IBM 4300 Series

MANAGEMENT SUMMARY

UPDATE: *IBM has made few alterations to 4300 processor hardware in recent months; the most significant move in that area has been the extension of the channeling capabilities of the 4381 Model Group 3. However, IBM has made several peripheral and software introductions which significantly affect the 4300 line. IBM has increased the disk storage potential of 4300 systems by adding more powerful Direct Access Storage Device drives and controllers. In addition, the company has introduced a Unix-based operating system, along with system software for the VM, VSE, and MVS environments. Data base management, programming, and engineering/scientific software offerings have also been added.*

To provide more high-speed peripheral support, IBM has increased the maximum number of 3MB-per-second channels on the 4381 Model Group 3 from 8 to 12. In addition, all channels which previously supported transfer rates up to 1MB per second now support rates up to 2MB per second. According to IBM, this channel enhancement (available at no extra charge) increases the maximum data rates on six channels. The enhancement reportedly has no effect on the optional channel adapter of the 4381 Model Group 3 or on the field installability of the channel-to-channel adapter or of optional channels.

On the peripheral side, four new Extended Capability drives have been added to IBM's 3380 DASD line; according to IBM, subsystems composed of these drives can demonstrate throughput improvements of up to 15 percent over subsystems composed of standard 3380 drives. The company also contends that these drives reduce costs per megabyte of storage, floor space, power consumption, heat load, and maintenance.

The new 3380 Models AD4 and BD4 provide up to 2.52GB of storage per drive (1.26GB per head disk assembly, or HDA) and 10.08GB per string. Although those two models have the same capacities as standard 3380 drives, IBM claims that they provide enhanced performance and data availability through features such as: denser circuit packag- ▷

IBM's six-member 4300 Series of super-minicomputers competes in both the engineering/scientific and commercial systems market. IBM has recently enhanced the high-speed channeling capabilities of the top-of-the-line 4381 Model Group 3 and increased the storage capacities of all models through the addition of Extended Capability 3380 DASD disk drives. A new Unix-based operating system complements enhancements to system, data base management, programming, and special-purpose software for the proprietary VM, VSE, and MVS operating environments.

MODELS: 4361 Model Groups 3, 4, and 5; 4381 Model Groups 1, 2, and 3.
MEMORY: 2MB to 32MB.
DISK CAPACITY: 258MB to 1209GB.
WORKSTATIONS: Up to 1,024.
PRICE: Purchase prices for CPUs with main memory range from $56,500 to $1,065,000.

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. ▶
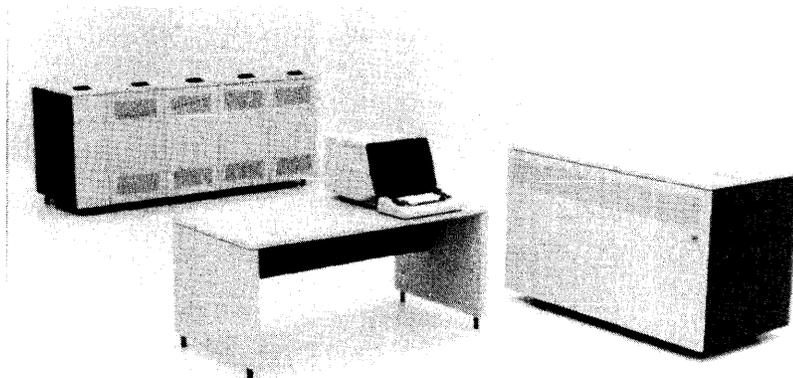
IBM's 4361 processor systems comprise Model Groups 3, 4, and 5. The 4361 systems are targeted toward department-level computing functions in engineering/scientific and technical environments. The 4361 systems can support up to 12MB of main memory, 241GB of online disk storage, and over 1,000 workstations. The three 4361 models run in IBM's proprietary DOS/VSE, SSX/VSE, and VM operating environments.

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ing; lowered number of subconnections; rewritten read/write logic; and Device Level Selection (DLS), a function that allows concurrent data transfer on any two actuators within a string. With DLS, drive operation can be sustained if a single internal data path fails.

Models AE4 and BE4 incorporate the same technological features as Models AD4 and BD4, but provide up to 5.04GB of storage per drive (2.52GB per HDA) and up to 20.16GB per string.

Purchased models AD4 and BD4 can be field-upgraded to Models AE4 and BE4, respectively. Models BD4 and BE4 can be intermixed within strings headed by either a Model AD4 or AE4. Although the Extended Capability drives cannot be intermixed in strings with standard drives, strings of Extended Capability drives can coexist with strings of standard drives on the same 3880 Model 3 or 23 controller.

Hand-in-hand with the introduction of the new 3380 drives, IBM has added new models to, and enhanced the capabilities of, the 3880 Model 23 storage controller. The two additional models, H23 and J23, have cache sizes of 48MB and 64MB, respectively; the caches are based on 256K-bit memory chips. In addition, 3880 Model 23 supports the four new 3380 Extended Capability drives.

While providing higher level storage devices, IBM has not neglected its intermediate DASD products. Two new models have been added to the 3880 Model 21 storage controller, which controls 3350 DASD drives. The two models, H21 and J21, include 48MB and 64MB cache memories, respectively; the caches on these new models also incorporate 256K-bit chips.

In yet another storage-related move, IBM has removed 3880 Models D11, B13, and D13, and model conversions for them, from marketing.

In software, IBM has added the Interactive Executive for System/370 (IX/370), an 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 8MB 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 coreside 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.

In addition to joining the Unix market, IBM continues to enhance its traditional operating environments for the 4300—VM, VSE, and MVS.

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.

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. ACRITH implements new floating-point instructions for the computation of the basic arithmetic operations (add, subtract, multiply, 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).

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*, which is standard on the 4381, is designed to improve the performance of certain mathematical computations such as matrix inversion, decomposition, and multiplication. Engineering Scientific Assist consists of a multiply-add instruction that reportedly reduces CPU busy time by 30 percent. The assist feature supports only long precision (64-bit) floating-point numbers. It is supplied on a microcode diskette and installed as part of the IML process.

The *Elementary Math Library Assist (EML)* is available only on the 4381 Model Groups 2 and 3 as a standard feature. It improves the speed of calculations for single- and double-precision versions of square root functions, exponentiation of natural logarithms, and common logarithms.

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). The SAMOS process relies on silicon or silicon compounds to enhance gate reliability and to control chip surface leakage. Memory in most systems is based on 64K-bit chips; the

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TABLE 1. SYSTEM COMPARISON

MODEL	4361 Model Group 3	4361 Model Group 4	4361 Model Group 5	4381 Model Group 1	4381 Model Group 2	4381 Model Group 3
SYSTEM CHARACTERISTICS						
Date announced	Sept. 1984	Sept. 1983	Sept. 1983	Sept. 1983	Sept. 1983	Oct. 1984
Date first delivered	Dec. 1984	2nd Quarter 1984	1st Quarter 1984	3rd Quarter 1984	1st Quarter 1984	2nd Quarter 1985
Field upgradable to	4361-4/-5	4361-5	Not applicable	4381-2	4381-3	Not applicable
Relative performance*	—	49	66	100	133	226 (approx.)
Number of processors	1	1	1	1	1	2
Cycle time, nanoseconds	—	—	—	—	—	68
Word size, bits	32	32	32	32	32	32
Operating systems	DOS/VSE, SSX/VSE, VM/370, VM/SP, IX/370	DOS/VSE, SSX/VSE, VM/370, VM/SP, IX/370	DOS/VSE, SSX/VSE, VM/370, VM/SP, MVS/370, IX/370	MVS/370, MVS/XA, DOS/VSE, VM/370, VM/SP, IX/370	MVS/370, MVS/XA, DOS/VSE, VM/370, VM/SP, IX/370	MVS/370, MVS/XA, DOS/VSE, VM/370, VM/SP, IX/370
MAIN MEMORY						
Type	64K-bit SAMOS	64K-bit SAMOS	64K-bit SAMOS	64K-bit SAMOS	256K-bit SAMOS	256K-bit SAMOS
Minimum capacity, bytes	2M	2M	2M	4M	4M	8M
Maximum capacity, bytes	4M	12M	12M	16M	32M	32M
Increment size	2M	2M or 4M	2M or 4M	4M	4M	—
Cycle time, nanoseconds	—	—	—	68	68	—
BUFFER STORAGE						
Minimum capacity	8KB	8KB	16KB	8KB	32KB	32KB/processor
Maximum capacity	8KB	8KB	16KB	8KB	32KB	32KB/processor
Increment size	—	—	—	—	—	—
INPUT/OUTPUT CONTROL						
Number of channels:	3	6	6	12	12	18
Byte multiplexer	1 optional	1 optional	1 standard	1 std., 1 opt.	1 std., 1 opt.	2 std., 2 opt.
Block multiplexer	1 optional	1 standard	2 standard	6 std., 6 opt.	6 std., 6 opt.	6 std., 6 opt.
Word	—	—	—	—	—	—
Other	—	—	—	—	—	—

*Relative Performance ratings based on an IBM 370/158-3 equaling 45. Data for these figures, except for those designated as approximate, was gathered by International Data Corporation (IDC). Copyright © 1984, C.W. Communications Inc., Framingham, MA 01701.
Note: A dash (—) in a column indicates that the information is unavailable from the vendor.

▷ Two significant VM products have recently been added: VM/XA Systems Facility and VM/SP Entry. VM/XA Systems Facility allows users to run multiple System/370 and System/370 Extended Architecture operating systems as guests in both uniprocessor and dyadic processor environments. The VM/XA Systems Facility supersedes the VM/XA Migration Aid, incorporating all its features and implementing additional capabilities.

The VM/XA Systems Facility supports guest production and migration, allowing the customer migrating to MVS/XA 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 3, 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.

VM/SP Entry is a specialized version of VM/SP that provides an interactive, load-and-go system for selected 4300 configurations. According to IBM, VM/SP Entry includes the full Conversational Monitor System (CMS) facilities of VM/SP, and is intended to meet the needs of ▷

▶ 24MB and 32MB storage options on the 4381 Model Groups 2 and 3, however, employ 256K-bit high-density DRAM chips.

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.

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.

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 workspace, and system data.

Information is unavailable for reserved storage on the 4381.

CACHE MEMORY: 4361 Model Groups 3 and 4 have 8K bytes of cache memory, while Model Group 5 features 16K bytes of cache. The 4381 Model Group 1 supports 8K bytes of cache, while the Model Group 2 supports 32K bytes of ▶

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▷ entry-level VM users running CMS-only applications on uniprocessor systems in departmental environments. VM/SP Entry runs on 4361 systems and on the 4381 Model Groups 2 and 3.

The DOS/VSE environment has been enhanced by the addition of VSE/Advanced Functions Version 2, Release 1, Modification Level 1 (VSE/AF 2.1.1) and VSE System Product Version 2, Release 1, Modification Level 1 (VSE/SP 2.1.1). These programs provide functional and performance-related capabilities for DOS/VSE, including 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 3, 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 provide support for the remote auto start/programmable power-off features of the IBM 4361 and for the 3380 DASD Models AD4 and BD4.

For the MVS environment, TSO/Extensions (TSO/E) Release 2.1 provides virtual storage constraint relief for MVS/XA installations, with savings between 155K and 350K bytes, depending upon environmental and installation options. IBM has also enhanced the Job Entry Subsystem (JES) products for MVS/XA. There have been two new MVS/SP-JES2 releases: Version 1 Release 3.6 and Version 2 Release 1.5. Both provide spool restructure and constraint removal and improved spool offload facilities; Version 2 Release 1.5 provides virtual storage constraint relief in the private area by utilizing the 31-bit addressing and extended private virtual storage capabilities of MVS/XA. Release 1.5 of JES3 Version 2 provides similar virtual storage constraint relief for JES3, along with other enhancements, including expanded trace and job networking facilities.

In the data base management area, Release 3 of the Structured Query Language/Data Systems (SQL/DS) includes enhancements such as decreased lock contention for access module creation and for read access to data, an accounting facility for VM and VSE operating systems, and blocking of data by application programs to improve performance in multiple-user mode. A new product, 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 SQL/DS in the VM/SP environment.

Programming language additions include the Program Multitasking Facility for VS Fortran and Fortran Utilities for VM/370. The Program Multitasking Facility is a set of routines that uses existing MVS/370 or MVS/XA facilities to allow a single VS Fortran application program to simultaneously use both processors of the 4381 Model Group 3 (or other multiprocessor system). 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 of ▷

▶ cache memory. The Model Group 3 supports 32K bytes of cache in each processor. Cache memory, also referred to as buffer storage, is transparent to all programs.

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 which is invoked by the customer. Detailed information on machine failures, suspected hardware problem sources, and the need for making 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.

The 4381 features an 8-byte-wide data flow within the processor as well as an 8-byte-wide data flow between 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 ▶

VM/370. The subroutines can execute with other programs written in either Fortran 77 or Fortran 66.

Engineering/scientific software additions include Release 2 of the High Accuracy Arithmetic (ACRITH) Subroutine Library and new products for IBM's integrated Engineering/Scientific Support System (E/S³). The ACRITH library is a set of subroutines for solving numerical analysis problems with verified accuracy; the subroutines can be called from VS Fortran or Assembler Language programs. (The ACRITH is standard on all 4361 processors.) The ACRITH Release 2 operates under VM/SP with or without HPO (High Performance Option), MVS/370, MVS/XA, and VSE/SP.

New E/S³ products include Release 1.1 of the system offering with a Productivity Facility (PF) and ES³-Entry. ES³ System Offering 1.1 provides 3380 DASD support, a VS Fortran Interactive Debug, and Profs Release 2.1. The E/S³ PF is included in the base system and provides dialogues, samples, and examples to aid system users in employing E/S³ facilities. E/S³-Entry is an entry-level interactive CMS system built on VM/SP Entry; it is intended to provide a load-and-go system for predefined 4300 processor configurations. Four optional packages in E/S³-Entry provide application support for problem solving, professional text functions, data base functions, and presentation graphics.

In 1984, the 4321 and 4331 were withdrawn from marketing and the 4341 was taken out of new production, so the 4300 Series now consists of six processors: the 4361 Model Groups 3, 4, and 5, and the 4381 Model Groups 1, 2, and 3.

The 4300 Series processors offer full System/370 compatibility and significant price/performance ratios. They can operate in System/370-compatible mode or in an extended control program (ECPS) mode; the 4381 processors can operate in a 370-XA mode, which was only used previously on 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, interactive problem solving, and engineering/scientific applications. The 4361 has a main storage capacity of 2MB to 12MB, and 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, ▷

370-XA mode, the 4381 will support MVS/SP-JES2 and MVS/SP-JES3 and the VM/XA Migration Aid.

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 3 independent processors: the instruction processor, the input/output processor, and the service processor. The instruction processor includes a high-speed cache buffer, a 3-port local store, high-speed instruction processing, a 370 instruction buffer, a floating-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 4 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. The channel subsystem includes 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, 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 3 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 3 cannot be partitioned into two distinct uniprocessor systems.

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, which is standard in all models, is the mechanism that translates the virtual ▶

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TABLE 2. MASS STORAGE

MODEL	3310	3340/3344	3350	3370
Cabinets per subsystem	1 to 32	1 to 32	1 to 32	1 to 32
Disk packs/HDAs per cabinet	1 or 2	1 or 2	2 HDAs	1 HDA
Capacity	64.5MB or 129MB	69.8MB or 279.6MB per HDA	317.5MB per HDA	571.3MB or 729.8MB
Tracks/segments per drive unit	126,016 sectors	4,176 to 33,408 tracks	16,650 tracks	—
Average seek time, msec.	27	25	25	19
Average access time, msec.	36.6	35.1	33.4	29.1
Average rotational delay, msec.	9.6	10.1	8.4	10.1
Data transfer rate	1.03MB/sec.	885KB/sec	1.2MB/sec.	1.86MB/sec.
Controller model	Integrated	3880-1 or -2	3830-2 or 3880-1, -2, or -21	3880-1, -2, or -4
Comments	Model A2 includes 2 drives and supports up to 2 more. For use on the 4361 only.	3344 attaches to the 3340 A2.	Fixed head models available; Model A2 includes logic and power for up to three B2s, or two B2s and one C2 unit.	Model A units include logic and power for up to three B units.

which is optional on all models, provides for the direct attachment of up to 32 peripheral devices and intelligent workstations via 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 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.

4381 Model Groups 1 and 2 are available with from 4MB to 16MB and 4MB to 32MB of main memory, respectively; each supports up to 12 I/O channels. A unique air cooling technique used on the 4381, termed "impingement cooling," ensures adequate cooling without the need for a raised floor. Room-temperature air is blown by a fan into an air chamber equipped with ducts or nozzles, allowing each module to receive a similar amount of cooling. The 4381-1 is field upgradable to a 4381-2, and the 4381-2 is field upgradable to the 4381-3.

The 4381 Model Group 3 is a dual processor system which extends the growth path for IBM 4300 users. According to IBM, the 4381 Model Group 3 offers up to 1.7 times the performance of the Model Group 2 for commercial workloads and up to 1.9 times the older system's performance for scientific workloads.

The 4381 Model Group 3 consists of two integrated central processors operating under a single control program. Each processing unit has a 68-nanosecond internal processor cycle time. Each processor has its own channels and high-speed cache memory (referred to by IBM as a "buffer"). Storage is shared by both processors. The basic 4381 Model Group 3 system includes 8MB of shared processor storage; the system may also be purchased with 16MB, 24MB, or 32MB of main memory. The system's two 32KB high-speed caches support only 4K pages. The 24MB and 32MB models use 256K-bit high-density memory chips, with a relatively small amount of this storage required for IBM microcode.

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.

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 requires an operating temperature between 50 and 90 degress Fahrenheit (10 to 32 degrees Centigrade). The Model Groups 1 and 2 generate 13,650 BTUs per hour, while the Model Group 3 generates 22,525 BTUs per hour. Power consumption for the Model Groups 1 and 2 is 4.7 KVA at 50 or 60 Hz; for the Model Group 3, power consumption is 7.2 KVA at 50 or 60 Hz.

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

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 3278-2A or 3279-2C Display Console and up to 15 additional devices chosen from the following: the 3178 Display Station Models C1 and C2; 3179 Color Display Station Model 1 (3279-2A mode); 3278 Display Station Model 2; 3279 Color Display Station Models 2A, S2A, and 2X; 3262 System Line Printer Models 1 and 11; 3268 Printer Models 2 and 2C; 3287 Printer Models 1, 2, 1C, and 2C; and 4250 Printer Model 1. The DPA also supports the attachment of the IBM Personal Computer, 3270 PC, 6580 Displaywriter, and, with the new 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

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TABLE 2. MASS STORAGE

MODEL	3375	3380 Models A4, AA4, B4	3380 Models AD4, BD4	3380 Models AE4, BE4
Cabinets per subsystem	1 to 32	1 to 16	1 to 16	1 to 16
Disk packs/HDAs per cabinet	1 HDA	1 HDA	1 HDA	2 HDAs
Capacity	819.7MB	1260MB per HDA	1260MB per HDA	2520MB per HDA
Tracks/segments per drive unit	—	—	—	—
Average seek time, msec.	19	16	15	17
Average access time, msec.	29.1	24.3	23.3	25.3
Average rotational delay, msec.	10.1	8.3	8.3	8.3
Data transfer rate	1.86MB/sec.	3MB/sec.	3MB/sec.	3MB/sec.
Controller model	3880-1, 2, or 4	3880-2, -3, or -23 (-23 for AA4 & B4 only)	3880-3, or -23	3880-3, or -23
Comments	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.	Model AD4 can control up to three BD4 or BE4 drives.	Model AE4 can control up to three BD4 or BE4 drives.

Twelve channels are included with the basic 4381 Model Group 3 system; six additional channels are optional. Up to twelve 3MB-per-second data streaming channels can be configured to allow the attachment of advanced peripherals.

Like the 4381 Model Groups 1 and 2, the Model Group 3 uses impingement air cooling to ensure adequate cooling of the high-density modules, using room temperature air as the cooling medium.

The 4300 Series processors support most peripheral devices supported by IBM's System/370 and 303X, 308X, and 3090 Series computers. Those devices include: the 3310 (4361 only), 3340/3344, 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 1403 Model N1, 4245, 4248, and 3800 printers.

All 4300 Series processors require 3278-2A, a 3279-2C, or a 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: 8 on the Display/Printer Adapter and 32 on the Work Station Adapter.

The operating systems available for the 4300 Series processors include: DOS/VS Extended (DOS/VSE), SSX/VSE, Virtual Machine Facility 370 (VM/370), MVS, and MVS/XA.

DOS/VSE is said to be 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.

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 feature, which provides support for various devices for scientific and engineering applications. The DPA supports up to 2 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 4 OEM adapters with an aggregate data rate of 22K bytes per second inbound and 45K bytes per second outbound.

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 2 DASD/8809 Adapters. The first one allows attachment of up to 4 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. The 4361 Model Group 4 supports either two DASD/8809 Adapters and one High-Speed Block Multiplexer Channel or one DASD/8809 Adapter and two High-Speed Block Multiplexer Channels.

Model Group 5 has 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 or 3279-2C 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 3 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 8 control unit positions and up to 36 subchannels, 4 of which are shared subchannels with up to 16 devices each. The number of ▶

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TABLE 3. INPUT/OUTPUT UNITS

Magnetic Tape Units	Number of Tracks	Recording Density, Bits/Inch	Encoding	Tape Speed Inches/Sec.	Transfer Rate, Bytes/Sec.
3420:					
Model 3	7	556/800	NRZI	75	41,700/60,000
	9	800/1600	NRZI/ PE	75	60,000/120,000
Model 5	7	556/800	NRZI	125	69,500/100,000
	9	800/1600	NRZI/ PE	125	100,000/200,000
Model 7	7	556/800	NRZI	200	111,200/160,000
	9	800/1600	NRZI/ PE	200	160,000/320,000
Model 4	9	1600/ 6250	PE/ GCR	75	120,000/470,000
Model 6	9	1600/ 6250	PE/ GCR	125	200,000/780,000
Model 8	9	1600/ 6250	PE/ GCR	200	320,000/ 1,250,000
3410/3411:					
Model 1	7	200/556/ 800	NRZI	12.5	2,500/6,900/ 10,000
	9	800/1600	NRZI/ PE	12.5	10,000/20,000
Model 2	7	200/556/ 800	NRZI	25	500/13,900/ 20,000
	9	800/1600	NRZI/ PE	25	20,000/40,000
Model 3	7	200/556/ 800	NRZI	50	10,000/27,800/ 40,000
	9	800/1600	NRZI/ PE	50	40,000/80,000
3430	9	1600 or 6250	PE or GCR	50	80,000 or 312,500
3480*	18	38,000	—	79	3,000,000
8809**	9	1600	PE	12.5 or 100***	20,000 or 160,000***

*4381 systems only.
**4361 systems only.
***Streaming mode.

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.

With VM/370, the 4300 user can operate in mixed-mode environments where CMS interactive computing is combined with a guest SCP (DOS/VSE or OS/VS1) on the 4300 processors.

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

subchannels is reduced by one if the Communications Adapter is installed. In addition, each communications line reduces by 1 the number of subchannels available.

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 the attachment of high-speed peripheral devices such as the 3340/3344, 3350, 3370, and 3375 DASD via control units. Each of the block multiplexer channels for the 4361 Model Group 3 provides 8 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 8. (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 1 and 2 block multiplexer channels, respectively. The block multiplexer channel operates at up to 1.25 megabytes per second

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TABLE 3. INPUT/OUTPUT UNITS (Continued)

Printers	Printing Speed	Print Positions	Horizontal Spacing, Chars./Inch	Vertical Spacing, Lines/Inch	Form Size, Inches
1403 Model N1	1100 lpm	132	10	6 or 8	3.5 to 18.75 wide, 22 long
3203 Model 5	1200 lpm	132	10	6 or 8	3.5 to 20 wide, 3 to 24 long
3211 Model 1	2000 lpm	132 std., add'l. 18 opt.	10	6 or 8	3.5 to 18.75 wide, 3 to 24 long
3262: Model 1**	650 lpm	132	10	6 or 8	3.5 to 16 wide, 6 to 14 long
Model 5	650 lpm	132	10	6 or 8	3.5 to 16 wide, 6 to 14 long
Model 11**	325 lpm	132	10	6 or 8	3.5 to 16 wide, 6 to 14 long
3268 Model 2	340 cps	132	10 or 16.7	3, 4, 6 or 8	16 wide continuous
3287: Model 1 & 1C	80 cps	132	10	6 or 8	—
Model 2 & 2C	120 cps	132	10	6 or 8	—
3800: Model 1	Up to 20,040	136, 163, 204	10, 12, 15	6, 8, 12	6.5 to 14.75 wide, 3.5 to 11 long
Model 3	Up to 20,040	136, 163, 204	10, 12, 15	6, 8, 12	6.5 to 14.75 wide, 3.5 to 11 long
4245 Model 1	2000 lpm	132	10	6 or 8	3.5 to 22 wide, 3 to 24 long
4248 Model 1*	2200 to 3600 lpm	132 std.; 168 opt.	10	6 or 8	—

*4381 systems only.
**4361 systems only.
***Streaming mode.

▷ 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.

IBM offers a wide range of data communications products for the 4300 Series for systems interconnection, multisystem networking, and distributed processing. 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 compact but formidable supermini product line which runs the gamut from department-level processors to systems with near-mainframe power and configurability. ▷

▶ 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, 3350, and 334X Direct Access Storage Devices. The data transfer rate is up to 3.0 megabytes per second.

The *4381 Model Groups 1 and 2* come equipped with 6 channels: 5 block multiplexer and 1 byte multiplexer channels. Four of the block multiplexer channels have data rates of up to 3.0 megabytes per second in data streaming 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 the maximum aggregate data rate to 22 megabytes per second. The optional channels consist of two 2-megabyte and four 1-megabyte data streaming block multiplexer channels.

A Channel-to-Channel Adapter (feature 1850) allows the interconnection of 2 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. ▶

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TABLE 4. TERMINALS

MODEL	3178	3179	3180	3278	3290
DISPLAY PARAMETERS					
Max. chars./screen	1,920	1,920	1,920 to 3,564	960 to 3,564	9,920
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	62 x 160
Symbol formation	7 x 14 dot matrix	7 x 14 dot matrix	8 x 11 to 8 x 8 dot-matrix	7 x12 or 7 x 14 dot-matrix	5 x 8 char. matrix
Character phosphor	—	Green (monochrome mode)	—	—	Orange
Total colors/no. simult. displayed	None	7 displayed	None	None	None
KEYBOARD PARAMETERS					
Style	75-key data entry or 85-key typewriter	Typewriter	Data entry or typewriter	Data entry or typewriter	Typewriter
Character/code set	94	94	—	94	—
Detachable	Yes	Yes	Yes	Yes	Yes
Program function keys	10 or 24	24	24	12	24
OTHER FEATURES					
Buffer capacity	—	—	—	—	24K characters
Tilt/swivel	Standard	Standard	Standard	No	Tilt standard
Graphics capability	—	—	—	—	—
TERMINAL INTERFACE	RS-232-C, display/printer adapter	RS-232-C, display/printer adapter	RS-232-C, display/printer adapter	RS-232-C, display/printer adapter	RS-232-C

▷ 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 now available through the 3380 Extended Capability disk drives provides the systems with facilities for storing the large data bases involved in engineering/scientific and technical 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. (In fact, third-party vendors are already making SOEMI-attachable devices available.)

The smallest of the 4361 systems, Model Group 3, can certainly compete effectively against department-level engineering/scientific and technical processors from other vendors. A primary competitor is Harris' H60. The H60 provides 12MB of main memory to the 4361-3's 4MB, and operates at 0.88 MIPS, compared to the 4361-3's approximately 0.38-MIPS performance. However, the 4361-3 provides 80.6GB of disk, far in excess of the 1.6GB provided by the Harris system. Similarly, the 4361 system can support up to 1,024 terminals, a vastly larger number than the 32 supported by the H60.

At the upper end of the family, the 4381 systems are targeted toward both commercial and scientific/technical applications, and meet their stiffest competition from Digital Equipment Corporation's VAX Systems. Competition is hottest at the very top of the line, where the 4381 Model Group 3 comes into conflict with the VAX 8600, a machine of similarly recent vintage. Both systems support up to 32MB of main memory. The 4381 Model Group 3 has the edge in intrinsic workstation support (1024 versus ▷

▷ The *4381 Model Group 3* comes with 12 standard channels: 2 byte multiplexer channels and 10 block multiplexer channels. Two of the standard block multiplexer channels can be configured as byte multiplexer channels, for a system total of 4 byte multiplexer channels. Six additional block multiplexer channels can be configured with the 4381 Model Group 3—4 with a data transfer rate of 2 megabytes per second and 2 with a rate of 3 megabytes per second.

The channels on each processor of a 4381 Model Group 3 with 12 channels can provide an instantaneous aggregate data rate of 15MB per second for an aggregate data rate of 30MB per second. The channels on each processor of a 4381 Model Group 3 with 18 channels can provide an instantaneous processor data rate of 16 megabytes per second, for a system aggregate data rate of 32 megabytes per second.

Up to twelve 3-megabyte-per-second data streaming channels can be configured on the 4381 Model Group 3 to support advanced peripherals such as the 3380 Direct Access Storage Device subsystem and the 3480 magnetic tape subsystem. The remaining block multiplexer channels have data rates of 2 megabytes per second. The 4381 Model Group 3 can also support one channel-to-channel adapter.

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 provides the capability of interconnecting from 4 to 8 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 the attachment of high-performance non-IBM input/output devices to 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 DEC Unibus interfaces.

CONFIGURATION RULES

GENERAL: A Model 3205, 3278, or 3279 display console is required for all 4300 models. ▶

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▷ 512 on the VAX 8600; DEC claims, however, that its system can support additional stations through Ethernet connections). The new 4381 also supports much more disk storage than the VAX 8600 (1209GB versus 164GB).

The two systems are roughly similar in processor power; the 4381 Model Group 3 can operate at about 5.13 MIPS, while the DEC processor executes about 4.45 MIPS; Digital claims, however, that its VAX clustering mechanisms allow the VAX 8600 to achieve 30 MIPS and up through addition of extra processors. Even if it cannot play the VAX 8600 to a total standstill in processor power, however, the 4381 Model Group 3 is a powerful system that gives the 4300 Series additional leverage in its struggle against the most firmly entrenched competitor in the supermini arena.

On a more general note, IBM has helped itself competitively in several ways by adding the Unix-based IX/370 to the already formidable array of operating systems for the 4300 Series. With the addition of IX/370, IBM has not only provided 4300 users with a special-purpose alternative to its proprietary systems, but has also kept up with its superminicomputer competitors, most of whom offer Unix in some form. Also, by selecting AT&T's Unix System V as the basis for IX/370, IBM has at least tacitly acknowledged System V as a Unix "standard."

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 1. (Moreover, now that IBM has phased out the 4341 systems, there is a bit of a gap between the 4361 and 4381 processors.)

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 the older to the newer systems. Speaking of peripherals, it must be noted that the amounts of storage provided by the new 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 the recently introduced 3090 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.

An additional software advantage for the 4300 comes from IBM's willingness not only to roll out new operating system ▷

▶ The 4361 has integrated DASD/8809 adapters and high-speed BMPX channels to attach high-performance DASD, tape, and other I/O devices. These adapters and channels are available in several combinations. One byte multiplexer channel is standard on the Model Group 5 and optional on the Model Groups 3 and 4. Model Groups 3 and 5 also offer the option of a high-speed block multiplexer channel (3MB/second transfer rate).

Standard channels for the 4381 Model Groups 1 and 2 include one byte and five block multiplexer channels. An optional group of six block multiplexer channels is also available.

The 4381 Model Group 3 comes with 12 standard channels: 2 byte multiplexer channels and 10 block multiplexer channels. Two of the standard block multiplexer channels can be configured as byte multiplexer channels, for a system total of 4 byte multiplexer channels. Six additional block multiplexer channels can be configured with the 4381 Model Group 3. Up to twelve 3-megabyte-per-second data streaming channels can be configured on the 4381 Model Group 3 to support advanced peripherals, such as the 3380 Direct Access Storage Device subsystem and the 3480 magnetic tape subsystem.

For more 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 3340/3344, 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 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 laser printers with speeds up to 20,040 characters per second.

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.

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.

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▷ products like IX/370, but also to enhance its proprietary environments—VM, VSE, and MVS. Through such multiple offerings, the vendor demonstrates to its customers that it is willing both to meet the new demands and support the ongoing needs of its users.

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 1984 survey of general-purpose computer users yielded responses from 437 IBM 4300 users; because the 4361 and 4381 had only been introduced within a few months of the survey's being conducted, most of the users' responses were for 4300 systems no longer actively marketed. The respondents are divided into the following groupings: 184 with 4331s, 244 with 4341s, 5 with 4361s, and 4 with 4381s. The 4331 systems had been in use for an average of 43.7 months, the 4341 systems for an average of 35.1 months, and the 4361/4381 systems for an average of 1.6 months. (Although the 4331 systems have been withdrawn from marketing, the users' ratings of these systems should be relevant to anyone considering a 4361 system, because of the similarities between the two systems.)

The survey respondents represented a variety of industries, including manufacturing (148 responses), retail/wholesale (44 responses), education (40 responses), and banking/finance (38 responses). The majority of the respondents were using between 2 and 4 megabytes of main memory and from 1.2 to 4.8 billion bytes of disk storage. Of the 437 survey respondents, 317 were using a data communications monitor and 181 were using a data base management system.

The users' ratings for all 4300 Series models have been combined and are listed in the table below.

	Excellent	Good	Fair	Poor	WA*
Ease of operation	117	270	36	4	3.17
Reliability of system	323	105	5	1	3.73
Reliability of peripherals	230	184	16	6	3.51
Maintenance service:					
Responsiveness	224	189	19	1	3.47
Effectiveness	214	207	11	1	3.46
Technical support:					
Troubleshooting	89	268	67	5	3.03
Education	74	263	79	10	2.94
Documentation	61	252	104	12	2.84
Manufacturers software:					
Operating system	112	276	37	4	3.16
Compiler & assemblers	139	274	14	2	3.28
Application programs	45	237	66	9	2.89
Ease of programming	49	305	58	8	2.94
Ease of conversion	51	253	83	16	2.84
Overall satisfaction	85	317	24	7	3.15

*Weighted Average on a scale of 4.0 for Excellent.   ▷

▶ 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.

COMMUNICATIONS CONTROL

The principal communications control unit for the 4361 is the Integrated Communications Adapter, described below. The programmable 3704 and 3705 Communications Controllers, also described below, are the prime communications devices for the 4381. They can also serve as alternatives to the Communications Adapter when more than 8 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 provides for the direct attachment of up to 8 BSC, start/stop, or SDLC communications lines in any combination. (At any given time, the "any combination" may be 2 of the 3 available types.) The aggregate data rate capacity may not exceed 64,000 bits per second. For 7 of the 8 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 Release 6 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 8 lines attached to the communications adapter may have these optional features in addition to the high-speed line feature (4720) already mentioned: up to 8 line features without internal clock for attachment to external modems with (4695) or without (4696) clock (data circuit-terminating equipment); up to 8 line features with integrated 1200 bps modems; up to 8 line features with local attachments (4801); up to 8 line features with digital data service adapters (5650); and auto call unit interfaces for up to 2 of the installed lines (1020).

Certain configuration parameters for each line may be specified from the display console keyboard. These 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).

Certain configuration parameters can be selected at installation time and set by the IBM CE. These parameters include duplex instead of half-duplex connection (2-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.   ▶

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▷ To gain additional insight into the users' experiences with the 4300 Series, we talked to two of the survey respondents in October 1984. The first user interviewed was the DP manager in a southern manufacturing company that had installed a 4361 Model Group 5 in April 1984 as an upgrade from a 4331. The installation includes 4 megabytes of main memory, between 50 and 100 megabytes of disk storage, from 16 to 30 local workstations, and from 6 to 15 remote workstations. This user said that he had no problems in converting from the 4331 to the 4361 and cited reliability, power, and speed as the primary advantages of the 4361 system. However, he added that the 4300 Series processors are not as user friendly as many other systems, including IBM's System/38. Therefore, he is becoming "less and less satisfied" with the 4300 Series and may switch to another system within the next few years.

The second user interviewed represented a direct marketing organization. The company converted from a 4341 Model Group 2 to a 4381 Model Group 2 in November 1983. The installation includes over 4.8 billion bytes of disk storage, from 16 to 30 local workstations, and over 60 remote workstations. Although the 4341 is not field upgradable to a 4381, the user said that this presented no problem. The new system was up and running within a few hours. This user said he considered upgrading to an IBM 3083, but chose the 4381 because he wanted a machine that was air cooled. He was extremely enthusiastic about the system, especially about the reliability of the CPU. He said the 4341 ran for 18 months before it went down, and the 4381 hasn't been down yet. In this user's opinion, the 4381 is "the best all around package you can get." He added that some competitive systems may sell for less, but it is "a false economy."

The users' ratings and comments indicate that they are quite satisfied with the 4300 Series processors. Of the 437 respondents, 421 (96 percent) said they would recommend the 4300 Series to others, 2 (0.45 percent) said they would not, and 13 (2.9 percent) were undecided. □

▶ The 4361 Communications Adapter supports communications with virtually all of the current IBM terminals, systems, and communications controllers in one or more of the 3 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) provide for 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 an RPQ (Request for Price Quotation) basis only.

The following devices can be connected to directly attached loops at 9600 bps or to data link attached loops at 2400, 4800, or 9600 bps: the 3640 Plant Data Communications Terminals, the 8775 Display Terminal Model 1 or 2, and the 3274 Control Unit Model 51C and 3276 Control Unit Display Station Models 11 to 14, with their associated terminals (3278 Display Station, 3279 Color Display Station, 3262 Line Printer, 3287 Printer, and 3289 Printer). 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 direct attached loops can be up to 1.25 miles (2000 meters) when operating at 38,400 bps or 2 miles (3200 meters) when operating at up to 9600 bps. Data link attached loops can be up to 2 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 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 communication 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 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 Programming 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 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 *3704 Communications Controller* can be connected to a byte multiplexer channel on a 4361 or 4381 processor. The 3704 is available in 4 models, with main memory capacities ranging from 16K to 64K bytes. It can accommodate a maximum of 32 lines. The 3704 uses the same software as the 3705.

The *3725 Communications Controller* consists of a central control unit that operates under control of the Advanced Communications Function/Network Control Program, Emulator Program, or Partitioned Emulator Program. Main storage is available in 512K-, 786K-, or 1024K-byte sizes. It can be attached to either byte or block multiplexer or selector channels on the host processor. Up to 6 channel adapters are available. Two adapters are standard in the base frame and 4 can be added via the 3726 Expansion Unit. With the optional 2-processor switch feature, connection can be made to a maximum of 8 processors, 6 of which can operate concurrently. The Maintenance and Operator Subsystem allows for host-independent maintenance. Communication scanners and line interfaces are provided by a transmission subsystem. The scanners are microprocessor-based and can control 8 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. ▶

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► 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 it 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 computer 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 will operate 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 3, 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 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.

DOS/VSE supports the 4381 Model Group 3 when it runs as a guest operating system under VM/SP with or without the VM/SP high-performance option (HPO).

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 2 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 that are unique to SSX/VSE and components that are based on DOS/VSE. Unique functions of SSX/VSE include: 1) system installa- ►

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▶ tion 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 4 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, native SNA support via the VM/Group Control System, interuser communication capability, CMS full-screen 3270 editor, additional CMS functions and productivity aids, a command retrieve capability, a trace table recording facility, and SQL/DS support.

A specialized version, VM/SP Entry, provides an interactive, load-and-go system for selected 4300 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. VM/SP Entry runs on the 4361 and the 4381 Model Groups 2 and 3; it requires at least 4MB of real storage, 2 actuators (addresses) of 3370 or 3380 DASD space, one tape device, and one terminal.

OS/VS1 provides support for the 4361 and 4381 processors in the System/370 mode. IBM has announced that it plans no further releases of OS/VS1. However, OS/VS1 is highly compatible with MVS, IBM's currently supported large systems operating system. The 4 major functions of the control program routines of OS/VS1 are: job management through the use of 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.

OS/VS1 supports the 4381 Model Group 3 when it runs as a guest operating system under VM/SP with or without the VM/SP high-performance option.

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. IBM has stated that the MVS/System Products will 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 TSO (Time Sharing Option) batch job submission and RJE (Remote Job Entry) 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 reliability, availability, and serviceability (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 the use of 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 Version 2 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 supersedes the VM/XA Migration Aid, incorporating all its features and implementing additional capabilities. ▶

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▶ 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 3, 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 8MB 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 coreside 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 MVS/370 and MVS/XA operating systems. It permits multiple users to concurrently access and change data within the same DB2 table. DB2 also provides full recovery capabilities in case of system, storage media, or application program failure.

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, and 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 SQL structured query language 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.

LANGUAGES: Languages available for the 4300 Series include Pascal/VS, Fortran, Basic, VS APL, PL/1, Cobol, and RPG II. Available for the VS implementation of Fortran is a Program Multitasking Facility—a set of routines that uses existing MVS/370 or MVS/XA facilities to allow a single VS Fortran application program to simultaneously use both processors of the 4381 Model Group 3.

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.

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.

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 ▶

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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 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 (Customer Information Control System/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; calendar management; and other end-user services, such as conference room scheduling and electronic messaging. Profs runs in the VM/SP environment.

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 *Engineering Scientific Support System (E/S³)*, an integrated, VM/SP-based load-and-go system that provides engineers and scientists with facilities for performing tasks that they might encounter as part of their daily routine, including design and presentation graphics, analysis/simulation, interactive and personal computing, and engineering/scientific administration. An adjunct to E/S³ is Scientific Support Productivity Facility (E/S³ PF), which provides user dialogues for installation, administration, maintenance, and application-oriented tasks.

A specialized version of the system, E/S³-Entry, is an entry-level interactive CMS system built on VM/SP Entry, and is intended to provide a load-and-go system for predefined 4300 processor configurations. Four optional packages in E/S³-Entry provide application support for problem-solving, professional text functions, data base functions, and presentation graphics.

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 one-time 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:

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	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, 7-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 problem still cannot be resolved, the PSR (Program Support Representative) from the customer's local office will be dispatched to assist. Under the new 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: The indicated prices for the following typical configurations include all the required control units and adapters, but do not include software.

The following is a typical 4361 Model Group 5 configuration:

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
2501 Model B2 card reader	19,920
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 Price	**$ 351,986**

The following is a typical 4381 Model Group 3 configuration:

4381 Model Q3 dual processor system with 24MB of main memory and 12 I/O channels	$ 935,500
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
2501 Model B2 card reader	19,920
Three 4245 Model 1 2000 lpm printers	190,500
Two 3274 Model 31A communications controllers	33,300
Six workstation adapters	5,508
64 3178 Model C10 display stations	106,240
Total Price	**$1,739,648** ■

IBM 4300 Series Equipment Prices

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	295.00	3,775	NA
4361 L3 Same as 4361 K3, but with 4,194,304 bytes of main memory	71,500	347.00	4,961	NA
4361 K4 Processor with 2,097,152 bytes of main memory and 8K-byte buffer	135,000	490.00	9,095	NA
4361 L4 Same as 4361 K4, but with 4,194,304 bytes of main memory	150,000	542.00	10,281	NA
4361 LK4 Same as 4361 K4, but with 6,291,456 bytes of main memory	170,000	594.00	4,467	NA
4361 M4 Same as 4361 K4, but with 8,388,608 bytes of main memory	185,000	646.00	12,653	NA
4361 ML4 Same as 4361 K4, but with 12,852,912 bytes of main memory	215,000	750.00	15,025	NA
4361 K5 Processor with 2,097,152 bytes of main memory and 16K-byte buffer	180,000	590.00	12,090	NA
4361 L5 Same as K5, but with 4,194,304 bytes of main memory	195,000	642.00	13,276	NA
4361 LK5 Same as K5, but with 6,291,456 bytes of main memory	210,000	694.00	14,462	NA
4361 M5 Same as K5, but with 8,388,608 bytes of main memory	225,000	746.00	15,648	NA
4361 ML5 Same as K5, but with 12,582,912 bytes of main memory	255,000	850.00	18,020	NA
4381 L1 Processor with 4,194,304 bytes of main memory and 8K-byte buffer	370,000	603.00	26,390	NA
4381 M1 Same as L1, but with 8,388,608 bytes of main memory	410,000	656.00	29,240	NA
4381 P1 Same as L1, but with 16,777,216 bytes of main memory	490,000	763.00	34,940	NA
4381 L2 Processor with 4,194,304 bytes of main memory and 32-byte buffer	500,000	719.00	35,660	NA
4381 M2 Same as L2, but with 8,388,608 bytes of main memory	540,000	772.00	38,510	NA
4381 P2 Same as L2, but with 16,777,216 bytes of main memory	620,000	879.00	44,210	NA
4381 Q2 Processor with 24 megabytes of main memory and 32K-byte buffer	700,000	986.00	49,920	NA
4381 R2 Processor with 32 megabytes of main memory and 32K-byte buffer	780,000	1,090.00	55,620	NA
4381 M3 Dual processor system with 8 megabytes of main memory and two 32K-byte buffers	825,000	920.00	58,850	NA
4381 P3 Dual processor system with 16 megabytes of main memory and two 32K-byte buffers	905,000	1,025.00	64,550	NA
4381 Q3 Dual processor system with 24 megabytes of main memory and two 32K-byte buffers	985,000	1,130.00	70,250	NA
4381 R3 Dual processor system with 32 megabytes of main memory and two 32K-byte buffers	1,065,000	1,240.00	75,950	NA

System upgrades:

	Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly 2-Year Lease Charge* ($)
4361 K3 to 4361 L3	15,000	NA	NA	NA
4361 K3 to 4361 K4***	66,660	NA	NA	NA
4361 K3 to 4361 L4***	81,660	NA	NA	NA
4361 K3 to 4361 LK4***	101,660	NA	NA	NA
4361 K3 to 4361 M4***	116,660	NA	NA	NA
4361 K3 to 4361 ML4***	146,660	NA	NA	NA
4361 L3 to 4361 L4***	66,660	NA	NA	NA
4361 L3 to 4361 LK4***	86,660	NA	NA	NA
4361 L3 to 4361 M4***	101,660	NA	NA	NA
4361 L3 to 4361 ML4***	131,660	NA	NA	NA
4361 K3 to 4361 K5***	108,995	NA	NA	NA
4361 K3 to 4361 L5***	123,995	NA	NA	NA
4361 K3 to 4361 LK5***	138,995	NA	NA	NA
4361 K3 to 4361 M5***	153,995	NA	NA	NA
4361 L3 to 4361 L5***	108,995	NA	NA	NA
4361 L3 to 4361 LK5***	123,995	NA	NA	NA
4361 L3 to 4361 M5***	138,995	NA	NA	NA
4361 L3 to 4361 ML5***	168,995	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

*Rental/lease prices include equipment maintenance.
**Requires feature 1870 if not already installed.
***Standard 4361 Model Group 4 or 5 features that are optional on the 4361 Model Group 3 must already be installed.
****RPQ (Request for Price Quotation) required. Not recommended for field installation.
NC—No charge.
NA—Not applicable.

IBM 4300 Series

	Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly 2-Year Lease Charge* ($)
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 LK4 to 4361 M4	15,000	NA	NA	NA
4361 LK4 to 4361 ML4	45,000	NA	NA	NA
4361 M4 to 4361 ML4	30,000	NA	NA	NA
4361 K4 to 4361 K5	42,335	NA	NA	NA
4361 K4 to 4361 L5	57,335	NA	NA	NA
4361 K4 to 4361 LK5	72,335	NA	NA	NA
4361 K4 to 4361 M5	87,335	NA	NA	NA
4361 K4 to 4361 ML5	117,335	NA	NA	NA
4361 L4 to 4361 L5	42,335	NA	NA	NA
4361 L4 to 4361 LK5	57,335	NA	NA	NA
4361 L4 to 4361 M5	72,335	NA	NA	NA
4361 L4 to 4361 ML5	102,335	NA	NA	NA
4361 LK4 to 4361 LK5	37,335	NA	NA	NA
4361 LK4 to 4361 M5	52,335	NA	NA	NA
4361 LK4 to 4361 ML5	82,335	NA	NA	NA
4361 M4 to 4361 M5	37,335	NA	NA	NA
4361 M4 to 4361 ML5	67,335	NA	NA	NA
4361 ML4 to 4361 ML5	37,335	NA	NA	NA
4361 K5 to 4361 L5	15,000	NA	NA	NA
4361 K5 to 4361 LK5	30,000	NA	NA	NA
4361 K5 to 4361 M5	45,000	NA	NA	NA
4361 K5 to 4361 ML5	75,000	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 LK5 to 4361 M5	15,000	NA	NA	NA
4361 LK5 to 4361 ML5	45,000	NA	NA	NA
4361 M5 to 4361 ML5	30,000	NA	NA	NA
4381 L1 to 4381 L2	130,000	NA	NA	NA
4381 L1 to 4381 M1	40,000	NA	NA	NA
4381 L1 to 4381 M2	170,000	NA	NA	NA
4381 L1 to 4381 P1	120,000	NA	NA	NA
4381 L1 to 4381 P2	250,000	NA	NA	NA
4381 L1 to 4381 Q2	330,000	NA	NA	NA
4381 L1 to 4381 R2	410,000	NA	NA	NA
4381 M1 to 4381 M2	130,000	NA	NA	NA
4381 M1 to 4381 P1	80,000	NA	NA	NA
4381 M1 to 4381 P2	210,000	NA	NA	NA
4381 M1 to 4381 Q2	290,000	NA	NA	NA
4381 M1 to 4381 R2	370,000	NA	NA	NA
4381 P1 to 4381 P2	130,000	NA	NA	NA
4381 P1 to 4381 Q2	210,000	NA	NA	NA
4381 P1 to 4381 R2	290,000	NA	NA	NA
4381 L2 to 4381 M2	40,000	NA	NA	NA
4381 L2 to 4381 P2	120,000	NA	NA	NA
4381 M2 to 4381 P2	80,000	NA	NA	NA

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IBM 4300 Series

	Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly 2-Year Lease Charge* ($)
4381 L2 to 4381 Q2	200,000	NA	NA	NA
4381 L2 to 4381 R2	280,000	NA	NA	NA
4381 L2 to 4381 M3	289,420	NA	NA	NA
4381 L2 to 4381 P3	369,420	NA	NA	NA
4381 L2 to 4381 Q3	449,420	NA	NA	NA
4381 L2 to 4381 R3	529,420	NA	NA	NA
4381 M2 to 4381 Q2	160,000	NA	NA	NA
4381 M2 to 4381 R2	240,000	NA	NA	NA
4381 M2 to 4381 M3	249,420	NA	NA	NA
4381 M2 to 4381 P3	329,420	NA	NA	NA
4381 M2 to 4381 Q3	409,420	NA	NA	NA
4381 M2 to 4381 R3	489,420	NA	NA	NA
4381 P2 to 4381 Q2	80,000	NA	NA	NA
4381 P2 to 4381 R2	160,000	NA	NA	NA
4381 P2 to 4381 M3	****	NA	NA	NA
4381 P2 to 4381 P3	249,420	NA	NA	NA
4381 P2 to 4381 Q3	329,420	NA	NA	NA
4381 P2 to 4381 R3	409,420	NA	NA	NA
4381 Q2 to 4381 R2	80,000	NA	NA	NA
4381 Q2 to 4381 M3	****	NA	NA	NA
4381 Q2 to 4381 P3	****	NA	NA	NA
4381 Q2 to 4381 Q3	249,420	NA	NA	NA
4381 Q2 to 4381 R3	439,420	NA	NA	NA
4381 R2 to 4381 Q2	****	NA	NA	NA
4381 R2 to 4381 M3	****	NA	NA	NA
4381 R2 to 4381 P3	****	NA	NA	NA
4381 R2 to 4381 Q3	****	NA	NA	NA
4381 R2 to 4381 R3	249,420	NA	NA	NA
4381 L2 to 4381 Q2**	200,000	NA	NA	NA
4381 L2 to 4381 R2**	280,000	NA	NA	NA
4381 L2 to 4381 M3**	325,000	NA	NA	NA
4381 L2 to 4381 P3**	405,000	NA	NA	NA
4381 L2 to 4381 Q3**	485,000	NA	NA	NA
4381 L2 to 4381 R3**	565,000	NA	NA	NA
4381 M2 to 4381 Q2**	160,000	NA	NA	NA
4381 M2 to 4381 R2**	240,000	NA	NA	NA
4381 M2 to 4381 M3**	285,000	NA	NA	NA
4381 M2 to 4381 P3**	365,000	NA	NA	NA
4381 M2 to 4381 Q3**	445,000	NA	NA	NA
4381 M2 to 4381 R3**	525,000	NA	NA	NA
4381 P2 to 4381 Q2**	80,000	NA	NA	NA
4381 P2 to 4381 R2**	160,000	NA	NA	NA
4381 P2 to 4381 M3**	****	NA	NA	NA
4381 P2 to 4381 P3**	285,000	NA	NA	NA
4381 P2 to 4381 Q3**	365,000	NA	NA	NA
4381 P2 to 4381 R3**	445,000	NA	NA	NA
4381 Q2 to 4381 R2**	80,000	NA	NA	NA
4381 Q2 to 4381 M3**	****	NA	NA	NA
4381 Q2 to 4381 P3**	****	NA	NA	NA
4381 Q2 to 4381 Q3**	285,000	NA	NA	NA
4381 Q2 to 4381 R3**	365,000	NA	NA	NA
4381 R2 to 4381 Q2**	****	NA	NA	NA
4381 R2 to 4381 M3**	****	NA	NA	NA
4381 R2 to 4381 P3**	****	NA	NA	NA
4381 R2 to 4381 Q3**	****	NA	NA	NA
4381 R2 to 4381 R3**	285,000	NA	NA	NA
4381 M3 to 4381 P3	80,000	NA	NA	NA
4381 M3 to 4381 Q3	160,000	NA	NA	NA
4381 M3 to 4381 R3	$240,000	NA	NA	NA

*Rental/lease prices include equipment maintenance.
**Requires feature 1870 if not already installed.
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NC—No charge.
NA—Not applicable.

IBM 4300 Series

	Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly 2-Year Lease Charge* ($)
4381 P3 to 4381 M3	****	NA	NA	NA
4381 P3 to 4381 Q3	80,000	NA	NA	NA
4381 P3 to 4381 R3	160,000			
4381 Q3 to 4381 M3	****	NA	NA	NA
4381 Q3 to 4381 P3	****	NA	NA	NA
4381 Q3 to 4381 R3	80,000	NA	NA	NA
4381 R3 to 4381 M3	****	NA	NA	NA
4381 R3 to 4381 P3	****	NA	NA	NA
4381 R3 to 4381 Q3	*****	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	20.00	518	NA
1200	Auto Start	1,200	5.00	74	NA
5248	Byte Multiplexer Channel (standard on Model Group 5)	2,665	3.00	150	NA
1421	Block Multiplexer Channel (standard on Model Groups 4 and 5)	3,340	3.00	189	NA
1431	High-Speed Block Multiplexer Channel	4,760	3.50	294	NA
1432	High-Speed Block Multiplexer Channel, additional (Model Groups 4 and 5 only)	4,760	3.50	294	NA
1433	High-Speed Block Multiplexer Channel, additional (Model Group 5 only)	4,760	3.50	294	NA
2002	Work Station Adapter	7,500	30.00	456	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	156	NA
3202	DASD/8809 Adapter, additional	2,730	5.00	156	NA
3203	DASD/8809 Adapter, additional (Model Group 5 only)	2,730	5.00	156	NA
3204	DASD/8809 Adapter, additional (Model Group 5 only)	2,730	5.00	156	NA

Features for the 4381:

1850	Channel-to-Channel Adapter	23,150	31.00	1,650	NA
1870	Block Multiplexer Channels, additional	35,580	12.50	2,535	NA
1871	Additional Block Multiplexer Channels	35,580	12.50	2,535	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	22.50	NA	NA
	Integrated operator control panel for 4361 processor (RPQ 7B0987)	2,770	NA	NA	NA
3278 2A	Display Console	2,505	18.50	135	115
3279 2C	Color Display Console	4,045	27.50	210	179
	4631 75-Key Operator Console Keyboard with channel-to-channel interface and operator control panel (for 4381)	977	5.50	54	46
	4632 same as 4631 without channel-to-channel interface (for 4381)	909	5.50	52	44
	4633 same as 4631 without operator control panel (for 4381)	472	4.00	23	20
	4634 same as 4631 without channel-to-channel interface (for 4361)	909	6.00	52	44

MASS STORAGE

3310	Disk Storage:				
	Model A1; one drive with controller; 64.5MB	6,960	68.00	580	494
	Model A2; two drives with controller; 64.5MB each	11,570	110.00	962	819
	Model B1; one drive; 64.5MB (for attachment to Model A2)	5,510	62.50	457	389
	Model B2; two drives; 64.5MB each (for attachment to Model A2)	10,120	104.00	839	714
3340	Direct Access Storage Facility; 34.9 or 69.8MB per drive:				
	Model A2; two drives plus control	8,600	124.00	1,862	1,585
	Model B2; two drives	6,020	107.00	1,316	1,120

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NA—Not applicable.

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IBM 4300 Series

		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly 2-Year Lease Charge* ($)
	4301 Fixed-Head Feature (for 3340 A2 or B2)	1,165	2.50	78	66
	6202 Rotational Position Sensing (for 3340 A2 or B2)	590	1.50	40	34
	6148 Remote Switch Attachment	NC	NC	NC	NC
	8150 String Switch for 3340 A2	4,915	16.00	371	316
3344	Direct Access Storage; 279.6MB per drive:				
	Model B2; Add-on Dual Disk Drive for 3340 Direct-Access Storage Facility	14,820	123.00	1,674	1,425
3348	Data Module (for 3340 drives):				
	Model 35; 34.9MB	1,600	NA	59	50
	Model 70; 69.8MB	2,200	NA	82	70
	Model 70F; 69.8MB of which 502,080 are served by fixed heads	4,400	NA	192	163
3350	Direct Access Storage; 317.5MB per drive:				
	Model A2; Dual Disk Drive	32,030	173.00	2,103	1,790
	Model A2F; Dual Disk Drive with 2MB fixed-head storage	39,970	224.00	2,620	2,230
	Model B2; Add-on Dual Disk Drive	25,360	130.00	1,674	1,425
	Model B2F; Add-on Dual Disk Drive for 2MB fixed-head storage per drive	33,300	182.00	2,191	1,865
	Model C2; Two-drive disk storage and associated control	33,130	182.00	2,191	1,865
	Model C2F; Two-drive disk storage and associated control	41,070	234.00	2,708	2,305
	1320 Primary Controller Adapter (permits selection of A2/AF controller as on-line controller via manual switch on the C2/C2F)	220	1.50	15	13
	8150 String Switch for 3350 A2, A2F, C2, C2F	3,690	9.50	257	219
3830	Storage Control, Model 2; for 3340/3344 or 3350 disk drives	8,120	120.00	2,815	2,365
	2150 Control Store Extension	1,880	11.00	650	546
	2151 Expanded Control Store; requires 2150	3,285	12.00	396	333
	6111 Register Expansion	109	3.50	37	31
	6148 Remote Switch Attachment	NC	NC	NC	NC
	6149 Remote Switch Attachment, additional	NC	NC	NC	NC
	8170 Two-Channel Switch	2,290	12.00	272	228
	8171 Two-Channel Switch, additional	2,290	12.00	272	228
3370	Direct Access Storage:				
	Model A1; Single Disk Drive; 571.3MB	35,480	147.00	1,563	1,330
	Model B1; Add-on Single Disk Drive for attachment to Model A1	26,600	110.00	1,173	998
	Model A2; 729.8MB; contains logic and power for up to three Model B2 units	35,480	134.00	2,030	NA
	Model B2; connects to a 3370 Model A2	26,600	101.00	1,520	NA
	8150 String Switch for 3370 A1	3,830	1.50	168	143
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	1,563	1,330
	Model B1; connects to a 3375 Model A1	28,770	105.00	1,251	1,065
	Model D1; provides dual controller function in a 3375 string; requires one Model A1 and two Model B1s	36,290	128.00	1,486	1,265
	Model B1 to Model D1 Upgrade	7,520	NA	NA	NA
	4951 Model D1 Attachment for Model A1	2,590	6.00	95	81
	4952 Model D1 Attachment for Model B1	NC	NC	NC	NC
	8150 String Switch Feature for 3375 A1	3,795	1.50	168	143
3380	Direct Access Storage; 2.52 billion bytes per unit:				
	Model A4; connects to one 3880 storage director	77,680	285.00	4,471	3,805
	Model AA4; connects to one 3880 storage director	88,780	325.00	5,105	4,345
	Model B4; connects to a Model A unit	64,440	240.00	3,707	3,155
	Model AD4; 2.52GB Extended Capability drive; attaches to 3880 Model 3 or 23 storage directors	88,780	295.00	4,730	NA
	Model AE4; 5.04GB Extended Capability drive; attaches to 3880 Model 3 or 23 storage directors	134,740	295.00	7,030	NA
	Model BD4; 2.52GB Extended Capability drive; can be attached to AD4, AE4, BE4, or another BD4	64,440	215.00	3,440	NA
	Model BE4; 5.04GB Extended Capability drive; can be attached to AD4, AE4, BD4, or another BE4	110,400	215.00	5,735	NA

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NC—No charge.
NA—Not applicable.

IBM 4300 Series

		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly 2-Year Lease Charge* ($)
3880	Storage Control; includes two storage directors:				
	Model 1; each storage director can attach up to four 3330/3333, 3340 A2, 3350 A2/A2F, 3370 A1, or 3375 A1 or D1 in any combination	60,270	176.00	3,819	3,250
	Model 2; provides one storage director for 3330/3333, 3340/3344, 3350, 3370, or 3375 storage and one for 3380 storage	60,270	176.00	3,819	3,250
	Model 3; provides two storage directors for 3380 storage	60,270	176.00	3,819	3,250
	Model 4; provides one storage director which can attach up to four 3375 Model A1s	35,000	82.50	2,195	NA
	Model D21; paging subsystem for 3350; includes two storage directors; 8 mega-bytes (4381 only)	143,750	575.00	8,305	NA
	Model E21; same as D21, but with 16 megabytes (4381 only)	183,750	600.00	10,470	NA
	Model G21; same as D21, but with 32 megabytes (4381 only)	263,750	650.00	14,800	NA
	Model H21; same as D21, but with 48 megabytes (4381 only)	343,750	700.00	19,130	NA
	Model J21; same as D21, but with 64 megabytes (4381 only)	423,750	750.00	23,460	NA
	Model D23; includes two cache storage directors for 3380; 8 megabytes (for 4381 only)	143,750	575.00	8,305	NA
	Model E23; same as D23, but 16 megabytes (4381 only)	183,750	600.00	10,470	NA
	Model G23; same as D23, but with 32 megabytes (4381 only)	263,750	650.00	14,800	NA
	Model H23; same as D23, but with 48 megabytes (4381 only)	343,750	700.00	19,130	NA
	Model J23; same as D23, but with 64 megabytes (4381 only)	423,750	750.00	23,460	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	11,420	40.00	553	471
	8170 Two-Channel Switch Pair	6,225	11.00	390	332
	8171 Two-Channel Switch Pair, additional	16,610	38.50	1,053	896
	8172 Eight-Channel Switch	22,850	53.50	1,451	1,235

MAGNETIC TAPE EQUIPMENT

		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly 2-Year Lease Charge* ($)
3410	Magnetic Tape Unit:				
	Model 1; 20,000 bytes/sec.	3,365	123.00	325	273
	Model 2; 40,000/20,000 bytes/sec.	4,365	135.00	432	363
	Model 3; 80,000/40,000 bytes/sec.	5,365	149.00	544	457
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	16.00	94	79
	3221 Dual Density Feature (for 3410 and 3411)	2,185	57.00	138	116
	7360 System/360/370 Attachment (required on 3411)	1,950	39.50	260	218
3420	Magnetic Tape Units:				
	Model 3; 120,000 bytes/sec. at 1600 bpi; 75 ips	11,930	226.00	648	544
	Model 4; 470,000 bytes/sec. at 6250 bpi; 75 ips	15,340	226.00	907	762
	Model 5; 200,000 bytes/sec. at 1600 bpi; 125 ips	16,000	248.00	874	734
	Model 6; 780,000 bytes/sec. at 6250 bpi; 125 ips	17,920	248.00	1,045	878
	Model 7; 320,000 bytes/sec. at 1600 bpi; 200 ips	17,920	297.00	1,035	869
	Model 8; 1250 bytes/sec. at 6250 bpi; 200 ips	19,880	365.00	1,240	1,042
	6420 6250 bpi Density Feature (for 3420 Models 4, 6, and 8)	1,600	68.00	88	74
	6425 6250/1600 bpi Density Feature (for 3420 Models 4, 6, and 8)	2,205	90.00	128	108
	6631 Single Density Feature (for Models 3, 5, and 7)	2,870	67.50	150	126
	3550 Dual Density Feature (for Models 3, 5, and 7)	3,705	113.00	196	165
	6407 7-Track Feature (for Models 3, 5, and 7)	2,870	98.00	150	126
3430	Magnetic Tape Subsystem:				
	Model A1; Tape Unit and Control	33,400	251.00	2,175	NA
	Model B1; Tape Unit only	16,900	176.00	1,155	NA
3480	Magnetic Tape Subsystem:				
	Model A22 Control Unit	65,430	385.00	3,880	NA
	Model B22 Magnetic Tape Unit	43,120	240.00	2,545	NA
	1511 First Channel Attachment	5,785	21.00	331	NA
	1512 Second Channel Attachment	5,785	21.00	331	NA
	1513 Third Channel Attachment	5,785	21.00	331	NA

*Rental/lease prices include equipment maintenance.
**Requires feature 1870 if not already installed.
***Standard 4361 Model Group 4 or 5 features that are optional on the 4361 Model Group 3 must already be installed.
****RPQ (Request for Price Quotation) required. Not recommended for field installation.
NC—No charge.
NA—Not applicable.

IBM 4300 Series

		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly 2-Year Lease Charge* ($)
3803	Tape Controller:				
	Model 1; for 3420 Models 3, 5, 7	20,680	144.00	1,125	945
	Model 2; for 3420 Models 3 through 8 drives	27,550	199.00	1,640	1,378
	5310 9-Track NRZI Feature (permits connection of 800-bpi drives to 3803-2)	3,080	2.00	158	133
	6320 7-Track NRZI Feature (permits connection of 800-bpi drives to 3803-2; 5310 is prerequisite)	1,515	2.00	79	66
	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	328	276
	1793 for 3 Tape Controls	7,820	23.00	425	357
	1794 for 4 Tape Controls	9,195	23.00	498	418
	6148 Remote Switch Attachment	910	NA	48	40
	8100 Two-Channel Switch	4,600	6.50	243	204
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. (not in new production)	11,960	88.00	774	493
	Model 2; second, fourth, or sixth drive; attaches to Model 1A or 3	10,610	79.50	692	438
	Model 3; third or fifth drive; attaches to Model 2	11,960	88.00	774	493

DISKETTE EQUIPMENT

3540	Diskette Input/Output Unit:				
	Model B1; one drive; 242.9KB	27,520	85.00	1,263	1,075
	Model B2; two drives	41,910	117.00	1,886	1,605

PUNCHED CARD EQUIPMENT

1442	Card Read Punch (with control), Model N1; 400/91 cpm	24,040	348.00	1,230	NA
2501	Card Reader (with control):				
	Model B1; 600 cpm	19,610	144.00	623	NA
	Model B2; 1000 cpm	19,920	158.00	767	NA
3525	Card Punch:				
	Model P1; 100 cpm	25,520	199.00	960	NA
	Model P2; 200 cpm	26,520	269.00	1,210	NA
	Model P3; 300 cpm	27,520	336.00	1,455	NA
	1533 Card Read Feature	7,645	50.00	283	NA
	1421 Basic Card Print	16,750	198.00	621	NA
	5273 Multi-Line Card Print	1,365	57.50	166	NA
	8339 Two-Line Card Print	874	8.00	25	NA

PRINTERS

1403	Printer:				
	Model N1; 1100 lpm; 132 print positions	40,040	735.00	1,664	NA
	1416 Interchangeable Train Cartridge (required for 1403 N1)	2,930	NA	190	NA
	4740 Interchangeable Train Cartridge Adapter (for 1403-2 or -7)	2,030	NA	99	NA
	8640 Universal Character Set Feature (for 1403 N1)	447	4.00	14	NA
	8641 Universal Character Set Feature (for 1403-2)	313	4.00	14	NA
2821	Control Unit:				
	Model 2; for one 1403	27,190	100.00	1,200	NA
	Model 3; for two 1403s	54,270	205.00	2,395	NA
	3615 1100 lpm Printer Adapter (for 2821; required for 1403 N1)	2,815	3.00	131	NA
	7945 Third Printer Control (for 2821 Model 3 or 5)	22,560	16.00	939	NA
	8100 Two-Channel Switch	9,895	20.00	368	NA
	8637 Universal Character Set Adapter	718	6.50	22	NA
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

*Rental/lease prices include equipment maintenance.
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****RPQ (Request for Price Quotation) required. Not recommended for field installation.
NC—No charge.
NA—Not applicable.

IBM 4300 Series

		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly 2-Year Lease Charge* ($)
3211	Printer, Model 1; 2000 lpm, 132 print positions	40,080	1,045.00	2,985	NA
	3216 Interchangeable Train Cartridge	11,600	226.00	706	NA
	5554 18 Additional Print Positions	2,150	17.00	86	NA
3811	Control Unit for 3211 Printer	17,685	135.00	1,315	NA
	5553 18 Additional Print Positions	789	5.00	28	NA
3262	Line Printer:				
	Model 1; 650 lpm (4361 only)	15,040	202.50	679	NA
	Model 5; 650 lpm (attachment to virtual storage processors)	17,000	202.50	941	NA
	Model 11; 325 lpm (4361 only)	12,620	148.00	499	NA
3268	Model 2	7,500	69.00	NA	NA
	Model 2C	8,990	92.00	NA	NA
3287	Serial Printer:				
	Model 1; 80 cps	4,830	37.50	NA	NA
	Model 2; 120 cps	5,150	46.50	NA	NA
	Model 1C; 4 colors; 80 cps	5,210	42.50	NA	NA
	Model 2C; 4 colors; 120 cps	5,530	51.50	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
4245	Printer, Model 1; 2000 lpm; 132 print positions (for 4381 only)	63,500	715.00	4,015	NA
4248	Printer, Model 1; 2200 to 3600 lpm; 132 print positions (for 4381 only)	99,000	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 x 600 dots per square inch (4361 only)	21,000	170.00	1,285	NA

OPTICAL AND MAGNETIC READERS

		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly 2-Year Lease Charge* ($)
1255	Magnetic Character Reader:				
	Model 1; 500 dpm, 6 stackers	41,040	443.00	1,650	NA
	Model 2; 750 dpm, 6 stackers	46,970	694.00	2,025	NA
	Model 3; 750 dpm, 12 stackers	63,960	870	2,665	NA
	3215 Dash Symbol Transmission (for 1255 or 1419)	56	NC	38	NA
	4380 51-Column Card Sorting (for 1255 or 1419)	661	NC	18	NA
	4520 High-Order Zero and Bank Selection (for 1255 Model 3 only)	1,515	NA	54	NA
	7060 Self-Checking Numbers (for 1255)	2,465	NA	89	NA
	6360 System/360/370 Adapter (required on 1255)	22,910	60.50	933	NA
1419	Magnetic Character Reader; 1600 dpm	89,050	1,350.00	4,175	NA
	7061 Self-Checking Number, Modulus 10	1,560	6.00	66	NA
	7062 Self-Checking Number, Modulus 11	2,410	9.00	108	NA
3890	Document Processor; Model A has 13K bytes, Model B has 29K bytes of memory:				
	Model A1; 6 pockets	280,350	440.00	8,755	NA
	Model A2; 12 pockets	327,300	529.00	10,150	NA
	Model A3; 18 pockets	374,250	614.00	11,550	NA
	Model A4; 24 pockets	421,200	701.00	12,940	NA
	Model A5; 30 pockets	468,150	785.00	14,340	NA
	Model A6; 36 pockets	515,100	873.00	15,730	NA
	Model B1; 6 pockets	302,560	536.00	10,910	NA
	Model B2; 12 pockets	349,510	625.00	12,300	NA
	Model B3; 18 pockets	396,460	709.00	13,700	NA
	Model B4; 24 pockets	443,410	798.00	15,090	NA

*Rental/lease prices include equipment maintenance.
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****RPQ (Request for Price Quotation) required. Not recommended for field installation.
NC—No charge.
NA—Not applicable.

IBM 4300 Series

	Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly 2-Year Lease Charge* ($)
Model B5; 30 pockets	490,360	883.00	16,490	NA
Model B6; 36 pockets	537,310	968.00	17,890	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

		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly 2-Year Lease Charge* ($)
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
	3604 Keyboard/Display, Model 6, one required	1,745	14.50	126	98
	1520 Channel Expansion Internal—4 Control Unit Interfaces	1,550	1.00	80	64
	1521 Channel Expansion Internal—8 Control Unit Interfaces	3,100	1.00	156	125
	6010 Remote Two-Channel Switch Control—Basic	5,180	19.50	263	210
	6011 Remote Two-Channel Switch Control—Additional	2,415	14.50	124	99
	6350 System Power Sequencing—Additional	207	NA	8	6

COMMUNICATIONS EQUIPMENT

For the 4361:

		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly 2-Year Lease Charge* ($)
	1020 Autocall Unit Interface	330	3.50	16	NA
	1601 Communications Adapter, base (optional on all model groups)	2,330	3.00	131	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	20	NA
	4720 High-Speed Modem Adapter	1,000	3.50	48	NA
	4801 Local Attachment Interface	830	4.50	41	NA
	5650 Digital Data Service Adapter	750	4.00	34	NA
	4717 High-Speed Digital Interface	2,050	6.00	126	NA
	5655 X.25 Adapter, nonswitched	770	2.50	31	NA
4994	ASCII Device Attachment Control Unit:				
	Model A; supports up to 16 devices	16,735	214.00	959	NA
	Model B; supports up to 32 devices	25,850	282.00	1,490	NA
	Model C; supports up to 48 devices	32,300	344.00	1,865	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-II	Communication Controller; for detailed pricing see the IBM 308X Series report in this section				

*Rental/lease prices include equipment maintenance.
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****RPQ (Request for Price Quotation) required. Not recommended for field installation.
NC—No charge.
NA—Not applicable.

IBM 4300 Series

		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly 2-Year Lease Charge* ($)
3725	**Communication Controller:**				
	Model 1; up to six channel adpaters and from 512K to 1024K bytes of main storage capacity	75,000	224.00+	3,725	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+	2,810	NA
	1561 Channel Adapter	6,750	8.50+	337	NA
	4666 Internal Clock Control	1,500	2.00+	73	NA
	4771 LAB Type A	19,000	17.00+	943	NA
	4772 LAB Type B	26,400	29.00+	1,315	NA
	4911 LIC Type 1	2,600	2.00+	131	NA
	4921 LIC Type 2	3,000	2.00+	148	NA
	4931 LIC Type 3	3,000	2.00+	148	NA
	4941 LIC Type 4A	2,600	2.00+	131	NA
	4942 LIC Type 4B	3,000	2.00+	148	NA
	7100 Storage Increment 256K	4,375	20.00+	217	NA
	8320 Two Processor Switch	4,000	3.00+	200	NA
3726	Communication Controller Expansion	32,000	42.00+	1,585	NA
3727	Operator Console	2,390	27.00+	182	NA

*Rental/lease prices include equipment maintenance.
**Requires feature 1870 if not already installed.
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****RPQ (Request for Price Quotation) required. Not recommended for field installation.
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	*18,000	1,315	1,105	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, Release 1, Modification Level 1	*11,430	NA	410	NA	99
5666-316	VSE/SP Version 2, Release 1, Modification Level 1	36,730	33,057	NA	NA	394
5666-313	ACF/VTAM Version 3 for VSE	963	864	321	288	NA
5668-981	X.25 Packet Switching Interface	770	557	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

*One-time license charge.
NA—Not applicable.

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IBM 4300 Series

		Initial Charge		Monthly Charge		
		Basic License Charge ($)	DSLO License Charge ($)	Basic License Charge ($)	DSLO Charge ($)	Licensed Program Support Charge ($)
5666-273	VSE/POWER Version 2	498	447	166	149	33
5746-AM5	VSE/3270 Bisync Pass Through	*4,325	NA	198	NA	NA
5746-AM2	VSE/VSAM	NA	NA	82	74	24
	VSE/VSAM Space Management for SAM feature	NA	NA	44	30	9
5746-AM4	VSE/Fast Copy Data Set Program	*454	NA	NA	NA	NA
5746-UT3	VSE/Data Interfile Transfer, Testing, and Operations Utility (VSE/DITTO)	NA	NA	40	31	5
5746-XE7	VSE/Access Control—Logging and Reporting	*2,360	*2,125	63	57	24
5746-SA1	VSE/Interactive Problem Control System	*800	*600	37	26	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	7
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, Release 3	NA	NA	464	347	28
5664-169	VM/XA Systems Facility	11,220	8,415	3,740	2,805	583
5664-301	VM/SP Entry	*40,000	*36,000	2,000	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	NA	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	NA	NA	448	NA	NA
5748-SA1	VM/Interactive Problem Control System Extension	*1,000	*750	50	34	6
5748-MS1	Interactive Productivity Facility	NA	NA	50	36	6
5748-RC1	VM/Pass-Through Facility	NA	NA	185	139	90
5798-DFH	Fortran Utilities for VM/370 III	2,400	NA	NA	NA	NA
5798-DLL	Data Base Edit Facility for VM/SP-CMS	5,500	NA	NA	NA	NA
5798-DLQ	Data Base Edit Facility for MVS/TSO	7,000	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	NA	NA	341	255	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-XYS	MVS/SP-JES2 Version 1	NA	NA	2,150	1,612	117
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	2,150	1,612	117
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	NA
5665-313	ACF/VTAM Version 3 for MVS/370	5,130	3,840	1,710	1,280	NA
5665-285	TSO/Extensions Release 2.1	1,500	1,125	555	416	108
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

*One-time 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 ($)
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

*One-time license charge.
NA—Not applicable.

		One-Time License Charge ($)	Monthly Program Support ($)	Monthly Multiple Program Support ($)
IX/370				
5667-126	IX/370 operating system			
4506	IX/370; support for up to 16 currently signed-on terminal users (CSTUs)	10,000	475	792
4507	IX/370; support for up to 32 CSTUs; requires 4506	10,000	475	792
4508	IX/370; support for up to 64 CSTUs; requires 4506 and 4507	20,000	475	792
4509	IX/370; support for 65+ CSTUs; requires 4506, 4507, and 4508	35,000	475	792

	Monthly Program Support ($)	Monthly Multiple Program Support ($)
CHARGES FOR LOCAL SYSTEM SUPPORT FOR CONTROL PROGRAMMING		
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 1:		
Category A	688	1,101
Category B	982	1,571
For Class 1 SCP on 4381 Model Group 2:		
Category A	724	1,158
Category B	1,030	1,648
For Class 1 SCP on 4381 Model Group 3:		
Category A	824	1,318
Category B	1,175	1,880