IBM 4300 Series

MANAGEMENT SUMMARY

Since its introduction in January 1979, the 4300 Series has grown to include seven model groups. The 4300 Series initially consisted of two central processors, the 4331 and the 4341. In May 1980, IBM filled the conspicuously large performance gap between the two original processors by adding the 4331 Model Group 2. The new processor featured twice the processing power and up to four times the main memory capacity of the original 4331, which was designated the 4331 Model Group 1. In September 1980, IBM announced the 4341 Model Group 2, which provided increased processing power and up to twice the main memory capacity of the original 4341, now designated the 4341 Model Group 1.

In November 1981, four new processor models were introduced: the 4321, the 4331 Model Group 11, the 4341 Model Group 10, and the 4341 Model Group 11. The 4321 is a preconfigured workstation-oriented system. The 4331 Model Group 11 falls between the original 4331 Model Group 1, which has been withdrawn from marketing, and the 4331 Model Group 2 in capacity and performance. The 4341 Model Group 10 provides an entry-level 4341 processor, while the 4341 Model Group 11 fits between the 4341 Model Group 1 and 4341 Model Group 2 in capacity and performance. IBM also doubled the maximum main memory capacity of the 4341 Model Group 2 processors.

The 4300 Series processors are versatile systems that offer full System/370 compatibility and impressive price/performance ratios. Moreover, incremental main memory is currently offered at only $15,700 per megabyte.

PROCESSORS AND PERIPHERALS

The 4300 Series central processors can operate either in a System/370-compatible mode or in an extended control program (ECPS) mode. The latter mode takes full advantage of the extensive microcoding available in these

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

MODELS: 4321, 4331 Model Groups 11 and 2, and 4341 Model Groups 10, 1, 11, and 2.
CONFIGURATION: Uniprocessor systems with 1 to 16 megabytes of main memory, 4K to 16K bytes of buffer storage, and up to 6 I/O channels.
COMPETITION: Burroughs B 3900 and B 5900, Honeywell DPS 8, IPL 4400 Series, Magnuson M80 Series, NCR 8500 Series, and Sperry Univac 90/60, 90/80, 1100/60, and System 80.
PRICE: Purchase prices for CPUs plus main memory range from $85,000 to $578,800.

CHARACTERISTICS

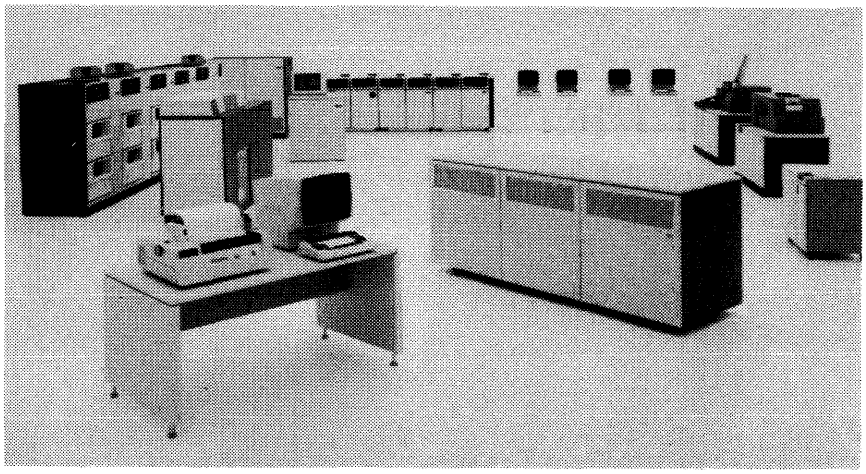
MANUFACTURER: International Business Machines Corporation, Data Processing Division, 1133 Westchester Avenue, White Plains, New York 10604. Telephone (914) 696-1900.

MODELS: 4321; 4331 Model Group 11 (Models J11 and K11); 4331 Model Group 2 (Models J2, K2, KJ2, and L2); 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); and 4341 Model Group 2 (Models K2, L2, M2, N2, and P2).

PREVIOUS MODELS: The 4331 Model Group 1 has been withdrawn from marketing.

DATE ANNOUNCED: See tables on second and third pages of this report.

DATE OF FIRST DELIVERY: See tables.



The 4341 processor provides 2 to 16 megabytes of main memory, 4K to 16K bytes of buffer storage, and up to 6 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 4341 supports the MVS operating system as well as OS/VS1, VM/370, and DOS/VSE.

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CHARACTERISTICS OF THE 4300 SERIES PROCESSORS

	4321	4331 Model Group II	4331 Model Group 2
SYSTEM CHARACTERISTICS			
Date of introduction	November 1981	November 1981	May 1980
Date of first delivery	March 1982	March 1982	4th quarter 1980
Number of CPUs per system	1	1	1
Principal operating systems	SSX/VSE, VM/370 with CMS	DOS/VSE, VM/370, SSX/VSE	DOS/VSE, OS/VS1 Rel. 7, VM/370 Rel. 6, SSX/VSE
Purchase price of CPU with minimum main storage capacity	$85,000	$109,650	$125,000
Upgradable to	4331-11	4331-2	—
MAIN STORAGE			
Storage type	MOS	MOS	MOS
Bytes fetched per cycle	4	4	4
Minimum capacity, bytes	1,048,576	1,048,576	1,048,576
Maximum capacity, bytes	1,048,576	2,097,152	4,194,304
Increment size, bytes	None	1,048,576	1,048,576
Error-correcting memory	Standard	Standard	Standard
BUFFER STORAGE			
Capacity, bytes	None	4,096	8,192
Cycle time, nanoseconds	—	200	200
Bytes fetched per cycle	—	4	4
CENTRAL PROCESSOR			
Cycle time, nanoseconds	300 to 1600	200 to 1600	200 to 1600
Operating modes	ECPS:VSE, System/370	ECPS:VSE, System/370	ECPS:VSE, System/370
System/370 mode options	ECPS:VM/370	Basic control, Extended Control, ECPS:VM/370	Basic Control, Extended Control, ECPS:VM/370
Instruction set	S/370 Universal	S/370 Universal	S/370 Universal
Reloadable control storage capacity, bytes	131,072	131,072	131,072
Data path width, bytes	4	4	4
Direct Access Storage Compatibility	No	No	Optional
IBM 1401/1440/1460 Compatibility	No	No	Optional
I/O CHANNELS AND ADAPTERS			
No. of byte multiplexer channels	0	1	1
No. of block multiplexer channels	0	1	2
No. of high-speed block multiplexer channels	0	0	1
Maximum total no. of channels	0	2	4
Maximum channel data rates, bytes/second:			
Byte multiplexer (byte mode)	—	36,000	36,000
Byte multiplexer (burst mode)	—	500,000	500,000
Block multiplexer	—	1.25M	1.25M
High-speed block multiplexer	—	—	1.86M
Integrated DASD Adapter (for 3310, 3370, and/or 3340/3344)	1 standard	1 standard	Optional (1 or 2)
Display/Printer Adapter	Standard	Standard	Standard
5424 Multi-Function Card Unit Adapter	No	No	Optional
8809 Magnetic Tape Unit Adapter	Standard	Standard	Optional
Integrated Communications Adapter	3 lines std.	3 lines std., 5 opt.	Optional (8 lines)
3704/3705 Communications Controllers	No	Optional	Optional
3880 Storage Control (for 3330/3333, 3340/3344, 3350, 3370, 3375, or 3380)	No	No	Optional
Channel-to-Channel Adapter	No	No	No

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CHARACTERISTICS OF THE 4300 SERIES PROCESSORS (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
Number of CPUs per system	1	1	1	1
Principal operating systems	DOS/VSE, OS/VS1 Rel. 7, VM/370 Rel. 6, MVS	DOS/VSE, OS/VS1 Rel. 7, VM/370 Rel. 6, MVS	DOS/VSE, OS/VS1 Rel. 7, VM/370 Rel. 6, MVS	DOS/VSE, OS/VS1 Rel. 7, VM/370 Rel. 6, MVS
Purchase price of CPU with minimum main storage capacity	$178,000	$225,000	$275,000	$359,000
Upgradable to	4341-11	4341-11 or -2	4341-2	—
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
Error-correcting memory	Standard	Standard	Standard	Standard
BUFFER STORAGE				
Capacity, bytes	4,096	8,192	8,192	16,348
Cycle time, nanoseconds	Not specified	225	225	120
Bytes fetched per cycle	Not specified	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 mode 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	ECPS:VS/1, ECPS:VM/370, ECPS:MVS
Instruction set	S/370 Universal	S/370 Universal	S/370 Universal	S/370 Universal
Reloadable control storage capacity, bytes	Not specified	Not specified	Not specified	Not specified
Data path width, bytes	8	8	8	8
Direct Access Storage Compatibility	No	No	No	No
IBM 1401/1440/1460 Compatibility	No	No	No	No
I/O CHANNELS AND ADAPTERS				
No. of byte multiplexer channels	1 or 2	1 or 2	1 or 2	1 or 2
No. of block multiplexer channels	2, 4, or 5	2, 4, or 5	4 or 5	4 or 5
No. of high-speed block multiplexer channels	0	0	0	0
Maximum total no. of channels	6	6	6	6
Maximum channel data rates, bytes/second:				
Byte multiplexer (byte mode)	16,000 or 22,000	16,000 or 22,000	16,000 or 22,000	16,000 or 22,000
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	—	—	—	—
Integrated DASD Adapter (for 3310, 3370, and/or 3340/3344)	No	No	No	No
Display/Printer Adapter	No	No	No	No
5424 Multi-Function Card Unit Adapter	No	No	No	No
8809 Magnetic Tape Unit Adapter	No	No	No	No
Integrated Communications Adapter	No	No	No	No
3704/3705 Communications Controllers	Optional	Optional	Optional	Optional
3880 Storage Control (for 3330/3333, 3340/3344, 3350, 3370/3375, or 3380)	Optional	Optional	Optional	Optional
Channel-to-Channel Adapter	Optional	Optional	Optional	Optional

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machines to reduce operating system overhead and improve system throughput. The processors employ 64K-bit memory chips and logic chips that contain up to 704 circuits each.

All of the 4300 Series processors share these common features: the System/370 Universal Instruction Set, channels with virtual storage addressing, CE maintenance support functions including a support processor and remote support facility, store and fetch storage protection, byte-oriented operands, clock comparator and CPU timer, time-of-day clock, interval timer, PSW key handling, control registers, extended-precision floating point, machine check handling, and program event recording.

The 4321 is a purchase-only, entry-level processor with the same internal performance as the earlier 4331 Model Group 1. The 4321 is a preconfigured workstation-oriented system that is designed for ease of installation and ease of use by non-EDP personnel. It can be used as a standalone system or in a remote computing environment. All input/output devices are attached to the system by integrated adapters. No multiplexer channels or other options are available. The 4321 system consists of a processor with 1 megabyte of main memory, 128K bytes of control storage, a Display/Printer Adapter with 16 ports, a 3310 DASD Adapter for up to 16 drives, an 8809 Magnetic Tape Unit Adapter for up to 6 drives, and an integrated communications adapter that supports 3 BSC or SDLC communications lines. The 4321 can be field-upgraded to a 4331 Model Group 11.

The 4331 Model Group 11 falls between the 4321 and the 4331 Model Group 2 in capacity and performance. According to IBM, the 4331 Model Group 11 provides from 1.4 to 1.6 times the internal performance of a 4321 for commercial workloads and approximately 2.5 times the internal performance of a 4321 for scientific and engineering workloads. The 4331 Model Group 11 is equipped with 1 or 2 megabytes of main memory, 128K bytes of reloadable control storage plus 12K bytes of read-only control storage, and 4K bytes of buffer storage. Many features that are optional on the 4331 Model Group 2 are standard on the Model Group 11, including 1 byte and 1 block multiplexer channel, a Display/Printer Adapter with 16 ports, a DASD Adapter for up to 4 strings of 3310, 3340/3344, or 3370 disk drives, an 8809 Magnetic Tape Unit Adapter for up to 6 drives, and an integrated communication adapter that supports 3 BSC or SDLC communications lines. Options include support for 5 additional communications lines and a diskette drive with a capacity of 242,944 bytes. The 4331 Model Group 11 can be field-upgraded to a 4331 Model Group 2. Installed 4331 Model Group 1 processors can be upgraded to a 4331 Model Group 11.

The 4331 Model Group 2 processor offers twice the performance of the 4321 and a little over one-half the performance of the 4341 Model Group 1. The 4331 Model Group 2 has an 8K-byte buffer storage unit and 1,

DATA FORMATS

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

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

FLOATING-POINT OPERANDS: 1 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).

MASS 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.

CYCLE TIME: See table.

CAPACITY: From 1,048,576 to 16,777,216 bytes. See table 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 include these common features: LSI technology, one-level addressing facility, virtual storage capability by dynamic addressing, channels with virtual storage, System/370 Universal Instruction Set, CE maintenance support functions including support processor and remote support facility, store and fetch storage protection, byte-oriented operands, clock comparator and CPU timer, time of day clock, interval timer, reloadable control storage, PSW Key handing, 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 elected 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.

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2, 3 or 4 megabytes of main memory. The Model Group 2 can be equipped with the same integrated peripheral adapters as the Group 11 processor, plus an optional second DASD Adapter and greatly improved I/O channel capabilities. The maximum Model Group 2 channel complement consists of one byte multiplexer channel, two standard block multiplexer channels, and one high-speed block multiplexer channel. The latter channel can handle a data transfer rate of up to 1.86 million bytes per second, permitting the attachment of high-speed disk storage units via the 3880 Storage Control.

The 4341 Model Group 10 is an entry-level 4341 processor that provides approximately 0.85 times the performance of a 4341 Model Group 1 for typical commercial applications or 0.95 times the Model Group 1 for engineering and scientific applications. The 4341 Model Group 10 is available with a 4K-byte buffer and 2 or 4 megabytes of main memory. It can be field-upgraded to a 4341 Model Group 11.

The 4341 Model Group 1 is available with 2 or 4 megabytes of main memory and an 8K-byte buffer. The internal performance of the 4341 Model Group 1 is up to 1.1 times an equivalently configured System/370 Model 158-3. The Model Group 1 can be field-upgraded to a 4341 Model Group 11 or Model Group 2.

The 4341 Model Group 11 offers 1.25 times the internal performance of the 4341 Model Group 1. The Model Group 11 is available with an 8K-byte buffer and 2, 4, or 8 megabytes of main memory. It can be field-upgraded to a 4341 Model Group 2.

The top-of-the-line 4341 Model Group 2 is available with from 2 to 16 megabytes of main memory and 16K bytes of buffer storage. The internal performance of the Model Group 2 is from 1.6 to 1.8 times faster than the Model Group 1.

None of the integrated peripheral adapters used on the 4331 processors is available for the 4341 processors. Instead, all peripheral and communications devices are connected via standard I/O channels and control units. Two block multiplexer channels and one byte multiplexer channel are standard on the 4341 Model Groups 10 and 1. An Optional Channel Group adds either three more block multiplexer channels or two block multiplexer channels and a second byte multiplexer channel. Five block multiplexer channels and one byte multiplexer channel are standard on the 4341 Model Groups 11 and 2. One of the block multiplexer channels can be optionally selected as a byte multiplexer channel.

The 4300 Series processors support most of the System/370, 303X Series, and 308X Series peripheral devices. Five peripheral devices were introduced along with the 4300 Series computers: the 64.5-megabyte 3310 Direct Access Storage Device (4321 and 4331 only), the 571-megabyte 3370 Direct Access Storage Device, the

The 4341 features an eight-byte-wide data flow within the processor as well as an eight-byte-wide data flow between the processor, storage, and channels. Data flow within the 4321 and 4331 is four bytes wide.

There are two modes of operation available to the 4300 user. On the 4321 and 4331, the mode is selected at initial program load (IPL) time; on the 4341, at initial microcode load (IML) time. One of the two operating modes 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. The other operating mode, 370 mode, has one option on the 4321, three options on the 4331, and three options on the 4341. On the 4321, the ECPS:VM/370 option provides improved system performance with VM/370. This option is recommended for operation in a CMS environment only. On the 4331, 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 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.

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.

Programs written to run on IBM 1401, 1440, or 1460 systems can be executed on the 4331 Model Group 2 using the IBM Systems 1401/1440/1460 Emulator program product and can achieve improved performance with a special feature on the processor. Another optional feature allows programs written for DOS, DOS/VS, or DOS/VSE and 2311/2314/2319 disk drives to be executed, with only JCL changes, using IBM 3310 Direct Access Storage.

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 eight-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 display. The remote connection can be completely

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3880 Storage Control, the 650-lpm 3262 Line Printer (4321 and 4331 only), and the 1200-lpm 3203 Model 5 Printer. In 1980, IBM announced the 819-megabyte 3375 and 2.5-gigabyte 3380 Direct Access Storage Devices. The 3375 DASD can be used with the 4331 Model Group 2 and the 4341 processors. The 3380 DASD is available for use with the 4341 processors only.

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 processors. The Display/Printer Adapter on the 4321 and 4331 processors can accommodate as many as 15 additional display units or printers.

SOFTWARE

Three operating systems are available for all 4331 and 4341 processors: DOS/VS Extended (DOS/VSE), OS/VS1 Release 7, and the Virtual Machine Facility 370 (VM/370) Release 6. In addition, SSX/VSE supports the 4321 and 4331 processors, and OS/VS2 (MVS) can be used with the 4341 processors.

DOS/VSE is said to be a major expansion of DOS/VS incorporating new functional and I/O support. Unfortunately, DOS/VSE provides only limited multiprogramming capabilities unless the user acquires 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.

IBM says the OS/VS1 Release 7 support is of particular importance in a distributed data processing environment, since it will generally provide a high level of compatibility with an MVS host system. As with DOS/VSE and VM/370, OS/VS1 Release 7 can run in ECPS mode with the ECPS:VS1 feature on either the 4331 or 4341 processor or in 370 mode.

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.

SSX/VSE (Small Systems Executive/VSE) is the principal operating system for the 4321 processors. SSX/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 4321 or 4331 processors operating in standalone or distributed environments.

MVS support is provided on the 4341 through the ECPS: MVS option, which includes new privileged instructions that enable the 4341 to utilize either MVS/SP-JES2 or

broken at any time by depression of a console key on the customer's display console.

CONTROL STORAGE: The 4300 Series processors utilize reloadable control storage (RCS) to hold the microcode which controls their operations. The RCS is composed of 18K-bit SAMOS-process N-channel FET chips.

On the 4321 and 4331 processors, 131,072 bytes of RCS are standard. The 4331 processors also include 12,288 bytes of read-only control storage. In addition to the RCS, some main memory is required for microcode storage and is therefore unavailable to the user. Approximately 168,000 bytes of main memory are required for microcode and system use on the 4321, and approximately 200,000 bytes are required on the 4331 Model Group 11. On the 4331 Model Group 2, at least 16,348 bytes of main memory are required for microcode storage. The total amount of microcode required is dependent upon the features installed and the functions performed.

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.

BUFFER STORAGE: Buffer storage is standard on all 4300 Series models except the 4321. Storage capacities range from 4096 to 16,348 bytes, depending on the model. (See tables for the buffer capacities for the individual processors models.) The buffer storage is transparent to all programs and significantly reduces the effective main memory access time. On the 4331, the buffer storage is automatically replenished from main memory in 64-byte units; the 64-byte fetch cycle takes 2.6 microseconds, and the 64-byte store cycle takes 3.1 microseconds.

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 (ECPS:VSE mode).

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 look-aside 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," 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 Look-Aside Buffer, Store Then AND System Mask, and Store Then OR System

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MVS/SP-JES3. 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.

USER REACTION

Datapro's 1982 survey of general-purpose computer users yielded responses from 785 IBM 4300 Series users, who had a total of 897 processors installed. Of this total, 359 systems were 4331s and 538 were 4341s. The 4331 systems had been in use for an average of 16.9 months; the 4341 systems, for an average of 11.1 months.

The survey respondents represented a wide variety of industries, including manufacturing (259 responses), banking/finance (92 responses), retail/wholesale (84 responses), and insurance (61 responses).

The user's ratings are listed in the table below. Two separate weighted average columns are provided for the 4331 and 4341 systems, although the numbers of user responses for both systems have been combined:

	Excel.	Good	Fair	Poor	4331 WA*	4341 WA*
Ease of operation	250	464	50	4	3.12	3.35
Reliability of mainframe	618	155	8	1	3.77	3.78
Reliability of peripherals	302	390	75	3	3.30	3.28
Maintenance service:						
Responsiveness	322	395	56	8	3.34	3.31
Effectiveness	262	418	82	8	3.21	3.22
Technical support:						
Trouble-shooting	120	429	187	38	2.77	2.85
Education	79	431	224	31	2.68	2.77
Documentation	70	407	255	39	2.60	2.71
Manufacturer's software:						
Operating system	148	486	118	19	2.94	3.03
Compilers & assemblers	189	528	49	7	3.18	3.15
Application programs	61	387	120	21	2.84	2.82
Ease of programming	106	532	101	14	2.94	2.99
Ease of conversion	159	412	134	31	2.84	3.04
Overall satisfaction	160	571	38	3	3.11	3.19

*Weighted Average on a scale of 4.0 for Excellent.

In July we interviewed two of the survey respondents to gain additional insight into their experiences with the 4300 Series.

The first user interviewed represented a petroleum company that had upgraded from an IBM System/3 to a 4331, and, in June 1982, from the 4331 to a 4341 Model Group 2. This user said that the conversion from the System/3 to the 4331 took 14 months because they had to do a "total rewrite" of programs for on-line applications. He added that he was well satisfied with the 4331 after the conversion was completed and that he has experienced no problems with the 4341. He is currently using the DOS/VSE operating system. Future plans call for

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.

INSTRUCTION TIMES: Average execution times, in microseconds, for some representative instructions on the *IBM 4341 Model Group 1* processor are as follows:

Add (32-bit binary)	0.600
Multiply (32-bit binary)	3.900
Divide (32-bit binary)	7.425
Load (32-bit binary)	0.375
Store (32-bit binary)	0.375
Add (6-digit packed decimal)	1.275
Compare (6-digit packed decimal)	1.275
Add (short floating-point)	1.472
Multiply (short floating-point)	4.350
Divide (short floating-point)	6.300
Add (long floating-point)	1.425
Multiply (long floating-point)	5.400
Divide (long floating-point)	10.950

IBM has released the following processor performance comparisons:

- The 4321, when operating in ECPS:VSE mode with 3310 direct-access storage, has a measured instruction execution rate averaging 0.91 times that of a System/370 Model 138 running under DOS/VS Release 3 with 3330 direct-access storage.
- The 4331 Model Group 2 has an internal speed approximately twice as fast as the 4321.
- The 4341 Model Group 1 has an instruction execution speed up to 1.1 times as fast as the System/370 Model 158-3.

Furthermore, it is generally agreed that the instruction execution speed of the 4341 Model Group 1 is 3.4 to 4 times that of the 4321, or 1.7 to 2 times that of the 4331 Model Group 2. The 4341 Model Group 2 is 1.6 to 1.8 times faster than the 4341 Model Group 1.

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.

ENGINEERING SCIENTIFIC ASSIST: This feature, which is standard on the 4341 Model Groups 10, 11, and 2, is designed to improve the performance of certain mathematical computations such as matrix inversion, decomposition, and multiplication. Engineering Scientific Assist consists of a new 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.

3838 ARRAY PROCESSOR: A special-purpose scientific processor available on 4341 systems only. The 3838 processes single-precision floating-point vector operations independently of the host CPU. Three models are available: the Model 1 with 256K bytes of bulk storage, the Model 2 with 512K bytes of bulk storage, and the Model 3 with 1024K bytes of bulk storage. The bulk storage provides independent data storage for up to seven concurrent users. The 3838 subsystem also includes an arithmetic processor

running multiple DOS machines under the VM/370 operating system.

The second user interviewed was a manufacturer that had converted from a Burroughs B 3500 to a 4341 Model Group 1 in November 1980. He commented that the conversion was "as bad as most, but no worse." He said he was well satisfied with the 4341, which was "more dependable than the B 3500." Future plans included distributed processing capabilities and expanded data communications facilities.

In addition, a number of the survey respondents provided written comments about their experiences with the 4300 Series. One 4331 user stated, "Broken code in the supervisor that caused it to be blind to disk errors allowed the undetected loss of those disk records. IBM assistance was slow and barely effective." Another 4331 user commented that DOS/VSE is "obviously dated and needs fundamental design changes to take advantage of cheap disk and memory, instead of relying on improvements to 80-column card image processing. The hardware from IBM is outstanding. I can only hope that the software will get there someday."

A third 4331 user commented, "We are a division of a large corporation which has an IBM 3033. Because of reliability problems, we converted our applications programs to a locally operated 4331 Model Group 1, which was sorely undersized for our PL/1, CICS, TOTAL-oriented environment. We upgraded to a 4331 Model Group 2 immediately and have since had to move away from a totally on-line environment. The TOTAL DBMS has its performance degraded considerably because we use fixed-block architecture DASD."

Concerning the 4341, one user stated, "We are using ADABAS and Natural on a DOS/VS 4341 with CICS and are going to something else. I do not recommend that a user try this combination." Another 4341 user termed the 4341 Model Group 1 "a highly cost-effective machine." He plans to upgrade to a Model Group 2, but said, "We currently have no growth path beyond the 4341-2 without going to water-cooled units or leaving the IBM line, neither of which is a direction we want to take. We would like to see IBM announce a significantly faster 4341 or a new addition to the 4300 line (e.g., a 4351)."

Despite some negative statements, the users' ratings and comments indicate that they are fairly well satisfied with the 4300 Series processors. Of the 785 survey respondents, 728 said they would recommend the 4300 Series to others, 10 said they would not, and 46 were undecided.□

with 16K bytes of control storage, a control processor, a data transfer controller, and a channel interface that attaches to a block multiplexer channel on the 4341 host.

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 anti-glare 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.

The 3278-2A or 3279-2C connects directly to a 4300 Series processor. On the 4321 and 4331, connection is via the standard Display/Printer Adapter, which permits connection of the required 3278-2A or 3279-2C plus up to 7 (or 15 with the optional Display/Printer Adapter Expansion) additional devices chosen from the following list: 3278 Display Station Model 2, 3287 Printer Models 1 (80 cps) and 2 (120 cps), 3287 Color Printer Model 1C (80 cps) and 2C (120 cps), 3289 Line Printer Model 4 (400 lpm), and 3262 Line Printer Models 1 (650 lpm) and 11 (325 lpm). These devices may be installed in any combination, except that the number of system printers (3262 Model 1 or 3289 Model 4) may not exceed two. On the 4341, up to three optional 3278-2A display consoles, 3279-2C display consoles, or 3287 printers can be added.

INPUT/OUTPUT CONTROL

I/O CHANNELS: On the *4321* processor, all input/output devices are attached to the system via integrated adapters. No multiplexer channels are available.

On the *4331 Model Group 11,* one block multiplexer channel and one byte multiplexer channel are standard. The block multiplexer channel has a data transfer rate of 1.25 million bytes per second. It provides 8 control unit positions and can be configured with up to 256 shared or nonshared subchannels that support a maximum of 256 devices. The block multiplexer channel on the 4331 Model Group 11 does not support 33XX series disk units.

The byte multiplexer channel attaches the 3203-5 Printer and System/370 byte multiplex devices to the 4331 Model Group 11. With this channel, the single-byte interleaved mode provides a speed of 36K bytes per second, and the burst mode provides a speed of up to 500K bytes per second. The byte multiplexer channel provides 8 control unit positions and up to 32 subchannels, 4 of which are shared subchannels supporting up to 16 devices each. The maximum number of subchannels is reduced by five with the Additional Line Group feature.

The *4331 Model Group 2* processor can have up to four integrated channels: one 5248 Byte Multiplexer Channel, one 1421 Block Multiplexer Channel, one 1422 Additional Block Multiplexer Channel, and one 1431 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 one the number of subchannels available.

The 1421 and 1422 Block Multiplexer Channels can each 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 3330/3333, 3340/3344, 3350, and 3370 via control units. If both the 1422 and the 1431 are installed on the same processor, the data transfer rate of the 1422 cannot exceed 600K bytes per second. Each of the block multiplexer channels for the 4331 Model Group 2 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.

In addition to the I/O channels described above, the 4331 processors can be equipped with integrated I/O adapters. A Display/Printer adapter, for attaching the required 3278-2A or 3279-2C Display Console and up to seven additional displays or printers, is standard on both the 4331 Model Group 11 and the 4331 Model Group 2. The following adapters are standard on the Model Group 11 and optional on the Model Group 2: the DASD Adapter (for 3310, 3370, or 3340/344 Direct Access Storage Devices), 8809 Adapter (for up to six 8809 Magnetic Tape Units), and Communications Adapter (for controlling up to eight communications lines). A 5424 Adapter (for a 96-column 5424 Multi-Function Card Unit) and a second DASD Adapter are also optional on the 4331 Model Group 2.

The *4341 Model Group 10 and Model Group 1* processors can have up to six I/O channels in two three-channel groups, one standard and the other optional. The standard group consists of one byte multiplexer channel and two 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 two 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 10 and 1 consists of three 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 three 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 two standard block multiplexer channels is six million bytes per second. The aggregate data rate of the five block multiplexer channels including the optional group is 11 million bytes per second. If one of the three optional channels is configured as a second byte multiplexer channel, the aggregate data rate of the remaining four block multiplexer channels is nine 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 six channels as standard: one byte multiplexer channel and five 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 five 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 four 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.

A Channel-to-Channel Adapter (feature 1850) allows the interconnection of two channels, which may be on a 4341, 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, or 4341 processors. The 3088 provides the capability of interconnecting from four to eight processor channels. The channel interfaces can be configured with 32 or 64 contiguous unit addresses that provide the function of a Channel-to-Channel Adapter. From 126 to 252 logical Channel-to-Channel Adapter links are provided. The 3088 requires one control unit position on each processor channel to which it is attached. One unshared subchannel is required on each attached channel for each unit address.

SIMULTANEOUS OPERATIONS: Concurrently with computing, a 4331 or 4341 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 4321 is a preconfigured system with the following integrated peripheral adapters: the 3310 DASD Adapter for up to 16 drives; the 8809 Magnetic Tape Unit Adapter for up to 6 drives; the Display/Printer Adapter with 16 ports for the attachment of the operator console, display stations, line printers, and terminal printers; and the Communications Adapter for 3 communications lines. The Display/Printer Adapter supports the 3278-2A Console, 3279-2C Console, 3278-2 Displays, 3279-2A Displays, 3287 Printer Models 1, 2, C, and 2C, 3262 Printer Models 1 and 11, and 3289 Printer Model 4. No optional features are available for the 4321.

The 4331 is a highly integrated system, with numerous peripheral adapters mounted in the processor cabinet, including those for 3310, 3370, and 3340 Direct-Access Storage Devices (up to 9,000 megabytes per adapter); 8809 Magnetic Tape Units; diskette drive; 5424 Multi-Function Card Unit; and communications adapter. Also available are byte and block multiplexer channels, as described under the "Input/Output Control" heading. The integrated Support Processor has a standard Display/Printer Adapter for up to 8 devices, with optional expansion to 16 devices. These devices include a 3278-2A Console, 3278-2 Displays, 3287 Printer Models 1, 2, 1C, and 2C, 3262 Printer Model 1, and 3289 Printer Model 4.

The 4341 is a more traditional mainframe, 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, or 3287 Printers, Models 1, 2, 1C, and 2C, can be attached to the Support Processor.

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

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MASS STORAGE

The 4300 Series processors can utilize most of the System/360 and System/370 mass storage devices in addition to the 3310 and 3370 subsystems that were announced with the 4300 Series. The available devices, their control units, and the manner of attachment can be summarized as follows:

- 3310 Direct Access Storage, connected to the DASD Adapter on the 4321 and 4331.
- 3330/3333 Disk Storage Models 1, 2, and 11, connected via either the 3830 Model 2 Storage Control or the 3880 Model 1 Storage Control to a block multiplexer channel on the 4341 or to a high-speed block multiplexer channel on the 4331 Model Group 2.
- 3340/3344 Direct Access Storage, connected to the DASD Adapter on the 4331, or connected via either the 3830 Model 2 Storage Control or the 3880 Model 1 Storage Control to a block multiplexer channel on the 4341 or to a high-speed block multiplexer channel on the 4331 Model Group 2.
- 3350 Direct Access Storage, connected via either the 3830 Model 2 Storage Control or the 3880 Model 1 or 11 Storage Control to a block multiplexer channel on the 4341 or to a high-speed block multiplexer channel on the 4331 Model Group 2.
- 3370 Direct Access Storage, connected to the DASD Adapter on the 4331, or connected via the 3880 Model 1 Storage Control to a block multiplexer channel on the 4341 or to a high-speed block multiplexer channel on the 4331 Model Group 2.
- 3375 Direct Access Storage, connected via the 3880 Model 1 Storage Control to a block multiplexer channel on the 4341 or to a high-speed block multiplexer channel on the 4331 Model Group 2.
- 3380 Direct Access Storage, connected via the 3880 Model 2, 3, or 13 Storage Control to a block multiplexer channel on the 4341 only.

The 3310, 3370, 3375, and 3380 Direct Access Storage Devices, and the 3880 Storage Control are described in the following paragraphs. For details on the other equipment listed above, please refer to Report 70C-491-06 (303X Series).

3310 DIRECT-ACCESS STORAGE DEVICE: Provides 64.5 megabytes of disk storage for the 4321 and 4331 processors only. The 3310 connects to the 4321 or 4331 via an integrated DASD Adapter. Each drive consists of a fixed and sealed head and disk assembly. The actuator is a swing-arm mechanism which moves in an arc over the disk surface.

The 3310 uses fixed block architecture providing linear contiguous data address space. Each 512-byte block can be addressed and accessed individually as well as in a contiguous string of arbitrary length. Rotational position sensing is standard. There are 512 bytes per sector (block), 352 sectors per cylinder, 180,224 bytes per cylinder, 358 cylinders per drive, and 64,520,192 bytes per drive.

Average head positioning time is 27 milliseconds. Average rotational delay is 9.6 milliseconds. Data transfer rate is 1031K bytes per second.

The 3310 Model A1 is a single drive with its associated control; the A2, dual drives with associated control; the B1, a single slave drive for attachment to the A2; and the B2, a dual-drive slave unit for attachment to the A2. Each DASD Adapter accommodates up to four strings, each with up to four 3310 drives.

3370 DIRECT-ACCESS STORAGE DEVICE: Provides up to 285.6 megabytes of storage per actuator and 571.3 megabytes per drive. The 3370 can be connected to an integrated DASD Adapter on the 4331 or to a 3880 Storage Control Model 1 on the 4331 Model Group Group 2 or the 4341.

The 3370 employs thin-film technology heads and high-density LSI circuitry. Each 3370 has a single 571.3-megabyte spindle of disks which are accessed by two independent, movable actuators. The 3370 makes use of fixed block architecture. Fixed block architecture provides for recording data in permanent pre-formatted 512-byte blocks on the disk surface. Each block of data is separately addressable and separately accessible, either singly or in contiguous strings of a variable number of blocks (maximum, approximately 65,000). The 3370 has 558,000 blocks per actuator, 285,696,000 bytes per actuator, and 571,392,000 bytes per drive. Minimum, average, and maximum head movement times are 5, 20, and 40 milliseconds, respectively. Average rotational delay is 10.1 milliseconds, and the data transfer rate is 1.859 megabytes per second.

The 3370 is available in two models. The 3370 Model A1 contains the control adapter functions required for attachment to the 3880 or the 4331 DASD Adapter. The 3370 Model B1 attaches through an A1 unit. Up to three 3370 Model B1s can be attached to a 3370 Model A1 for a maximum of four units per string.

3375 DIRECT ACCESS STORAGE: The 3375 is a count-key-data formatted disk drive that provides 819 million bytes of storage capacity. The 3375 is similar in most respects to the 3370 Direct Access Storage. The principal differences between the two devices are in storage capacity and data format. The 3375's 819-megabyte capacity is 43 percent larger than the 3370's 571 megabytes, and the 3375 uses the count-key-data format employed in the 3380, the 3350, and other large-capacity IBM disk drives in contrast to the fixed 512-byte blocks used in the 3370 and 3310.

Each 3375 drive contains one non-removable head and disk assembly (HDA). The HDA has two actuators, each providing independent access to approximately 409 million bytes of data. Average seek time is 19 milliseconds, average rotational delay is 10.1 milliseconds, and data is transferred at the rate of 1.859 million bytes per second. There are two models of the 3375. Model A1 contains a storage control interface and connects to a 3880 Model 1 or 2 Storage Control. Up to three 3375 Model B1 drives can be attached to a 3375 Model A1 for a maximum string capacity of 3.27 billion bytes. The 3375 can be used with the 4331 Model Group 2 or the 4341 processors.

3380 DIRECT ACCESS STORAGE: The 3380 offers a significantly larger storage capacity, faster data transfer rate, and lower cost per byte than any previous IBM disk drive. Each 3380 drive unit has a data storage capacity of 2.52 billion bytes, an average seek time of 16 milliseconds, an average rotational delay of 8.3 milliseconds, and a data transfer rate of 3.0 megabytes per second. The 3380 also uses the count-key-data format. Each 3380 unit contains two 1.26-billion-byte head and disk assemblies (HDAs), which are permanently mounted and house the heads, disks, and access mechanisms in a sealed enclosure. Each HDA, in turn, has two actuators, and each actuator accesses 630 megabytes of data. A 3380 string can consist of up to 4 drive units and 16 actuators, with each actuator operating independently and overlapping its seeking and rotational position sensing operations with those of other actuators. There are six models of 3380 Direct Access Storage, all with the same 2.52-gigabyte storage capacity.

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The 3380 can be used with the 4341 processors only. One of three models of the 3880 Storage Control, Model 2, Model 3, or Model 13 is a prerequisite. Up to two 4-unit strings of 3380 drives can be connected to one of the two storage directors on the 3880 Model 2, and to both storage directors on the 3880 Model 3 or 13. Operation at the 3.0-megabyte data transfer rate requires attachment to a 3.0-megabyte block multiplexer channel on the 4341.

3880 STORAGE CONTROL: This control unit provides two completely independent paths for the transfer of file positioning commands and data between an IBM central processor channel and direct-access storage devices. Each path, called a Storage Director, attaches to a block multiplexer channel on a 4341 or to the high-speed block multiplexer channel on a 4331 Model Group 2. Both Storage Directors can be attached to the same channel, to different channels on the same processor, or to channels on two separate processors.

There are five models of the 3880. Model 1 can accommodate various combinations of 3330/3340/3350/3375 storage units. Model 2 functions similarly to Model 1 except that one of the two storage directors can also attach 3380 disk drives. Model 3 supports 3380 drives only. Model 11 is a paging subsystem designed for use with 3350 storage units. It consists of a conventional storage director and a paging storage director that dynamically manages an eight-megabyte solid-state storage unit for paging and swapping data. Model 13 is a non-paging subsystem for use with 3380 storage units. It consists of a cache unit attached to a 3880 Model 3 to form a two-level storage hierarchy. The Model 13 includes two cache storage directors with either four or eight megabytes of solid-state storage. A two-channel switch (#8170/8171) and eight-channel switch (#8172) can be selected to increase the number of channels connected to a storage director from two to eight.

Up to 14 3340/3344 disk drives can be configured on a storage director. As many as 16 3330/3333/3350 drives can be configured in various combinations on a director. At the high-performance end, a storage director can control a maximum of 16 3370/3375 or 8 3380 drives.

INPUT/OUTPUT DEVICES

The 4300 Series processors support most of the System/360, System/370, 303X Series, and 308X Series peripheral devices, connectable to a byte multiplexer channel, a block multiplexer channel, and/or through integrated attachment features. In the following list, the type of connection appears in parentheses. If not otherwise specified, the device can be used with either the 4331 or the 4341. Devices that can be attached include:

- 3410/3411 Magnetic Tape Units and Control, Models 1, 2, and 3 (byte or block).
- 3420 Magnetic Tape Unit Models 3 to 8 via the 3803 Tape Control Model 1 or 2 (byte or block).
- 8809 Magnetic Tape Unit Models 1A, 2, and 3 (attachment, on 4321 or 4331).
- 3540 Diskette Input/Output Unit Model B1 or B2 (byte or block).
- 2501 Card Reader Model B1 or B2 (byte or block).
- 3505 Card Reader Model B1 or B2 (byte or block).
- 2520 Card Reader Punch Model B1, B2, and B3 (byte or block).
- 2540 Card Read Punch Model 1 via the 2821 Control Unit Model 1, 5, or 6 (byte or block).
- 1442 Card Read Punch Model N1 (byte or block).
- 3525 Card Punch Model P1, P2, or P3 (byte or block).
- 5424 Multi-Function Card Unit Model A1 or A2 (attachment, on 4331).
- 1403 Printer Models 2, 7, and N1 via the 2821 Control Unit Model 1, 2, 3, or 5 (byte or block).
- 1443 Printer Model N1 (byte or block).
- 3203 Printer Model (byte or block).
- 3211 Printer Model 1 via the 3811 Printer Model 1 (byte or block).
- 3262 Printer Model 1 or 11 (attachment, 4321 or 4331 only).
- 3287 Printer Model 1, 2, 1C, or 2C (attachment).
- 3289 Printer Model 4 (attachment, 4321 or 4331 only).
- 3800 Printing Subsystem Model 1 (byte or block).
- 1255 Magnetic Character Reader Models 1, 2 and 3 (byte or block).
- 1419 Magnetic Character Reader Model 1 (byte or block).
- 1287 Optical Reader Models 1 to 5 (byte or block).
- 1288 Optical Reader Model 1 (byte or block).
- 3881 Optical Mark Reader Model 1, 2 or 3 (byte or attachment on 4331; byte or block on 4341).
- 3886 Optical Character Reader Model 1 or 2 (byte or block).
- 3890 Document Processor Models A1 to A6 and B1 to B6 (byte or block).

Many of these devices are described in the following paragraphs. For information on the other equipment listed above, please refer to Report 70C-491-06 (303X Series).

3410/3411 MAGNETIC TAPE SUBSYSTEM: These compact, low-cost tape units, designed primarily to bring magnetic tape capabilities to the small-scale systems such as the IBM System/3 Model 10, are also available for use with the 4300 Series. The 3410 is a tape unit only, while the 3411 contains both a tape unit and the subsystem control unit. The 3410 and 3411 are available in three models, whose principal characteristics are as follows:

	Model 1	Model 2	Model 3
Tape speed, inches/sec.	12.5	25	50
Recording density, bpi	1600	1600/800	1600/800
Data rate, bytes/sec.:			
At 1600 bpi (phase-encoded)	20,000	40,000	80,000
At 800 bpi (NRZI)	Not avail.	20,000	40,000

All three models use half-inch tape recorded in the standard IBM 9-track formats. A 3411 Model 1 Magnetic Tape Unit and Control can accommodate up to three additional 3410 Model 1 Magnetic Tape Units for a maximum subsystem capacity of four tape drives. A 3411 Model 2 can control up to five additional 3410 Model 2 units, and a 3411 Model 3 can control up to five additional 3411 Model 3 units. Models cannot be intermixed within a subsystem. Every 3410 and 3411 tape unit must be equipped with either the Single

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Density (1600 bpi) or Dual Density (1600 or 800 bpi) feature; the Dual Density capability is not available for the Model 1 units.

8809 MAGNETIC TAPE UNIT: Introduced with the IBM 8100, this unit transports tape directly from reel to reel without capstans or vacuum columns, with tape tension and velocity controlled electronically. The 8809 uses standard 1/2-inch, 9-track tape on up to 10.5-inch reels (2400 feet). Recording density is 1600 bpi, phase-encoded. The 8809 works in one of two operating modes, selectable by the 4300 processor. In start/stop mode, the 8809 runs at 12.5 inches per second to achieve a data transfer rate of 20,000 bytes per second. In streaming mode, the 8809 runs at 100 inches per second to achieve a transfer rate of 160,000 bytes per second. Tapes written in either the start/stop or streaming mode have the same format. Up to six 8809 drives can be connected to the 8809 Magnetic Tape Unit Adapter on the 4321 or 4331 processors only. The first drive must be the 8809 Model A1; the second, fourth, and sixth drives must be the 8809 Model 2; and the third and fifth drives must be the 8809 Model 3.

5424 MULTI-FUNCTION CARD UNIT (MFCU): For use with the 4331 Model Group 2 only, via the 6510 attachment on the 5424 and the 3901 Adapter on the 4331. Combines the functions of a 96-column card reader/punch, collator, and interpreter in a single unit. Consists of two 2,000-card feed hoppers, a read station, and four 600-card stackers. Cards fed from either or both hoppers can be read, punched, printed and fed into any of the four stackers under program control. Card sorting is also possible through the use of a multiple-pass sorting technique. The 5424 is offered in two models. Cards are read serially at 250 cpm in Model A1 and 500 cpm in Model A2. Punching is performed serially at 60 cpm in Model A1 and 120 cpm in Model A2 when printing in any or all of the first three line positions on each card. There is a fourth line position, which, if used, causes the printing speed to drop to 48 cpm for Model A1 and 96 cpm for Model A2. Each of the 4 lines can hold up to 32 printed characters.

1403 PRINTER: Provides high-quality printed output by means of a horizontal chain or train mechanism. The standard character set contains 48 characters, and the Universal Character Set (a no-charge option for Model 2 or N1 only) permits up to 240 characters to be printed. Line spacing of 6 or 8 lines per inch is operator-controlled. Standard skipping speed is 33 inches per second; a dual-speed carriage in Models 2 and N1 permits a speed of 75 inches per second on skips of more than 8 lines.

Models 2, 7, and N1 of the 1403 Printer can be connected to any 4331 or 4341 processor via the 2821 Control Unit. Characteristics of the three models are as follows:

- Model 2: 600 lpm (750 lpm maximum with UCS option), 132 print positions;
- Model 7: 600 lpm, 120 print positions; and
- Model N1: 1100 lpm (1400 lpm maximum with UCS Option), 132 print positions; requires the 1416 Interchangeable Train Cartridge.

1443 PRINTER, MODEL N1: Uses a horizontally oscillating typebar. Rated speed is 240 lpm with the standard 52-character set. Standard model has 120 print positions, with 24 more positions available as an option. Selective Character Set Feature permits the use of other interchangeable typebars; speeds range from 200 lpm for a 63-character set to 600 lpm for a 13-character set. The 1443 N1 includes an integrated control unit. It can be used with the 4331 and 4341 processors only.

3203 MODEL 5 PRINTER: Uses IBM's proven horizontal-train printing technology to produce high-quality printed output. The 3203 is an improved version of the 1403 Model N1 Printer and uses the same 1416 Interchangeable Train Cartridge. The 3203 Model 5 has a rated print speed of 1200 lpm with the standard 48-character set. The print speed can vary depending upon the frequency of character repetition on the cartridge. The Universal Character Set Feature, with a 240-position buffer, is standard. All models have 132 print positions. Horizontal spacing is 10 characters/inch, and vertical spacing is 6 or 8 lines/inch. Forms ranging from 3.5 to 20 inches in width and from 3 to 24 inches in length can be fed.

The 3203 Model 5 Printer contains an integrated controller and can be connected to any 4331 or 4341 processor via an available control unit position on either a byte or block multiplexer channel. It is not available on the 4321.

3262 PRINTER: An interchangeable-belt printer that is available in two models. Model 1 is rated at 650 lpm with a 48-character belt, 467 lpm with a 64-character belt, and 364 lpm with a 96-character belt. Model 11 is rated at 325 lpm with a 48-character belt, 230 lpm with a 64-character belt, and 180 lpm with a 96-character belt. The 3262 has 132 print positions, horizontal spacing of 10 characters/inch, and vertical spacing of 6 or 8 lines/inch under system control. Forms skipping and spacing are program-controlled. The carriage is a single-speed unit allowing skipping at up to 20 inches per second. Forms tractors are standard on the 3262, allowing the use of paper up to 16 inches wide. Also standard is a 288-character Universal Character Set buffer. The 3262 Model 1 or 11 connects to the 4321 or 4331 processor via the standard Display/Printer Adapter; it is not available with the 4341.

3289 MODEL 4 PRINTER: An interchangeable-belt printer that provides printing at up to 400 lpm with a 48-character set, 300 lpm with a 64-character set, and 230 lpm with a 94-character set. A variable-width forms tractor for feeding marginally punched continuous forms (one to six parts) up to 15 inches in overall width is provided. The 3289 provides these standard functions: paper jam detection, front forms loading, Universal Character Set buffer, and vertical channel selection under 4321 or 4331 control. The unit has 132 print positions, character spacing of 10 characters/inch, and line spacing of 6 or 8 lines/inch. The 3289 Model 4 connects to the 4321 or 4331 processor via the standard Display/Printer Adapter; it is not available with the 4341.

3287 PRINTER: Bidirectional serial matrix printer available in four models. The Model 1 and 1C are rated at 80 cps, and the Model 2 and 2C are rated at 120 cps. Models 1C and 2C can print in black, blue, green, or red. Models 1 and 2 print in black only. Character spacing on all models is 10 characters/inch, and line spacing is 6 or 8 lines/inch. The printers have 132 print positions; however, when using the multicolor ribbon on Models 1C or 2C, only 120 print positions can be printed. The 3287 printers connect to the 4321 or 4331 processor via the Display/Printer Adapter or to the 4341 processor as a console printer.

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 Report 70D9-491-20 in Volume 2.

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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 Reports 70D1-491-45, 70D2-491-11, 70D3-491-46, and 70D4-491-43 in the Peripherals section of DATAPRO 70 (Volume 2).

COMMUNICATIONS CONTROL

The principal communications control unit for the IBM 4321 and 4331 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 can also serve as alternatives to the Communications Adapter when more than eight lines must be connected to a 4331. Loop Adapters are also available for the 4331. Other available communications control units for both the 4331 and the 4341 include the older 2701 Data Adapter Unit, which connects up to four lines, and the 3791 Controller, which serves as an intelligent base for local workstations of the 3790 Communication System.

4321 COMMUNICATIONS ADAPTER: A standard feature on the 4321, the Integrated Communications Adapter supports three BSC or SDLC communications lines. Line speeds range from 1200 to 9600 bits per second. The SDLC protocol is supported by ACF/VTAME operating under SSX/VSE. Each communications line has one Line Attachment Base for clocked modems and one EIA/CCITT interface for external modems. The communications adapter provides the following functions: auto answer, autopoll operation, multipoint central station functions, multipoint tributary station functions for BSC only, EBCDIC Transparent mode for BSC only, and EBCDIC/ASCII code for BSC only.

Certain parameters for each line can be configured from the operator console. These include selected stand-by, half-speed operation, NRZI mode in SDLC Mode, error index byte mode for BSC lines, ASCII code instead of EBCDIC code for BSC lines, and tributary station addresses for BSC lines. The following parameters can be configured at installation time and set by the IBM CE: BSC or SDLC protocol per line, duplex instead of half-duplex transmission, switched network facility instead of non-switched, new sync for multipoint primary station functions, and connect data set to line or data terminal ready procedure.

4331 COMMUNICATIONS ADAPTER: This feature is standard on the 4331 Model Group 11 and optional on the Model Group 2. It provides for the direct attachment of up to eight BSC, start/stop, or SDLC communications lines in any combination. (At any given time, the "any combination" may be two of the three available types.) The aggregate data rate capacity may not exceed 64,000 bits per second. For seven of the eight lines, the data rate per line may not exceed 9600 bps. The eighth line may be a BSC or SDLC high-speed line with 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 eight lines attached to the communications adapter may have these optional features in addition to the high-speed line feature (4720) already mentioned: up to eight line features without internal clock for attachment to external modems with (4695) or without (4696) clock (data circuit-terminating equipment); up to eight line features with integrated 1200-bps modems (nonswitched, 4781; switched with auto answer, 4782; nonswitched with switched network backup and manual answer, 4787; nonswitched with switched network backup and auto answer, 4788); up to eight line features with local attachments (4801); up to eight line features wth digital data service adapters (5650); and auto-call unit interfaces for up to two of the installed lines (1020).

Certain configuration parameters for each line may be specified from the display console keyboard. 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 (two-way alternate data flow transmission), switched network facility instead of nonswitched lines for external modems, new sync for BSC or SDLC in multipoint primary station function only, connect data set to line or data terminal ready procedure, and selection of WE202 or V.23 answer tone frequencies for 1200-bps integrated modems with automatic answering.

The 4331 Communications Adapter supports communications with virtually all of the current IBM terminals, systems, and communications controllers in one or more of the three transmission modes: SDLC, BSC, or start/stop.

4331 LOOP ADAPTERS: Provide the capability to attach certain terminals and control units to a 4331 Model Group 2, 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 following devices can be connected to direct 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 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 4331 supports one Loop Adapter 1, one Loop Adapter 2, and up to two Data Link Adapters. The loop and data link adapters are mutually exclusive with the 5424 Adapter.

3705 COMMUNICATIONS CONTROLLER: This programmable front-end network processor can be connected to either a byte or block multiplexer channel on a 4331 or 4341 processor.

The 3705 consists of a Basic Module and up to three Expansion Modules. The Basic Module houses the Central Control Unit and Control Panel. Also contained in these

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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.

In March 1981, IBM announced the entry-level 3705-80 series, which consists of Models 81, 82, and 83. The 3705-80 has 256K bytes of storage and supports 4, 10, or 16 communications lines. The 3705-80 can be used as a front-end communications processor or as a remote concentrator linked to a local 3705-II Controller.

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.

For further details on the 3705 Communications Controllers, please refer to Report 70C-491-06 (303X Series).

3704 COMMUNICATIONS CONTROLLER: The 3704 is a smaller version of the 3705 that can be connected to a byte multiplexer channel on either a 4331 or 4341 processor. The 3704 is available in only four models with a main memory capacity of 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.

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 processors. In the latter instance, 3275 emulation is performed by microcode in the host 4331.

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 or 4331 system, ROCF suppresses the activities of all devices attached to the Display/Printer Adapter. When MVS/OCCF is used to initialize a remote 4341 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 VM system has been initialized, continued control can be provided by the Programmable Operator Facility of VM/SP Release 2.

7770 AUDIO RESPONSE UNIT: Provides audio responses, in recorded human-voice form, to digital inquiries from pushbutton telephones or other inquiry-type terminals. Handles a maximum of 48 lines, any or all of which can be active simultaneously. Has a 32-word basic vocabulary, expandable in 16-word increments to a maximum of 128 words. Receives inquiry messages and forwards them to the processing unit, which processes each message and composes an appropriate reply. The 7770 then converts the reply into a sequence of English words which are read from its magnetic drum and transmitted to the inquirer.

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.

Any program written for the IBM 4331 Processor in ECPS:VSE mode or System/370 mode will operate on the 4341 Processor provided it follows the above rules.

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, and OS/VS2 (MVS).

DOS/VSE: This extended disk-resident operating system provides enhancements over IBM's older DOS/VS in the

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specific areas of processor support, hardware features, device support, usability improvements, and serviceability.

DOS/VSE supports the System/370 mode and the ECPS:VSE Mode of the 4300 processors. When operating in ECPS:VSE Mode, DOS/VSE takes advantage of the 4300 processor's concept of relocating channels and page management. To support the hardware extensions to page management, the DOS/VSE assembler has additional privileged instructions.

The basic DOS/VSE system provides the capability for multiprogramming of five concurrent job streams, which will typically include the VSE/POWER spooler, a real-time subsystem such as CICS/VS, one or two batch job streams, and an unscheduled work partition for jobs that require fast turnaround. The system's capabilities can be significantly expanded through the addition of the VSE/Advanced Functions program product.

The VSE/Advanced Functions (AF) Release 1 and 2 (5646-XE8) add functions to DOS/VSE in the areas of performance, usability, and installation and maintenance. AF is required for most of the program products available with DOS/VSE. Release 1 of AF provides seven partitions for all SYSRES DASD types, support of the 3310/3370/3375 DASD with VM/370 on 4300 processors in System/370 mode, and an implicit link function for reducing the number of job control statements an application programmer needs to code for program compilation and testing. AF Release 2 provides all the functions of AF Release 1 plus DASD sharing across processors, support for up to 12 partitions and 208 user tasks, and extended label area support.

Device support within DOS/VSE includes the 5424 Multi-Function Card Unit, the 3287 Console Printers, 3289 Model 4 Line Printer, 3278 Model 2A Operator Console, 3279 Model 2C Color Display Console, the 8809 Magnetic Tape Unit, and the 3310/3370/3375 DASD units. In conjunction with the new DASDs, DOS/VSE provides support for ISAM via VSAM and the ISAM Interface Program. Support of the 3310 and 3370 is provided in the ECPS:VSE mode only, unless operation is under VM/370. Support for the 3310 and 3370 is enhanced by utilities provided with DOS/VSE; these include the Surface Analysis Utility and the VSE/Fast Copy Data Set Program. Changes in support for the 3800 Printing Subsystem include merging part of the 3800 ICR into DOS/VSE.

Unlike DOS/VS, where the interval timer is employed, DOS/VSE makes use of the time-of-day clock and the clock comparator. Job accounting times are calculated through the CPU timer. IBM claims these changes result in more accurate reporting without an effect on user interfaces.

DOS/VSE extends the use of alternate-path I/O from magnetic tape to DASD. If a DASD device is attached to a processor via two channels, DOS/VSE automatically switches to the second channel if the first one is busy. DOS/VSE also provides several improvements in user interfaces. These include simplified command syntax for IPL and JCL, reduction in the number of supervisor generation options, and a VOLUME JCL command for displaying DASD information. IBM has also added an Extent macro for DOS/VSE data management routines. This macro allocates extent information for all DASD types for DASD file protection.

The DOS/VSE supervisor has been enhanced in at least six specific areas. First, supervisor services for I/O operations have been improved by shortening the I/O interrupt path length. Second, the number of logical unit blocks has been increased; under DOS/VSE, up to 255 symbolic logical units per partition are available. Third, the use of job information blocks for file protection information has been eliminated. Fourth, a symbolic interface is provided to programs processing label information, such as OPEN and CLOSE routines. The interface provides a label area space that is dynamically managed to satisfy the individual requirements of each partition. This label area space is somewhat larger than in DOS/VS. Fifth, besides a channel command block, an I/O request block can be specified which contains a list of addresses (fixlist). By specifying the I/O area explicitly in the fixlist, the performance of the supervisor can be increased when running in ECPS:VSE mode. Finally, a system function now performs loading of modules into the SVA at IPL time without any user action. The user may add additional modules at any job control time.

The minimum main storage requirement for the DOS/VSE supervisor in System/370 mode is 112K bytes of which 24K bytes can be made pageable. In ECPS:VSE mode, the minimum requirement is 106K bytes, of which 26K bytes can be made pageable. (These minimum sizes can be reduced by approximately 18K bytes if part of the supervisor is made pageable at IPL time.)

SMALL SYSTEMS EXECUTIVE/VSE (SSX/VSE): A subset of DOS/VSE, SSX/VSE 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 4321 or 4331 processors operating in standalone or distributed environments. Prompts and procedures are provided to aid in installation, operation, program development, and service related activities. According to IBM, a standalone SSX/VSE system can be installed in two hours or less.

SSX/VSE 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, CICS/VS table maintenance, and system operation support such as job creation and submission and backup and recovery; 3) 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.

Pregenerated DOS/VSE-based components include: basic system control; spooling and RJE networking based on VSE/POWER Version 2; on-line control based on CICS/DOS/VS; interactive control based on VSE/ICCF and IPF; terminal and network control based on ACF/VTAME; data management based on VSE/VSAM; utilities based on DOS/VS Sort/Merge, VSE/DITTO, and VSE/Fast Copy Data Set Program; operator support based on VSE/OCCF; and problem determination support based on VSE/IPCS.

The standard programming language is DOS/VS Cobol. Also available are SSX/VSE prompter-supported program products, which are DOS/VSE licensed programs that have been adapted to, and tested under, SSX/VSE. These prompter-supported program products include the SSX/VSE PL/1 Optimizing Compiler and Libraries, SSX/VSE PL/1 Transient Library, SSX/VSE RPG II, and DL/1 SSX/VSE. RPG II is supported for batch programming only.

The minimum hardware configuration required for the installation and operation of SSX/VSE consists of a 4321 or 4331 processor with one megabyte of main memory, one 3278 or 3279 System Console, one additional 3278 or 3279 Display Station, one 3289 Model 4 or 3262 Line Printer, one 8809 Magnetic Tape Unit, either two 3310 Direct Access

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Storage Devices or, on the 4331 only, one 3370 Direct Access Storage Device, and the associated integrated I/O adapters.

VM/370 RELEASE 6: Announced with the 4300 Series computers in January 1979, this release of IBM's Virtual Machine Facility/370 (VM/370) is an operating environment that manages a computer system's facilities in such a way that each of many users has at his or her disposal the functional equivalent of a dedicated computer system. A detailed description of VM/370 can be found in Report 70C-491-06 (IBM 303X Series).

VM/370 Release 6 provides support for the 4331 and 4341 processors in System/370 mode, as well as for the channel-attached 3203 Model 5 Printer. The 3800 Printing Subsystem can be supported as either a dedicated device or a VM/370 spooling device. Journaling and security enhancements optionally track unsuccessful LOG ON and all LINK attempts. Masking of LOG ON and LINK passwords can be forced as an installation option. A final enhancement provides a new CP command that allows messages to be sent to a virtual machine's storage.

ECPS:VM/370, an optional hardware assist feature for the 4300 Series processors, reduces the CPU time required to execute certain frequently used supervisor functions of VM/370 Release 6.

The *VM/Basic System Extensions, Release 2,* (5748-XX8), include major Conversational Monitor System (CMS) improvements such as an interactive "HELP" facility, file system enhancements, and the upgrade of CMS/DOS to DOS/VSE. Several Control Program enhancements are provided for improved system performance, and support is provided for the 3289 Model 4 Printer, the 8809 Magnetic Tape Unit, and the 3310 and 3370 Direct Access Storage Devices. In addition, the *VM/System Extensions* (5748-XE1) provide a resource manager function, enhanced shadow page and shadow segment table management, and support of MVS/SE.

The *VM/System Product* (VM/SP), 5664-167, contains all of the functions currently available in Release 2 of both the VM/Basic System Extensions and VM/System Extensions program products, as well as the following previously announced capabilities: multiprocessor support, enhanced support for attached processors, a new CMS editor and EXEC interpreter, an enhanced CMS HELP facility, a CMS OS LOADER capability, full screen console support via an SIO interface, enhanced CP spooling, a single console image facility, an IPL command enhancement, a new inter-user communication capability, and support for the 3278 Model 5 and 3279 display terminals. Other VM/SP enhancements include support for the 4331 Model Group 2 Processor and the 3375 and 3380 Direct Access Storage devices; enhanced DASD support; enhanced support for the 3270 Information Display System; new functions to enhance the integrity, security, and reliability of the VM/SP systems; enhanced SPTAPE command support; support for MVS/SP-JES2 and MVS/SP-JES3 as guest operating systems; CMS support of the LKED command for OS application program development; and an upgrade of CMS/DOS program execution support to the Release 2 levels of the VSE/Advanced Functions and VSE/VSAM.

The *VM/System Product Release 2,* announced in October 1981, includes all of the functions of Release 1, plus the following enhancements: programmable operator support, new CMS functions for the end user, new CMS productivity aids, DIAL command support for BSC 3270 users, a restructured CMS nucleus, removal of the CMS tokenization eight-byte restriction, starter system full screen support, enhanced HELP file installation, CMS/DOS upgrade to VSE/Advanced Functions, a command retrieve capability, an enhanced Query command, enhanced ASCII support, enhanced 3800 support, and a Trace Table recording facility.

OS/VS1 RELEASE 7: This release of IBM's OS/VS1 operating system, which is described in Report 70C-491-06 (IBM 303X Series), provides support for the 4331 and 4341 processors in the System/370 mode, with the ECPS:VS1 hardware assist feature on the 4341 providing improved performance of certain frequently executed OS/VS1 supervisor functions through microcoding. Improvements to the OS/VS1 SCP include a new SYSOUT display command, concatenated procedure libraries, allocation deserialization, graphics console roll/delete, page supervisor preferred pages, non-zero memory VM/370 IPL, and enhanced automatic volume recognition. OS/VS1 has also been improved through message enhancements, list/search technique, RQE serviceability, and IOS short-term fix/long-term fix. Device support for the 3203 Model 5 Printer and the 3880 Storage Control is now a part of OS/VS1.

The *OS/VS1 Basic Programming Extensions* (5662-257) provide support for the 4331 and 4341 Model Group 2 processors, the 3262 Printer Model 1 and 11, and the 3375 Direct Access Storage unit. Additional enhancements include an improved dump facility, VM/VTAM Communications Network Applications support, and support for the Data Facility/Device Support program, which provides a new indexed volume table of contents (VTOC) for improved system performance.

OS/VS2 (MVS): In July 1980, IBM announced MVS support for the 4341 processors. A no-charge option, ECPS:MVS, provides new privileged instructions that enable the 4341 processor to utilize either of two VMS/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. For 4341 Model Group 2 processors, ECPS:MVS has been enhanced to include cross memory services, the page fault assist function, and the ADD FRR (Functional Recovery Routine) instruction.

RMF (Resource Measurement Facility) support for the 4341 is provided by RMF Version 2 Release 3. The ECPS:MVS, ECPS:VM/370, and ECPS:VS1 options on the 4341 are mutually exclusive—except that a 4341 Model Group 2 equipped with the ECPS Expansion feature can operate concurrently in ECPS:MVS and ECPS:VM/370 modes.

For additional details on MVS, please refer to Report 70C-491-06 (IBM 303X Series).

OTHER SOFTWARE FACILITIES: Enhancements to other IBM software products supplied with DOS/VSE, VM/370 Release 6, and OS/VS1 Release 7 are summarized below. Detailed descriptions of most of these products can be found in Report 70C-491-06 (IBM 303X Series).

Some of the facilities available in conjunction with *DOS/VSE* and *DOS/VSE AF* include ACF/VTAME; VSE/POWER for spooling; Job Entry and File Transfer programs; the VSE/3270 Bisync Pass Through, which allows a 4300 processor to appear as a remotely attached BSC 3271 control unit to an IBM System/370, 303X, or another 4300 host computer; a DOS/VSE Remote Job Entry Workstation facility; the VSE/IPCS (Interactive Problem Control System) required to aid in problem determination by the regional support centers in the new IBM support plans; BTAM-ES (Extended Support); 1400

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Emulation; and the ability for DOS/VSE to run together with VM/370 to provide CMS interactive facilities and virtual machine functions.

Additional data mangement facilities are also available with DOS/VSE. A newer version of DL/1 DOS/VS supports the 3310 and 3370/3375 disk devices, as well as supporting RPG II applications and running with the VSE/ICCF (Interactive Computing and Control Facility). Also available is a VSE/VSAM access method, a VSE/Fast Copy Data Set utility, VSE/DITTO, support for CICS/DOS/VS Release 1.4, the DB/DC Data Dictionary Release 3, and support for IBM's relational data management system, SQL/Data System.

To assist the DOS/VSE user in improving productivity, IBM offers the VSE/ICCF program product, mentioned above, which is the successor to the popular DOS/VS ETSS-II (Entry Time-Sharing System) field-developed product. DMS/CICS/VS (Development Management System) replaces the Display Management System program product available to DOS/VS users. VS/APL support has been extended to the 4300 Series computers, as has support for all standard and extended IBM programming language compilers, sort/merges and utilities available with DOS/VS.

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 pre-applied, and ready to use in specific operating environments. IPO/E is provided for DOS/VSE, OS/VS1 Release 7, and VM/370 Release 6. Optional features, such as additional program products, can be integrated into the base IPO via an interactive prompter.

In addition to supporting DL/1 DOS/VS and VSE/VSAM, *VM/370 Release 6* supports VS/IFS (Interactive File Sharing), which allows multiple CMS users to share VSAM data sets; VM/Directory Maintenance, for management of the VM/370 directory; Display Management System/CMS; the Query-By-Example (QBE) interactive end-user query language; SPF/CMS (Structured Programming Facility/CMS); the DES (Display Editing System); high-level language support; and IPO/E. There is one IPO/E that supports a standalone and guest SCP environment, and a VM/DOS/VSE System IPO/E that supports DB/DC and DC environments.

Two of the communications-oriented enhancements available with *OS/VS1 Release 7* include: RES (Remote Entry Services) a component of OS/VS1 which allows jobs and commands to be submitted from remote terminals, with output returned; and HRNES (Host Remote Node Entry System), which allows an OS/VS1 system to be a remote job entry station to any MVS/JES2 or SVS/HASP system or to another OS/VS1 system. Operation is not dedicated; batch and on-line applications can be run concurrently.

ACF/VTAM and ACF/TCAM are both supported under Release 7, as is the NCCF (Network Communication Control Facility) and the Cryptographic Subsystem. OS/VS1 Release 7 will support IMS/VS Version 1.1.5, CICS/OS/VS Version 1.4, IMS and CICS Aids, the DL/1 Data Language, VSAM, and the DB/DC Data Dictionary. DMS/CICS/VS, CICS/VS, VSPC personal computing capabilities, and CADAM (Computer-Graphic Augmented Design and Manufacturing system) can be implemented under OS/VS1. The various compilers and utilities are also supported. The System IPO for OS/VS1 includes Release 7, IMS/VS, ACF/NCP/VS, ACF/VTAM, and CICS/VS.

OS/VS1 also supports the Direct Access Device Migration Aid, a tool that facilitates the migration of data and programs to the 3375 DASD, and the Data Facility/Data Set Services, a dump/restore program product that supports the 3375. (OS/VS1 does not support the 3380 DASD.)

Additional software facilities for *OS/VS2 (MVS)* include: Data Facility/Device Support, which provides an indexed VTOC for improved system perormance; Data Facility/Extended Functions, a functional replacement for VSAM master catalogs, VSAM user catalogs, and OS control volumes; Data Facility/Data Set Services, a dump/restore program that supports the 3375 and 3380 direct-access storage devices; the Direct Access Storage Device Migration Aid, which facilitates the migration of MVS data and programs to the 3375 and 3380; the Hierarchical Storage Manager, which manages 3330/3350/3375/3380 DASD devices, 3420 tape drives, and the 3850 Mass Storage System; and the MVS/Operator Communication Control Facility (MVS/OCCF), which allows one or more remote MVS systems to be operated from a host MVS system.

PRICING

POLICY: The 4321 is available for purchase only. IBM offers the 4331 and 4341 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 November 1981, IBM introduced a volume purchase discount plan for the 4300 Series. A discount of 6 percent is offered on the purchase of 5 to 9 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 8:0 a.m. Monday)	4	7	9	11	12

*Outside of the hours 7:00 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 $126 per hour, and during off hours the charge is $145 per hour.

SOFTWARE: IBM 4300 Series users receive the basic DOS/VSE, OS/VS1 Release 7, VM/370 Release 6, or

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OS/VS2 (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 $135 per hour during regular hours and $155 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 he gets advice on temporary fixes or bypasses.

The Support Center is the first level of support. If it 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 4321 SYSTEM: Includes a 4321 Processor with one megabyte of main memory, two 3278-2A Operator Consoles with keyboards, a 3310 DASD Model A2 with attached Model B2 (258 megabytes), two 8809 Magnetic Tape Units, a 650-lpm 3262 Model 1 Printer, and integrated tape and disk adapters. Purchase price is $165,841.

TYPICAL 4331 GROUP 11 SYSTEM: Includes a 4331 Model K11 Processor with two megabytes of main memory and two I/O channels, two 3278-2A Operator Consoles with keyboards, a 3310 DASD Model A2 with attached Model B2 (258 megabytes), four 8809 Magnetic Tape Units, a 2520 Card Read Punch, two 650-lpm 3262 Model 1 Printers, and integrated tape and disk adapters. Purchase price is $300,097 and the monthly charge on a two-year lease is $10,474.

TYPICAL 4341 GROUP 10 SYSTEM: Includes a 4341 Model L10 Processor with four megabytes of main memory and three I/O channels, two 3278-2A Operator Consoles with keyboards, 3287 Model 1 Console Printer, two 3370 DASDs (1140 megabytes), a 3880 Model 1 Storage Control, six 3420 Model 3 Magnetic Tape Units (120KBS), a 3803 Model 1 Tape Control, a 2520 Card Read Punch, and a 1200-lpm 3203 Model 5 Printer. Purchse price is $585,025 and the monthly charge on a two-year lease is $19,701.

TYPICAL 4341 GROUP 2 SYSTEM: Includes a 4341 Model N2 Processor with 12 megabytes of main memory and 6 I/O channels, two 3278-2A Operator Consoles with keyboards, 3287 Model 2 Console Printer, a 3380 DASD Model A4 (2.5 billion bytes), a 3880 Model 2 Storage Control, eight 3420 Model 3 Magnetic Tape Units (120KBS), a 3803 Model 1 Tape Control, a 2520 Card Read Punch, and two 1200-lpm 3203 Model 5 Printers. Purchase price is $991,230 and the monthly charge on a two-year lease is $31,613.

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Monthly Rental Charge*	Monthly Lease Charge (2-Year Lease)*
PROCESSORS AND UPGRADES					
4321 J11	Processor with 1,048,576 bytes of main memory, one DASD Adapter, one 8809 Magnetic Tape Unit Adapter, one Display/Printer Adapter, one Communications Adapter Base, and three Line Adapter Bases	$ 85,000	$ 295.00	$ —	$ —
4331 J11	Processor with 1,048,576 bytes of main memory, 4K-byte buffer, one byte and one block multiplexer channel, one DASD Adapter, one 8809 Magnetic Tape Unit Adapter, one Display/Printer Adapter, one Communications Adapter Base, and three Line Adapter Bases	109,650	324.00	4,880	4,155
4331 K11	Same as 4331 J11, but with 2,097,152 bytes of main memory	125,350	350.00	5,430	4,625
4331 J2	Processor with 1,048,576 bytes of main memory and 8K-byte buffer	125,000	303.00	5,810	4,945
4331 K2	Same as 4331 J2, but with 2,097,152 bytes of main memory	140,700	329.00	6,360	5,415
4331 KJ2	Same as 4331 J2, but with 3,145,728 bytes of main memory	156,400	355.00	6,910	5,885
4331 L2	Same as 4331 J2, but with 4,194,304 bytes of main memory	172,100	381.00	7,460	6,355

*Rental/lease prices include equipment maintenance.

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Monthly Rental Charge*	Monthly Lease Charge (2-Year Lease)*
PROCESSORS AND UPGRADES (Continued)					
4341 K10	Processor with 2,097,152 bytes of main memory and 4K-byte buffer	178,000	575.00	8,560	7,285
4341 L10	Same as 4341 K10, but with 4,194,304 bytes of main memory	209,400	627.00	9,676	8,235
4341 K1	Processor with 2,097,152 bytes of main memory and 8K-byte buffer	225,000	601.00	9,729	8,280
4341 L1	Same as 4341 K1, but with 4,194,304 bytes of main memory	256,400	653.00	10,845	9,230
4341 K11	Processor with 2,097,152 bytes of main memory and 8K-byte buffer	275,000	750.00	12,150	10,340
4341 L11	Same as 4341 K11, but with 4,194,304 bytes of main memory	306,400	802.00	13,266	11,290
4341 M11	Same as 4341 K11, but with 8,388,608 bytes of main memory	369,200	906.00	15,498	13,190
4341 K2	Processor with 2,097,152 bytes of main memory and 16K-byte buffer	359,000	879.00	14,653	12,470
4341 L2	Same as 4341 K2, but with 4,194,304 bytes of main memory	390,400	931.00	15,769	13,420
4341 M2	Same as 4341 K2, but with 8,388,608 bytes of main memory	453,200	1,035.00	18,001	15,320
4341 N2	Same as 4341 K2, but with 12,582,912 bytes of main memory	516,000	1,139.00	20,233	17,220
4341 P2	Same as 4341 K2, but with 16,777,216 bytes of main memory	578,800	1,243.00	22,465	19,120
System upgrades:					
	4321 to 4331 J11	24,650	—	—	—
	4321 to 4331 K11	40,350	—	—	—
	4331 J11 to 4331 K11	15,700	—	—	—
	4331 J11 to 4331 J2	37,003	—	—	—
	4331 J11 to 4331 K2	52,703	—	—	—
	4331 J11 to 4331 KJ2	68,403	—	—	—
	4331 J11 to 4331 L2	84,103	—	—	—
	4331 K11 to 4331 K2	37,003	—	—	—
	4331 K11 to 4331 KJ2	52,703	—	—	—
	4331 K11 to 4331 L2	68,403	—	—	—
	4331 J2 to 4331 K2	15,700	—	—	—
	4331 J2 to 4331 KJ2	31,400	—	—	—
	4331 J2 to 4331 L2	47,100	—	—	—
	4331 K2 to 4331 KJ2	15,700	—	—	—
	4331 K2 to 4331 L2	31,400	—	—	—
	4331 KJ2 to 4331 L2	15,700	—	—	—
	4341 K10 to 4341 L10	31,400	—	—	—
	4341 K10 to 4341 K11**	79,210	—	—	—
	4341 K10 to 4341 L11**	110,610	—	—	—
	4341 K10 to 4341 M11**	173,410	—	—	—
	4341 L10 to 4341 L11**	79,210	—	—	—
	4341 L10 to 4341 M11**	142,010	—	—	—
	4341 K1 to 4341 L1**	31,400	—	—	—
	4341 K1 to 4341 K11**	42,210	—	—	—
	4341 K1 to 4341 L11**	73,610	—	—	—
	4341 K1 to 4341 M11**	136,410	—	—	—
	4341 L1 to 4341 L11**	42,210	—	—	—
	4341 L1 to 4341 M11**	105,010	—	—	—
	4341 K1 to 4341 K2**	116,210	—	—	—
	4341 K1 to 4341 L2**	147,610	—	—	—
	4341 K1 to 4341 M2**	210,410	—	—	—
	4341 K1 to 4341 N2**	273,210	—	—	—
	4341 K1 to 4341 P2**	336,010	—	—	—
	4341 L1 to 4341 L2**	116,210	—	—	—
	4341 L1 to 4341 M2**	179,010	—	—	—
	4341 L1 to 4341 N2**	241,810	—	—	—
	4341 L1 to 4341 P2**	304,610	—	—	—
	4341 K11 to 4341 L11	31,400	—	—	—
	4341 K11 to 4341 M11	94,200	—	—	—
	4341 L11 to 4341 M11	62,800	—	—	—
	4341 K11 to 4341 K2	84,000	—	—	—
	4341 K11 to 4341 L2	115,400	—	—	—

*Rental/lease prices include equipment maintenance.
**Requires Feature 1870.

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EQUIPMENT PRICES

	Purchase Price	Monthly Maint.	Monthly Rental Charge*	Monthly Lease Charge (2-Year Lease)*
PROCESSORS AND UPGRADES (Continued)				
System upgrades:				
4341 K11 to 4341 M2	178,200	—	—	—
4341 K11 to 4341 N2	241,000	—	—	—
4341 K11 to 4341 P2	303,800	—	—	—
4341 L11 to 4341 L2	84,000	—	—	—
4341 L11 to 4341 M2	146,800	—	—	—
4341 L11 to 4341 N2	209,600	—	—	—
4341 L11 to 4341 P2	272,400	—	—	—
4341 M11 to 4341 M2	84,000	—	—	—
4341 M11 to 4341 N2	146,800	—	—	—
4341 M11 to 4341 P2	209,600	—	—	—
4341 K2 to 4341 L2	31,400	—	—	—
4341 K2 to 4341 M2	94,200	—	—	—
4341 K2 to 4341 N2	157,000	—	—	—
4341 K2 to 4341 P2	219,800	—	—	—
4341 L2 to 4341 M2	62,800	—	—	—
4341 L2 to 4341 N2	125,600	—	—	—
4341 L2 to 4341 P2	188,400	—	—	—
4341 M2 to 4341 N2	62,800	—	—	—
4341 M2 to 4341 P2	125,600	—	—	—
4341 N2 to 4341 P2	62,800	—	—	—
PROCESSOR FEATURES & CHANNELS				
Many of the features listed below include microcode as well as hardware. Microcode is supplied on diskettes.				
Features for the 4331 Model Group 11:				
1605 Line Group, Additional	6,070	31.50	239	196
3401 Diskette Drive	3,140	25.50	131	112
Features for the 4331 Model Group 2:				
1001 Adapter Power Prerequisite for Communications Adapter	2,140	9.00	89	76
1002 Adapter Logic Prerequisite for 5424 Adapter	3,930	16.50	165	140
1421 Block Multiplexer Channel	3,930	2.50	165	140
1422 Block Multiplexer Channel, Additional	3,930	2.50	157	133
1431 High-Speed Block Multiplexer Channel	5,610	3.00	255	218
2001 Display/Printer Adapter Expansion	1,085	2.50	38	33
3201 DASD Adapter; for 3310/3340/3370	3,215	4.50	136	115
3202 DASD Adapter, Additional	3,215	4.50	129	110
3401 Diskette Drive; reads IBM Type 1 Diskettes	3,140	25.50	131	112
3898 External Signals; for external interrupt	268	1.50	11	9
3901 5424 Adapter	5,890	11.50	248	211
3950 1401/1440/1460 Compatibility	NC	NC	NC	NC
4910 8809 Mag Tape Unit Adapter	3,215	4.50	136	115
5248 Byte Multiplexer Channel	3,140	2.50	131	112
5531 Power Interface	1,965	2.00	81	69
5532 Power Interface, Additional	982	2.00	41	34
7851 3340/3344 Direct Attachment	NC	NC	NC	NC
7901 Direct-Access Storage Compatibility; provides 2311/2314 emulation on 3310 or 3370 DASDs and 3330 emulation on 3370 DASDs	NC	NC	NC	NC
8701 ECPS: VM/370	NC	NC	NC	NC
Features for the 4341:				
1601 ECPS Expansion Feature (for 4341 Model Group 2 Processors only)	26,250	22.00	979	833
1850 Channel-to-channel adapter	23,150	29.00	852	725
1870 Optional channel group; three additional channels (for 4341 Group 1 and 10 Processors only)	17,790	6.00	656	558
1890 Channel control unit positions, additional	2,755	10.00	101	86
3088 Multisystem Channel Communication Unit:				
Model 1; connects to 4 processors	95,000	120	—	—
Model 2; connects to 8 processors	145,000	150	—	—
3838 Array Processor:				
Model 1; 256K bytes of bulk storage	553,600	1,810.00	23,188	21,080***
Model 2; 512K bytes of bulk storage	613,150	2,180.00	28,182	25,620***
Model 3; 1024K bytes of bulk storage	732,250	2,925.00	38,170	34,700***

*Rental/lease prices include equipment maintenance.
***Monthly charge on a 4-year lease.
NC—No Charge.

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Monthly Rental Charge*	Monthly Lease Charge (2-Year Lease)*
PROCESSOR FEATURES & CHANNELS (Continued)					
System Consoles:					
3278 2A	Display Console	2,505	24.50	110	94
3279 2C	Color Display Console	4,525	39.50	183	156
	4631 75-Key Operator Console Keyboard with channel-to-channel interface and operator control panel (for 4341)	1,085	7.00	45	38
	4632 Same as 4631 without channel-to-channel interface (for 4341)	1,010	7.00	43	37
	4633 Same as 4631 without operator control panel (for 4341)	524	6.50	20	17
	4634 Same as 4631 without channel-to-channel interface (for 4321 or 4331)	1,010	7.00	43	37
	6340 Security Keylock	35	—	—	—
MASS STORAGE					
3310	Disk Storage:				
	Model A1; 1 drive with controller; 64.5MB	10,710	80.50	507	432
	Model A2; 2 drives with controller; 64.5MB each	17,800	135.00	840	716
	Model B1; 1 drive; 64.5MB (for attachment to Model A2)	8,475	61.00	400	341
	Model B2; 2 drives; 64.5MB each (for attachment to Model A2)	15,565	117.00	733	625
3330	Disk Storage:				
	Model 1; 2 drives; 200MB	33,670	178.00	2,000	1,680
	Model 2; 1 drive; 100MB	20,110	105.00	1,193	1,015
	Model 11; 2 drives; 400MB	47,920	178.00	2,860	2,402
3333	Disk Storage and Control (up to three 3330 modules can be attached):				
	Model 1; 2 drives; 200MB	42,200	199.00	2,497	2,125
	Model 11; 2 drives; 400MB	56,450	199.00	3,355	2,855
3336	Disk Pack, Model 1	775	—	—	—
3336	Disk Pack, Model 11	1,150	—	—	—
3340	Direct Access Storage Facility; 34.9 or 69.8MB per drive:				
	Model A2; Two drives plus control	24,570	116.00	1,516	1,290
	Model B1; One drive	13,510	62.00	851	724
	Model B2; Two drives	17,200	100.00	1,073	913
	4301 Fixed-Head Feature (for 3340 A2 or B2)	1,165	2.50	63	54
	4302 Fixed-Head Feature (for 3340 B1)	583	2.00	33	28
	6201 Rotational Position Sensing (for 3340 B1)	467	1.50	26	22
	6202 Rotational Position Sensing (for 3340 or A2 or B2)	590	1.50	34	29
	6148 Remote Switch Attachment	NC	NC	NC	NC
	8150 String Switch for 3340 A2	4,915	15.00	302	257
3344	Direct Access Storage; 279.6MB per drive:				
	Model B2; Add-on Dual Disk Drive for 3340 Direct-Access Storage Facility	32,940	128.00	1,363	1,160
	Model B2F; Add-on Dual Disk Drive for 3340 Direct-Access Storage Facility with 2MB fixed-head storage	43,250	179.00	1,780	1,515
3348	Data Module (for 3340 drives):				
	Model 35; 34.9MB	1,600	Time & mat'l.	59	50
	Model 70; 69.8MB	2,200	Time & mat'l.	82	70
	Model 70F; 69.8MB of which 502,080 are served by fixed heads	4,400	Time & mat'l.	165	140
3350	Direct Access Storage; 317.5MB per drive				
	Model A2; Dual Disk Drive	41,600	170.00	1,710	1,455
	Model A2F; Dual Disk Drive with 2MB fixed-head storage	51,910	221.00	2,127	1,810
	Model B2; Add-on Dual Disk Drive	32,940	128.00	1,363	1,160
	Model B2F; Add-on Dual Disk Drive with 2MB fixed-head storage per drive	43,250	179.00	1,780	1,515
	Model C2; Two-drive disk storage and associated control	43,030	179.00	1,780	1,515
	Model C2F; Two-drive disk storage and associated control	53,340	230.00	2,197	1,870
	1320 Primary Controller Adapter (permits selection of A2/AF controller as on-line controller via manual switch on the C2/C2F)	286	1.50	13	11
	8150 String Switch for 3350 A2, A2F, C2, C2F	4,790	9.00	210	179
3830	Storage Control, Model 2; for 3330/3333, 3340/3344, or 3350 disk drives	23,200	166.00	2,285	1,919
	2150 Control Store Extension	5,365	14.00	527	443
	2151 Expanded Control Store; requires 2150	3,285	14.00	322	270
	6111 Register Expansion	312	4.50	31	26
	6148 Remote Switch Attachment	NC	NC	NC	NC
	6149 Remote Switch Attachment, Additional	NC	NC	NC	NC
	8170 Two-Channel Switch	2,290	14.00	223	187
	8171 Two-Channel Switch, Additional	2,290	14.00	223	187

*Rental/lease prices include equipment maintenance.
NC—No Charge.

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Monthly Rental Charge*	Monthly Lease Charge (2-Year Lease)*
MASS STORAGE (Continued)					
3370	Direct Access Storage; 571.3MB per drive:				
	Model A1; Single Disk Drive	44,350	126.00	1,463	1,245
	Model B1; Add-on Single Disk Drive for attachment to Model A1	29,550	94.50	976	831
	8150 String Switch for 3370 A1	4,505	1.50	143	122
3375	Direct Access Storage; 819.7MB per drive:				
	Model A1; contains logic and power for up to three Model B1 units	50,720	130.00	1,463	1,245
	Model B1; connects to a 3375 Model A1	33,850	98.50	976	831
	Model D1; provides dual controller function in a 3375 string; requires one Model A1 and two Model B1s	48,390	120.00	1,392	1,185
	4951 Model D1 Attachment for Model A1	3,045	6.00	89	76
	4952 Model D1 Attachment for Model B1	NC	NC	NC	NC
	8150 String Switch Feature for 3375 A1	4,465	1.50	143	122
3380	Direct Access Storage; 2.52 billion bytes per unit:				
	Model A4; connects to one 3880 storage director	101,550	285.00	2,750	2,340
	Model AA4; connects to one 3880 storage director	116,050	325.00	3,143	2,675
	Model B4; connects to a Model A unit	84,240	240.00	2,280	1,940
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	78,790	176.00	2,350	2,000
	Model 2; provides one storage director for 3330/3333, 3340/3344, 3350, 3370, or 3375 storage and one for 3380 storage	78,790	176.00	2,350	2,000
	Model 3; provides two storage directors for 3380 storage	78,790	176.00	2,350	2,000
	Model 11; paging subsystem for 3350	251,520	676.00	7,145	6,080
	Model B13; includes two cache storage directors for 3380; 4 megabytes	202,640	576.00	5,765	4,905
	Model D13; same as B13, but with 8 megabytes	260,880	711.00	7,410	6,305
	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	341	290
	8170 Two-Channel Switch Pair	8,140	11.00	241	205
	8171 Two-Channel Switch Pair, additional	21,720	38.50	647	551
	8172 Eight-Channel Switch	29,870	53.50	894	761
MAGNETIC TAPE EQUIPMENT					
3410	Magnetic Tape Unit:				
	Model 1; 20,000 bytes/sec.	4,675	98.00	264	222
	Model 2; 40,000/20,000 bytes/sec.	6,250	108.00	351	295
	Model 3; 80,000/40,000 bytes/sec.	7,735	119.00	441	370
3411	Magnetic Tape Unit and Control:				
	Model 1; 20,000 bytes/sec.	10,300	150.00	587	493
	Model 2; 40,000/20,000 bytes/sec.	13,030	162.00	747	627
	Model 3; 80,000/40,000 bytes/sec.	15,890	171.00	907	762
	3211 Single Density Feature (for 3410 & 3411)	1,515	13.00	76	64
	3221 Dual Density Feature (for 3410 & 3411)	2,185	45.50	113	95
	7360 System/360/370 Attachment (required on 3411)	3,825	31.50	212	178
3420	Magnetic Tape Units:				
	Model 3; 120,000 bytes/sec. at 1600 bpi; 75 ips	14,910	179.00	526	442
	Model 4; 470,000 bytes/sec. at 6250 bpi; 75 ips	19,170	179.00	735	617
	Model 5; 200,000 bytes/sec. at 1600 bpi; 125 ips	19,990	196.00	708	595
	Model 6; 780,000 bytes/sec. at 6250 bpi; 125 ips	22,390	196.00	850	714
	Model 7; 320,000 bytes/sec. at 1600 bpi; 200 ips	22,400	235.00	839	705
	Model 8; 1,250 bytes/sec. at 6250 bpi; 200 ips	24,840	288.00	1,010	848
	6420 6250 bpi Density Feature (for 3420 Models 4, 6, and 8)	2,000	54.00	72	60
	6425 6250/1600 bpi Density Feature (for 3420 Models 4, 6, and 8)	2,755	71.50	105	88
	6631 Single Density Feature (for Models 3, 5, and 7)	3,585	53.50	123	103
	3550 Dual Density Feature (for Models 3, 5, and 7)	4,630	89.50	160	134
	6407 7-Track Feature (for Models 3, 5, and 7)	3,585	78.00	123	103

*Rental/lease prices include equipment maintenance.
NC—No Charge.

IBM 4300 Series

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Monthly Rental Charge*	Monthly Lease Charge (2-Year Lease)*
MAGNETIC TAPE EQUIPMENT (Continued)					
3803	Tape Controller:				
	Model 1; for 3420 Model 3, 5, and 7 drives	25,840	120.00	916	769
	Model 2; for 3420 Model 3 through 8 drives	34,430	165.00	1,330	1,117
	5310 9-Track NRZI Feature (permits connection of 800-bpi drives to 3803-2)	3,850	1.50	129	108
	6320 7-Track NRZI Feature (permits connection of 7-track drives to 3803-2; 5310 is prerequisite)	1,890	1.50	64	54
	Multiple Tape Control Switches (for switching up to sixteen 3420 tape drives between up to four 3803 control units):				
	1792 For 2 Tape Controls	7,660	12.00	267	224
	1793 For 3 Tape Controls	9,775	19.00	345	290
	1794 For 4 Tape Controls	11,490	19.00	404	339
	3551 Dual Density Feature (for 3803-1)	2,870	3.00	98	82
	6148 Remote Switch Attachment	1,135	NC	39	33
	6408 7-Track Feature (for 3803-1)	2,870	3.00	98	82
	8100 Two-Channel Switch	5,745	6.00	199	167
8809	Magnetic Tape Unit:				
	Model 1A; first drive; operates in start/stop mode at 20,000 bytes/sec. or in streaming mode at 160,000 bytes/sec.	11,960	76.50	470	400
	Model 2; second, fourth, or sixth drive; attaches to Model 1A or 3	10,610	69.00	418	356
	Model 3; third or fifth drive; attaches to Model 2	11,960	66.50	470	400
DISKETTE EQUIPMENT					
3540	Diskette Input/Output Unit:				
	Model B1; one drive; 242.9KB	27,520	74.50	1,023	871
	Model B2; two drives	41,910	103.00	1,533	1,305
PUNCHED CARD EQUIPMENT					
1442	Card Read Punch (with control), Model N1; 400/91 cpm	24,040	305.00	997	—
2501	Card Reader (with control):				
	Model B1; 600 cpm	19,610	152.00	505	—
	Model B2; 1000 cpm	19,920	166.00	622	—
2520	Card Read Punch (with control), Model B1; 500 cpm	53,460	629.00	1,770	—
2520	Card Punch (with control):				
	Model B2; 500 cpm	47,340	591.00	1,575	—
	Model B3; 300 cpm	46,950	472.00	1,215	—
2540	Card Read Punch; 1000/300 cpm (requires 2821 control unit)	44,420	411.00	1,375	—
2821	Control Unit:				
	Model 1; one 2540 and one 1403 printer	43,850	110.00	1,555	1,306
	Model 5; for one 2540 and two 1403's	71,050	192.00	2,530	2,125
	Model 6; for one 2540 only	14,920	240.00	713	599
	8100 Two-Channel Switch	9,895	18.00	319	268
	8637 Universal Character Set Adapter	718	6.00	19	16
3505	Card Reader:				
	Model B1; 800 cpm	36,030	267.00	1,100	—
	Model B2; 1200 cpm	37,270	364.00	1,300	—
	5450 Optical Mark Read	10,130	108.00	349	—
	6555 Selective Stacker	2,845	19.00	89	—
	8103 3525 Punch Adapter	6,370	8.00	192	—
	8105 3525 Read/Punch Adapter	7,010	10.00	240	—
	8100 3525 Card Print Control	3,810	10.00	106	—
3525	Card Punch:				
	Model P1; 100 cpm	25,520	173.00	778	—
	Model P2; 200 cpm	26,520	234.00	988	—
	Model P3; 300 cpm	27,520	292.00	1,185	—
	1533 Card Read Feature	7,645	43.50	230	—
	1421 Basic Card Print	16,750	172.00	503	—
	5273 Multi-Line Card Print	1,365	50.00	136	—
	8339 Two-Line Card Print	874	7.50	21	—

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IBM 4300 Series

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Monthly Rental Charge*	Monthly Lease Charge (2-Year Lease)*
PUNCHED CARD EQUIPMENT (Continued)					
5424	Multi-Function Card Unit, 96 col.:				
	Model A1; 60 cpm	8,950	289.00	565	—
	Model A2; 120 cpm	11,840	435.00	853	—
	6510 4331 Attachment	2,670	6.00	60	—
PRINTERS					
1403	Printer:				
	Model 2; 600 lpm; 132 print positions	23,100	592.00	1,335	1,121
	Model 7; 600 lpm; 120 print positions	22,190	460.00	1,125	945
	Model N1; 1100 lpm; 132 print positions	40,040	687.00	1,555	1,306
	1416 Interchangeable Train Cartridge (required for 1403 N1)	2,930	Time & Mat'l.	144	—
	4740 Interchangeable Train Cartridge Adapter (for 1403-2 or -7)	2,030	NC	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 1; one 2540 card unit and one 1403 printer	43,850	110.00	1,555	1,306
	Model 2; for one 1403	27,190	83.00	976	820
	Model 3; for two 1403s	54,270	170.00	1,940	1,630
	Model 5; for one 2540 and two 1403s	71,050	192.00	2,530	2,125
	3615 1100 lpm Printer Adapter (for 2821; required for 1403 N1)	2,815	2.50	114	96
	7945 Third Printer Control (for 2821 Model 3 or 5)	22,560	14.50	813	683
	8100 Two-Channel Switch	9,895	18.00	319	268
	8637 Universal Character Set Adapter	718	6.00	19	16
1443	Printer (with control), Model N1; 240 lpm	47,460	326.00	1,285	1,079
3203	Printer, Model 5; 1200 lpm, 132 print positions	38,850	410.00	1,868	1,590
	1416 Interchangeable Train Cartridge (required)	2,930	Time & mat'l.	144	—
3211	Printer; 200 lpm, 132 print positions	40,080	936.00	2,420	2,033
	3216 Interchangeable Train Cartridge	11,600	213.00	493	—
	5554 18 Additional Print Positions	2,150	16.50	75	63
3811	Control Unit for 3211 Printer	17,685	135.00	1,065	895
	5553 18 Additional Print Positions	789	6.00	25	21
3262	Line Printer:				
	Model 1; 650 lpm	17,690	180.00	566	482
	Model 11; 325 lpm	12,620	132.00	397	338
	5951 0.079-inch char. height	NC	NC	NC	NC
	5950 0.095-inch char. height	NC	NC	NC	NC
	5940 48-char. EBCDIC Set	186	—	—	—
	5944 64-char. EBCDIC Set	186	—	—	—
	5946 64-char. EBCDIC Set (optimized)	186	—	—	—
	5948 96-char. EBCDIC Set	186	—	—	—
3287	Serial Printer:				
	Model 1; 80 cps	5,365	41.50	239	203
	Model 2; 120 cps	5,720	51.50	291	248
	Model 1C; 4 colors; 80 cps	5,790	47.00	295	251
	Model 2C; 4 colors; 120 cps	6,145	57.00	347	295
	1120 APL/Text	183	0.50	6	5
	3610 Extended Character Set Adapter	477	3.50	19	16
	3880 Extended Print Buffer	220	0.50	7	6
	4110 Friction Feed Paper Handling	168	0.50	6	5
	8330 3271/3272 Attachment for Models 1 and 2	955	3.00	42	36
	8331 3274/3276 Attachment for Models 1 and 2	183	0.50	6	5
	8700 Variable-Width Forms Tractor	168	0.50	6	5
3289	Line Printer, Model 4; 230 to 400 lpm	13,140	205.00	805	685
	5821 48-char. EBCDIC print belt	160	—	—	—
	5822 64-char. EBCDIC print belt	160	—	—	—
	5823 94-char. EBCDIC print belt	160	—	—	—

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IBM 4300 Series

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Monthly Rental Charge*	Monthly Lease Charge (2-Year Lease)*
PRINTERS (Continued)					
3800	Printing Subsystem; up to 20,040 lpm	373,150	938.00	10,693	9,100
	5401 Additional Character Generation Storage	4,475	26.50	114	97
	8170 Two-Channel Switch	9,790	20.50	305	260
	1490 Burster-Trimmer-Stacker	56,280	250.00	1,598	1,360
	7810 Tape to Print Subsystem Feature	12,030	46.50	424	361
OPTICAL AND MAGNETIC READERS					
1255	Magnetic Character Reader:				
	Model 1; 500 dpm, 6 stackers	41,040	348.00	1,305	—
	Model 2; 750 dpm, 6 stackers	46,970	557.00	1,595	—
	Model 3; 750 dpm, 12 stackers	63,960	733.00	2,100	—
	3215 Dash Symbol Transmission (for 1255 or 1419)	35	NC	56 (1-time)	—
	4380 51-Column Card Sorting (for 1255 or 1419)	661	NC	17	—
	4520 High-Order Zero and Bank Selection (for 1255 Model 3 only)	1,515	6.50	46	—
	7060 Self-Checking Numbers (for 1255)	2,465	3.00	76	—
	6360 System/360/370 Adapter (required on 1255)	22,910	51.00	735	—
1287	Optical Reader:				
	Model 1; reads documents only	108,450	1,405.00	4,245	—
	Model 3; reads documents only	163,550	2,015.00	6,560	—
	Model 5; reads handprinted digits from documents only	120,650	2,040.00	5,335	—
	3945 Farrington 7B Font	968	2.00	37	—
	4470 1428 and ANSCS OCR Font	968	2.00	37	—
	5300 NCR Optical Type Font	3,885	7.50	149	—
	5370 Numeric Handwriting	31,140	87.50	1,205	—
	5479 Optical Mark Reading	3,885	7.50	149	—
1288	Optical Page Reader	198,600	1,700.00	7,475	—
	3850 Expanded Symbol Set	2,710	4.50	104	—
	5370 Numeric Handwriting	46,710	103.00	1,515	—
	5479 Optical Mark Reading	4,575	9.00	149	—
	6550 Serial Numbering (for 1288 or 1287)	11,100	83.50	452	—
1419	Magnetic Character Reader; 1600 dpm	145,950	802.00	3,580	—
	7061 Self-Checking Number, Modulus 10	2,560	4.50	61	—
	7062 Self-Checking Number, Modulus 11	3,950	7.50	100	—
3881	Optical Mark Reader:				
	Model 1; for on-line use	62,420	239.00	2,174	1,850
	Model 2; for off-line use with 3410 Model 1 Magnetic Tape Unit	56,860	190.00	1,974	1,680
	Model 3; on-line use with IBM Diskette Unit	72,800	227.00	2,397	2,040
	1471 BCD Read	2,600	3.00	85	72
	3450 Document Counters	1,030	3.50	27	23
	3550 Dual Density (for Model 2 only)	6,565	2.00	223	190
	3801 Expanded Storage	2,600	2.00	85	72
	6451 Serial Numbering	7,680	42.50	262	223
3886	Optical Character Reader:				
	Model 1; on-line	101,500	497.00	3,760	3,200
	Model 2; off-line	109,200	497.00	4,042	3,440
	3210 Additional Data Storage	1,020	0.50	35	30
	4520 Additional Hopper and Stacker Capacity	8,235	26.00	300	255
	4610 Additional Instruction Storage	5,120	11.00	187	159
	4720 Line Marking	5,680	11.00	203	173
	5340 Numbering/Marking Adapter	1,545	0.50	47	40
	5360 Numeric Handprinting	6,685	30.00	241	205
	6450 Serial Numbering	8,235	26.00	300	255
3890	Document Processor; Model A has 13K bytes, Model B has 29K bytes memory:				
	Model A1; 6 pockets	280,350	323.00	6,410	5,455
	Model A2; 12 pockets	327,300	388.00	7,432	6,325
	Model A3; 18 pockets	374,250	450.00	8,454	7,195
	Model A4; 24 pockets	421,200	514.00	9,471	8,060
	Model A5; 30 pockets	468,150	576.00	10,499	8,935
	Model A6; 36 pockets	515,100	640.00	11,515	9,800
	Model B1; 6 pockets	328,400	393.00	7,978	6,790
	Model B2; 12 pockets	375,350	458.00	8,995	7,655
	Model B3; 18 pockets	422,300	520.00	10,017	8,525
	Model B4; 24 pockets	469,250	585.00	11,039	9,395
	Model B5; 30 pockets	516,200	647.00	12,056	10,260
	Model B6; 36 pockets	563,150	709.00	13,078	11,130

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IBM 4300 Series

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Monthly Rental Charge*	Monthly Lease Charge (2-Year Lease)*
	SYSTEM MANAGEMENT				
3814	Switching Management System (requires one Model A):				
	Model A1; Controller; 4x4 switch	47,480	124.00	1,981	1,585
	Model A2; Controller; 4x8 switch	60,420	161.00	2,518	2,015
	Model A3; Controller; 8x4 switch	64,740	158.00	2,706	2,165
	Model A4; Controller; two 4x4 switches	69,570	173.00	2,906	2,325
	Model B1; Remote Unit; 4x4 switch	39,710	84.00	1,656	1,325
	Model B2; Remote Unit; 4x8 switch	52,660	122.00	2,200	1,755
	Model B3; Remote Unit; 8x4 switch	56,970	118.00	2,381	1,905
	Model B4; Remote Unit; two 4x4 switches	61,800	133.00	2,581	2,065
	Model C1; Expansion Unit; 4x4 switch	37,980	81.00	1,581	1,265
	Model C2; Expansion Unit; 4x8 switch	50,930	119.00	2,125	1,695
	Model C3; Expansion Unit; 8x4 switch	55,240	115.00	2,306	1,845
	Model C4; Expansion Unit; two 4x4 switches	60,070	130.00	2,506	2,005
	3604 Keyboard/Display, Model 6, one required	1,745	12.50	—	83
	1520 Channel Expansion Internal—4 Control Unit Interfaces	1,550	1.00	65	52
	1521 Channel Expansion Internal—8 Control Unit Interfaces	3,100	1.00	128	103
	1530 Channel Expansion External	5,350	1.00	222	178
	1810 Control Unit Power Sequencing	518	1.00	21	17
	6010 Remote Two-Channel Switch Control—Basic	5,180	17.00	215	172
	6011 Remote Two-Channel Switch Control—Additional	2,415	13.00	101	81
	6350 System Power Sequencing—Additional	207	—	8	6

DISPLAY AND DATA ENTRY TERMINALS

A number of IBM terminals can be connected to a 4300 system in local or remote configurations. For details and prices please refer to Reports 70D1-491-45, 70D2-491-11, 70D3-491-46, and 70D4-491-43 in Volume 2 of DATAPRO 70.

COMMUNICATIONS EQUIPMENT

For the 4331 Model Group 2:

	1020 Autocall Unit Interface	393	3.00	15	12
	1601 Communications Adapter, base	2,745	2.50	115	98
	3701 EIA/CCITT Interface	393	3.00	15	12
	4695 Line Attachment Base; for clocked modems	393	1.50	15	12
	4696 Line Attachment Base; for non-clocked modems	464	1.50	17	15
	4720 High-Speed Modem Adapter	1,180	3.00	42	35
	4781 1200-bps Integrated Modem; non-switched	596	4.50	22	19
	4782 1200-bps Integrated Modem; switched, with auto-answer	768	4.50	31	27
	4787 1200-bps Integrated Modem; non-switched, with switch network backup and manual answer	812	4.50	33	28
	4788 1200-bps Integrated Modem; non-switched, with switch network backup and auto-answer	905	5.00	36	31
	4801 Local Attachment Interface	982	4.00	36	31
	5650 Digital Data Service Adapter	750	3.50	30	25
	3863 2400-bps Modem:				
	Model 1; non-switched	2,685	14.00	96	82
	Model 2; switched	2,935	16.50	103	88
	3864 4800-bps Modem:				
	Model 1; non-switched	4,410	22.00	166	141
	Model 2; switched	4,660	23.00	176	150
	3865 9600-bps Modem; non-switched	6,690	32.00	264	225
	4830 Loop Adapter 1; requires Adapter Power Prerequisite; cannot be installed with 5424 Adapter	9,490	45.00	486	413
	4831 Loop Adapter 2; requires 4830	1,920	23.00	91	77
	4840 Data Link Adapter; requires 4830	1,180	10.50	57	48
	3843 Loop Control Unit	5,625	28.00	195	166
7770	Audio Response Unit, Model 3 (up to 4 lines)	58,760	96.00	1,865	—
	4677 I/O Line Expander (up to 4 more lines)	8,575	30.00	273	—
	4679 I/O Line Panel (one required for each 8 lines beyond the first 8)	3,660	3.50	116	—
	4668 I/O Line Frame (required for over 16 lines)	9,790	4.00	312	—
	8721 16 Additional Vocabulary Words	4,890	4.00	154	—
3705-II	Communications Controller: For detailed pricing see Report 70C-491-06 (303X Series)				

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IBM 4300 Series

SOFTWARE PRICES

		Monthly Charge		Monthly Licensed Program Support Charge	Monthly Multiple Licensed Program Support Charge
		Basic License Charge	DSLO Charge		
5666-265	SSX/VSE*	$1,000	$750	$90	$54
5666-274	SSX/VSE RPG II	114	86	5	3
5666-276	SSX/VSE PL/1 Optimizing Compiler and Library	281	211	41	25
5666-277	SSX/VSE PL/1 Transient Library	28	20	5	3
5666-275	DL/1 SSX/VSE	324	243	110	66
5668-981	X.25 Packet Switching Interface	190	112	30	18
5735-RC2	ACF/VTAM, OS/VS	322	241	42	67
	Networking Feature	773	579	127	203
5746-RC3	ACF/VTAM, DOS/VSE	134	100	42	67
	Networking Feature	254	190	127	203
5735-RC3	ACF/TCAM Version 2, OS/VS	615	461	71	114
	Networking Feature	1,035	776	88	141
5735-XX1	ACF/NCP/VS	155	116	24	38
5735-XX7	Network Terminal Option	146	109	9	14
5746-XE8	VSE/Advanced Functions, Releases 1 and 2	180	135	48	76
5746-RC7	Advanced Communications Function for VTAM Entry (ACF/VTAME)	131	98	61	98
5746-TS1	VSE/Interactive Computing and Control Facility	97	72	22	35
5746-XE3	VSE/POWER Releases 1 and 2	51	38	13	20
5746-RC9	DOS/VSE Remote Job Entry Workstation	103	—	—	—
5746-AM5	VSE/3270 Bisync Pass Through	159	—	—	—
5746-AM2	VSE/VSAM Releases 1 and 22	55	41	18	29
	VSE/VSAM Space Management for SAM feature	32	24	7	11
5746-AM4	VSE/Fast Copy Data Set Program	417	—	—	—
5746-UT3	VSE/Data Interfile Transfer, Testing and Operations Utility (VSE/DITTO)	36	27	5	8
5746-XE7	VSE/Access Control—Logging and Reporting	48	36	17	28
5746-SA1	VSE/Interactive Problem Control System	31	23	5	8
5746-RC5	Basic Telecommunications Access Method Extended Support	32	24	5	8
5746-SU1	IBM Systems 1401/1440/1460 Emulator	133	99	5	8
5746-LM3	DOS FORTRAN IV Library Option I	38	28	5	8
5746-CB1	DOS/VS Cobol Compiler and Library	157	117	12	19
5746-LM4	DOS/VS Cobol Library	29	21	5	8
5736-PL1	DOS PL/1 Optimizing Compiler	235	176	31	50
5736-LM4	DOS PL/1 Resident Library	55	41	5	8
5736-LM5	DOS PL/1 Transient Library	32	24	5	8
5736-PL3	DOS PL/1 Optimizing Compiler and Library	322	241	41	66
5746-RG1	DOS/VS RPG II	131	98	5	8
5746-SM2	DOS/VS Sort/Merge (Version 2)	128	90	11	18
5746-XX1	DL/1 DOS/VS (Version 1)	372	279	110	176
5748-XXJ	SQL/Data System	345	258	105	168
5748-XX8	VM/Basic System Extensions	136	102	33	52
5748-XE1	VM/System Extensions	1,345	1,005	148	237
5664-167	VM/System Product	330	247	50	80
5748-XP1	Remote Spooling Communications Subsystem (RSCS) Networking	84	63	28	45
5748-XXC	VM/Interactive File Sharing	40	30	12	19
5748-XXB	Display Management System/CMS	30	22	7	11
5748-XE4	VM/Directory Maintenance	98	73	23	37
5748-XT3	VM/CMS-3270 Display Support and Structured Programming Facility	419	—	—	—
5748-SA1	VM/Interactive Problem Control System Extension	41	30	5	8
5748-MS1	Interactive Productivity Facility	41	30	5	8
5748-RC1	VM/Pass-Through Facility	139	104	65	104
5746-XX3	CICS/VS/DOS	450	337	116	186
5740-XX1	CICS/OS/VS	1,425	1,065	116	186
5740-XC5	Development Management System/CICS/VS-OS	269	201	40	64
5746-XC4	Development Management System/CICS/VS-DOS	139	104	40	64
5740-XXF	DB/DC Data Dictionary for OS/VS	805	603	84	134
5746-XXC	DB/DC Data Directory for DOS/VS	366	274	66	105
5662-257	OS/VS1 Basic Programming Extension	189	141	35	56
5740-XYW	OS/VS1 Job Networking Facility	200	—	—	—

*One-time license charge of $20,000 (Basic License) or $15,000 (DSLO) is also available.

IBM 4300 Series

SOFTWARE PRICES

		Monthly Charge		Monthly Licensed Program Support Charge	Monthly Multiple Licensed Program Support Charge
		Basic License Charge	DSLO Charge		
5740-XE1	MVS/System Extension	1,700	1,275	85	136
5740-XYS	MVS/SP-JES2 Release 1	1,700	1,275	85	136
	Release 2 or 3	1,715	1,285	175	280
5740-XYN	MVS/SP-JES3 Release 1	1,700	1,275	85	136
	Release 2 or 3	1,880	1,410	375	600
5665-288	MVS Operator Communication Control Facility	300	225	7	11
5740-XY4	RMF Version 2, Release 4	380	285	13	21
5740-XR8	JES2 NJE	693	519	72	115
5799-AZT	JES3 NJE	1,535	1,150	260	416
5740-XRB	MVS Hierarchical Storage Manager, Release 3	420	315	94	150
5748-FO3	VS Fortran Compiler and Library	212	159	15	24
5748-LM3	VS Fortran Library	63	47	5	8
5748-AP1	VS APL Release 4	305	228	33	52
5734-PL3	OS PL/1 Compiler and Library	339	254	41	66
5734-PL1	OS PL/1 Compiler	252	189	31	50
5734-LM4	OS PL/1 Resident Library	55	41	5	8
5734-LM5	OS PL/1 Transient Library	32	24	5	8
5740-SM1	OS/VS Sort/Merge Release 5	231	173	16	26
5740-CB1	OS/VS Cobol Compiler and Library	311	233	12	19
5740-LM1	OS/VS Cobol Library	101	75	5	8
5740-AM6	Data Facility/Device Support Release 1 (OS/VS1)	66	49	18	29
5740-UT3	Data Facility/Data Set Services Release 1 (OS/VS1 and MVS)	67	50	17	27
5740-XYQ	Data Facility/Extended Function (MVS)	103	77	50	80
5740-AM7	Data Facility/Device Support (MVS)	70	52	14	22
5668-002	Direct Access Storage Device Migration Aid Release 1 (OS/VS1 and MVS)	1,150	—	—	—

	Monthly Program Support Charge	Monthly Multiple Program Support Charge
CHARGES FOR LOCAL PROGRAMMING SUPPORT		
For Class 1 SCP on 4321	$154	$246
For Class 1 SCP on 4331 Model Group 11:		
Category A (DOS/VSE, OS/VS1 Release 7, VM/370 Release 6)	182	291
For Class 1 SCP on 4331 Model Group 2:		
Category A	220	132
For Class 1 SCP on 4341 Model Group 10:		
Category A	390	624
Category B (all SCP's in Category A, MVS Release 3.8, MVS corequisite SCP's)	550	880
For Class 1 SCP on 4341 Model Group 11:		
Category A	450	720
Category B	650	1,040
For Class 1 SCP on 4341 Model Group 2:		
Category A	518	829
Category B	740	1,185 ■