1200	Auto Start	1,200	5.00	79	NA
5248	Byte Multiplexer Channel (standard on Model Group 5)	2,665	3.00	162	NA
1421	Block Multiplexer Channel (standard on Model Groups 4 and 5)	3,340	3.00	204	NA
1422	Second block muiltiplexer channel (Model Group 4)	3,340	3.00	204	NA
1431	High-Speed Block Multiplexer Channel	4,760	3.50	318	NA
1432	High-Speed Block Multiplexer Channel, additional (Model Groups 4 and 5 only)	4,760	3.50	318	NA
1433	High-Speed Block Multiplexer Channel, additional (Model Groups 4 and 5)	4,760	3.50	318	NA
2002	Work Station Adapter	7,500	32.00	492	NA
3299	Terminal Multiplexer, Model 1; required for every 8 ports on a Work Station Adapter	1,175	NA	NA	NA
3201	DASD/8809 Adapter	2,730	5.00	166	NA
3202	DASD/8809 Adapter, additional	2,730	5.00	166	NA
3203	DASD/8809 Adapter, additional (Model Groups 4 and 5)	2,730	5.00	166	NA
3204	DASD/8809 Adapter, additional (Model Groups 4 and 5)	2,730	5.00	166	NA
Features for the 4381:					
1850	Channel-to-Channel Adapter	23,150	31.00	1,780	NA
1870	Block Multiplexer Channels, additional	35,580	12.50	2,735	NA
1871	Additional Block Multiplexer Channels	35,580	12.50	2,735	NA
3088 Multisystem Channel Communication Unit:					
	Model 1; connects to 4 processors	95,000	128.00	NA	NA
	Model 2; connects to 8 processors	145,000	160.00	NA	NA
System Consoles:					
3205 100	Color Display Console	2,895	24.75	NA	NA
	Integrated operator control panel for 4361 processor (RPQ 7B0987)	2,770	NA	NA	NA
3278 2A	Display Console	2,505	19.00	146	124
	4631 75-Key Operator Console Keyboard with channel-to-channel interface and operator control panel (for 4381)	977	5.50	58	49
	4632 same as 4631 without channel-to-channel interface (for 4381)	909	5.50	55	47
	4633 same as 4631 without operator control panel (for 4381)	472	5.00	24	21
	4634 same as 4631 without channel-to-channel interface (for 4361)	909	6.00	55	47
MASS STORAGE					
3310	Disk Storage:				
	Model A1; one drive with controller; 64.5MB	6,960	73.00	626	533
	Model A2; two drives with controller; 64.5MB each	11,570	118.00	1,039	884
	Model B1; one drive; 64.5MB (for attachment to Model A2)	5,510	67.00	494	420
	Model B2; two drives; 64.5MB each (for attachment to Model A2)	10,120	112.00	906	771

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IBM 4300 Series

		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly 2-Year Lease Charge* ($)
MASS STORAGE (Continued)					
3350	Direct Access Storage; 317.5MB per drive:				
	Model A2; Dual Disk Drive	32,030	173.00	2,268	1,930
	Model A2F; Dual Disk Drive with 2MB fixed-head storage	39,970	224.00	2,826	2,405
	Model B2; Add-on Dual Disk Drive	25,360	130.00	1,804	1,535
	Model B2F; Add-on Dual Disk Drive for 2MB fixed-head storage per drive	33,300	182.00	2,362	2,010
	Model C2; Two-drive disk storage and associated control	33,130	182.00	2,362	2,010
	Model C2F; Two-drive disk storage and associated control	41,070	234.00	2,920	2,485
	1320 Primary Controller Adapter (permits selection of A2/AF controller as on-line controller via manual switch on the C2/C2F)	220	1.50	16	14
6148	Remote switch attachment	NC	NC	NC	NC
	8150 String Switch for 3350 A2, A2F, C2, C2F	3,690	9.50	277	236
3370	Direct Access Storage:				
	Model A1; Single Disk Drive; 571.3MB	35,480	158.00	1,686	1,435
	Model B1; Add-on Single Disk Drive for attachment to Model A1	26,600	118.00	1,263	1,075
	Model A2; 729.8MB; contains logic and power for up to three Model B2 units	35,480	134.00	2,190	NA
	Model B2; connects to a 3370 Model A2	26,600	101.00	1,640	NA
	8150 String Switch for 3370 A1 and A2; 2-year lease price applies to A1 string switch only	3,830	1.50	181	154
3375	Direct Access Storage; 819.7MB per drive:				
	Model A1; contains logic and power for up to three Model B1 units	38,040	139.00	1,686	1,435
	Model B1; connects to a 3375 Model A1	28,770	105.00	1,351	1,150
	Model D1; provides dual controller function in a 3375 string; requires one Model A1 and two Model B1s	36,290	128.00	1,604	1,365
	4951 Model D1 Attachment for Model A1	2,590	6.00	102	87
	4952 Model D1 Attachment for Model B1	NC	NC	NC	NC
	8150 String Switch Feature for 3375 A1	3,795	1.50	181	154
3380	Direct Access Storage; 2.52 billion bytes per unit:				
	Model A4; connects to one 3880 storage director	77,680	285.00	4,823	4,105
	Model AA4; connects to one 3880 storage director	88,780	325.00	5,511	4,690
	Model B4; connects to a Model A unit	64,440	240.00	4,001	3,405
	Model AD4; 2.52GB Extended Capability drive; attaches to 3880 Model 3 or 23 storage directors	88,780	295.00	5,105	NA
	Model AE4; 5.04GB Extended Capability drive; attaches to 3880 Model 3 or 23 storage directors	134,740	295.00	7,590	NA
	Model BD4; 2.52GB Extended Capability drive; can be attached to AD4, AE4, BE4, or another BD4	64,440	215.00	3,715	NA
	Model BE4; 5.04GB Extended Capability drive; can be attached to AD4, AE4, BD4, or another BE4	110,400	215.00	6,190	NA
3880	Storage Control; includes two storage directors:				
	Model 1; each storage director can attach up to four 3350 A2/A2F, 3370 A1, or 3375 A1 or D1 in any combination	60,270	176.00	4,124	3,510
	Model 2; provides one storage director for 3350, A2/A2F, 3370 A1, or 3375 storage and one for 3380 storage	60,270	176.00	4,124	3,510
	Model 3; provides two storage directors for 3380 storage	60,270	176.00	4,124	3,510
	Model 4; provides one storage director which can attach up to four 3375 Model A1s	35,000	82.50	2,370	NA
	Model D21; paging subsystem for 3350; includes two storage directors; 8 megabytes (4381 only)	143,750	575.00	8,965	NA
	Model E21; same as D21, but with 16 megabytes (4381 only)	183,750	600.00	11,300	NA
	Model G21; same as D21, but with 32 megabytes (4381 only)	263,750	650.00	15,970	NA
	Model H21; same as D21, but with 48 megabytes (4381 only)	343,750	700.00	20,640	NA
	Model J21; same as D21, but with 64 megabytes (4381 only)	423,750	750.00	25,310	NA
	Model D23; includes two cache storage directors for 3380; 8 megabytes (for 4381 only)	143,750	575.00	8,965	NA
	Model E23; same as D23, but 16 megabytes (4381 only)	183,750	600.00	11,300	NA
	Model G23; same as D23, but with 32 megabytes (4381 only)	263,750	650.00	15,970	NA
	Model H23; same as D23, but with 48 megabytes (4381 only)	343,750	700.00	20,640	NA
	Model J23; same as D23, but with 64 megabytes (4381 only)	423,750	750.00	25,310	NA
	6148 Remote Switch Attachment	NC	NC	NC	NC
	6149 Remote Switch Attachment, additional	NC	NC	NC	NC
	6150 Remote Switch Attachment for Eight-Channel Switch	NC	NC	NC	NC
	6550 Speed Matching Buffer for 3380	9,705	40.00	597	508

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NA—Not applicable.

IBM 4300 Series

		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly 2-Year Lease Charge* ($)
MASS STORAGE (Continued)					
	6560 Speed Matching Buffer	11,420	40.00	518	441
	8160 Two-channel switch	3,850	5.00	241	NA
	8170 Two-Channel Switch Pair	6,225	11.00	421	358
	8171 Two-Channel Switch Pair, additional	16,610	38.50	1,136	967
	8172 Eight-Channel Switch	22,850	53.50	1,563	1,330
MAGNETIC TAPE EQUIPMENT					
3410	Magnetic Tape Unit:				
	Model 1; 20,000 bytes/sec.	3,365	132.00	351	295
	Model 2; 40,000/20,000 bytes/sec.	4,365	145.00	466	391
	Model 3; 80,000/40,000 bytes/sec.	5,365	160.00	587	493
3411	Magnetic Tape Unit and Control:				
	Model 1; 20,00 bytes/sec.	7,910	190.00	724	608
	Model 2; 40,00/20,000 bytes/sec. (not in new production)	9,910	204.00	921	774
	Model 3; 80,000/40,000 bytes/sec. (not in new production)	11,910	216.00	1,115	937
	3211 Single Density Feature (for 3410 and 3411)	1,140	17.00	101	85
	3221 Dual Density Feature (for 3410 and 3411)	2,185	61.00	149	125
	7360 System/370 Attachment (required on 3411)	1,950	39.50	288	235
3420	Magnetic Tape Units:				
	Model 3; 120,000 bytes/sec. at 1600 bpi; 75 ips	11,930	226.00	699	587
	Model 4; 470,000 bytes/sec. at 6250 bpi; 75 ips	15,340	226.00	979	822
	Model 5; 200,000 bytes/sec. at 1600 bpi; 125 ips	16,000	248.00	943	792
	Model 6; 780,000 bytes/sec. at 6250 bpi; 125 ips	17,920	248.00	1,125	945
	Model 7; 320,000 bytes/sec. at 1600 bpi; 200 ips	17,920	297.00	1,115	937
	Model 8; 1250 bytes/sec. at 6250 bpi; 200 ips	19,880	365.00	1,335	1,121
	6420 6250 bpi Density Feature (for 3420 Models 4, 6, and 8)	1,600	68.00	95	80
	6425 6250/1600 bpi Density Feature (for 3420 Models 4, 6, and 8)	2,205	90.00	138	116
	6631 Single Density Feature (for Models 3, 5, and 7)	2,870	67.50	162	136
	3550 Dual Density Feature (for Models 3, 5, and 7)	3,705	113.00	211	177
	6407 7-Track Feature (for Models 3, 5, and 7)	2,870	98.00	162	136
3422	Magnetic Tape Unit:				
	A1 drive and control unit	36,800	400.00	2,240	NA
	B1 magnetic tape unit	17,900	165.00	1,060	NA
	3020 Data Streaming Feature	1,575	32.00	111	NA
	3005 Two Channel Switch	3,250	4.00	167	NA
	3010 Two Control Unit Switch (Communicator), primary	7,350	19.00	387	NA
	3015 Same as 3010, but secondary	5,250	19.00	282	NA
3430	Magnetic Tape Subsystem:				
	Model A1; Tape Unit and Control	33,400	251.00	2,345	NA
	Model B1; Tape Unit only	16,900	176.00	1,245	NA
	4991 Multiple Drive Attachment	600	5.00	42	NA
3480	Magnetic Tape Subsystem:				
	Model A22 Control Unit	65,430	385.00	4,190	NA
	Model B22 Magnetic Tape Unit	43,120	240.00	2,745	NA
	1511 First Channel Attachment	5,785	21.00	357	NA
	1512 Second Channel Attachment	5,785	21.00	357	NA
	1513 Third Channel Attachment	5,785	21.00	357	NA
3803	Tape Controller:				
	Model 1; for 3420 Models 3, 5, 7	20,680	144.00	1,215	1,021
	Model 2; for 3420 Models 3 through 8 drives	27,550	199.00	1,770	1,487
	5310 9-Track NRZI Feature (permits connection of 800-bpi drives to 3803-2)	3,080	2.00	170	143
	6320 7-Track NRZI Feature (permits connection of 800-bpi drives to 3803-2; 5310 is prerequisite)	1,515	2.00	85	71
	Multiple Tape Control Switches (for switching up to sixteen 3420 tape drives among up to four 3803 control units):				
	1792 for 2 Tape Controls	6,130	14.00	354	297
	1793 for 3 Tape Controls	7,820	23.00	459	385
	1794 for 4 Tape Controls	9,195	23.00	537	451

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IBM 4300 Series

		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly 2-Year Lease Charge* ($)
MAGNETIC TAPE EQUIPMENT (Continued)					
	6148 Remote Switch Attachment	910	NA	51	43
	8100 Two-Channel Switch	4,600	6.50	262	220
8809	Magnetic Tape Unit (4361 only):				
	Model 1A; first drive; operates in start/stop mode at 20,000 bytes/sec. or in streaming mode at 160,000 bytes/sec.	11,960	95.00	835	532
	Model 2; second, fourth, or sixth drive; attaches to Model 1A or 3	10,610	85.00	747	473
	Model 3; third or fifth drive; attaches to Model 2	11,960	95.00	835	532
PUNCHED CARD EQUIPMENT					
3525	Card Punch:				
	Model P1; 100 cpm	25,520	214.00	1,035	NA
	Model P2; 200 cpm	26,520	290.00	1,305	NA
	Model P3; 300 cpm	27,520	362.00	1,570	NA
	1533 Card Read Feature	7,645	54.00	305	NA
	1421 Basic Card Print	16,750	213.00	670	NA
	5273 Multi-Line Card Print	1,365	62.00	179	NA
	8339 Two-Line Card Print	874	8.00	27	NA
PRINTERS					
3203	Printer, Model 5; 1200 lpm, 132 print positions	33,875	451.00	2,155	1,835
	1416 Interchangeable Train Cartridge (required)	2,930	NA	190	NA
3262	Line Printer:				
	Model 1; 650 lpm (4361 only)	15,040	202.50	733	624
	Model 3; 650 lpm (3274)	15,040	202.50	733	624
	Model 11; 325 lpm (4361 only)	12,620	148.00	539	459
	Model 13; 325 lpm (3274)	12,620	148.00	539	459
3268	Model 2	7,500	74.00	NA	NA
	Model 2C	8,990	99.00	NA	NA
3287	Serial Printer:				
	Model 1; 80 cps	4,830	40.00	NA	NA
	Model 2; 120 cps	5,150	50.00	NA	NA
	Model 1C; 4 colors; 80 cps	5,210	45.00	NA	NA
	Model 2C; 4 colors; 120 cps	5,530	55.00	NA	NA
	1120 APL/Text	165	0.50	NA	NA
	3610 Extended Character Set Adapter	429	3.00	NA	NA
	3880 Extended Print Buffer	198	0.50	NA	NA
	4110 Friction Feed Paper Handling	151	0.50	NA	NA
	8330 3271/3272 Attachment for Models 1 and 2	860	2.50	NA	NA
	8331 3274/3276 Attachment for Models 1 and 2	165	0.50	NA	NA
	8700 Variable-Width Forms Tractor	151	0.50	NA	NA
3812	Nonimpact tabletop page printer Model 1	7,490	115.00	NA	NA
	3060 bisync communication feature for VM attachment	250	NA	NA	NA
3820	Laser page printer				
	Model 1	28,350	310.00	1,680	NA
	3005 pattern storage memory 256KB	1,050	10.00	61	NA
	3010 pattern storage memory 512KB	1,700	20.00	102	NA
	3020 pattern storage memory 1024KB	3,000	40.00	184	NA
	3025 pattern storage memory 2048KB	6,000	80.00	368	NA
	3030 pattern storage memory 3072KB	9,000	120.00	552	NA
	3035 control storage memory 128KB	750	10.00	46	NA
	3050 System/370 channel interface attachment	2,600	40.00	164	NA
4245	Band printer				
	Model 12; 1200 lpm	28,000	300.00	1,850	NA
	Model D12; 1200 lpm	28,000	300.00	1,850	NA
	Model 20; 2000 lpm	35,000	400.00	2,340	NA
	Model D20; 2000 lpm	35,000	400.00	2,340	NA
4248	Printer, Model 1; 2200 to 3600 lpm; 132 print positions (for 4381 only)	75,000	1,070.00	6,205	NA
	3751 Additional 36 Print Positions (plant installation)	10,000	110.00	615	NA
	3753 Additional 36 Print Positions (field installation)	15,000	110.00	615	NA
4250	Nonimpact printer, Model 1; 600 by 600 dots per square inch (4361 only)	21,000	183.00	1,385	NA

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IBM 4300 Series

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OPTICAL AND MAGNETIC READERS					
1255	Magnetic Character Reader:				
	Model 1; 500 dpm, 6 stackers	41,040	467.00	1,780	NA
	Model 2; 750 dpm, 6 stackers	46,970	749.00	2,185	NA
	Model 3; 750 dpm, 12 stackers	63,960	939	2,875	NA
	3215 Dash Symbol Transmission (for 1255 or 1419)	56	NC	41	NA
	4380 51-Column Card Sorting (for 1255 or 1419)	661	NC	20	NA
	4520 High-Order Zero and Bank Selection (for 1255 Model 3 only)	1,515	NA	63	NA
	7060 Self-Checking Numbers (for 1255)	2,465	NA	104	NA
	6360 System/360/370 Adapter (required on 1255)	22,910	65.00	1,005	NA
1419	Magnetic Character Reader; 1600 dpm	89,050	2,010.00	6,160	NA
	7061 Self-Checking Number, Modulus 10	1,560	NA	97	NA
	7062 Self-Checking Number, Modulus 11	2,410	12.00	159	NA
3890	Document Processor; Model A has 13K bytes, Model B has 29K bytes of memory:				
	Model A1; 6 pockets	280,350	440.00	9,455	NA
	Model A2; 12 pockets	327,300	529.00	10,960	NA
	Model A3; 18 pockets	374,250	614.00	12,470	NA
	Model A4; 24 pockets	421,200	701.00	13,975	NA
	Model A5; 30 pockets	468,150	785.00	15,485	NA
	Model A6; 36 pockets	515,100	873.00	16,985	NA
	Model B1; 6 pockets	302,560	536.00	11,780	NA
	Model B2; 12 pockets	349,510	625.00	13,280	NA
	Model B3; 18 pockets	396,460	709.00	14,795	NA
	Model B4; 24 pockets	443,410	798.00	16,295	NA
	Model B5; 30 pockets	490,360	883.00	17,805	NA
	Model B6; 36 pockets	537,310	968.00	19,320	NA
	Model E2; 12 stackers	243,785	698.00	NA	NA
	Model E3; 18 stackers	290,735	778.00	NA	NA
	Model E4; 24 stackers	337,685	859.00	NA	NA
	Model E5; 30 stackers	384,635	937.00	NA	NA
	Model E6; 36 stackers	431,585	1,015.00	NA	NA
	Model F2; 12 stackers	265,995	786.00	NA	NA
	Model F3; 18 stackers	312,945	866.00	NA	NA
	Model F4; 24 stackers	359,895	949.00	NA	NA
	Model F5; 30 stackers	406,845	1,025.00	NA	NA
	Model F6; 36 stackers	453,795	1,105.00	NA	NA
SYSTEM MANAGEMENT					
3814	Switching Management System (requires one Model A):				
	Model A1; Controller; 4 x 4 switch	47,480	145.00	2,438	1,950
	Model A2; Controller; 4 x 8 switch	60,420	189.00	3,106	2,485
	Model A3; Controller; 8 x 4 switch	64,740	185.00	3,331	2,665
	Model A4; Controller; two 4 x 4 switches	69,570	203.00	3,588	2,870
	Model B1; Remote Unit; 4 x 4 switch	39,710	98.00	2,044	1,635
	Model B2; Remote Unit; 4 x 8 switch	52,660	143.00	2,706	2,165
	Model B3; Remote Unit; 8 x 4 switch	56,970	138.00	2,931	2,345
	Model B4; Remote Unit; two 4 x 4 switches	61,800	156.00	3,181	2,545
	Model C1; Expansion Unit; 4 x 4 switch	37,980	95.00	1,950	1,560
	Model C2; Expansion Unit; 4 x 8 switch	50,930	139.00	2,613	2,090
	Model C3; Expansion Unit; 8 x 4 switch	55,240	134.00	2,838	2,270
	Model C4; Expansion Unit; two 4 x 4 switches	60,070	153.00	3,094	2,475
	1520 Channel Expansion Internal—4 Control Unit Interfaces	1,550	1.00	86	69
	1521 Channel Expansion Internal—8 Control Unit Interfaces	3,100	1.00	168	135
	6010 Remote Two-Channel Switch Control—Basic	5,180	19.50	284	226
	6011 Remote Two-Channel Switch Control—Additional	2,415	14.50	133	106
	6350 System Power Sequencing—Additional	207	NA	8	6
COMMUNICATIONS EQUIPMENT					
For the 4361:					
	1020 Autocall Unit Interface	330	3.50	16	NA
	1601 Communications Adapter, base (optional on all model groups)	2,330	3.00	141	NA
	3701 EIA/CCITT Interface	330	3.50	16	NA
	4695 Line Attachment Base; for clocked modems	330	2.00	16	NA
	4696 Line Attachment Base; for nonclocked modems	390	2.00	21	NA
	4720 High-Speed Modem Adapter	1,000	3.50	50	NA

**Rental/lease prices include equipment maintenance.*
***Standard 4361 Model Group 4 or 5 features that are optional on the 4361 Model Group 3 must already be installed.*
NC—No charge.
NA—Not applicable.

IBM 4300 Series

	COMMUNICATIONS EQUIPMENT (Continued)	Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly 2-Year Lease Charge* ($)
	4801 Local Attachment Interface	830	4.50	44	NA
	5650 Digital Data Service Adapter	750	4.00	35	NA
	4717 High-Speed Digital Interface	2,050	6.00	136	NA
	5655 X.25 Adapter, nonswitched	770	2.50	33	NA
4994	ASCII Device Attachment Control Unit:				
	Model A; supports up to 16 devices	16,735	214.00	1,035	NA
	Model B; supports up to 32 devices	25,850	282.00	1,605	NA
	Model C; supports up to 48 devices	32,300	344.00	2,010	NA
7171	ASCII Device Attachment Control Unit, Model 1; supports up to 64 devices	12,420	245.00	NA	NA
	4000 8-Line Increment	830	13.50	NA	NA
	4002 8-Line Increment, additional	1,325	13.50	NA	NA
	4001 Spare Parts Kit	5,705	NA	NA	NA
3705-80	Communication Controller				
	Model 81	36,600	259.00	1,986	1,690
	Model 82	46,600	271.00	2,603	2,215
	Model 83	52,600	282.00	3,067	2,610
	1544 Channel Adapter Type 4	4,410	8.00	308	262
	1551 Channel Adapter Type 1	3,340	9.50	223	190
	8002 Two Channel Switch	2,090	2.50	111	95
3725	Communication Controller:				
	Model 1; up to six channel adapters and from 512K to 1024K bytes of main storage capacity	75,000	224.00+	4,020	NA
	Model 2; up to two channel adapters and 512K bytes of main storage capacity (Model 2 to Model 1 Upgrade charge is $16,000)	60,500	200.00+	3,030	NA
	1561 Channel Adapter	6,750	8.50+	363	NA
	4666 Internal Clock Control	1,500	2.00+	78	NA
	4771 LAB Type A	19,000	17.00+	1,015	NA
	4772 LAB Type B	26,400	29.00+	1,420	NA
	4911 LIC Type 1	2,600	2.00+	141	NA
	4921 LIC Type 2	3,000	2.00+	159	NA
	4931 LIC Type 3	3,000	2.00+	159	NA
	4941 LIC Type 4A	2,600	2.00+	141	NA
	4942 LIC Type 4B	3,000	2.00+	159	NA
	7100 Storage Increment 256K	4,375	20.00+	234	NA
	8320 Two Processor Switch	4,000	3.00+	216	NA
3726	Communication Controller Expansion	32,000	42.00	1,710	NA
3727	Operator Console	2,390	27.00	196	NA

**Rental/lease prices include equipment maintenance.*
***Standard 4361 Model Group 4 or 5 features that are optional on the 4361 Model Group 3 must already be installed.*
NC—No charge.
NA—Not applicable.

SOFTWARE PRICES

		Initial Charge		Monthly Charge		
		Basic License Charge ($)	DSLO License Charge ($)	Basic License Charge ($)	DSLO Charge ($)	Licensed Program Support Charge ($)
5666-265	SSX/VSE	*20,000	*15,000	1,315	922	123
5666-274	SSX/VSE RPG II	NA	NA	160	120	7
5666-276	SSX/VSE PL/1 Optimizing Compiler and Library	NA	NA	347	260	50
5666-277	SSX/VSE PL/1 Transient Library	NA	NA	35	25	7
5666-275	DL/1 SSX/VSE	NA	NA	429	322	126
5666-301	VSE/Advanced Functions Version 2	*11,430	*10,287	438	394	108

**Onetime license charge.*
NA—Not applicable.

IBM 4300 Series

		Initial Charge		Monthly Charge		
		Basic License Charge ($)	DSLO License Charge ($)	Basic License Charge ($)	DSLO Charge ($)	Licensed Program Support Charge ($)
5666-316	VSE/SP Version 2	*48,500	*43,650	2,160	1,945	433
5666-313	ACF/VTAM Version 3 for VSE	963	864	321	288	82
5668-981	X.25 Packet Switching Interface	770	577	269	202	40
5735-RC2	ACF/VTAM, OS/VS	1,320	990	457	343	55
	Networking Feature	3,080	2,310	1,100	825	163
5746-RC3	ACF/VTAM, DOS/VSE	NA	NA	197	177	58
	Networking Feature	NA	NA	374	337	174
5735-RC3	ACF/TCAM Version 2, OS/VS	2,420	1,815	874	655	91
	Networking Feature	4,070	3,053	1,465	1,099	113
5735-XX1	ACF/NCP/VS	1,305	979	234	176	35
5735-XX7	Network Terminal Option	660	495	206	155	12
5746-XE8	VSE/Advanced Functions	NA	NA	299	270	61
5746-RC7	Advanced Communications Function for VTAM Entry (ACF/VTAME)	*4,000	*3,000	191	172	82
5746-TS1	VSE/Interactive Computing and Control Facility	NA	NA	161	144	28
5746-XE3	VSE/POWER Version 1	*1,800	*1,350	68	61	17
5666-273	VSE/POWER Version 2	498	447	166	149	33
5746-AM5	VSE/3270 Bisync Pass Through	*4,755	NA	217	NA	NA
5746-AM2	VSE/VSAM	NA	NA	82	74	24
5746-AM4	VSE/Fast Copy Data Set Program	*499	NA	NA	NA	5
5746-UT3	VSE/Data Interfile Transfer, Testing, and Operations Utility (VSE/DITTO)	NA	NA	44	34	5
5746-XE7	VSE/Access Control—Logging and Reporting	*2,360	*2,125	63	57	24
5746-SA1	VSE/Interactive Problem Control System	*880	*660	40	28	6
5746-RC5	Basic Telecommunications Access Method Extended Support	NA	NA	44	40	7
5746-LM3	DOS Fortran IV Library Option I	NA	NA	40	30	NA
5746-CB1	DOS/VS Cobol Compiler and Library	NA	NA	184	138	15
5746-LM4	DOS/VS Cobol Library	NA	NA	33	24	7
5736-PL1	DOS PL/1 Optimizing Compiler	NA	NA	251	188	39
5736-LM4	DOS PL/1 Resident Library	NA	NA	58	43	7
5736-LM5	DOS PL/1 Transient Library	NA	NA	34	25	7
5736-PL3	DOS PL/1 Optimizing Compiler and Library	NA	NA	344	258	53
5746-RG1	DOS/VS RPG II	NA	NA	160	120	7
5746-SM2	DOS/VS Sort/Merge (Version 2)	NA	NA	108	81	14
5746-XX1	DL/1 DOS/VS (Version 1)	NA	NA	459	344	149
5748-XXJ	SQL/Data System	NA	NA	464	347	144
5664-169	VM/XA Systems Facility	11,220	8,415	3,740	2,805	623
5664-301	VM/SP Entry	*40,000	*36,000	2,000	NA	NA
	VM/SP Entry with Engineering/Scientific Enhancement	*50,000	*45,000	2,569	NA	NA
5748-XX8	VM/Basic System Extensions	NA	NA	181	135	44
5748-XE1	VM/System Extensions	NA	NA	1,435	1,076	197
5664-167	VM/System Product	142	NA	443	332	69
5748-XP1	Remote Spooling Communications Subsystem (RSCS) Networking	NA	NA	111	83	38
5748-XXC	VM/Interactive File Sharing	NA	NA	52	39	16
5748-XXB	Display Management System/CMS	NA	NA	40	27	9
5748-XE4	VM/Directory Maintenance	NA	NA	112	84	30
5748-XT3	VM/CMS-3270 Display Support and Structured Programming Facility	*13,440	NA	448	NA	NA
5748-SA1	VM/Interactive Problem Control System Extension	*1,100	*787	55	39	6
5748-MS1	Interactive Productivity Facility	NA	NA	50	36	6
5748-RC1	VM/Pass-Through Facility	*3,000	*2,700	185	139	90
5664-173	VM/SP High Performance Option	5,325	3,993	1,775	1,331	136
5664-283	VM/SP End User Software Support System Productivity Facility	*2,000	*1,800	107	NA	16
5664-315	File Transfer Program for VM	*450	*337	11,250	8,437	NA
5798-DWD	VM/XA Realtime Monitor/System Facility	*7,500	NA	NA	NA	NA
5798-DFH	Fortran Utilities for VM/370 III	*2,400	NA	NA	NA	NA
5798-DLL	Data Base Edit Facility for VM/SP-CMS	*6,050	NA	NA	NA	NA
5798-DLQ	Data Base Edit Facility for MVS/TSO	*7,700	NA	NA	NA	NA
5746-XX3	CICS/DOS/VS	NA	NA	686	617	149
5740-XX1	CICS/OS/VS	5,730	4,290	1,910	1,430	160
5740-XC5	Development Management System/CICS/VS-OS	*8,380	*6,285	392	293	54
5740-XXF	DB/DC Data Dictionary for OS/VS	NA	NA	1,110	832	115
5746-XXC	DB/DC Data Dictionary for DOS/VS	NA	NA	491	367	91
5662-257	OS/VS1 Basic Programming Extension	NA	NA	259	194	48
5740-XYR	Database 2 (DB2)	16,050	12,036	2,675	2,006	374
5740-XYS	MVS/SP-JES2 Version 1	NA	NA	2,170	1,627	240

**Onetime license charge.*
NA—Not applicable.

IBM 4300 Series

		Initial Charge		Monthly Charge		
		Basic License Charge ($)	DSLO License Charge ($)	Basic License Charge ($)	DSLO Charge ($)	Licensed Program Support Charge ($)
5740-XC6	MVS/SP-JES2 Version 2	12,840	9,630	4,280	3,210	673
5740-XYN	MVS/SP-JES3 Version 1	NA	NA	2,380	1,784	517
5665-291	MVS/SP JES3 Version 2	14,430	10,821	4,810	3,607	1,335
5665-288	MVS Operator Communication Control Facility	1,050	786	350	262	8
5665-289	ACF/VTAM Version 3 for MVS/XA	6,255	4,695	2,085	1,565	302
5665-313	ACF/VTAM Version 3 for MVS/370	5,130	3,840	1,710	1,280	275
5665-285	TSO/Extensions for MVS/XA	1,500	1,125	555	416	108
	TSO/Extensions for MVS/370	1,500	1,125	500	375	87
5740-XY4	RMF Version 2	NA	NA	406	304	17
5740-XR8	JES2 NJE	NA	NA	807	605	96
5799-AZT	JES3 NJE	NA	NA	2,055	1,545	326
5740-XRB	MVS Hierarchical Storage Manager	NA	NA	579	434	129
5748-FO3	VS Fortran Compiler and Library	747	558	249	186	18
5748-LM3	VS Fortran Library	219	162	73	54	7
5748-AP1	VS APL	NA	NA	386	289	41
5734-PL3	OS PL/1 Compiler and Library	NA	NA	398	298	53
5734-PL1	OS PL/1 Compiler	NA	NA	296	222	39
5734-LM4	OS PL/1 Resident Library	NA	NA	64	48	7
5734-LM5	OS PL/1 Transient Library	NA	NA	37	27	7
5740-SM1	OS/VS Sort/Merge	NA	NA	247	185	19
5740-CB1	OS/VS Cobol Compiler and Library	NA	NA	365	273	15
5740-LM1	OS/VS Cobol Library	NA	NA	118	88	7
5740-AM6	Data Facility/Device Support (OS/VS1)	NA	NA	90	67	25
5740-UT3	Data Facility/Data Set Services (OS/VS1 and MVS)	NA	NA	88	66	40
5668-002	Direct Access Storage Device Migration Aid (OS/VS1 and MVS)	1,450	NA	NA	NA	19
5664-185	High-Accurancy Arithmetic (ACRITH) Subroutine Library for VM/SP	*2,500	NA	NA	NA	NA
5665-337	ACRITH for MVS/370 and MVS/XA	*6,000	NA	NA	NA	NA
5666-320	ACRITH for VSE/SP	*2,500	NA	NA	NA	NA
5664-201	Serial OEM Interface (SOEMI) Access Method for VM/SP and VM/SP Entry	*4,596	NA	4,595	NA	NA
5666-330	SOEMI Access Method for VSE/SP and VSE/AF	*4,579	NA	4,578	NA	NA

IX/370

		Onetime License Charge ($)	Monthly Program Support ($)	Monthly Multiple Program Support ($)
5667-126	IX/370 operating system			
4506	IX/370; support for up to 16 currently signed-on terminal users (CSTUs)	10,000	495	792
4507	IX/370; support for up to 32 CSTUs; requires 4506	10,000	495	792
4508	IX/370; support for up to 64 CSTUs; requires 4506 and 4507	20,000	495	792
4509	IX/370; support for 65+ CSTUs; requires 4506, 4507, and 4508	35,000	495	792

CHARGES FOR LOCAL SYSTEM SUPPORT FOR CONTROL PROGRAMMING

	Monthly Program Support ($)	Monthly Multiple Program Support ($)
For Class 1 SCP on 4361 Model Group 3:		
Category A (VM, DOS/VSE, VSI)	368	588
For Class 1 SCP on 4361 Model Group 4:		
Category A	556	889
For Class 1 SCP on 4361 Model Group 5:		
Category A (VM, DOS/VSE, VS1)	730	1,168
Category B	934	1,495
For Class 1 SCP on 4381 Model Group 11:		
Category A	634	1,015
Category B	905	1,450
For Class 1 SCP on 4381 Model Group 12:		
Category A	688	1,100
Category B	982	1,570
For Class 1 SCP on 4381 Model Group 13:		
Category A	724	1,160
Category B	1,035	1,655
For Class 1 SCP on 4381 Model Group 14:		
Category A	824	1,320
Category B	1,175	1,880

**Onetime license charge.*
NA—Not applicable. ■