IBM 4300 Series

MANAGEMENT SUMMARY

IBM has revamped the 4300 Series product line by withdrawing the 4321 and 4331 systems, taking the 4341 processors out of new production, introducing the entry-level 4361 Model Group 3, and adding several new features to all 4361 models. The SSX/VSE operating system has also been enhanced.

The 4321 and 4331 processors will be withdrawn from marketing effective December 31, 1984. Thus, the 4361 processors now represent the low end of the 4300 Series product line. The new 4361 Model Group 3 is available with 2 or 4 megabytes of main memory and up to 3 I/O channels. It is field upgradable to a 4361-4 or 4361-5. In engineering/scientific environments, the 4341-3 provides up to 2.2 times the performance of a 4331-2, according to IBM. In commercial environments, the 4361-3 is about equal to a 4331-2.

The new features for all 4361 models include the Work Station Adapter (WSA) and the Serial OEM Interface (SOEMI), both of which increase the flexibility of 4361 configurations. The WSA, 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. An Auto Start feature and a Programmable Power-Off feature were also introduced for the 4361 processors. In addition, a new release of SSX/VSE, Release 4, was added to provide support for the new hardware.

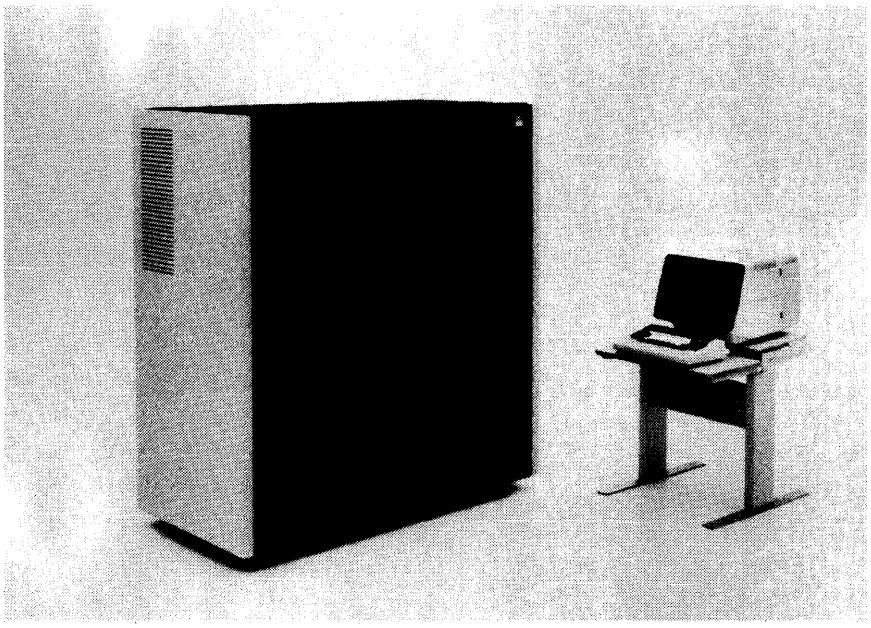
The IBM 4300 Series is a family of medium- to large-scale processors that can perform well as standalone systems, as distributed processing systems, or as nodes in a communications network.

MODELS: 4361 Model Groups 3, 4, and 5; 4341 Model Groups 9, 10, 1, 11, 2, and 12; 4381 Model Groups 1 and 2.
CONFIGURATION: Uniprocessor systems with 1 to 16 megabytes of main memory, 2K to 32K bytes of buffer storage, and up to 12 I/O channels.
COMPETITION: Burroughs A 3, A 9, B 4900, and B 5900; DEC VAX; Honeywell DPS 8; IPL 4400 Series; NAS 6600 Series; NCR V-8600 Series; Prime 9950; Sperry 1100/70.
PRICE: Purchase prices for CPUs plus main memory range from $56,500 to $620,000.

CHARACTERISTICS

MANUFACTURER: International Business Machines Corporation, Old Orchard Road, Armonk, New York 10504. Contact your local IBM representative. In Canada, 1150 Eglinton Avenue, Don Mills, Ontario. Telephone (416) 443-2111.

MODELS: 4341 Model Group 9 (Models J9, K9, and L9); 4341 Model Group 10 (Models K10 and L10); 4341 Model Group 1 (Models K1 and L1); 4341 Model Group 11 (Models K11, L11, and M11); 4341 Model Group 2 (Models K2, L2, M2, N2, and P2); 4341 Model Group 12 (Models K12, L12, M12, N12, and P12); 4361 Model Group 3 (Models K3



At the left is a picture of the 4381 processor and console which features from 4 to 16 megabytes of main memory, 4K to 32K bytes of buffer storage, and up to 12 I/O channels. It can utilize virtually all of the System/370 communications and peripheral equipment, including the high-performance 3380 Direct Access Storage Device. The 4381 supports the MVS/XA operating system as well as OS/VS1 and DOS/VSE.

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TABLE 1. SYSTEM COMPARISON

	4361 Model Group 3	4361 Model Group 4	4361 Model Group 5	4341 Model Group 9
SYSTEM CHARACTERISTICS				
Date of introduction	September 1984	September 1983	September 1983	October 1982
Date of first delivery	December 1984	2nd quarter 1984	1st quarter 1984	March 1983
Relative Performance*	—	49	66	24
Principal operating systems	DOS/VSE, SSX/VSE, and VM/370	DOS/VSE, SSX/VSE, and VM/370	DOS/VSE, SSX/VSE, VM/370, and MVS/370	MVS/370, DOS/VSE, SSX/VSE, and VM/370
Purchase price of CPU with min. main storage capacity	$56,500	$135,000	$180,000	$81,000
Upgradable to	4361-4 or -5	4361-5	—	4341-10
MAIN STORAGE				
Storage type	MOS	MOS	MOS	MOS
Bytes fetched per cycle				
Minimum capacity, bytes	2,097,152	2,097,152	2,097,152	1,048,576
Maximum capacity, bytes	4,194,304	12,852,912	12,852,912	4,194,304
Increment size, bytes	12,097,152	2,097,152 or 4,194,304	2,097,152 or 4,194,304	1,048,576 or 2,097,152
BUFFER STORAGE				
Capacity, bytes	8,192	8,192	16,384	2,048
Cycle time, nanoseconds	—	—	—	225
Bytes fetched per cycle	—	—	—	8
CENTRAL PROCESSOR				
Cycle time, nanoseconds	100	100	100	150 to 300
Operating modes	ECPS:VSE, System/370	ECPS:VSE, System/370	ECPS:VSE, System/370	ECPS:VSE, System/370
System/370 model options	Basic Control, Extended Control, ECPS:VM/370	Basic Control, Extended Control, ECPS:VM/370	Basic Control, Extended Control, ECPS:MVS, ECPS:VM/370	ECPS:VS1, ECPS-VM/370, ECPS:MVS
Control storage capacity, bytes	—	16,384	16,384	—
Data path width, bytes	—	4 and 8	4 and 8	8
I/O CHANNELS & ADAPTERS				
No. of byte multiplexer channels	1 optional	1 optional	1 standard	1 Std. 1 opt.
No. of block multiplexer channels	1 optional	1 standard	2 standard	2 std., 3 opt.
No. of high-speed block multiplexer channels	1 optional	2 optional	3 optional	0
Maximum total no. of channels	3	6	6	6
Maximum channel data rates bytes/second:				
Byte multiplexer (byte mode)	36K	36K	36K	16K or 22K
Byte multiplexer (burst mode)	500K	500K	500K	1.0M or 2.0M
Block multiplexer	1.25M	1.25M	1.25M	1.0M, 2.0M, or 3.0M
High-speed block multiplexer	1.86M	1.86M or 3.0M	1.86M or 3.0M	No
Display/Printer Adapter	Standard	Standard	Standard	No
DASD/8809 Adapter	1 or 2 optional	1 or 2 optional	1, 2, 3, or 4 optional	No
Work Station Adapter	Optional	Optional	Optional	No
Integrated Communications Adapter	8 lines opt.	8 lines std.	8 lines std.	No
Channel-to-Channel Adapter	No	No	No	Optional

**Relative Performance Ratings are based on an IBM 370/158-3 equaling 45. Data for these figures was gathered by CW Communications, Inc.*

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TABLE 1. SYSTEM COMPARISON (Continued)

	4341 Model Group 10	4341 Model Group 1	4341 Model Group 11	4341 Model Group 2
SYSTEM CHARACTERISTICS				
Date of Introduction	November 1981	January 1979	November 1981	September 1980
Date of first delivery	March 1982	4th quarter 1979	March 1982	2nd quarter 1981
Relative Performance*	34	40	50	66
Principal operating systems	MVS/370, DOS/VSE, SSX/VSE, and VM/370	MVS/370, DOS/VSE, SSX/VSE, and VM/370	MVS/370, DOS/VSE, SSX/VSE, and VM/370	MVS/370, DOS/VSE, SSX/VSE, and VM/370
Purchase price of CPU with min. main storage capacity	$142,500	$184,500	$211,200	$297,000
Upgradable to	4341-11 to -12	4341-11 or -2 or -12	4341-12	4341-12
MAIN STORAGE				
Storage type	MOS	MOS	MOS	MOS
Bytes fetched per cycle	8	8	8	8
Minimum capacity, bytes	2,097,152	2,097,152	2,097,152	2,097,152
Maximum capacity, bytes	4,194,304	4,194,304	8,388,608	16,777,216
Increment size, bytes	2,097,152	2,097,152	2,097,152 or 4,194,304	2,097,152 or 4,194,304
BUFFER STORAGE				
Capacity, bytes	4,096	8,192	8,192	16,384
Cycle time, nanoseconds	225	225	180	120
Bytes fetched per cycle	8	8	8	16
CENTRAL PROCESSOR				
Cycle time, nanoseconds	150 to 300	150 to 300	120 to 240	120 to 240
Operating modes	ECPS:VSE, System/370	ECPS:VSE, System/370	ECPS:VSE System/370	ECPS:VSE System/370
System/370 model options	ECPS:VS/1, ECPS:MVS ECPS:VM/370	ECPS:VS/1, ECPS:MVS ECPS:VM/370	ECPS:VS/1, ECPS:MVS ECPS:VM/370	ECPS:VS/1, ECPS:MVS ECPS:VM/370
Control storage capacity, bytes	—	—	—	—
Data path width, bytes	8	8	8	8
I/O CHANNELS & ADAPTERS				
No. of byte multiplexer channels	1 std., 1 opt.	1 std., 1 opt.	1 std., 1 opt.	1 std., 1 opt.
No. of block multiplexer channels	2 std., 3 opt.	2 std., 3 opt.	5 std.	5 std.
No. of high-speed block multiplexer channels	0	0	0	0
Minimum total no. of channels	6	6	6	6
Maximum channel data rates bytes/second				
Byte multiplexer (byte mode)	16K or 22K	16K or 22K	16K or 22K	16K or 22K
Byte multiplexer (burst mode)	1.0M or 2.0M	1.0M or 2.0M	1.0M or 2.0M	1.0M or 2.0M
Block multiplexer	1.0M, 2.0M, or 3.0M	1.0M, 2.0M, or 3.0M	2.0M or 3.0M	2.0M or 3.0M
High-speed block multiplexer	No	No	No	No
Display/Printer Adapater	No	No	No	No
DASD/8809 Adapter	No	No	No	No
Work Station Adapter	No	No	No	No
Integrated Communications Adapter	No	No	No	No
Channel-to-Channel Adapter	Optional	Optional	Optional	Optional

**Relative Performance Ratings are based on an IBM 370/158-3 equaling 45. Data for these figures was gathered by CW Communications, Inc.*

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TABLE 1. SYSTEM COMPARISON (Continued)

	4341 Model Group 12	4381 Model Group 1	4381 Model Group 2
SYSTEM CHARACTERISTICS			
Date of Introduction	October 1982	September 1983	September 1983
Date of first delivery	February 1983	3rd quarter 1984	1st quarter 1984
Relative Performance*	76	100	133
Principal operating systems	MVS/370, DOS/VSE, SSX/VSE, and VM/370	MVS/370, MVS/XA, DOS/VSE, and VM/370	MVS/370, MVS/XA, DOS/VSE, and VM/370
Purchase price of CPU with minimum main storage capacity	$316,800	$370,000	$500,000
Upgradable to	—	4381-2	—
MAIN STORAGE			
Storage type	MOS	MOS	MOS
Bytes fetched per cycle	—	16	16
Minimum capacity, bytes	2,097,152	4,194,304	4,194,304
Maximum capacity, bytes	16,777,216	16,777,216	16,777,216
Increment size, bytes	2,097,152 or 4,194,304	4,194,304	4,194,304
BUFFER STORAGE			
Capacity, bytes	16,384	4,096 to 8,192	4,096 to 32,768
Cycle time, nanoseconds	115	68	68
Bytes fetched per cycle	—	16	16
CENTRAL PROCESSOR			
Cycle time, nanoseconds	115 to 230	68	68
Operating modes	ECPS:VSE, System/370	370, 370-XA	370, 370-XA
System/370 model options	ECPS:VS/1, ECPS:VM/370, ECPS:MVS	ECPS:VS/1, ECPS:VM/370, ECPS:MVS	ECPS:VS/1, ECPS:VM/370, ECPS:MVS
Control storage capacity, bytes	—	—	—
Data path width, bytes	8	8	8
I/O CHANNELS & ADAPTERS			
No. of byte multiplexer channels	1 std., 1 opt.	1 std., 1 opt.	1 std., 1 opt.
No. of block multiplexer channels	5 std.	6 std., 6 opt.	6 std., 6 opt.
No. of high-speed block multiplexer channels	0	—	—
Minimum total no. of channels	6	12	12
Maximum channel data rates bytes/second			
Byte multiplexer (byte mode)	16K or 22K	30K to 120K	30K to 120K
Byte multiplexer (burst mode)	1.0M or 2.0M	2.0M to 3.0M	2.0M to 3.0M
Block multiplexer	2.0M or 3.0M	1.0M, 2.0M, or 3.0M	1.0M, 2.0M, or 3.0M
High-speed block multiplexer	No	No	No
Display/Printer Adapater	No	No	No
DASD/8809 Adapter	No	No	No
Work Station Adapter	No	No	No
Integrated Communications Adapter	No	No	No
Channel-to-Channel Adapter	Optional	Optional	Optional

**Relative Performance Ratings are based on an IBM 370/158-3 equaling 45. Data for these figures was gathered by CW Communications, Inc.*

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 the larger systems. ECPS mode takes 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 L3); 4361 Model Group 4 (Models K4, L4, LK4, M4, and ML4); 4361 Model Group 5 (Models K5, L5, LK5, M5, and ML5); 4381 Model Group 1 (Models L1, M1, and P1); and 4381 Model Group 2 (Models L2, M2, and P2).

PREVIOUS MODELS: The 4321 and 4331 systems have been withdrawn from marketing.

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."

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and engineering/scientific applications. The 4361 has a main storage capacity of from 2 to 12 megabytes, up to three times that of the 4331. Separate instruction and I/O processing units provide improved throughput over previous models. 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 three more are optional.

The 4341, which is no longer being manufactured, is available in six model groups: the Model Groups 9, 10, 1, 11, 2, and 12. The 4341 processors include from 2K to 16K bytes of buffer storage. Main memory ranges from 1 to 16 megabytes. All 4341 processor models support a maximum of 6 I/O channels.

The top-of-the-line 4381 Models 1 and 2 are available with from 4 to 16 megabytes of main memory capacity and up to 12 I/O channels. The 4381-1 can provide an internal throughput rate of from 1.4 to 1.6 times that of the 4341-2 for commercial workloads and up to 1.7 times that of the 4341-2 for scientific workloads. The 4381-2 offers an internal throughput rate of from 1.7 to 2.3 times that of the 4341-2 for commercial workloads and from 2.4 to 3 times that of the 4341-2 for scientific workloads. Despite having approximately twice the internal speed of the 4341 Model Group 2, the 4381 requires less space and power, produces less heat, and weighs less. A unique air cooling technique used on the 4381, termed "impingement cooling," assures 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.

The 4300 Series processors support most of the System/370, 303X Series, and 308X Series peripheral devices. These peripheral devices include: the 3310 (4361 only), 3350, 3370, 3375, and 3380 Direct Access Storage Devices; the 3830 and 3880 Storage Control Devices; the 3410/3411, 3420, 3430, 3480, and 8809 (4361 only) Magnetic Tape Units; and the 1403 Model N1, 4245, 4248, and 3800 printers.

All 4300 Series processors require a 3278 Model 2A Display Console or 3279 Model 2C Display Console as the operator console. Both consoles have a 1920-character display and keyboard, for operation and maintenance. Up to three additional consoles or 3287 Printers (for a total of four devices) can be attached to the 4341 or 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) Release 6, MVS, and MVS/XA.

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

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

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

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

MAIN STORAGE

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 is composed of 64K-bit chips, with four chips mounted on each ceramic substrate. Maximum density is achieved by stacking pairs of substrates to form 8-chip modules. The 4381 uses a 1K-by-9 bit bipolar array chip which operates with a 20-nanosecond cycle time. It is used for the microcode control storage and the high-speed buffer in the memory subsystem.

CYCLE TIME: See Table 1.

CAPACITY: From 1,048,576 to 16,777,216 bytes. See Table 1 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.

CENTRAL PROCESSORS

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 4341 and 4381 users to identify valid hardware problems as the cause

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TABLE 2. MASS STORAGE

Subsystems	3310 DASD	3340/3344 DASD	3350 DASD
Cabinets per subsystem	1 to 32	1 to 32	1 to 32
Disk packs/HDAs per cabinet	1 or 2	1 or 2	2 HDAs
Capacity	64.5MB or 129MB	69.8MB or 279.6MB per HDA	317.5 per HDA
Tracks/segments per drive unit	—	8,352 or 66,816	33,300
Average access time, msec.	27	25	25
Average rotational delay, msec.	9.6	10.1	8.4
Data transfer rate	1,031,000 bytes/sec.	885,000 bytes/sec.	1,198,000 bytes/sec.
Controller model	Integrated	3830-2 or 3880-1, -2	3830-2 or 3880-1, -2, -11, or -21
Comments	Not for use with 4341 or 4381 systems	3344 attaches to 3340 A2	Fixed-head models available; Model A2 includes logic and power for up to three B2s or two B2s and one C2 unit

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

SSX/VSE (Small Systems Executive/VSE) is a pregenerated, preconfigured subset of DOS/VSE that is designed for users with limited data processing skills. SSX/VSE supports batch or interactive applications on 4361 or 4341 processors operating in standalone or distributed environments.

With VM/370 Release 6, 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, 4341, and 4381 processors. MVS Release 3.8 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.

MVS/XA is supported only on the 4381 processors and includes two programs: MVS/SP Version 2 and the Data Facility Product. MVS/XA allows address space sizes to be expanded up to 2,000 megabytes.

COMPETITIVE POSITION

The major competition for the 4361 is the new Burroughs A 3 and the Burroughs A 9 Model B, the NCR V-8635, and **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 is used to run a subset of Problem Analysis from the user installation. The 4381 only, however, is available in six languages other than English.**

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 Remote Operator Console Facility (ROCF). The 4361 processors now also include a programmable power-off function as a standard feature.

The 4341 and 4381 feature 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 4341 and 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 and three options on the 4341. 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. On the 4341, the ECPS/VS1 option improves processor performance with OS/VS1, the ECPS:VM/370 option provides improved system performance with VM/370, and the ECPS:MVS option allows the

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TABLE 2. MASS STORAGE (Continued)

Subsystems	3370 DASD	3375 DASD	3380 DASD
Cabinets per subsystem	1 to 32	1 to 32	1 to 16
Disk packs/HDAs per cabinet	1 HDA	1 HDA	2 HDAs
Capacity	571.3MB or 729.8MB	819.7MB	1260MB per HDA
Tracks/segments per drive unit	—	—	—
Average access time, msec.	19 to 20	19	16
Average rotational delay, msec.	10.1	10.1	8.3
Data transfer rate	1,859,000 bytes/sec.	1,859,000 bytes/sec.	3,000,000 bytes/sec.
Controller model	3880-1, -2, or -4	3880-1 or -2	3880-2, -3, -13, or 23
Comments	Model A units include logic and power for up to three B units	Model A1 includes logic and power for up to three B1s or two B1s and one D1 unit	Model A4 includes logic and power for up to three B4 units

the Sperry 1100/70. For the 4381, the competition will come from the Burroughs B 4900 and A 9 Models D and F, the NCR V-8645, the NAS 6650 and 6660, the IPL 4400, and the Prime 9950.

When the 4300 Series was first introduced, IBM categorized the systems as mid-range mainframes. However, when the 4361 and 4381 models were announced, IBM billed them as superminis. The term is certainly appropriate for the 4361. Unlike the 4381, the 4361 includes integrated I/O and communications adapters that permit the direct connection of various devices without the need for separate control units. The latest round of 4361 announcements included additional connectivity options that enable the system to support a wide variety of devices from other vendors as well as from IBM. The 4361 also supports the new a ASCII control unit that permits the connection of up to 64 ASCII terminals to the system.

The 4381 is structured more like a mainframe. Its architecture is similar to the larger 308X Series, and it is the only 4381 model that runs MVS/XA. Thus, the 4381 serves as a bridge between the 4300 Series and the 308X Series. Unlike the 308X, however, the 4381 is air cooled and can be used in an ordinary office environment.

IBM has been placing considerable emphasis on the 4300 Series' suitability for engineering and scientific applications, as well as continuing to stress its ability to serve in a distributed processing environment.

ADVANTAGES AND RESTRICTIONS

The IBM 4300 user can grow within the 4300 family of computer systems. All models are uniprocessor systems with from 1 to 16 megabytes of main memory, allowing the users to buy only what they need today and to upgrade later as necessary. The 4300 Series uses the System/370 architecture and software, which makes it compatible with the

4341 processor to be supported by MVS/SP JES2 and JES3. With the ECPS Expansion Feature, the 4341 Model Group 2 can support concurrent operation of ECPS:MVS and ECPS: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 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.

FUNCTIONAL UNITS: The 4341 systems include a Support Processor, a separately powered subsystem integrated within the processor housing and designed to automate and simplify failure diagnosis. The Support Processor provides failure monitoring, including environmental monitoring and recording capabilities for temperature fluctuations, power variances, and electrostatic discharges. Processor failures result in the generation of an 8-digit reference code logged on the system diskette and displayed on the console to alert the operator. The reference code contains information to guide the IBM customer engineer to the failing unit.

The Support Processor also provides support functions for the operator/support console and a remote data link for the Remote Support Facility (RSF) software. RSF is implemented via a customer-supplied telephone line to an IBM field technical support center. After customer authorization, initiation of the data link connection can be made only from the customer's location while the system is in maintenance mode and only by IBM customer engineering personnel who have proper sign-on authority. Additionally, all remote console screen activity can be observed on the customer's console

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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***

**4341 and 4381 systems only.*
***4361 systems only.*
****Streaming mode.*

308X Series. This is advantageous for those users migrating to the larger systems.

The 4300 Series can function well as a standalone system, as part of a distributed processing system, or as a node in a communications network. A variety of connectivity options are available to provide flexibility in configuring a system. For example, the integrated adapters on the 4361 permit the attachment of IBM PCs or Displaywriters as intelligent terminals. In addition, IBM's Communications Facility/Host licensed program allows the user to process and route transactions between the host 4300 system and Series/1 systems operating with the Series/1 EDX Communications Facility.

display. The remote connection can be completely broken at any time by depression of a console key on the customer's display console.

The design of the 4361 is unique in comparison to the older 4300 Series processors in that it has 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, which is similar to the Support Processor on the 4341 models, includes the Prob-

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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	—

Punched Card Equipment	Columns	Speed Cards/Min.	Input Hopper Capacity	Output Stacker Capacity	Options
1442 Card Reader/ Punch	80	400 (read); 91-265 (punch)	1200	1300	Card image mode
2501 Card Reader	80	600 or 100	1200	1300	Card image mode
3525 Card Punch	80	100, 200, or 300	1200	1200	Card read, card print

**4341 and 4381 systems only.*
***4361 systems only.*
****Streaming mode.*

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Now that IBM is phasing out the 4341 systems, there is a bit of a gap between the 4361 and 4381 processors. The older 4331 systems can be field upgraded to a 4361, but the 4341 and 4361 systems cannot be field upgraded to a 4381. This is not necessarily a disadvantage, however, according to one user who converted from a 4341 to a 4381. (See the User Reaction Section below.)

USER REACTION

Datapro's 1984 survey of general-purpose computer users yielded responses from 437 IBM 4300 users: 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 wide 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.

To gain additional insight into the users' experiences with the 4300 Series, we talked to two of the survey respondents in October. 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

lem 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's design 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 is similar to the support and service processors on the other 4300 systems and 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.

CONTROL STORAGE: All 4300 Series processors except the 4361 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.

On the 4341 processor, the microcode resides entirely in RCS but keeps dynamic tables in main memory, thereby reducing the amount of main memory available to the user by from 18K to 124K bytes, depending upon the configuration.

Control storage on the 4361 consists of 16K bytes. The 4381 utilizes reloadable control storage; however, the amount was not specified by IBM.

BUFFER STORAGE: Buffer storage is standard on all 4300 Series models. Storage capacities range from 2048 to 32,768 bytes, depending on the model. (See Table 1 for the buffer capacities for the individual processor models.) The buffer storage is transparent to all programs and significantly reduces the effective main memory access time.

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.

DYNAMIC ADDRESS TRANSLATION: This facility, which is standard in all models, is the mechanism that translates the virtual storage addresses contained in instructions into real main storage addresses as each instruction is executed. All models can address a virtual storage space of 16,777,216 bytes.

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

INSTRUCTION REPERTOIRE: 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,"

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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 well 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. □

usable only by the operating system, handle 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.

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.

HIGH-ACCURACY ARITHMETIC FACILITY (ACRITH): This feature 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).

FLOATING-POINT ACCELERATOR: This feature is optional on the 4361 Model Group 3 and standard on the 4361 Model Group 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.

ENGINEERING SCIENTIFIC ASSIST: This feature, which is standard on the 4341 Model Groups 9, 10, 11, 2, and 12, and 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.

ELEMENTARY MATH LIBRARY ASSIST (EML): This assist is available only on the 4381 Model Group 2 and is 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.

SYSTEM CONSOLES: A 3278 Model 2A Display Console or a 3279 Model 2C Color Display Console is required with every 4300 Series processor. The 3278-2A and 3279-2C consoles consist of an antiglare CRT display and a separately priced 75-key operator console keyboard with operator control panel. The CRT displays 1920 characters in 24 rows of 80 characters each. Both models have character sets of 96 characters. The 3279-2C displays console messages in four colors: white, red, blue, and green.

The 3278-2A or 3279-2C console allows the operator to manually control such functions as storage display and operation, address comparing, and normal versus instruction step processing. The console indicates to the operator both proper operations and malfunctions. For maintenance and service, the console can display and store the status of the processor complex and other valuable servicing information as well as initiating and monitoring diagnostic tools. An audible alarm is a standard feature sounded under program control for special conditions.

INPUT/OUTPUT CONTROL

4361 I/O ADAPTERS: 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; 3289 System Line Printer Model 4 (withdrawn from marketing); 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 new Work Station Adapter (WSA) is available as an option for the 4361 processors. The WSA supports up to 32 devices and workstations via the 3299 Terminal Multiplexer. When the WSA is installed, the number of available ports on the DPA is reduced to 8. Each group of 8 ports requires one 3299 Model 1.

Both the DPA and WSA include the Serial OEM Interface 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.

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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.

I/O CHANNELS: 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 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 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, MICR and OCR devices.

The High-Speed Block Multiplexer Channels include support for the 3880/3380, 337X, 3350, 334X, and 333X Direct Access Storage Devices. The data transfer rate is up to 3.0 megabytes per second.

The *4341 Model Groups 9, 10, and 1* processors can have up to 6 I/O channels in two 3-channel groups, one standard and the other optional. The standard group consists of 1 byte multiplexer channel and 2 block multiplexer channels. The standard byte multiplexer channel has a maximum data rate of 16K bytes per second in single-byte mode, 64K bytes per second in 4-byte mode, and 1.0 million bytes per second in burst mode. Each of the 2 standard block multiplexer channels accommodates a maximum block transfer rate of 3.0 million bytes per second.

The Optional Channel Group (feature 1870) for the 4341 Model Groups 9, 10, and 1 consists of 3 additional block multiplexer channels. Two of the optional block multiplexer channels have a data rate of 2.0 million bytes per second each. The data rate of the third channel is 1.0 million bytes per second. One of the 3 channels can optionally be configured as a second byte multiplexer channel with a maximum data rate of 22K bytes per second in single-byte mode, 88K bytes per second in 4-byte mode, and 2.0 million bytes per second in burst mode.

The aggregate data rate of the 2 standard block multiplexer channels is 6 million bytes per second. The aggregate data rate of the 5 block multiplexer channels including the optional group is 11 million bytes per second. If one of the 3 optional channels is configured as a second byte multiplexer channel, the aggregate data rate of the remaining 4 block multiplexer channels is 9 million bytes per second. All of the block multiplexer channels support the Data Streaming mode.

The *4341 Model Group 11 and Model Group 2* processors provide 6 channels as standard: 1 byte multiplexer channel and 5 block multiplexer channels. The transfer rate for the block multiplexer channels is 3.0 million bytes per second for channels 1 and 2, and 2.0 million bytes for channels 3, 4, and 5. One of the block multiplexer channels can be selected as a second byte multiplexer channel.

The aggregate data rate of the 5 block multiplexer channels is 12 million bytes per second. If one of the channels is configured as a byte multiplexer channel, the aggregate data rate of the remaining 4 channels is 10 million bytes per second.

The 4341 Model Group 12 processors also provide 6 channels as standard, including 1 byte multiplexer channel and 5 block multiplexer channels. The transfer rate, however, is 3.0 million bytes per second for channels 1, 2, and 4, and 2.0 million bytes per second for channels 3 and 5. One of the block multiplexer channels may be selected as a second byte multiplexer channel.

The aggregate data rate of the 5 block multiplexer channels is 13 million bytes per second. If channel 5 is selected as a byte multiplexer channel, the aggregate data rate of the remaining 4 channels is 11 million bytes per second. If channel 4 is selected as a byte multiplexer channel, the aggregate data rate of the remaining 4 channels is 10 million bytes per second. All block multiplexer channels support the Data Streaming Mode.

The capability for the attachment and automatic I/O power sequencing of up to 24 separate control units is standard on the 4341. Optionally, 48 control units can be accommodated through the addition of the 1890 Channel Control Unit Positions Feature. No one channel may attach and power-sequence more than eight control units.

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,

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4381, System/360, or System/370. Only one of the interconnected processors needs to be equipped with this feature.

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, 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.

SIMULTANEOUS OPERATIONS: Concurrently with computing, a 4361, 4341, or 4381 can control one high-speed I/O data transfer operation per block multiplexer channel and one low speed I/O operation on each subchannel of a byte multiplexer channel. Alternatively, a byte multiplexer channel can operate in burst mode and handle a single higher speed I/O operation.

CONFIGURATION RULES

The 4361 is a highly integrated system, with a number of peripheral adapters housed in the processor cabinet. These include the Display/Printer Adapter (DPA), the Work Station Adapter (WSA), the DASD/8809 Adapters, and the Communications Adapter. The DPA is standard on all 4361 systems, while the WSA and DASD/8809 Adapters are optional on all models. The Communications Adapter is optional on the 4361 Model Group 3 and standard on the Model Groups 4 and 5. With both the DPA and WSA installed, a 4361 processor can support up to 40 peripheral devices and workstations without additional control units. Intelligent workstations can also be attached to a 4361 system through the 4994 or 7171 ASCII Device Attachment Control Unit.

The 4341 and 4381 are more traditional mainframes, with only the Support Processor, the byte and block multiplexer channels, and the optional Channel-to-Channel Adapter feature integrated into the processor cabinet. Up to four 3278-2A Consoles, 3279-2C Consoles, 3268 Printers, Model 2, or 3287 Printers, Models 1, 2, 1C, and 2C, can be attached to the Support Processor on the 4341 or the Maintenance Subsystem on the 4381.

For information on channel configurability, see the Input/Output Control and Communications Control sections of this report.

MASS STORAGE

For information on mass storage devices available on the 4300 Series, refer to Table 2.

INPUT/OUTPUT DEVICES

For information on magnetic tape units, impact printers, and card equipment supported on the 4300 Series, refer to Table 3.

4250 PRINTER: Available for the 4361 only, the 4250 is a high-resolution, nonimpact printer with a printing density of 600 by 600 dots per square inch. The printing time for an 8½-by-11 inch page ranges from 1½ to 2½ minutes. The 4250 provides the capability of printing and merging text and graphics. The printer uses electroerosion technology and produces a typeset quality camera-ready masterpage directly from the host computer system.

3814 SWITCHING MANAGEMENT SYSTEM: This facility 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 extensive self-diagnostic functions. As compared to the earlier IBM 2914 Model 1 Switching Unit, the 3814 provides increased capacity, extended functions, and improved reliability. The system is covered in greater detail in Volume 2.

MICR/OCR EQUIPMENT: MICR devices supported on the 4300 Series include models 1255, 1419, and 3890. Each model has an E13B type font. Their speed in documents per minute ranges from 500 to 2400, and the number of stackers ranges from 6 to 36. Document size ranges from 2.5 to 4.17 inches in width and from 4.85 to 8.75 inches in length. Options include a 51-column sort, self-checking numbers, batch numbering, item numbering, and microfilming. Optical reading devices supported include Models 1287, 3881, and 3886. Readable fonts include: OCR-A, OCR-B, and OCR-C; 1428; marks; and handprint numeric. Speed in documents per minute range from 96 to 665 and each reader can accommodate from 2 to 3 stackers. Document size ranges from 2.25 to 9 inches in width and from 3 to 14 inches in length. Options include serial numbering, expanded symbols, and document counters.

TERMINALS: Numerous IBM display terminals, batch terminals, and typewriter terminals can be connected to a 4300 system in remote and/or local configurations. For details, please refer to Sections 70D1, 70D2, and 70D3 in Volume 2 of DATAPRO 70.

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 4341 and 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.

4361 COMMUNICATIONS ADAPTER: This feature 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 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 wth digital data service adapters (5650); and autocall unit interfaces for up to 2 of the installed lines (1020).

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Certain configuration parameters for each line may be specified from the display console keyboard. These parameters include select stand-by, 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.

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 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, the 3287 Printer Model 11 or 12, 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, 3287 Models 11 and 12, 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 4331 Model Group 2 or 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 support one Loop Adapter 1, one Loop Adapter 2, and up to two Data Link Adapters.

3705 COMMUNICATIONS CONTROLLER: This programmable front-end network processor can be connected to either a byte or block multiplexer channel on a 4361, 4341, or 4381 processor.

The 3705 consists of a Basic Module and up to 3 Expansion Modules. The Basic Module houses the Central Control Unit and Control Panel. Also contained in these modules are the storage, Channel Adapters, Communications Scanners, Line Interface Bases, and Line Sets required to accommodate up to 352 communication lines. Configuration rules for the 3705 are quite complex. The maximum number of lines that can be connected is a function of the 3705 model, the line speeds and types, and the mode of operation. In the 2701/2/3 Emulation mode, a maximum of 255 lines can be controlled. Line speeds can range from 45.5 to 56,000 bits per second. In the Network Control Program (NCP) mode, data is transferred between the 3705 and the host computer via a single subchannel interface.

The 3705-II offers significant price/performance improvements over the original model, now designated the 3705-I. (The 3705-I is no longer available.) The 3705-II is available in 44 different models depending upon the number of frames and the storage capacity, which ranges from 32K to 512K bytes. Processor cycle time is 1.0 microseconds on Models E1-E8, F1-F8, G1-G8, and H1-H8, and 900 nanoseconds on Models J1-J4, K1-K4, and L1-L4. Other 3705-II features include a high-speed Communications Scanner, an upgraded Channel Adapter that transfers data in blocks of 32 characters, transmission speeds to 9600 bps in synchronous mode, a maximum transmission rate of 56,000 bps, and a Cycle Utilization Counter that accumulates statistical data to assist in measuring machine performance.

The entry-level 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.

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 Controllers are supported under the VTAM and TCAM 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.

3704 COMMUNICATIONS CONTROLLER: The 3704 is a smaller version of the 3705 that can be connected to a byte multiplexer channel on a 4361, 4341, or 4381 processor. The 3704 is available in only 4 models with a main memory capacity of from 16K to 64K bytes. It can accommodate a maximum of 32 lines, just one-half the capacity of the basic 3705 configuration. The 3704 uses the same software as the 3705, thereby ensuring upward compatibility for economic expansion of a small network into a large one.

3725 COMMUNICATIONS CONTROLLER: The 3725 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

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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.

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 24 full-duplex or half-duplex lines. Model 2 is field-upgradeable to Model 1.

4994 ASCII DEVICE ATTACHMENT CONTROL UNIT: The 4994 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 the 4361, 4341, 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.

7171 ASCII DEVICE ATTACHMENT CONTROL UNIT: The 7171 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.

REMOTE OPERATOR CONSOLE FACILITY (ROCF): The 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, 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 Release 2. MVS/OCCF is designed to operate on any IBM host computer that supports MVS/SP Version 1, while the VM/Pass-Through Facility Release 2 requires the new VM/SP Release 2 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 4331 or 4361 processors. In the latter instance, 3275 emulation is performed by microcode in the host 4331 or 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 4321, 4331, or 4361 system, ROCF suppresses the activities of all devices attached to the Display/Printer Adapter. When MVS/OCCF is used to initialize a remote 4341 or 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 4341 or 4381 VM system has been initialized, continued control can be provided by the Programmable Operator Facility of VM/SP Release 2.

SOFTWARE

COMPATIBILITY: 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 depend on system facilities such as storage size, I/O equipment, optional features, etc., being present when the facilities are not included in the configuration; does not depend on system facilities such as interruptions, operation codes, etc., being absent 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 Release 6, OS/VS1 Release 7, MVS, and MVS/XA (on the 4381 only).

DOS/VSE: This disk-resident operating system is designed to control system resources and job processing and it is a prerequisite for VSE-related program products. DOS/VSE is enhanced by the VSE/Advanced Functions licensed program which provides functional and performance related capabilities. 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.

SMALL SYSTEMS EXECUTIVE/VSE (SSX/VSE): A subset of DOS/VSE, SSX/VSE Release 4 is a pregenerated, preconfigured operating system designed for use by personnel with limited data processing skills. SSX/VSE supports batch, interactive, and on-line applications on 4341 or 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. SSX/VSE unique functions include: 1) system installation and initialization; 2) system administration and operation functions, including library maintenance support, program development support, data set management support,

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CICS/VS table maintenance, and system operation support such as job creation and submission and 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.

The minimum hardware configuration required for the installation and operation of SSX/VSE consists of a 4341 or 4361 with one megabyte of main memory; one 3278 Model 2A or 3279 Model 2C System Console; one 3178, 3278, or 3279 locally attached display station; one 3262, 3289 Model 4, 3203, 3211, or 4245 Line Printer; one 8809, 3411, 3420, or 3430 Magnetic Tape Unit; either two 3310 or one 3370 Direct Access Storage Devices; and the associated integrated I/O adapters.

VM/370: VM/370 Release 6 is an operating environment that manages a computer system's facilities in such a way that each of many users 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) aids systems programmers in managing and resolving programming problems by reducing the need for using hardcopy documentation.

The *VM/System Product* (VM/SP), Release 4, contains all of the functions currently available in the VM/Basic System Extensions and VM/System Extensions program products, which extend the system control program of VM/370. These Extensions 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 Release 2 support.

OS/VS1 RELEASE 7: This release of the OS/VS1 operating system provides support for the 4341, 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.

MVS: MVS is supported on the 4361 Model Group 5, 4341, and 4381 processors. These processors can utilize either of two MVS/System Products, MVS/SP-JES2 or MVS/SP-JES3. MVS Release 3.8 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 Job Entry Subsystem (JES2 or JES3) which reduce restart and rerun costs; and the Virtual Input/Output Facility (VIO) which stores temporary data in a buffer.

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 post-processing. 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: The 4381 processors are the only processors in the 4300 line that support MVS/Extended Architecture (MVS/XA). 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 2,000 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 Migration Aid permits other operating systems to run with the 370-XA microcode as VM guest operating systems. Such support is also available for VSE and VS1.

For additional details on MVS, please refer to the IBM 308X Series report in this section.

OTHER SOFTWARE FACILITIES: Information about other IBM software products supplied with the operating system software previously described is summarized below.

To assist the DOS/VSE user in improving productivity, IBM offers the VSE/ICCF program product, which is the successor to the popular 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 the 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 the 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: simplification of the process of sending data

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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 displayed 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 Advanced Communications Function/Virtual Telecommunications Access Method (ACF/VTAM) is the base for the major IBM communication subsystems 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.

PRICING AND SUPPORT

POLICY: The 4361 is available for purchase or monthly rental only. IBM offers the 4341 and 4381 systems on a purchase, lease, or rental basis. The standard IBM lease or 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.

The current 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.

In October 1982, IBM introduced a volume purchase discount plan for the 4300 Series. A discount of 6 percent is offered on the purchase of five to nine 4300 Series processors. For quantities of 10 or more, the discount is 9 percent.

MAINTENANCE: For purchased, leased, or rented systems, the IBM 4300 Series is under maintenance group D. The minimum period of maintenance service is 9 consecutive hours between 7:00 a.m. and 6:00 p.m. Monday through Friday. Charges for maintenance coverage outside this period are based upon the following percentages of the minimum monthly maintenance charge (MMC) added to the MMC:

	Consecutive hours				
	9*	12	16	20	24
Monday-Friday (until 8:00 a.m. Saturday)	10	12	14	16	18
Saturday (until 8:00 a.m. Sunday	4	5	7	8	9
Sunday (until 8:00 a.m. Monday)	4	7	9	11	12

*Outside of the hours 7:00 a.m. to 6:00 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.

SOFTWARE: IBM 4300 Series users receive the basic DOS/VSE, OS/VS1 Release 7, VM/370 Release 6, or MVS system control programs at no additional cost. All other IBM software, including the DOS/VS Advanced Functions and the SSX/VSE operating system, 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. 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.

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.

SUPPORT CENTER: 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 on-line 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.

EQUIPMENT: The indicated prices for the following typical configurations include all the required control units and adapters, but do not include software.

TYPICAL 4361 GROUP 5 SYSTEM: Includes a 4361 Model L5 Processor with four megabytes of main memory and one I/O channel, two 3278-2A Operator Consoles with keyboards, a 3310 DASD Model A2 with a Model B2 attached (258 megabytes), four 8809 Magnetic Tape Units, a 2501 Model B2 Card Reader, two 650-lpm 3262 Model 1 Printers, and integrated tape and disk adapters. The monthly rental charge is $19,182, the monthly maintenance charge is $1,744, and the purchase price is $318,658.

TYPICAL 4341 GROUP 12 SYSTEM: Includes a 4341 Model N12 Processor with 12 megabytes of main memory and six I/O channels, two 3278-2A Operator Consoles with keyboards, one 3287 Model 2 Console Printer, a 3380 DASD Model A4 (2.5 billion bytes), a 3880 Model 2 Storage Control, eight 3420 Model 6 Magnetic Tape Units (780KBS), a 3803 Model 2 Tape Control, a 2501 Model B2 Card Reader, and two 2000-lpm 4245 Model 1 Printers. The monthly rental charge is $50,869.00, the monthly mainte-

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nance charge is $5,215.50, and the purchase price is $859,558.00.

TYPICAL 4381 GROUP 2 SYSTEM: Includes a 4381 Model L2 Processor with 16 megabytes of main memory and six I/O channels, two 3278-2A Display Consoles with keyboards, one 3287 Model 2 Console Printer, one 3380 DASD Model A4 and one 3380 DASD Model B4 (5.0 billion bytes), one 3880 Model 2 Storage Control, eight 3420 Model 6 Magnetic Tape Units (780KBS), one 3803 Model 2 Tape Control, one 2501 Model B2 Card Reader, and three 2000-lpm 4245 Model 1 Printers. The monthly rental charge is $66,587.00, the monthly maintenance charge is $5,617.50, and the purchase price is $1,095,698.00. ■

IBM 4300 Series Equipment Prices

		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly 2-Year Lease Charge* ($)
PROCESSORS AND UPGRADES					
4341 J9	Processor with 1,048,576 bytes of main memory and 2K-byte buffer	81,000	388.00	6,786	5,775
4341 K9	Same as 4341 J9, but with 2,097,152 bytes of main memory	88,500	414.00	7,385	6,285
4341 L9	Same as 4341 J9, but with 4,194,304 bytes of main memory	103,500	466.00	8,578	7,300
4341 K10	Processor with 2,097,152 bytes of main memory and 4K-byte buffer	142,500	518.00	9,888	8,415
4341 L10	Same as 4341 K10, but with 4,194,304 bytes of main memory	157,500	570.00	11,174	9,510
4341 K1	Processor with 2,097,152 bytes of main memory and 8K-byte buffer	184,500	541.00	11,239	9,565
4341 L1	Same as 4341 K1, but with 4,194,304 bytes of main memory	199,500	593.00	12,526	10,660
4341 K11	Processor with 2,097,152 bytes of main memory and 8K-byte buffer	211,200	675.00	14,030	11,940
4341 L11	Same as 4341 K11, but with 4,194,304 bytes of main memory	226,200	727.00	15,322	13,040
4341 M11	Same as 4341 K11, but with 8,388,608 bytes of main memory	256,200	831.00	17,895	15,230
4341 K2	Processor with 2,097,152 bytes of main memory and 16K-byte buffer	297,000	791.00	16,920	14,400
4341 L2	Same as 4341 K2, but with 4,194,304 bytes of main memory	312,000	843.00	18,213	15,500
4341 M2	Same as 4341 K2, but with 8,388,608 bytes of main memory	342,000	947.00	20,786	17,690
4341 N2	Same as 4341 K2, but with 12,582,912 bytes of main memory	372,000	1,050.00	23,371	19,890
4341 P2	Same as 4341 K2, but with 16,777,216 bytes of main memory	402,000	1,155.00	25,944	22,080
4341 K12	Processor with 2,097,152 bytes of main memory and 16K-byte buffer	316,800	900.00	18,859	16,050
4341 L12	Same as 4341 K12, but with 4,194,304 bytes of main memory	331,800	952.00	20,046	17,060
4341 M12	Same as 4341 K12, but with 8,388,608 bytes of main memory	361,800	1,055.00	22,431	19,090
4341 N12	Same as 4341 K12, but with 12,582,912 bytes of main memory	391,800	1,160.00	24,828	21,130
4341 P12	Same as 4341 K12, but with 16,777,216 bytes of main memory	421,800	1,265.00	27,213	23,160
4361 K3	Processor with 2,097,152 bytes of main memory and 8K-byte buffer	56,500	295.00	3,531	—
4361 L3	Same as 4361 K3, but with 4,194,304 bytes of main memory	71,500	347.00	4,647	—
4361 K4	Processor with 2,097,152 bytes of main memory and 8K-byte buffer	135,000	490.00	8,500	—
4361 L4	Same as 4361 K4, but with 4,194,304 bytes of main memory	150,000	542.00	9,616	—
4361 LK4	Same as 4361 K4, but with 6,291,456 bytes of main memory	170,000	594.00	10,732	—
4361 M4	Same as 4361 K4, but with 8,388,608 bytes of main memory	185,000	646.00	11,848	—
4361 ML4	Same as 4361 K4, but with 12,852,912 bytes of main memory	215,000	750.00	14,080	—
4361 K5	Processor with 2,097,152 bytes of main memory and 16K-byte buffer	180,000	590.00	11,300	—
4361 L5	Same as K5, but with 4,194,304 bytes of main memory	195,000	642.00	12,416	—
4361 LK5	Same as K5, but with 6,291,456 bytes of main memory	210,000	694.00	13,532	—
4361 M5	Same as K5, but with 8,388,608 bytes of main memory	225,000	746.00	14,648	—
4361 ML5	Same as K5, but with 12,582,912 bytes of main memory	255,000	850.00	16,880	—
4381 L1	Processor with 4,194,304 bytes of main memory and 8K-byte buffer	370,000	564.00	24,665	—
4381 M1	Same as L1, but with 8,388,608 bytes of main memory	410,000	614.00	27,330	—
4381 P1	Same as L1, but with 16,777,216 bytes of main memory	490,000	714.00	32,660	—
4381 L2	Processor with 4,194,304 bytes of main memory and 32-byte buffer	500,000	672.00	33,330	—
4381 M2	Same as L2, but with 8,388,608 bytes of main memory	540,000	722.00	35,995	—
4381 P2	Same as L2, but with 16,777,216 bytes of main memory	620,000	822.00	41,325	—
System upgrades:					
	4341 J9 to 4341 K9	7,500	—	—	—
	4341 J9 to 4341 L9	22,500	—	—	—
	4341 J9 to 4341 K10	61,500	—	—	—
	4341 J9 to 4341 L10	76,500	—	—	—
	4341 K9 to 4341 L9	15,000	—	—	—
	4341 K9 to 4341 K10	54,000	—	—	—
	4341 K9 to 4341 L10	69,000	—	—	—
	4341 L9 to 4341 L10	54,000	—	—	—
	4341 K10 to 4341 L10**	15,000	—	—	—
	4341 K10 to 4341 K11**	50,910	—	—	—
	4341 K10 to 4341 L11**	65,910	—	—	—
	4341 K10 to 4341 M11**	95,910	—	—	—

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NC—No Charge.

IBM 4300 Series Equipment Prices

	Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly 2-Year Lease Charge* ($)
PROCESSORS AND UPGRADES (Continued)				
4341 L10 to 4341 L11**	50,910	—	—	—
4341 L10 to 4341 M11**	80,910	—	—	—
4341 K10 to 4341 K12**	156,510	—	—	—
4341 K10 to 4341 L12**	171,510	—	—	—
4341 K10 to 4341 M12**	201,510	—	—	—
4341 K10 to 4341 N12**	231,510	—	—	—
4341 K10 to 4341 P12***	261,510	—	—	—
4341 L10 to 4341 L12**	156,510	—	—	—
4341 L10 to 4341 M12**	186,510	—	—	—
4341 L10 to 4341 N12**	216,510	—	—	—
4341 L10 to 4341 P12**	246,510	—	—	—
4341 K1 to 4341 L1**	15,000	—	—	—
4341 K1 to 4341 K11**	28,910	—	—	—
4341 K1 to 4341 L11**	43,910	—	—	—
4341 K1 to 4341 M11**	73,910	—	—	—
4341 L1 to 4341 L11**	28,910	—	—	—
4341 L1 to 4341 M11**	58,910	—	—	—
4341 K1 to 4341 K2**	94,710	—	—	—
4341 K1 to 4341 L2**	109,710	—	—	—
4341 K1 to 4341 M2**	139,710	—	—	—
4341 K1 to 4341 N2**	169,710	—	—	—
4341 K1 to 4341 P2**	199,710	—	—	—
4341 L1 to 4341 L2**	94,710	—	—	—
4341 L1 to 4341 M2**	124,710	—	—	—
4341 L1 to 4341 N2*	154,710	—	—	—
4341 L1 to 4341 P2**	184,710	—	—	—
4341 K1 to 4341 K12**	114,510	—	—	—
4341 K1 to 4341 L12**	129,510	—	—	—
4341 K1 to 4341 M12**	159,510	—	—	—
4341 K1 to 4341 N12**	189,510	—	—	—
4341 K1 to 4341 P12**	219,510	—	—	—
4341 L1 to 4341 L12**	114,510	—	—	—
4341 L1 to 4341 M12**	144,510	—	—	—
4341 L1 to 4341 N12**	174,510	—	—	—
4341 L1 to 4341 P12**	204,510	—	—	—
4341 K11 to 4341 L11	15,000	—	—	—
4341 K11 to 4341 M11	45,000	—	—	—
4341 L11 to 4341 M11	30,000	—	—	—
4341 K11 to 4341 K12	105,600	—	—	—
4341 K11 to 4341 L12	120,600	—	—	—
4341 K11 to 4341 M12	150,600	—	—	—
4341 K11 to 4341 N12	180,600	—	—	—
4341 K11 to 4341 P12	210,600	—	—	—
4341 L11 to 4341 L12	105,600	—	—	—
4341 L11 to 4341 M12	135,600	—	—	—
4341 L11 to 4341 N12	165,600	—	—	—
4341 L11 to 4341 P12	195,600	—	—	—
4341 M11 to 4341 M12	105,600	—	—	—
4341 M11 to 4341 N12	135,600	—	—	—
4341 M11 to 4341 P12	165,600	—	—	—
4341 K2 to 4341 L2	15,000	—	—	—
4341 K2 to 4341 M2	45,000	—	—	—
4341 K2 to 4341 N2	75,000	—	—	—
4341 K2 to 4341 P2	105,000	—	—	—

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NC—No Charge.

IBM 4300 Series Equipment Prices

	Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly 2-Year Lease Charge* ($)
PROCESSORS AND UPGRADES (Continued)				
4341 L2 to 4341 M2	30,000	—	—	—
4341 L2 to 4341 N2	60,000	—	—	—
4341 L2 to 4341 P2	90,000	—	—	—
4341 M2 to 4341 N2	30,000	—	—	—
4341 M2 to 4341 P2	60,000	—	—	—
4341 N2 to 4341 P2	30,000	—	—	—
4341 K2 to 4341 K12	19,800	—	—	—
4341 K2 to 4341 L12	34,800	—	—	—
4341 K2 to 4341 M12	64,800	—	—	—
4341 K2 to 4341 N12	94,800	—	—	—
4341 K2 to 4341 P12	124,800	—	—	—
4341 L2 to 4341 L12	19,800	—	—	—
4341 L2 to 4341 M12	49,800	—	—	—
4341 L2 to 4341 N12	79,800	—	—	—
4341 L2 to 4341 P12	109,800	—	—	—
4341 M2 to 4341 M12	19,800	—	—	—
4341 M2 to 4341 N12	49,800	—	—	—
4341 M2 to 4341 P12	79,800	—	—	—
4341 N2 to 4341 N12	19,800	—	—	—
4341 N2 to 4341 P12	49,800	—	—	—
4341 P2 to 4341 P12	19,800	—	—	—
4341 K12 to 4341 L12	15,000	—	—	—
4341 K12 to 4341 M12	45,000	—	—	—
4341 K12 to 4341 N12	75,000	—	—	—
4341 K12 to 4341 P12	105,000	—	—	—
4341 L12 to 4341 M12	30,000	—	—	—
4341 L12 to 4341 N12	60,000	—	—	—
4341 L12 to 4341 P12	90,000	—	—	—
4341 M12 to 4341 N12	30,000	—	—	—
4341 M12 to 4341 P12	60,000	—	—	—
4341 N12 to 4341 P12	30,000	—	—	—
4361 K3 to 4361 L3	15,000	—	—	—
4361 K3 to 4361 K4***	66,660	—	—	—
4361 K3 to 4361 L4***	81,660	—	—	—
4361 K3 to 4361 LK4***	101,660	—	—	—
4361 K3 to 4361 M4***	116,660	—	—	—
4361 K3 to 4361 ML4***	146,660	—	—	—
4361 L3 to 4361 L4***	66,660	—	—	—
4361 L3 to 4361 LK4***	86,660	—	—	—
4361 L3 to 4361 M4***	101,660	—	—	—
4361 L3 to 4361 ML4***	131,660	—	—	—
4361 K3 to 4361 K5***	108,995	—	—	—
4361 K3 to 4361 L5***	123,995	—	—	—
4361 K3 to 4361 LK5***	138,995	—	—	—
4361 K3 to 4361 M5***	153,995	—	—	—
4361 L3 to 4361 L5***	108,995	—	—	—
4361 L3 to 4361 LK5***	123,995	—	—	—
4361 L3 to 4361 M5***	138,995	—	—	—
4361 L3 to 4361 ML5***	168,995	—	—	—
4361 K4 to 4361 L4	15,000	—	—	—
4361 K4 to 4361 LK4	35,000	—	—	—
4361 K4 to 4361 M4	50,000	—	—	—
4361 K4 to 4361 ML4	80,000	—	—	—

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NC—No Charge.

IBM 4300 Series Equipment Prices

PROCESSORS AND UPGRADES (Continued)	Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly 2-Year Lease Charge* ($)
4361 L4 to 4361 LK4	20,000	—	—	—
4361 L4 to 4361 M4	35,000	—	—	—
4361 L4 to 4361 ML4	65,000	—	—	—
4361 LK4 to 4361 M4	15,000	—	—	—
4361 LK4 to 4361 ML4	45,000	—	—	—
4361 M4 to 4361 ML4	30,000	—	—	—
4361 K4 to 4361 K5	42,335	—	—	—
4361 K4 to 4361 L5	57,335	—	—	—
4361 K4 to 4361 LK5	72,335	—	—	—
4361 K4 to 4361 M5	87,335	—	—	—
4361 K4 to 4361 ML5	117,335	—	—	—
4361 L4 to 4361 L5	42,335	—	—	—
4361 L4 to 4361 LK5	57,335	—	—	—
4361 L4 to 4361 M5	72,335	—	—	—
4361 L4 to 4361 ML5	102,335	—	—	—
4361 LK4 to 4361 LK5	37,335	—	—	—
4361 LK4 to 4361 M5	52,335	—	—	—
4361 LK4 to 4361 ML5	82,335	—	—	—
4361 M4 to 4361 M5	37,335	—	—	—
4361 M4 to 4361 ML5	67,335	—	—	—
4361 ML4 to 4361 ML5	37,335	—	—	—
4361 K5 to 4361 L5	15,000	—	—	—
4361 K5 to 4361 LK5	30,000	—	—	—
4361 K5 to 4361 M5	45,000	—	—	—
4361 K5 to 4361 ML5	75,000	—	—	—
4361 L5 to 4361 LK5	15,000	—	—	—
4361 L5 to 4361 M5	30,000	—	—	—
4361 L5 to 4361 ML5	60,000	—	—	—
4361 LK5 to 4361 M5	15,000	—	—	—
4361 LK5 to 4361 ML5	45,000	—	—	—
4361 M5 to 4361 ML5	30,000	—	—	—
4381 L1 to 4381 L2	130,000	—	—	—
4381 L1 to 4381 M1	40,000	—	—	—
4381 L1 to 4381 M2	170,000	—	—	—
4381 L1 to 4381 P1	120,000	—	—	—
4381 L1 to 4381 P2	250,000	—	—	—
4381 M1 to 4381 M2	130,000	—	—	—
4381 M1 to 4381 P1	80,000	—	—	—
4381 M1 to 4381 P2	210,000	—	—	—
4381 P1 to 4381 P2	130,000	—	—	—
4381 L2 to 4381 M2	40,000	—	—	—
4381 L2 to 4381 P2	120,000	—	—	—
4381 M2 to 4381 P2	80,000	—	—	—

PROCESSOR FEATURES AND CHANNELS

Many of the features listed below include microcode as well as hardware. Microcode is supplied on diskettes.

Features for the 4341:

1601 ECPS Expansion Feature (for 4341 Model Group 2 or Group 12 Processors only)	26,250	22.00	1,129	961
1850 Channel-to-Channel Adapter	23,150	29.00	983	837

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NC—No Charge.

IBM 4300 Series Equipment Prices

		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly 2-Year Lease Charge* ($)
PROCESSOR FEATURES AND CHANNELS (Continued)					
	1870 Optional Channel Group; three additional channels (for 4341 Group 1 and Group 10 Processors only)	17,790	6.00	757	644
	1890 Channel Control Unit Positions, additional	2,755	10.00	116	99
Features for the 4361:					
1100	Floating-Point Multiply Accelerator (standard on Model Groups 4 and 5)	8,500	20.00	485	—
1200	Auto Start	1,200	5.00	70	—
5248	Byte Multiplexer Channel (standard on Model Group 5)	2,665	3.00	141	—
1421	Block Multiplexer Channel (standard on Model Groups 4 and 5)	3,340	3.00	177	—
1431	High-Speed Block Multiplexer Channel	4,760	3.50	275	—
1432	High-Speed Block Multiplexer Channel, additional (Model Groups 4 and 5 only)	4,760	3.50	275	—
1433	High-Speed Block Multiplexer Channel, additional (Model Group 5 only)	4,760	3.50	275	—
2002	Work Station Adapter	7,500	30.00	427	—
3299	Terminal Multiplexer, Model 1; required for every 8 ports on a Work Station Adapter	1,175	—	—	—
3201	DASD/8809 Adapter	2,730	5.00	146	—
3202	DASD/8809 Adapter, additional	2,730	5.00	146	—
3203	DASD/8809 Adapter, additional (Model Group 5 only)	2,730	5.00	146	—
3204	DASD/8809 Adapter, additional (Model Group 5 only)	2,730	5.00	146	—
Features for the 4381:					
1850	Channel-to-Channel Adapter	23,150	29.00	1,545	—
1870	Block Multiplexer Channels, additional	35,580	12.00	2,372	—
3088 Multisystem Channel Communication Unit:					
	Model 1; connects to 4 processors	95,000	120.00	—	—
	Model 2; connects to 8 processors	145,000	150.00	—	—
System Consoles:					
3278 2A	Display Console	2,505	18.50	126	108
3279 2C	Color Display Console	4,045	31.50	210	179
	4631 75-Key Operator Console Keyboard with channel-to-channel interface and operator control panel (for 4341 and 4381)	977	5.50	51	43
	4632 same as 4631 without channel-to-channel interface (for 4341 and 4381)	909	5.50	49	42
	4633 same as 4631 without operator control panel (for 4341 and 4381)	472	4.00	22	19
	4634 same as 4631 without channel-to-channel interface (for 4361)	909	6.00	49	42
MASS STORAGE					
3310	Disk Storage:				
	Model A1; one drive with controller; 64.5MB	6,960	62.00	542	462
	Model A2; two drives with controller; 64.5MB each	11,570	100.00	899	766
	Model B1; one drive; 64.5MB (for attachment to Model A2)	5,510	57.00	428	364
	Model B2; two drives; 64.5MB each (for attachment to Model A2)	10,120	95.00	785	668
3340	Direct Access Storage Facility; 34.9 or 69.8MB per drive:				
	Model A2; two drives plus control	8,600	116.00	1,745	1,485
	Model B2; two drives	6,020	100.00	1,234	1,050
	4301 Fixed-Head Feature (for 3340 A2 or B2)	1,165	2.50	73	62
	6202 Rotational Positon Sensing (for 3340 A2 or B2)	590	1.50	38	32
	6148 Remote Switch Attachment	NC	NC	NC	NC
	8150 String Switch for 3340 A2	4,915	15.00	348	296
3344	Direct Access Storage; 279.6MB per drive:				
	Model B2; Add-on Dual Disk Drive for 3340 Direct-Access Storage Facility	14,820	115.00	1,569	1,335
3348	Data Module (for 3340 drives):				
	Model 35; 34.9MB	1,600	—	59	50
	Model 70; 69.8MB	2,200	—	82	70
	Model 70F; 69.8MB of which 502,080 are served by fixed heads	4,400	—	192	163

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IBM 4300 Series Equipment Prices

MASS STORAGE (Continued)		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly 2-Year Lease Charge* ($)
3350	Direct Access Storage; 317.5MB per drive:				
	Model A2; Dual Disk Drive	32,030	162.00	1,968	1,675
	Model A2F; Dual Disk Drive with 2MB fixed-head storage	39,970	210.00	2,450	2,085
	Model B2; Add-on Dual Disk Drive	25,360	122.00	1,569	1,335
	Model B2F; Add-on Dual Disk Drive for 2MB fixed-head storage per drive	33,300	171.00	2,050	1,745
	Model C2; Two-drive disk storage and associated control	33,130	171.00	2,050	1,745
	Model C2F; Two-drive disk storage and associated control	41,070	219.00	2,532	2,155
	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	9.00	241	205
3830	Storage Control, Model 2; for 3340/3344 or 3350 disk drives	8,120	113.00	2,635	2,213
	2150 Control Store Extension	1,880	10.50	608	511
	2151 Expanded Control Store; requires 2150	3,285	11.50	371	311
	6111 Register Expansion	109	3.50	35	29
	6148 Remote Switch Attachment	NC	NC	NC	NC
	6149 Remote Switch Attachment, additional	NC	NC	NC	NC
	8170 Two-Channel Switch	2,290	11.50	255	214
	8171 Two-Channel Switch, additional	2,290	11.50	255	214
3370	Direct Access Storage:				
	Model A1; Single Disk Drive; 571.3MB	35,480	138.00	1,463	1,245
	Model B1; Add-on Single Disk Drive for attachment to Model A1	26,600	103.50	1,096	933
	Model A2; 729.8MB; contains logic and power for up to three Model B2 units	35,480	126.00	1,900	—
	Model B2; connects to a 3370 Model A2	26,600	94.50	1,425	—
	8150 String Switch for 3370 A1	3,830	1.50	157	134
3375	Direct Access Storage; 819.7MB per drive:				
	Model A1; contains logic and power for up to three Model B1 units	38,040	130.00	1,463	1,245
	Model B1; connects to a 3375 Model A1	28,770	98.50	1,171	997
	Model D1; provides dual controller function in a 3375 string; requires one Model A1 and two Model B1s	36,290	120.00	1,392	1,185
	Model B1 to Model D1 Upgrade	7,520	—	—	—
	4951 Model D1 Attachment for Model A1	2,590	6.00	89	76
	4952 Model D1 Attachment for Model B1	NC	NC	NC	NC
	8150 String Switch Feature for 3375 A1	3,795	1.50	157	134
3380	Direct Access Storage; 2.52 billion bytes per unit:				
	Model A4; connects to one 3880 storage director	77,680	285.00	4,183	3,560
	Model AA4; connects to one 3880 storage director	88,780	325.00	4,776	4,065
	Model B4; connects to a Model A unit	64,440	240.00	3,466	2,950
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	3,572	3,040
	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	3,572	3,040
	Model 3; provides two storage directors for 3380 storage	60,270	176.00	3,572	3,040
	Model 4; provides one storage director which can attach up to four 3375 Model A1s	35,000	82.50	2,055	—
	Model 11; paging subsystem for 3350	251,520	609.00	7,145	6,080
	Model B13, includes two cache storage directors for 3380; 4 megabytes	179,950	519.00	6,821	5,805
	Model D13; same as B13, but with 8 megabytes	224,300	640.00	8,713	7,415
	Model D21; paging subsystem for 3350; includes two storage directors; 8 megabytes (4341 and 4381 only)	143,750	575.00	7,765	—
	Model E21; same as D21, but with 16 megabytes (for 4341 and 4381 only)	183,750	600.00	9,790	—
	Model G21; same as D21, but with 32 megabytes (for 4341 and 4381 only)	263,750	650.00	13,840	—
	Model D23; includes two cache storage directors for 3380; 8 megabytes (for 4341 and 4381 only)	143,750	575.00	7,765	
	Model E23; same as D23, but 16 megabytes (4341 and 4381 only)	183,750	600.00	9,790	—
	Model G23; same as D23, but with 32 megabytes (4341 and 4381 only)	263,750	650.00	13,840	—
	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	518	441
	8170 Two-Channel Switch Pair	6,225	11.00	365	311
	8171 Two-Channel Switch Pair, additional	16,610	38.50	985	838
	8172 Eight-Channel Switch	22,850	53.50	1,357	1,155

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NC—No Charge.

IBM 4300 Series Equipment Prices

		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly 2-Year Lease Charge* ($)
MAGNETIC TAPE EQUIPMENT					
3410	Magnetic Tape Unit:				
	Model 1; 20,000 bytes/sec.	3,365	115.00	304	255
	Model 2; 40,000/20,000 bytes/sec.	4,365	127.00	404	339
	Model 3; 80,000/40,000 bytes/sec.	5,365	140.00	509	427
3411	Magnetic Tape Unit and Control:				
	Model 1; 20,00 bytes/sec.	7,910	178.00	677	569
	Model 2; 40,00/20,000 bytes/sec. (not in new production)	9,910	191.00	861	723
	Model 3; 80,000/40,000 bytes/sec. (not in new production)	11,910	202.00	1,045	878
	3211 Single Density Feature (for 3410 and 3411)	1,140	15.00	88	74
	3221 Dual Density Feature (for 3410 and 3411)	2,185	53.50	130	109
	7360 System/360/370 Attachment (required on 3411)	1,950	37.00	243	204
3420	Magnetic Tape Units:				
	Model 3; 120,00 bytes/sec. at 1600 bpi; 75 ips	11,930	212.00	606	509
	Model 4; 470,000 bytes/sec. at 6250 bpi; 75 ips	15,340	212.00	848	712
	Model 5; 200,000 bytes/sec. at 1600 bpi; 125 ips	16,000	232.00	817	686
	Model 6; 780,000 bytes/sec. at 6250 bpi; 125 ips	17,920	232.00	981	824
	Model 7; 320,000 bytes/sec. at 1600 bpi; 200 ips	17,920	278.00	968	813
	Model 8; 1,250 bytes/sec. at 6250 bpi; 200 ips	19,880	342.00	1,160	974
	6420 6250 bpi Density Feature (for 3420 Models 4, 6, and 8)	1,600	64.00	83	70
	6425 6250/1600 bpi Density Feature (for 3420 Models 4, 6, and 8)	2,205	84.50	120	101
	6631 Single Density Feature (for Models 3, 5, and 7)	2,870	63.50	141	118
	3550 Dual Density Feature (for Models 3, 5, and 7)	3,705	106.00	184	154
	6407 7-Track Feature (for Models 3, 5, and 7)	2,870	92.00	141	118
3430	Magnetic Tape Subsystem:				
	Model A1; Tape Unit and Control	33,400	235.00	2,035	—
	Model B1; Tape Unit only	16,900	165.00	1,080	—
3480	Magnetic Tape Subsystem:				
	Model A22 Control Unit	65,430	360.00	3,630	—
	Model B22 Magnetic Tape Unit	43,120	225.00	2,380	—
	1511 First Channel Attachment	5,785	20.00	310	—
	1512 Second Channel Attachment	5,785	20.00	310	—
	1513 Third Channel Attachment	5,785	20.00	310	—
3803	Tape Controller:				
	Model 2; for 3420 Model 3 through 8 drives	27,550	186.00	1,535	1,289
	5310 9-Track NRZI Feature (permits connection of 800-bpi drives to 3803-2)	3,080	2.00	148	124
	6320 7-Track NRZI Feature (permits connection of 800-bpi drives to 3803-2; 5310 is prerequisite)	1,515	2.00	74	62
	Multiple Tape Control Switches (for switching up to sixteen 3420 tape drives between up to four 3803 control units):				
	1792 for 2 Tape Controls	6,130	13.50	307	258
	1793 for 3 Tape Controls	7,820	21.50	398	334
	1794 for 4 Tape Controls	9,195	21.50	466	391
	6148 Remote Switch Attachment	910	—	45	38
	8100 Two-Channel Switch	4,600	6.50	228	192
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	82.50	727	461
	Model 2; second, fourth, or sixth drive; attaches to Model 1A or 3	10,610	74.50	647	410
	Model 3; third or fifth drive; attaches to Model 2	11,960	82.50	720	461
DISKETTE EQUIPMENT					
3540	Diskette Input/Output Unit:				
	Model B1; one drive; 242.9KB	27,520	85.00	1,181	1,005
	Model B2; two drives	41,910	117.00	1,763	1,500

**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.*
NC—No Charge.

IBM 4300 Series Equipment Prices

		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge* ($)	Monthly 2-Year Lease Charge* ($)
PUNCHED CARD EQUIPMENT					
1442	Card Read Punch (with control), Model N1; 400/91 cpm	24,040	332.00	1,150	—
2501	Card Reader (with control):				
	Model B1; 600 cpm	19,610	144.00	583	—
	Model B2; 1000 cpm	19,920	158.00	717	—
3525	Card Punch:				
	Model P1; 100 cpm	25,520	181.00	898	—
	Model P2; 200 cpm	26,520	245.00	1,135	—
	Model P3; 300 cpm	27,520	306.00	1,360	—
	1533 Card Read Feature	7,645	45.50	265	—
	1421 Basic Card Print	16,750	180.00	581	—
	5273 Multi-Line Card Print	1,365	52.50	156	—
	8339 Two-Line Card Print	874	8.00	24	—
PRINTERS					
1403	Printer:				
	Model N1; 1100 lpm; 132 print positions	40,040	735.00	1,664	1,397
	1416 Interchangeable Train Cartridge (required for 1403 N1)	2,930	—	178	—
	4740 Interchangeable Train Cartridge Adapter (for 1403-2 or -7)	2,030	—	99	83
	8640 Universal Character Set Feature (for 1403 N1)	447	4.00	14	12
	8641 Universal Character Set Feature (for 1403-2)	313	4.00	14	12
2821	Control Unit:				
	Model 2; for one 1403	27,190	96.00	1,124	944
	Model 3; for two 1403s	54,270	196.00	2,242	1,883
	3615 1100 lpm Printer Adapter (for 2821; required for 1403 N1)	2,815	3.00	123	103
	7945 Third Printer Control (for 2821 Model 3 or 5)	22,560	15.50	878	738
	8100 Two-Channel Switch	9,895	19.50	344	289
	8637 Universal Character Set Adapter	718	6.50	21	18
3203	Printer, Model 5; 1200 lpm, 132 print positions	33,875	410.00	2,015	1,715
	1416 Interchangeable Train Cartridge (required)	2,930	—	178	—
3211	Printer; 2000 lpm, 132 print positions	40,080	952.00	2,793	2,345
	3216 Interchangeable Train Cartridge	11,600	206.00	660	—
	5554 18 Additional Print Positions	2,150	15.50	81	68
3811	Control Unit for 3211 Printer	17,685	123.00	1,231	1,034
	5553 18 Additional Print Positions	789	5.00	27	23
3262	Line Printer:				
	Model 1; 650 lpm (4361 only)	15,040	193.00	637	541
	Model 5; 650 lpm (attachment to virtual storage processors)	17,000	193.00	881	749
	Model 11; 325 lpm (4361 only)	12,620	141.00	468	398
3268	Model 2	7,500	63.00	394	335
3287	Serial Printer:				
	Model 1; 80 cps	4,830	37.50	275	234
	Model 2; 120 cps	5,150	46.50	336	286
	Model 1C; 4 colors; 80 cps	5,210	42.50	340	290
	Model 2C; 4 colors; 120 cps	5,530	51.50	400	340
	1120 APL/Text	165	0.50	6	5
	3610 Extended Character Set Adapter	429	3.00	21	18
	3880 Extended Print Buffer	198	0.50	7	6
	4110 Friction Feed Paper Handling	151	0.50	6	5
	8330 3271/3272 Attachment for Models 1 and 2	860	2.50	49	42
	8331 3274/3276 Attachment for Models 1 and 2	165	0.50	6	5
	8700 Variable-Width Forms Tractor	151	0.50	6	5
3800	Printing Subsystem:				
	Model 1; up to 20,040 lpm	315,000	1,030.00	13,910	10,710
	Model 3; up to 20,040 lpm; 240 x 250 picture elements (for 4361-5, 4341, and 4381)	315,000	685.00	17,390	—

**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.*
NC—No Charge.

IBM 4300 Series Equipment Prices

	COMMUNICATIONS EQUIPMENT (Continued)	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	213.00	3,485	—
	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	190.00	2,630	—
	1561 Channel Adapter	6,750	8.00	315	—
	4666 Internal Clock Control	1,500	2.00	69	—
	4771 LAB Type A	19,000	16.00	882	—
	4772 LAB Type B	26,400	27.00	1,230	—
	4911 LIC Type 1	2,600	2.00	123	—
	4921 LIC Type 2	3,000	2.00	139	—
	4931 LIC Type 3	3,000	2.00	139	—
	4941 LIC Type 4A	2,600	2.00	123	—
	4942 LIC Type 4B	3,000	2.00	139	—
	7100 Storage Increment 256K	4,375	19.00	203	—
	8320 Two Processor Switch	4,000	3.00	187	—
3726	Communication Controller Expansion	32,000	40.00	1,485	—
3727	Operator Console	2,390	27.00	171	—

**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.*
NC—No Charge.

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 Release 4	*20,000	*18,000	1,230	1,105	112
5666-274	SSX/VSE RPG II	—	—	150	112	7
5666-276	SSX/VSE PL/1 Optimizing Compiler and Library	—	—	347	260	50
5666-277	SSX/VSE PL/1 Transient Library	—	—	35	25	7
5666-275	DL/1 SSX/VSE	—	—	429	322	126
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	—	—	185	166	53
	Networking Feature	—	—	350	315	159
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, Releases 1 and 2	—	—	280	253	56
5746-RC7	Advanced Communications Function for VTAM Entry (ACF/VTAME)	*4,000	*3,000	179	161	75
5746-TS1	VSE/Interactive Computing and Control Facility	—	—	150	136	26
5746-XE3	VSE/POWER Releases 1 and 2	*1,800	*1,350	64	57	16
5666-273	VSE/POWER Version 2	465	420	155	140	30
5746-AM5	VSE/3270 Bisync Pass Through	*4,325	—	185	—	—
5746-AM2	VSE/VSAM Releases 1 and 22	—	—	79	71	22
	VSE/VSAM Space Management for SAM feature	—	—	42	28	9
5746-AM4	VSE/Fast Copy Data Set Program	*454	—	—	—	—
5746-UT3	VSE/Data Interfile Transfer, Testing, and Operations Utility (VSE/DITTO)	—	—	38	29	5

*One-time license charge.

IBM 4300 Series Equipment Prices

		Initial Charge		Monthly Charge		
		Basic License Charge ($)	DSLO License Charge ($)	Basic License Charge ($)	DSLO Charge ($)	Licensed Program Support Charge ($)
5746-XE7	VSE/Access Control—Logging and Reporting	*2,360	*2,125	59	44	22
5746-SA1	VSE/Interactive Problem Control System	*800	*600	35	25	6
5746-RC5	Basic Telecommunications Access Method Extended Support	—	—	42	38	7
5746-LM3	DOS FORTRAN IV Library Option I	—	—	38	28	7
5746-CB1	DOS/VS Cobol Compiler and Library	—	—	172	128	14
5746-LM4	DOS/VS Cobol Library	—	—	31	23	7
5736-PL1	DOS PL/1 Optimizing Compiler	—	—	235	176	37
5736-LM4	DOS PL/1 Resident Library	—	—	55	41	7
5736-LM5	DOS PL/1 Transient Library	—	—	32	24	7
5736-PL3	DOS PL/1 Optimizing Compiler and Library	—	—	322	241	50
5746-RG1	DOS/VS RPG II	—	—	150	112	7
5746-SM2	DOS/VS Sort/Merge (Version 2)	—	—	101	76	13
5746-XX1	DL/1 DOS/VS (Version 1)	—	—	429	322	136
5748-XXJ	SQL/Data System	—	—	434	324	131
5748-XX8	VM/Basic System Extensions	—	—	170	127	41
5748-XE1	VM/System Extensions	—	—	1,345	1,005	185
5664-167	VM/System Product	—	—	414	310	63
5748-XP1	Remote Spooling Communications Subsystem (RSCS) Networking	—	—	104	78	35
5748-XXC	VM/Interactive File Sharing	—	—	51	37	15
5748-XXB	Display Management System/CMS	—	—	38	26	9
5748-XE4	VM/Directory Maintenance	—	—	105	78	29
5748-XT3	VM/CMS-3270 Display Support and Structured Programming Facility	—	—	448	—	—
5748-SA1	VM/Interactive Problem Control System Extension	*1,000	*750	47	34	6
5748-MS1	Interactive Productivity Facility	—	—	47	34	6
5748-RC1	VM/Pass-Through Facility	—	—	174	130	82
5746-XX3	CICS/DOS/VS	—	—	641	577	136
5740-XX1	CICS/OS/VS	5,350	3,750	1,785	1,335	145
5740-XC5	Development Management System/CICS/VS-OS	—	—	319	238	51
5740-XXF	DB/DC Data Dictionary for OS/VS	—	—	1,040	779	108
5746-XXC	DB/DC Data Dictionary for DOS/VS	—	—	459	343	83
5662-257	OS/VS1 Basic Programming Extension	—	—	244	181	45
5740-XYS	MVS/SP-JES2 Version 1:					
	Releases 1 and 2	—	—	2,015	1,510	107
	Releases 3 through 3.4	—	—	2,031	1,521	205
5740-XC6	MVS/SP-JES2 Version 2:					
	Releases 1.0, 1.1, and 1.2	12,000	9,000	4,000	3,000	629
5740-XYN	MVS/SP-JES3 Version 1:					
	Release 1	—	—	2,015	1,510	110
	Release 2	—	—	2,229	1,669	484
	Release 3 through 3.4	—	—	2,229	1,669	484
5665-291	MVS/SP JES3 Version 2:					
	Releases 1.0, 1.1, and 1.2	13,500	10,125	4,500	3,375	1,250
5665-288	MVS Operator Communication Control Facility	990	740	330	245	8
5740-XY4	RMF Version 2, Release 4	—	—	380	285	16
5740-XR8	JES2 NJE	—	—	755	566	90
5799-AZT	JES3 NJE	—	—	1,920	1,445	326
5740-XRB	MVS Hierarchical Storage Manager, Release 3	—	—	542	405	121
5748-FO3	VS Fortran Compiler and Library	699	524	233	174	17
5748-LM3	VS Fortran Library	207	155	69	51	7
5748-AP1	VS APL Release 4	—	—	361	270	39
5734-PL3	OS PL/1 Compiler and Library	—	—	372	279	50
5734-PL1	OS PL/1 Compiler	—	—	277	207	37
5734-LM4	OS PL/1 Resident Library	—	—	60	45	7
5734-LM5	OS PL/1 Transient Library	—	—	35	26	7
5740-SM1	OS/VS Sort/Merge Release 5	—	—	231	173	18
5740-CB1	OS/VS Cobol Compiler and Library	—	—	342	256	14
5740-LM1	OS/VS Cobol Library	—	—	111	82	7
5740-AM6	Data Facility/Device Support Release 1 (OS/VS1)	—	—	85	63	24
5740-UT3	Data Facility/Data Set Services Release 1 (OS/VS1 and MVS)	—	—	83	62	38
5668-002	Direct Access Storage Device Migration Aid Release 1 (OS/VS1 and MVS)	1,450	—	—	—	18

*One-time license charge.

IBM 4300 Series Equipment Prices

	Monthly Program Support ($)	Monthly Multiple Program Support ($)
CHARGES FOR LOCAL PROGRAMMING SUPPORT		
For Class 1 SCP on 4341 Model Group 9:		
Category A (VM, DOS/VSE, VS1)	291	465
Category B (all SCP's in Category A, MVS Release 3.8, MVS corequisite SCP's)	523	836
For Class 1 SCP on 4341 Model Group 10:		
Category A	459	734
Category B	646	1,030
For Class 1 SCP on 4341 Model Group 11:		
Category A	529	846
Category B	764	1,220
For Class 1 SCP on 4341 Model Group 2:		
Category A	609	974
Category B	870	1,390
For Class 1 SCP on 4341 Model Group 12:		
Category A	664	1,060
Category B	945	1,510
For Class 1 SCP on 4361 Model Group 3:		
Category A (VM, DOS/VSE, VSI)	335	536
For Class 1 SCP on 4361 Model Group 4:		
Category A	506	810
For Class 1 SCP on 4361 Model Group 5:		
Category A (VM, DOS/VSE, VS1)	656	1,050
Category B	934	1,495
For Class 1 SCP on 4381 Model Group 1:		
Category A	643	1,030
Category B	918	1,470
For Class 1 SCP on 4381 Model Group 2:		
Category A	677	1,085
Category B	966	1,545