IBM 4300 Series

MANAGEMENT SUMMARY

The IBM 4300 Series computer product line, unveiled on January 30, 1979, includes something to excite virtually everyone in the EDP field. Whether your primary interest is in hardware, software, or marketing, it's almost certain that the new IBM product line will have a significant impact on your future.

The 4300 Series, widely referred to as the "E Series" during its development period, initially consists of two medium-scale central processors supported by five new peripheral devices and three enhanced operating systems. Compatibility with the existing System/370 equipment and software has naturally been maintained.

The most noteworthy aspects of IBM's new product line are: 1) the strikingly improved price/performance it offers; 2) the advanced technology which IBM has employed to achieve those price/performance gains; and 3) the accompanying changes in IBM software pricing and support policies.

In terms of hardware performance per dollar, the new processors appear to offer approximately a four-fold increase over the corresponding System/370 processors. Moreover, IBM has priced incremental main memory for both processor models at the startlingly low figure of $15,000 per megabyte. These developments have set impressive new price/performance standards for the entire mainframe industry, and other computer vendors are hastily reacting by introducing new processor models and slashing the prices of existing processors and memory modules.

IBM's pricing of the 4300 Series equipment also appears to be designed to encourage outright purchase as op- ▷

> The long-awaited "E Series" from IBM's Data Processing Division initially consists of the medium-scale 4331 and 4341 Processors, newly enhanced operating systems, and several new peripherals. Designed to attract users of the old System/360 and the smaller System/370 computers, the new series offers excellent price/performance ratios, with a typical low-end 4331 system priced at $141,378 (purchase) or $3,572 per month (2-year lease).

CHARACTERISTICS

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

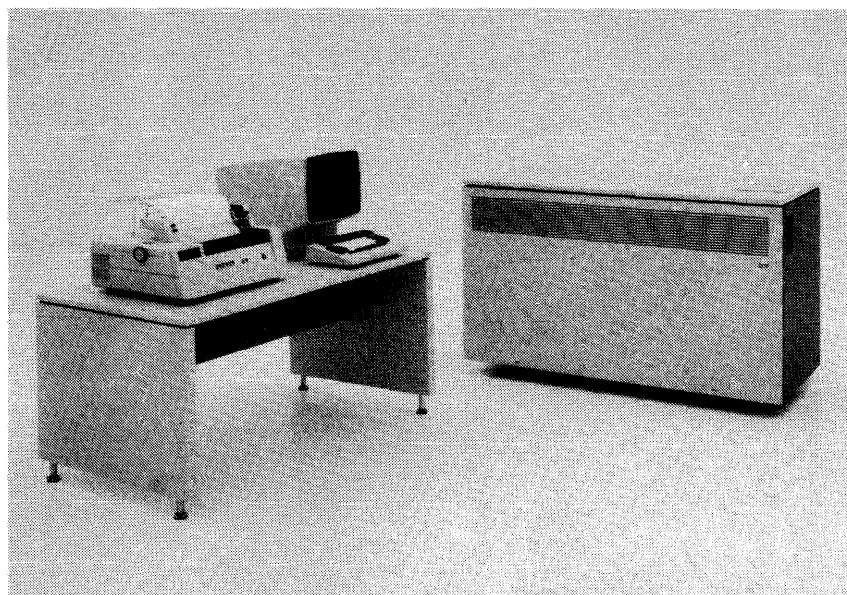**MODELS:** 4331 Models I1 and J1 and 4341 Models K1 and L1.

DATE ANNOUNCED: January 30, 1979.

DATE OF FIRST DELIVERY: 4331 Model I1 and 4331 Model J1, 2nd quarter 1979; 4341 Model K1, 4th quarter 1979; 4341 Model L1, 2nd quarter 1980.

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.

The smaller processor in IBM's new series, the 4331, can fit easily into an office environment. Shown here are the processor complete with its integrated adapters (right) and the system console with a hard-copy device. Missing from the photo are the two other elements needed for a basic 4331 configuration: a line printer and the new 3310 Direct Access Storage Device.

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posed to rental or leasing. If the company's strategy is indeed geared toward promoting the purchase of these systems, it will take in revenue more rapidly than through leasing—a suggestion that perhaps the new line's product life is viewed as relatively short. This, in turn, may simply reflect IBM's acknowledgement of the ever-increasing slope of the technology curve, with hardware declining rapidly in price and increasing just as rapidly in performance.

In achieving the new price/performance standards exhibited by the 4300 processors, IBM has confirmed its recently established position as a leader in electronic technology as well as in marketing. The new hardware convincingly demonstrates the company's ability to utilize effectively such state-of-the-art developments as high-density packaging, thin-film technology, intelligent controllers, and advanced firmware.

The software announcements that accompanied the 4300 Series introduction indicate a continuing IBM commitment to improve both the functionality of its software and the support it provides to users of these products. At the same time, the new software pricing policy is clearly designed to ensure that increased software and support costs will at least partially offset the savings in hardware costs that the new computers will bring to IBM users.

PROCESSORS AND PERIPHERALS

IBM's two new medium-scale processors, the 4331 and 4341, can operate either in a System/370-compatible mode or in an extended control program (ECPS) mode, which takes full advantage of the extensive microcoding available in these machines to reduce operating system overhead and improve system throughput. They feature 64K-bit memory chips and logic chips that contain up to 704 circuits each. These logic chips are the same as the ones introduced with the IBM System/38, switching electrical signals at a rate of over 300 million times per second.

The memory technology used is also similar to that of the System/38. The density of packaging for both logic chips and memory chips, however, has been enhanced over that of the System/38. In the System/38, only one logic chip was mounted on a ceramic substrate, whereas on the 4331 and 4341, up to nine logic chips are mounted per substrate. Memory density has been doubled over that of the System/38 at the module level by stacking two ceramic substrates, where each substrate contains four chips. Since each chip stores 64K bits, each module contains 512K bits. Up to 524,288 bytes of memory can thus be contained on each 4.875-by-7.5-inch board. In comparison with the 370/138, memory packaging on the 4300 Series is 32 times denser. Because of the density of packaging, the 4331 requires up to 70 percent less power than the 370/138, and the 4341 requires over 50 percent less power than the 370/138.

Both the 4331 and 4341 include these common features: LSI technology, channels with virtual storage addressing,

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).

MAIN STORAGE

STORAGE TYPE: SAMOS (silicon and aluminum metal oxide semiconductor) process N-channel FET (field effect transistor). The SAMOS process relies on silicon or silicon compounds to enhance gate reliability and to control chip surface leakage. Memory is composed of 64K-bit chips, with four chips mounted on each ceramic substrate. Maximum density is achieved by stacking pairs of substrates (a module).

Since each chip stores 64K bits, each module contains 512K bits. Up to 524,288 bytes of memory can thus be contained on each 4.875-by-7.5-inch board. In comparison with the 370/138, memory packaging on the 4300 Series is 32 times denser. Both timing and addressing functions are integrated on the memory chip, as well as two high-speed data registers. These registers act as a buffer, allowing up to eight bits to be sequentially read from the chip at a data rate of 100 nanoseconds for each access to the chip. Writing to the chip is also done through the same registers, thus eliminating the need for a read modify write cycle. Because of the density of packaging, the 4331 requires up to 70 percent less power than the 370/138, and the 4341 requires over 50 percent less power than the 370/138.

CYCLE TIME: IBM has not specified the effective memory cycle time for either the 4331 or 4341 to date. Access times on the 4331 are 900 nanoseconds for a four-byte fetch and 1300 nanoseconds for a four-byte store. Processor cycle time of the 4341 is 150 to 300 nanoseconds. The 4341 contains an 8,192-byte buffer which helps to reduce the effective access time. The basic 64K-bit chip used on both the 4331 and 4341 has a rated cycle time of 980 nanoseconds and an access time of 440 nanoseconds.

CAPACITY: 4331 Model I1, 524,288 bytes; 4331 Model J1, 1,048,576 bytes; 4341 Model K1, 2,097,152 bytes; and 4341 Model L1, 4,194,304 bytes.

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 and/or unauthorized reading of data in specified blocks of storage, are standard in all models.

CENTRAL PROCESSORS

The 4331 and 4341 are heavily microprogrammed processors that include these common features: LSI technology, one-level addressing facility, virtual storage capability by dynamic address translation, channels with virtual storage addressing, 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

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▷ System/370 Universal Instruction Set, 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 distinguishing characteristics of the two 4300 Series processors can be summarized as follows:

	4331	4341
Main memory capacity, megabytes	0.5 or 1	2 or 4
Microcode storage in main memory, bytes:		
With standard 64K-byte control storage	53,248	—
With standard and expansion control storage (128K)	16,384	—
With "sufficient" control storage	—	14K to 108K
Processor cycle time, nanoseconds	900-1300	150-300
Processor power rating in MIPS (millions of instructions per second)	0.2	0.8
Data flow in parallel	4 bytes	8 bytes
8K-byte high-speed buffer	No	Yes
Integrated communications adapter for SDLC, BSC, and start/stop	Optional	No
Communications front end via 3704/3705	No	Yes
Integrated DASD adapter for up to 24 drives (3310, 3340, 3370) providing up to 9000 megabytes of storage	Optional	No
3880 Storage Control for up to 32 3370 drives, 64 3340 drives, 56 3340/3344 drives, or 44 3340/3344/3370 drives providing up to 18,000 megabytes of storage per 3880	No	Yes
Integrated display/printer adapter for up to 8 devices, with expansion to 16 optional (3278-2A Console plus up to 15 3278 Display Stations, 3262/3289 Line Printers, or 3287 Printers)	Standard	No
3278-2A Console plus up to three optional 3278-2A's and/or 3287 Printers connected via support processor	No	Standard
500K bytes per second block multiplexer channel for 2311, 2314, and 2319 DASD; 3410, 3411, 3803, and 3420 tape drives	Optional	No
500K bytes (burst)/18K bytes (byte) per second byte multiplexer channel	Optional	No
1-megabyte per second byte multiplexer channel and two 2-megabyte per second block multiplexer channels	No	Standard
Three block multiplexer channels (one 1-megabyte and two 2-megabyte per second)	No	Optional
Diskette drive for microcode loading	Optional	Standard
5424 Multifunction Card Unit Adapter	Optional	No
8809 Magnetic Tape Adapter	Optional	No
1401/1440/1460 Compatibility	Optional	No

The IBM 4331 Processor with 524,288 bytes of memory is the Model 11; with 1,048,576 bytes of memory, the Model J1. The 4331 offers a lower purchase price and up to four times the instruction execution rate of a System/370 Model 115 with 65,536 bytes of memory. It appears to offer performance in the same range as the System/370 Model 138 at a fraction of the 138's price. According to IBM, the 4331 is designed for the first-time computer user, such as a department or branch office within a larger enterprise, that could benefit from data base/data communications, interactive, and distributed processing capabilities. It is also meant to replace a good portion of the remaining IBM 360's still in service. The 4331 can operate as a stand-alone unit, or it can be linked to other 4300's or attached to a central System/370 host. Under a 24-month contract, the 4331 Model 11 can be leased for $1,585 a month and the Model J1 for $1,775 a month. ▷

▶ CPU timer, time of day clock, interval timer, reloadable control storage, PSW key handling, control registers, extended precision floating point, machine check handling, and program event recording. Exclusive to the 4341 is an 8192-byte buffer designed to reduce effective storage access times.

Both processors feature logic chips that contain up to 704 circuits each. These logic chips are the same as those introduced for the IBM System/38, switching electrical signals at a rate of over 300 million times per second. Density of packaging for logic chips has been enhanced over that of the System/38. On the System/38, only one logic chip was mounted on a ceramic substrate, whereas on the 4331 and 4341, up to nine logic chips are mounted per substrate. The ceramic substrate is built from up to 23 layers, containing up to the equivalent of 33 feet of wire. The reduced processor power and cooling requirements result in a saving for the 4341 of up to 67 percent of the requirements of the 370/138, and for the 4331 of up to 45 percent of the requirements of the 360/40.

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.

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 4331 is four bytes wide with a four-byte memory fetch.

There are two modes of operation available to the 4300 user. On the 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 overhead and improve system throughput. The other operating mode, 370 mode, has three options on the 4331 and two options on the 4341. 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 one option is ECPS:VS1, which improves processor performance with OS/VS1, and the other is ECPS:VM/370.

According to IBM, the internal performance of the 4341 Processor has been measured as up to 3.2 times faster than an equivalently configured 370/138 when running DOS/VS, OS/VS1, and VM/370 jobs. These performance runs were done with the appropriate ECPS feature activated.

With ECPS:VSE, a reduction of up to 13 percent of total CPU time has been measured by IBM when compared with the same version of DOS/VSE running in an interactive 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 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 ▶

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▷ Monthly rental prices are $1,862 to $2,086, and purchase prices are $65,000 and $72,500, respectively. The minimum monthly maintenance charge for the 4331 11 is $150; for the 4331 J1, $160. Field·upgrade from the Model 11 to the Model J1 is priced at $7,500.

The IBM 4341 Processor with 2,097,152 bytes of memory is the Model K1; with 4,194,304 bytes, the Model L1. A 4341 Model K1 offers a lower purchase price and an instruction execution speed up to 3.2 times as fast as a System/370 Model 138 with 1,048,576 bytes of memory. The 4341's performance capability appears to fall between that of the 370/148 and the 370/158-3. IBM describes the 4341 as particularly suitable for experienced intermediate systems users who need increased processing power, and those who could benefit from distributed applications that require more capacity. Like the 4331, the 4341 can be used with existing IBM input/output and communications devices. Under a 24-month contract, the 4341 Model K1 can be leased for $5,975 a month and the Model L1 for $6,725 a month. Monthly rental prices are $7,021 and $7,902, and purchase prices are $245,000 and $275,000, respectively. The minimum monthly maintenance charge for the 4341 K1 is $475; for the 4341 L1, $515. Field upgrade from the Model K1 to the Model L1 is priced at $30,000.

First customer shipments of the 4331 and the 4341 Model K1 are scheduled for the second and fourth quarters of 1979, respectively. First customer delivery of the 4341 Model L1 is scheduled for the second quarter of 1980. The 4300 processors will be manufactured at IBM's facilities in Endicott, New York and Mainz, Germany.

Introduced at the same time as the 4300 Series were five peripheral devices. The IBM 3310 Direct-Access Storage Device is designed for use only with the 4331 and is available in two models, each with a storage capacity of 64.5 million bytes. Up to sixteen 3310 drives can be attached to a 4331 Processor through the integrated adapter. The IBM 3370 Direct-Access Storage is designed for use with both the 4331 and 4341. Featuring more than twice the recording density of previous IBM disk storage devices, the 3370 can store up to 571 million bytes per spindle and has a data transfer rate of 1.859 million bytes per second. A maximum of sixteen 3370's can be attached to the 4331 through its integrated adapter. Up to thirty-two 3370's can be attached to the new 3880 Storage Control, which, in turn, can be channel-attached to the 4341 Processor only. The 3880 provides two separate data paths into the 4341 Processor for direct-access storage devices including the 3370, 3340, and 3344. The new IBM 3262 Line Printer is designed for use only with the 4331. Attachable by an integrated adapter, the 3262 operates at a speed of 650 lines per minute with a 48-character print set. The new 3205 Model 5 Printer, for use with both the 4331 and 4341, operates at 1200 lines per minute with a 48-character set.

In addition to these new devices, IBM also announced that the 3289 Model 4 Printer, which operates at 400 lines per minute, is available for attachment to the 4331 ▷

▶ 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. The System/3 Data Import feature provides the capability, with attachment of 3340 Direct Access Storage, to read data from a 3348 Data Module previously recorded on an IBM System/3 Model 12 or 15 and store it on another 4331-attached DASD for subsequent processing.

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 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) and main memory for storage of additional microcode (4331) or dynamic tables (4341). RCS is composed of 18K-bit SAMOS-process n-channel FET chips.

On the 4331, the amount of microcode required is dependent on the features installed or functions required. Anywhere from 16,384 to 53,248 bytes of main memory are required for microcode storage in addition to RCS. A total of 65,536 bytes of RCS are standard, while an additional 65,536 bytes are optional (feature 1901). The following table lists all microcode groups.

Function/Feature Installed*	Microcode Group(s) Required
4331 Processor	1
Processor Storage—	
In System/370 mode, one req'd.	2
In ECPS:VSE mode, one req'd per megabyte of Virtual Storage defined for the IPL (up to 16)	2
3310 attached (#3201 and #9202)	3, 4, 5, 6
3370 attached (#3201 and #9201)	3, 4, 6, 17
8809 Magnetic Tape Unit attached (#4910)	3, 4, 6, 7
3340 Direct Attach (#7851 and #3201)	3, 6, 8, 15
S/3 Data Import (#6305 and #3201)	3, 6, 8, 15
2311/2314/2319/3310 Direct Access Storage Compatibility (#7901 and #3201 with #9202)	3, 4, 5, 6, 9, 15
Communications Adapter Base (#1601)	6, 10
BSC lines installed (#9671-9678)	6, 10, 11
S/S lines installed (#9681-9688)	6, 10, 12
SDLC lines installed (#9691-9698)	6, 10, 13
ECPS:VM/370 (#8701)	16
1401/1440/1460 Compatibility (#3950)	14

*Numbers in parentheses refer to feature numbers. ▶

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▷ Processor, and that up to six IBM 8809 Magnetic Tape Units, previously announced with the IBM 8100 Information System, can also be used with the 4331 through an integrated adapter.

Both processors use the IBM 3278 Model 2A Display Console, with a 1920-character display and keyboard, for operation and maintenance. Up to three additional consoles and or 3287 Printers (for a total of four devices) can be attached to the 4341.

SOFTWARE AND SUPPORT

Not since 1964 has IBM made an announcement that could impact users of its operating system software to such a magnitude as the software and support announcements that accompanied the January 30 unveiling of the 4300 Series computer line. These announcements distinctly spelled out the operating environments of the future, and clearly identified the life spans of several existing operating systems.

First, IBM announced the operating systems for the new 4300 Series computers. There will be three system control program environments: an extended version of DOS/VS called DOS VS Extended, or simply DOS/VSE; a new version of OS VS1 labeled Release 7; and Release 6 of the Virtual Machine Facility 370 (VM/370). These new system control programs (SCP's) will support a series of new program products, many geared to specifically support the 4300 Series computers.

What does this mean for current users? According to IBM, DOS VS Release 34, OS/VS1 Release 6.7, and VM 370 Release 6 will be supported on existing System/370 and 303X hardware systems under current support arrangements until December 31, 1980. Inasmuch as DOS VS Release 34 will also run in 370 mode on the 4300 Processors, it will be supported via regional support efforts on those computers as well—but only until December 31, 1979. The same holds true for OS/VS1 Release 6.7 and VM 370 Release 5. There are no changes in existing SVS or MVS support plans.

Before getting into the makeup of the individual SCP environments, an important point should be made regarding the pricing of this software. For all practical purposes, all IBM software has now been price-tagged. Although there is no charge for the basic SPC, there is a support charge associated with all the software implemented on the 4300 systems, including the SCP. More will be said about the operations of IBM's expanded Support Centers later.

These changes in software pricing and support policies mean that, almost without exception, the combined future cost of IBM software and support will exceed the present total cost of the free and extra-charge software running on current systems. Support for the basic SCP (which doesn't offer the user as much as he currently gets at no charge) is dependent on the model 4300 processor (or System 370) in use. With DOS/VSE, the user is ▷

▶ After the user selects the required microcode groups from the above table, the actual total main memory requirement in bytes for microcode storage may be calculated by utilizing the following table and either of two formulas:

(65, 536 — total of Col. A) — total of Col. B + total of Col. C = result rounded to next multiple of 4096. (Use this formula if total of column A is less than 65,536 bytes.)

(131,072 — total of Col. A) — total of Col. B + total of Col. C = result rounded to next multiple of 4096. (Use this formula if total of column A is more than 65,536 but less than or equal to 131,072 bytes.)

Microcode Group	Col. A Control Storage (only)	Col. B Control Storage or Processor Storage	Col. C Processor Storage (only)
1	33,792	66,816	12,764
2	—	—	2,048
3	6,144	24,320	3,150
4	5,120	12,288	—
5	—	4,608	11,250
6	—	—	10,250
7	6,144	9,728	3,060
8	5,216	13,312	11,600*
9	—	26,624	1,300**
10	8,192	9,216	2,150***
11	6,144	—	—
12	5,120	—	—
13	12,288	—	1,024
14	14,336	—	1,800
15	—	5,760	200
16	6,656	—	—
17	—	9,316	10,000

*Plus 8,800 per buffer; 1,800 for a second string of 3340's attached to the DASD adapter.

** Plus 4,096 per 2311 buffer; plus 7,680 per 2314 or 2319 buffer.

***Two of groups 11, 12, and 13 may be selected.

If Column A exceeds 131,072 bytes or Column A plus Column B exceeds 262,144 bytes, an invalid configuration has been generated. Microcode groups 7, 14, and 16 are mutually exclusive.

On the 4341, the amount of main memory required to store dynamic tables for RCS depends on the number of unit control words (UCW's) and the mode of operation selected by the user. A minimum of 128 UCW's are based on the 4341 and required 8,192 bytes of main storage. Additional UCW's are allocated as required in groups of 32 (2,048 bytes) up to a maximum of 1024 UCW's.

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 ▶

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▷ required to append the Advanced Function facility if he wishes to use any of the other new VSE program products and function with up to 12 partitions. According to IBM, the license fees for most of these program products will drop in proportion to the extra service charges being assessed, thereby "providing the program product at about the same price as before." However, according to most estimates, the actual cost will generally exceed the price currently being paid for similar capabilities.

All software price changes will take effect on January 1, 1980. An example of the price change algorithm shows a reduction in the basic monthly charge for DL/1 DOS/VS from its current $395 per month to a January 1, 1980 license cost of $295 per month—plus a monthly support charge of $100 and an additional monthly support charge of $60, or a total of $455 per month. Each licensed product will carry an additional support charge of 60 percent of the standard monthly support charge.

Effective January 1, 1980, local service or local assistance, as applicable, for many programs will be discontinued, and the new licensed program support plan will apply. Central service will continue to be available for some programs until discontinued by IBM upon 12 months' written notice. In addition, IBM Field Engineering local program support will also be available at the applicable hourly rate.

The first new SCP environment is DOS/VS-Extended (DOS/VSE), which is said to be a major expansion of DOS/VS incorporating new functional and I/O support. Unfortunately, DOS/VSE provides no multiprogramming capabilities unless the user acquires the DOS/VSE/Advanced Function product, an independently priced adjunct that will allow 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.

A major factor in the 4300 announcement is the expansion of the IBM Support Center activity. This approach to quick problem-solving via centralized telephone support will become the first level of support for the new software products announced with the 4300's as well as older IBM software products. According to IBM, this method of support has been in test for over one year, and "67 percent of all problems during that time have been ▷

▶ 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 Mask; the VTAM support instructions of Compare and Swap and Compare and Double 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 TIMINGS: IBM states that the 4341 has an instruction execution speed up to 3.2 times as fast as the System/370 Model 138, and that the 4331 offers up to four times the instruction execution rate of the System/370 Model 115. Also, according to IBM, the 4341 has been measured to be up to 3.1 times faster than the 370/148 when running the same FORTRAN job. No other timing information is currently available.

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.

INPUT/OUTPUT CONTROL

I/O CHANNELS: The 4331 features two integrated channels, the 1421 Block Multiplexer Channel and the 5248 Byte Multiplexer Channel. The 1421 provides the means of attaching I/O devices with data transfer rates up to 500K bytes per second, including 2311/2314/2319 Disk Drives, 3410/3411 Magnetic Tape Subsystems, and 3420 Model 3, 4, 5, and 7 Magnetic Tape Units. Up to 40 subchannels with either 4 or 8 shared subchannels are provided by the 1421. With microcode feature 9491, up to 8 shared subchannels with up to 16 devices each are possible. Microcode feature 9492 allows up to 4 shared subchannels with up to 32 devices each.

The 5248 Byte Multiplexer attaches the 3203-5 Printer and System/370 byte multiplex devices to the 4331. With this channel, the single-byte interleaved mode provides a speed of 18K bytes per second, and the burst mode provides a speed of up to 500K bytes per second. The 5248 provides up to 31 subchannels, 4 of which are shared subchannels supporting up to 16 devices each. The number of channels is reduced by certain features; see Configuration Rules.

Six channels in two groups are available on the 4341. The standard group consists of one byte multiplexer channel and two block multiplexer channels with a block transfer rate of up to 2.0 million bytes per second for each channel. The standard byte multiplexer channel is capable of data rates of up to 32K bytes per second when operating in byte mode and up to 1 megabyte per second in burst mode for buffered devices. This channel can attach a 3203-5 Printer, a 3540 ▶

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▷ resolved via the remote centralized support center." The centralized support center provides 24-hour, 7-day customer access by telephone (via a toll-free 800 number). 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 by-passes.

The new 4300 Series computers support four types of environments: stand-alone, distributed applications, distributed data applications, and distributed networks.

In the stand-alone system environment, compatible growth is provided from the 4331 to the 4341 or 303X systems operating under DOS/VSE, VM/370 Release 6, or OS/VS1 Release 7. Growth through intersystem connection can be achieved through VSE/POWER shared spooling support or through VM/370 RSCS Networking.

In a distributed applications environment, host-connect applications may vary from periodic transmission of summary data between the 4300 and the host system to a continuous connection offering RJE and/or pass-through capabilities. RJE is provided by DOS/VSE SNA and BSC program products plus VM/370 RSCS Networking and OS/VS1 HRNES IUP. Pass-through facilities are supported by ACF/VTAME, ACF/VTAM/MSNF, and VSE/3270 Bisync Pass-Through.

Data that is most frequently used locally may be stored on the 4300's own direct-access storage devices, with transaction-by-transaction access to the central host data base as needed in distributed data applications. Here, CICS/VS Intersystem Communications with DL/1 and IMS Multiple Systems Coupling provides support.

In a distributed network, communication can be established between local or remote 4300's to the host computer, or to IBM 8100 Information Systems. Transactions from the 8100's to CICS/VS Intersystem Communications are supported by the 8100 DPPX Host Transaction Facility. DPPX also supports RJE to OS/VS1 RES and VM/370 RSCS Networking systems.

With the advent of the 4300 Series, IBM has defined the standards for the next generation of computer equipment and software. The new IBM product line will unquestionably have a momentous impact upon the future of the entire data processing industry. Competitive mainframe makers will have to struggle more frantically than ever to remain competitive with the industry leader, while computer users should enjoy sharply lower data processing equipment costs which will be only partially offset by higher software and support costs.□

▶ Diskette Drive, and a wide variety of System/370 byte multiplex devices. Both standard block multiplexer channels can attach the 3880 Disk Storage Control plus 3370 and/or 3340/44 Direct Access Storage Devices. One of the block multiplexer channels can attach the 3830 Disk Storage Control plus 333X, 3340/44, and 3350 Direct Access Storage

Devices and 3410/11 and 3420 Models 3, 4, 5, and 7 Magnetic Tape Units.

The second group of channels for the 4341, available as a special feature, consists of three block multiplexer channels. A block transfer rate of up to 2.0 million bytes per second is available on each of two of the three optional channels, and 1.0 million bytes per second on the other.

The aggregate data rate of the two standard block multiplexer channels is 4 megabytes/second. The aggregate data rate of the five block multiplexer channels including the optional group is 9 megabytes/second.

The capability for the attachment and automatic I/O power sequencing of up to 24 separate control units is standard. 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), allowing interconnection of two channels which may be on a 4341, System/360, or System/370, is also available.

SIMULTANEOUS OPERATIONS: Disconnect during command chaining allows multiple I/O devices to operate concurrently.

CONFIGURATION RULES

The 4331 is a truly integrated system, with many of the peripheral adapters mounted in the processor cabinet, including those for 3310, 3370, and 3340 (System/3 Data Import) Direct-Access Storage Devices (optional, up to 9000 megabytes); 8809 Magnetic Tape Units (optional); diskette drive (optional); 5424 Multi-Function Card Unit (optional); and communications adapter (optional). Also optional are one byte multiplexer channels and one block multiplexer channel. 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 Printers, Models 1 and 2; 3262 Printers, Model 1; and 3289 Printers, Model 4.

The 4341 is a more traditional mainframe, with only the Support Processor, three standard channels, three optional channels, and the optional Channel-to-Channel Adapter feature integrated into the processor cabinet. Up to four 3278-2A Consoles and/or 3287 Printers, Models 1 and 2, are attached to the Support Processor.

For information on channel configurability, see the I/O Channels and Input/Output Units sections of this report. For native mass storage configurations, see the Mass Storage section of this report. For communications capabilities, see the Communications Control section of this report.

MASS STORAGE

3310 DIRECT-ACCESS STORAGE DEVICE: Provides 64.5 megabytes of disk storage for the 4331 processor only. The 3310 connects to the 4331 via an integrated DASD adapter (see below). 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. ▶

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

When the 2311/2314/2319/3310 Direct-Access Storage Compatibility Feature is installed on the 4331, up to seven 2311 volumes or two 2314/2319 volumes can be mapped onto one 3310 drive. Programs written for DOS, DOS/VS, or DOS/VSE and 2311/2314/2319 DASD's can be executed on the 4331 with this feature.

	3310 Fixed Block Mode Support	4331 Processor Mode
DOS/VSE	Yes	Native
VM/BSE Rel 2	Yes	S/370
VM/370 DOS/VSE AF	Yes	S/370

Access method support for the 3310 is VSE/VSAM, SAM, and ISAM through the ISAM interface program to VSE/VSAM. BDAM is not supported. Single data error bursts of up to 3 bits are corrected, while bursts of up to 14 bits are detected.

The 3310 Model A1 is a single drive with its associated control; the A2, dual drives with associated control; the B1, a slave drive for attachment to the A2; and the B2, a slave drive for attachment to the A2.

The integrated DASD adapter on the 4331 can attach up to 16 3310 DASD drives, up to 16 3340 DASD drives or up to 16 3370 DASD drives. In total, up to 24 DASD drives may be attached to the DASD adapter. By installation of a conversion aid special feature, the DASD adapter can read (only) data from an IBM 3348 Data Module which was recorded on a 3340 attached to an IBM System/3 Model 12 or 15.

3370 DIRECT-ACCESS DISK STORAGE DEVICE: Provides up to 285.6 megabytes of storage per actuator and 571.3 megabytes per drive. The 3370 attached to the integrated DASD adapter on the 4331 and to a 3880 Storage Control Model 1 on the 4341. The integrated DASD adapter is described under the 3310 heading above; the 3880, below.

The 3370 employs new 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. Seeking with either actuator may be overlapped with seeking and/or reading/writing on the other actuator. Each actuator accesses one 25 285.6-megabyte DASD volume and has a separate address on the channel.

The 3370 head disk assembly (HDA) consists of two actuators and two disk component volumes assembled as a unit. These units are field-replaceable and movable only by IBM Field Engineering.

Like the 3310, 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). One 3370 actuator (volume) spans 558,000 blocks of user space. User data is mapped, regardless of record size, to one or more 512-byte blocks on the disk.

On the 3370, data block position sensing is automatic. The fixed block architecture provides for relative block addressing. The 3370 has the capability to correct single data error bursts of up to 9 bits as well as to detect all single error bursts up to 16 bits in length. Command retry enables the storage control to recover from certain subsystem errors without

recourse to system error recovery procedures. A switch for each drive address provides the means to protect data from being rewritten or erased. When the read/write switch is in the read-only position, any write command is rejected. The switch's state can be changed only when the device is not selected.

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.

A special feature (8150) allows the attachment of the 3370 Model A1 to a second Storage Director (data path on the 3880). The two Storage Directors may be connected to the same processor or two different processors. Switching between the two Storage Directors is under program control. The 3370 may also be dedicated to a single attachment with an enable/disable switch.

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

Programming support for the 3770 is provided by DOS/VSE on the IBM 4300 processors operating in ECPS:VSE mode. The 3370 is also supported by VM/BSE Release 2 on the IBM 4300 processors operating in System/370 mode. When DOS/VSE is running as a guest operating system under VM/370, DOS/VSE with VSE/Advanced Functions supports the 3370 on the IBM 4300 processors in System/370 mode. The DOS/VSE access methods supported are VSE/VSAM, SAM, and ISAM through the ISAM interface program to VSE/VSAM; BDAM support is not provided.

The 3880 Storage Control provides two completely independent paths for the transfer of file positioning commands and data between an IBM 4341 Processor channel and direct-access storage devices. Each path, called a Storage Director, attaches to an IBM 4341 Processor Block Multiplexer Channel. Both Storage Directors can be attached to the same channel, to different channels on the same processor, or to channels on two separate processors. The two-Storage Director design of the 3880 allows a faulty Storage Director to transmit diagnostic information (logging of failure information) through the other Storage Director. Each Storage Director can attach either 3370 or 3340/3344 DASD Drives.

The 3880 is built on a specialized LSI bipolar microcontroller chip which is signal-compatible with TTL circuitry. The chip is fabricated from a master slice of over 1400 gates and includes more than 14,000 components. The internal logic circuits utilize current switch technology. The chip can execute more than 5 million instructions per second and has 94 I/O signal lines, built-in error detection circuits, 16-bit microinstructions, and 8-bit data words. The instruction set is rich in branch and register-oriented instructions.

The 3880 provides multiple requesting, allowing a 3880 Storage Director and its attached drives to disconnect from the channel during mechanical delays resulting from actuator positioning Locate, Seek, or Set Sector commands. Reconnection is attempted when the access mechanism is positioned at the desired track or when the specified rotational position has been reached. Other I/O operations can be initiated on other drives attached to the Storage Director during the period of disconnection.

Two-channel switching is available as an optional feature for the 3880 Storage Control. This feature allows two channels ►

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▶ to be switched to each Storage Director. A total of four channels, from the same or different processors, can therefore have access to the 3880, with a maximum of two channels per Storage Director.

For configurations attaching 3340/3344's, the Storage Director uses 64 contiguous device addresses irrespective of the number of drives attached. The 3340 Model A2's on the first and third strings may attach up to three 3340 Model B1's/B2's and/or 3344's in any combination. The 3340 Model A2 on the second string may attach up to three 3340 Model B1's/B2's. The 3340 Model A2 on the fourth string may attach one 3340 Model B1 or B2. If 3340's and 3344's are intermixed on a Storage Director, a maximum of 28 drives can be attached to that Storage Director; if 3340's only are attached, then 32 drives can be attached. While 3340's and 3344's can be intermixed on a Storage Director, they cannot be intermixed with 3370's on the same Storage Director. For a Storage Director attaching 3370's, a maximum of four 3370 Model A1s, each with up to three 3370 Model B1's, may be attached.

The 8170 Two-Channel Switch Pair allows each storage director to be attached to a second channel. Four unique channels may be switched, two to each Storage Director; or the same two channels switched may be on the same or different processors. An available control unit position is required on each channel. Switching is under program control. Each Storage Director can be dedicated to a single channel by means of an enable/disable switch.

3340 DIRECT ACCESS STORAGE FACILITY: Provides fairly rapid random access to large quantities of data stored in interchangeable 3348 Data Modules. The 3340 drives are available in three models. Model A2 contains two drives and a control. Models B1 and B2 contain one and two drives, respectively; they can be connected to a 3340 Model A2 to form a string of up to eight drives.

Each 3340 drive accommodates one 3348 Data Module, either Model 35 or Model 70, at a time. The Data Module is a self-contained unit that includes not only the magnetic disks, but also the associated access arms and read/write heads. Since the same heads always serve the same tracks, head alignment problems should be reduced and data reliability enhanced. Each Data Module is a sealed unit 8 inches high, 16 inches wide, 18 inches long, and 16 pounds (Model 35) or 18 pounds (Model 70) in weight. Loading of the Data Module is an automatic process; the operator simply places the Data Module on a drive, closes the drive cover, and turns on a switch. Processing can begin in less than 20 seconds.

The 3348 Model 35 Data Module has 348 cylinders and a total storage capacity of 34.9 million bytes. Model 70 has 696 cylinders and a total storage capacity of 69.8 million bytes. Both models have 12 tracks per cylinder and can store up to 8368 bytes in each track. Both models exhibit the same performance: average head movement time is 25 milliseconds, averge rotational delay is 10.1 milliseconds, and data transfer rate is 885,000 bytes/second.

In April 1974, IBM announced the 3348 Model 70F Data Module, which provides 502,080 bytes of fixed-head disk storage and 69.3 million bytes of storage accessed by moveable heads. The Model 70F Data Module can be used on a 3340 Model A2 or Model B2 disk drive that is equipped with the 4301 Fixed Head Feature, and can be intermixed and interchanged on a 3340 Model A2 or B2 with other 3348 Data Modules. The first five logical cylinders on the Model 70F are accessed by a fixed read/write arm, while the remaining cylinders are serviced by moving read/write heads. The performance characteristics of the 3348 Model 70 and Model 70F Data Modules are compared below: ▶

	3348 Model 70		3348 Model 70F
	Cylinders 0-695	Cylinders 1-5	Cylinders 0 & 6-695
Average seek time (ms)	25	0	25
Average rotational delay (ms)	10.1	10.1	10.1
Data rate (KB/sec)	885	885	885
Bytes per track	8,368	8,368	8,368
Data cylinders	696	5	691
Tracks per cylinder	12	12	12
Capacity (bytes)	69,889,536	502,080	69,387,456

Model 35 and 70 Data Modules cannot be field-upgraded to the Model 70F. Each Model 3340 Model A2 or B2 that operates with the Model 70F Data Module must be equipped with the 4301 Fixed Head Feature.

In addition to the sealed 3348 Data Modules, the 3340 subsystem includes other features that contribute to improved reliability. An error correction code permits automatic correction of an error up to 3 bits long and detection of an error up to 11 bits long in each record. A closed-loop air filtration system reduces airborne contaminants that might cause read/write errors. A read-only switch on every 3340 drive is activated by inserting a latch in the Data Module; when the latch is not inserted, the data is protected against erasure or overwriting.

3344 DIRECT ACCESS STORAGE: Announced in July 1975, the 3344 Direct Access Storage units expand the storage capacity of the 3340 Direct Access Storage Facility and can be intermixed with 3340 Model B1 and B2 units in a 3340 subsystem. Each 3344 Model B2 or B2F is a two-drive unit with a capacity of 560 million bytes (279,558,144 bytes per drive). The Model B2 attaches to a 3340 Model A2 and can be intermixed with 3340 Model B drives and 3344 Model B2F units in any combination of up to three B units per 3340 Model A2. The 3344 Model B2F has the same attachment capabilities as the 3344 Model B2 but has 1,004,160 bytes of fixed-head storage per spindle, or 2,008,320 bytes per dual-drive unit. The maximum 3340 subsystem includes one 3340 A2 unit and three 3344 Model B2 or B2F units for a total of 1.8 billion bytes per string.

Each of the two drives in a 3344 Model B2 or B2F unit is equivalent in format and capacity to four logical 3348 Model 70 Data Modules. The average seek time for the moving-head storage is 25 milliseconds, average rotational delay is 10.1 milliseconds, and data transfer rate is 885,000 bytes per second. Standard features include Read-Only Switch, Rotational Position Sensing, and Full-Track Read Command.

INPUT/OUTPUT UNITS

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

● 2311 Disk Storage Drive Model 1 via the 2821 Storage Control Model 1 (block);

● 2305 Fixed Head Storage Model 2 via the 2835 Storage Control Model 2 (block on 4341);

● 2314 Direct Access Storage Facility Model 1 (block); 3540 Diskette I/O Unit Models B1 or B2 (byte or block); 333X Disk Storage Models 1, 2, and 11; and 3340 Direct-Access Storage Facility Models A2, A2F, B2, B2F, C2 and C2F, all via the 3830 Storage Control Models 1 or 2 (block on 4341);

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- 2415 Magnetic Tape Unit and Control Models 1 to 6 (byte or block on 4331 and block on 4341);

- 2401 Magnetic Tape Unit Models 1 to 6 and 8 and 2420 Magnetic Tape Unit Models 5 and 7, all via the 2803 Tape Control Models 1, 2, or 3 (byte or block) or the 2804 Tape Control Models 1, 2, or 3 (block on 4341);

- 3420 Magnetic Tape Unit Models 3 or 8 via the 3803 Tape Control Models 1 or 2 (byte or block);

- 3410/3411 Magnetic Tape Units and Control Models 1, 2, and 3 (byte or block);

- 1403 Printer Models 2, 7, and N1 via the 2821 Control Unit Models 1, 2, or 3 (byte or block);

- 3287 Printer Models 1 and 2 (attachment on 4331);

- 3211 Printer Model 1 via the 3811 Printer Control Unit Model 1 (byte or block);

- 1443 Printer Model N1 (byte or block);

- 3800 Printing Subsystem Model 1 (byte or block);

- 2501 Card Reader Models B1 and B2 (byte or block);

- 3505 Card Reader Models B1 or B2 (byte or block);

- 2520 Card Reader Punch Models B1, B2, and B3 (byte or block);

- 2540 Card Read Punch Model 1 via the 2821 Control Unit Model 1 (byte or block);

- 1442 Card Read Punch Model N1 (byte or block);

- 1442 Card Punch Model N2 (byte or block);

- 1017 Paper Tape Reader Models 1 and 2 via the 2826 Paper Tape Control Model 1 (byte on 4341);

- 2671 Paper Tape Reader Model 1 via 2822 Paper Tape Control Model 1 (block or byte);

- 7770 Audio Response Unit Model 3 (byte);

- 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);

- 3895 Document Reader/Inscriber Models 1 and 2 (byte or block);

- 3890 Document Processor Models A1 to A6 and B1 to B6 (byte or block);

- 2701 Data Adapter Unit Model 1 (byte or block);

- 3704 Communications Controller (byte);

- 3705-I and 3705-II Communications Controller (byte or block in NCP mode, byte in emulation mode);

- 3791 Controller Models 1C, 2A, 2B, 11C, 12A, and 12B (byte or block);

- 2250 Display Unit Model 1 (byte or block);

- 2250 Display Unit Model 3 via the 2840 Display Control Model 2 (byte or block);

- 3251 Display Station Model 1 via the 3255 Display Control Model 1 and 3258 Control Unit Model 1 (block);

- 3277 Display Station Models 1 and 2, 3284 Printer Models 1 and 2, 3286 Printer Models 1 and 2, 3287 Printer Models 1 and 2, and 3288 Printer Models 1 and 2, all via the 3272 Control Unit Models 1 and 2 or 3274 Control Unit Models 1A, 1B, and 1D (byte or block);

- 3289 Printer via the 3274 Control Unit Models 1A, 1B, and 1D (byte or block);

- 3838 Array Processor Model 1, 2, or 3 (byte on 4341).

For more information on these units, please refer to Report 70C-491-04 (IBM System/370).

3278 DISPLAY CONSOLE, MODEL 2A: Consists of a CRT display and separately priced 75-key operator console keyboard. The anti-glare CRT displays 1920 characters in 24 rows of 80 characters each. The 96-character set provided on the 3278-2A consists of 26 upper case letters displayed through the use of a 7-by-9 matrix and 26 lower case alphabetic, 10 numeric, and 32 special characters displayed through the use of a 7-by-14 matrix. Rows 1 through 20 are usable by the operator, while rows 21 through 24 provide system status information.

The movable keyboard contains a typewriter layout with 12 program function keys available on the top row through use of the alternate shift key. Also provided are 49 data keys and 26 control keys including cursor move, tab, home, back tab, insert, delete, erase to end of field, and erase all input. In addition, the keyboard contains an operator control panel with four control keys—power off (4341 only), lamp reset, power on/IML (4341 only), and I/O interface—and 6 LED indicators (basic check, system wait, power in process, power complete, I/O interface disabled). The keyboard is available for the 4341 with I/O interface (4631), without I/O interface (4632), and without operator control panel (4633). On the 4331, the keyboard is available without I/O interface or power-on (4634).

The 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 can operate in one of two modes. In *Display Mode,* the keyboard is used for input and the display with 20 lines of 80 characters/line for output, and DOS/VSE, DOS/VS Release 34, OS/VS1 Release 7, or VM/370 Release 6 support is required. The optional 3287 Printer Model 1 or 2 has a separate address. In *Printer-Keyboard Mode,* the 3278-2A uses the keyboard for input and the display and a recommended 3287 Printer Model 1 or 2 for output. The display/keyboard and 3278 Printer apear to the system as a console printer-keyboard. This allows the user to run an operating system which has been generated for use on a System/360 with a 1052 Printer-Keyboard or a System/370 with a 3210 or 3215 Console Printer-Keyboard.

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- ▶

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▶ 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 attach to the integrated (optional) 8809 adapter. Model 1A attaches directly to the adapter, Model 2 to Model 1A, and Model 3 to Model 2.

3203 MODEL 5 PRINTER: Uses IBM's proven horizontal-train printing technology to produce high-quality printed output from either model of the 4300. 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. Normal skipping speed is up to 24 inches/second, with high-speed skipping at up to 55 inches/second after 6 lines have passed. A power-assisted stacker is standard.

Improvements over the 1403 Model N1 include: 1) an electronic forms control buffer that controls skipping and spacing, eliminating the need to change carriage control tapes; 2) a new tractor design to simplify forms loading; 3) higher print-hammer energy to produce copies of improved quality; 4) smaller size and reduced floor-space requirements; 5) quieter operation; and 6) a vacuum cleaning system that continually cleans the print train.

3289 MODEL 4 PRINTER: 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 on the 4331. The 3289 is an interchangeable-belt printer that attaches to the 4331 via the display/printer adapter. The user may select either a 48-, 64-, or 96-character belt to be delivered with the system. 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 4331 control. The unit has 132 print positions, character spacing of 10 characters per inch, and line spacing of 6 or 8 lines per inch.

3262 MODEL 1 PRINTER: An interchangeable-belt printer rated at 650 lpm with a 48-character belt, 625 lpm with a 64-character optimized set belt, 467 lpm with a 64-character belt, and 364 lpm with a 96-character belt. The character set height may be either 0.079 or 0.095 inch except for the 96-character belt, where the only available height is 0.095 inch. The 3262 can be attached to the 4331 only via the display/printer adapter. The 3262 has 132 print positions, horizontal spacing of 10 characters per inch, and vertical spacing of 6 or 8 lines per 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.

5424 MULTI-FUNCTION CARD UNIT (MFCU): For use with Model 4331 only, via the 6510 attachment on the 5424 and 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. Printing occurs at a speed of 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.

COMMUNICATIONS CONTROL

3704 AND 3705 COMMUNICATIONS CONTROLLERS: The use of these programmable communications controllers has been extended to the 4300 Series. The 3704 and 3705 are the prime communications devices on the 4341 and can serve as alternatives to the Integrated Communications Adapter on the 4331.

Designed as IBM's evolutionary replacement for the hard-wired 2701, 2702, and 2703 transmission controls, the original 3705 Communications Controller is a minicomputer-based front-end processor that can have from 16K to 240K bytes of core memory and control up to 352 communications lines. It is available in 20 models with varying storage sizes and line capacities. Customer shipments began in July 1972.

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 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 50,000 bits per second. In the NCP mode, data is transferred between the 3705 and the host computer via a single subchannel interface—a significant difference from the 2701/2/3 controls, which require a separate multiplexer subchannel for each communications line.

In November 1975, IBM announced an enhanced version of the 3705, the 3705-II, which offers significant price/performance improvements over the original model, now designated the 3705-I. The 3705-II has a storage capacity of from 32K to 256K bytes of metal oxide semiconductor (MOS) memory and has a faster processor cycle time of 1.0 microseconds (compared to 1.2 microseconds for the 3705-I). Other new features include a high-speed Communications Scanner, an upgraded Channel Adapter that transfers data in blocks of up to 32 characters, and increases in the supported transmission speeds to 9600 bits per second in synchronous mode and a maximum transmission rate of 56K bits per second. The 3705-II is available in 32 different models depending upon the storage capacity.

In November 1978, IBM announced 12 new models of the 3705-II Communications Controller; the first shipments are scheduled for June 1979. The new models (J1-J4, K1-K4, and L1-L4) feature memory beginning at 320K bytes, expandable to 512K bytes in 64K-byte increments; a memory cycle time of 0.9 microsecond (compared with 1.0 microsecond for the previous 3705-II models); and a Cycle Utilization Counter, which accumulates statistical data to assist in measuring machine performance.

All 12 of the new 3705-II Communications Controllers (Models J, K, and L) hold 256K bytes of memory storage in their first frame and at least 64K bytes in the second. ▶

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▶ Additional storage is added in the second frame in 64K-byte increments, depending on the model, up to the maximum of 512K bytes. The new 3705-II's, like the old, are capable of physically attaching up to 352 communications lines, but are limited in concurrent operation by line speed, Channel Adapter type, memory size, software mode of operation, etc. One significant change in the new models is that the Type 1 Channel Adapter cannot be used, indicating that IBM is gradually moving its users away from the System/360 and 270X emulation mode of operation and toward the high-speed System/370 with SNA compliance.

Also included in the new models is a Cycle Utilization Counter which allows the ACF/NCP/VS (R2) software programming to accumulate statistical data on 3705 cycle utilization for user access. The specific cycles computed are instruction execution and operator panel maintenance cycles, and cycle sharing operations. With this data, ACF/NCP/VS (R2) provides information on the percentage of available cycles used.

Also in November 1978, IBM announced the availability of two new line interfaces, which permit high-speed local data transfer between any 3705 and either another 3705 or a 377X terminal without modems.

In February 1973, IBM announced a smaller version of the 3705 called the 3704. 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, ensuring upward compatibility for economic expansion of a small network into a large one. Customer shipments began in May 1973.

When connected to a host IBM processor, a 370X 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 370X Controllers are supported under VTAM, the principal access method for communications support under DOS/VS and OS/VS. The major advantages of NCP operation through VTAM include the capabilities for dynamic allocation of terminals, lines, and the 370X Controllers among multiple applications programs and for simultaneous operation in the Emulation and NCP modes within one 370X. In addition, the 370X can be configured and used as a remote concentrator. Communication between a remote 370X and a local 370X connected to the host computer is over a leased line operating synchronously in the full-duplex mode at 4800 bits per second or in half-duplex mode at up to 50,000 bits per second.

With the announcement of the 3705-II in November 1975, IBM also added an additional software enhancement that permits PEP to support concurrent operations in a dual-processor environment in which one central processor supports communications through VTAM (or TCAM through VTAM) in the NCP mode and the other central processor supports communications via a non-VTAM control program which operates under the Emulation Program. When NCP or NCP/VS is used, a 370X functions as a true "front-end" communications processor and relieves the central processor of many routine tasks such as line control, character and block checking, character buffering, polling, and error recovery.

The Advanced Communication Function for NCP, ACF/NCP/VS (and related Systems Support Programs, for all operating systems), announced in November 1976, added capabilities that are significant for multi-system users.

Multiple processors can be interconnected via full- or half-duplex SDLC protocol lines linking their respective local 3705's. Any mix of VS operating systems is permissible. Transmission to a host CPU can be passed through interconnected 2705's to a down-stream CPU without any involvement of the host or intermediate CPU's. To utilize ACF/NCP/VS, an Advanced Communication Function for VTAM and TCAM is necessary.

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 3704 and 3705, see Reports 70D-491-32 and 70D-491-31, respectively.

4331 INTEGRATED COMMUNICATIONS ADAPTER: 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 a data rate of up to 56,000 bps, operating concurrently with other lines provided that the data rate limitations are not exceeded. The adapter operates with start/stop and BSC lines in 2703 compatibility mode. SDLC is supported only by ACF/VTAME operating under DOS/VSE or by ACF/VTAME operating under VM/370 Release 6 with DOS/VSE running as a guest. The communications adapter provides auto answer, auto-poll operation, multipoint station functions, EBCDIC transparent mode for BSC only, and EBCDIC/ASCII code for BSC only.

The 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 with digital data service adapters (5650); and auto-call unit interfaces for up to two of the installed lines (1020).

The high-speed modem adapter (4720) is for the attachment of an external modem with clock having a CCITT V.35 interface. One non-switched point-to-point BSC or SDLC line may be operated with speeds of 20,400, 40,800, 48,000 or 56,000 bps.

The clock speed internal to the line attachment base for non-clocked modems is wired by default to 134.5 bps for start/stop operation and 1200 bps for BSC and SDLC operation. Otherwise, the clock speed can be wired at installation to one of the following: start/stop, 75, 300, 600, or 1200 bps; BSC, 600 bps; and SDLC, 600 bps. For BSC or SDLC operations, if 1200 bps is wired, then either full-speed operation (1200 bps) or half-speed operation (600 bps) may be selected from the operator console keyboard.

The local attachment interface provides circuits and controls for the local attachment of one BSC or SDLC remote station to the communications adapter without the use of modems at either device. Transmission speed can be strapped at installation time by the customer engineer at 1200, 2400, 4800, and 9600 bps. The feature provides clocking for both the communications adapter and the terminal. The attached terminal must be equipped with an EIA RS-232C or CCITT V.24/V.28 interface, have no business machine clocking, and have an external modem cable. ▶

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▶ The digital data service adapter provides circuits and controls for attachment of one BSC or SDLC line and includes an internal Dataphone Digital Service (DDS) Adapter. This adapter will operate at synchronous speeds of 2400, 4800, 9600, or 56,000 bps. The speed must be set to the speed specified in the customer's order for service to the common carrier at installation time.

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.

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), VM/370 Release 6, and OS/VS1 Release 7, Both VM/ 370 Release 6 and OS/VS1 Release 7 provide new functions and complete support for the 4300 processors.

DOS/VSE: Provides enhancements over DOS/VS in the 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.

DOS/VSE also provides full support for the IBM 3031 processor complex in uni-processor mode, as well as for System/370 processors with clock comparator and CPU timer.

New device support within DOS/VSE includes the 5424 Multi-Function Card Unit, the 3284/3286/3287/3288 Con-

sole Printers, 3289 Model 4 Line Printer, 3278 Model 2A Operator Console, the 8809 Magnetic Tape Unit, and the 3310/3370 DASD units. In conjunction with the new DASD's, 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 3310 Surface Analysis Utility and the 3370 Surface Analysis Utility. Additional utility expansion is provided in the fast copy disk volume utility, where 2311/2314 support has been added. 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 MSHP (maintain system history program) is one of the numerous DOS/VSE serviceability improvements. MSHP creates a personalized history file (user's name, address, etc.), assists with the installation of new components and features, provides the function for application of preventive service packages, and records all program temporary fixes (PTF's) automatically in the history file. MSHP provides for sorting of entries by PTF, APAR, module name, component, and feature for a cross-referenced history file list. MSHP can also perform history searches for specific details. Other serviceability improvements include common EREP for DOS/VSE and OS/VS, improvements in the copy/merge operation for all DASD's except the 3310 and 3370, and the ability to execute the On-Line Test Executive Program (OLTEP) in any partition.

The VSE/Advanced Functions (AF). Release 1 and 2 (4746-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. ▶

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▶ Release 1 of AF provides seven partitions for all SYSRES DASD types, support of the 3310 and 3370 with VM/370 on 4331 and 4341 Processors in System/370 mode, and implicit link for reducing the number of job control statements an application programmer needs to code for program compilation and testing. AF Release 1 also provides a 256-byte area for job-to-job communication, multiple label areas on SYSRES, message retention on the console until answered or deleted by the operator, elimination of the LBLTYP statement, automated system initialization (IPL) and starting of subsystems in various partitions, and dump improvements including a high-speed dump taken each time a partition abends. Further, Release 1 provides fast B- and C-transient fetch, fast OPEN of hard-copy file, high-level SDL search (to one page), multiple extent page data sets, and JCL option for fast channel command and word translation. Importantly, AF Release 1 provides improved operation of DOS/VSE with VM/370 through job accounting improvements, CP commands SET PAGE X and SETRUN ON issued automatically at DOS/VSE IPL, and DOS/VSE IPL on VM/370 improvements.

AF Release 2, scheduled for availability by the end of 1979, provides DASD sharing across processors, 208 user tasks (within one partition, a maximum of 32 concurrent active tasks is allowed), 12 partitions, and extended label area support. This support provides labels on any DASD device, new Label ADD and Label DELETE functions, and permanent labels for foreground partitions loaded from the background partition. Improved librarian functions are another part of Release 2 of AF. These functions include multiple procedure libraries, shared libraries across partitions, library residence on disk devices other than SYSRES, and concatenation of up to 15 temporary and 15 permanent libraries within one job step. Release 2 of AF further provides on-line system generation in any DOS/VSE partition, DASD independence for SAM/DAM files, a list log utility for printing out SYSLOG messages on SYSLST at abnormal end of job, additional DLBL information for the SAM feature, SYSLNK in VSE/VSAM managed space with workfiles for the linkage editor dynamically allocated and deallocated in VSE/VSAM space, extended VOLUME command (by one parameter), new FREE command, 3262 Line Printer support, and system tailoring of IPL. IBM has designed AF Release 2 so that the B-transient area contention is reduced by marking frequently used system services (OPEN, end of job, attention routines) into SVA-resident code.

VM/370 RELEASE 6: Provides support for the 4331 and 4341 Processors as well as the 3033 Attached Processor Complex and the channel-attached 3203 Model 5 Printer. The 3800 Printing Subsystem can now be supported as either a dedicated device or a VM/370 spooling device. Journaling and security enhancements have been made that optionally track unsuccessful LOG ON and all LINK attempts. Masking of LOGON 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.

The VM/Basic Extensions, Release 2 (VM/BSF), include major CMS improvements such as an interactive "HELP" facility, file system enhancements, and the upgrade of CMS/DOS to DOS/VSE. Several Control Program additions are available to improve performance.

The VM/Systems Enhancements, Release 2 (VM/SE), allow dynamic SCP transition from a VM environment to a native OS/VS operation and back to VM with a minimum of disruption to system operations. Both have been enhanced to include hardware support for the 3289 Printer Model 4, the 8809 Magnetic Tape Unit, and the 3310/3370 DASD.

OS/VS1 RELEASE 7: Provides support for the 4331 and 4341 Processors in the System/370 mode, with the ECPS:

VS1 mode on the 4341 providing an OS/VS1 assist through microcoding. Improvements to 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 3 Printer and the 3880 Storage Control is now a part of OS/VS1.

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.

Some of the facilities available in conjunction with DOS/VSE and DOS/VSE AF include a new version of ACF/VTAM, called 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 Emulation; and the ability for DOS/VSE to run together with VM/370 to provide CMS interactive facilities and virtual machine functions.

A whole new level of data management facilities will also be available with DOS/VSE. A new version of DL/1 DOS/VS will support the new 3310 and 3370 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, and support for CICS/DOS/VS Release 1.4 and the DB/DC Data Dictionary, Release 3.

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 new 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, pre-generated, pre-configured, and pre-tested 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 will support VS/IFS (Interactive File Sharing), which will allow 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 stand-alone and guest SCP environment, and a ▶

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► 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, CIS/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 OS/VS1 Release 7, IMS/VS, ACF/NCP/VS, ACF/VTAM, and CICS/VS.

PRICING

POLICY: IBM offers the 4300 Series 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.

Prime-shift maintenance is included in the rental or lease price. The purchase option accrual equals 60 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. CPU's 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.

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

	Consecutive hours				
	9*	12	16	20	24
Monday-Friday (until 8:00 a.m. Saturday)	10	12	14	16	18
Saturday (until 8:00 a.m. Sunday)	4	5	7	8	9
Sunday (until 8:00 a.m. Monday)	5	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 $66.00 per hour, and during off hours the charge is $76.00 per hour. The hourly rate for IBM Systems Engineering service is $55.00.

SOFTWARE: IBM 4300 users receive DOS/VSE at no additional cost. All other IBM software, including DOS/VSE AF and other licensed program products, is priced separately. In addition, basic monthly charges have been established for maintenance of the IBM system control programs and other licensed program products. The minimum term of agreement is one year. A customer with multiple systems may choose to designate a single system for processor support. Each system control or licensed program run on a processor other than the designated processor is subject to an additional (but reduced) maintenance charge. For maintenance purposes, the problem program is transferred to the designated processor. Charges for software support appear at the end of the equipment price list. An alternative to contracted maintenance is per-call service, charged at the applicable hourly rate. The initial and prime interface for software problems and their solution is the IBM Support Center.

SUPPORT CENTER: This approach to quick problem-solving via centralized telephone support is the first level of support for the new software products announced with the 4300's as well as older software products. Support for DOS/VS Release 34, OS/VS1 Release 6.7, and VM/370 Release 5 will also be provided from the Support Centers without separate charge until December 31, 1980, one year beyond the deadline for terminating local support. As of January 1, 1981, no further central or local support will be provided for these products. For OS/VS1 Release 6.0, centralized programming services will be available without separate charge until 12 months after the availability of OS/VS1 Release 6.7.

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 will become billable activities.

PREVENTIVE SERVICE ASSISTANCE PROGRAM: This program has been enhanced to improve the handling of Program Update Tapes (PUT's). With the installation of DOS/VSE, OS/VS1 Release 7, and VM/370 Release 6, customers will be provided with integrated and customized Program Update Tapes for SCP's and specified licensed program products. In addition, a common service application vehicle will be provided for each system control program. For DOS/VSE it is MSHP, for OS/VS1 it is SMP4, and for VM/370 it is PLC. Each system PUT will be researched against a master service data base, synchronized to the applicable SCP, field-tested as one package, customized to the SCP and program product profile, and shipped directly to the customer.

Applying system PUT's within an established installation period (normally 75 days) is recommended to increase software stability. Distribution of customized preventive maintenance service tapes including both SCP and program product corrections will be provided only to users of IBM processors on which DOS/VSE, OS/VS1 Release 7, or VM/370 Release 6 is supported. Users of other licensed products will receive the licensed program portion of the ►

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▶ preventive service updates directly from PID (Program Information Department) on a periodic basis.

EQUIPMENT: The following typical purchase prices include all controllers and adapters.

TYPICAL 4331 SYSTEM: Includes a 4331 Processor with 1,048,576 bytes of main memory; a 3262 Printer; two 3278 Displays; two 3310 DASD's (129 megabytes); an 8809 Magnetic Tape Unit; integrated disk, tape, and communications adapters; a 1200-bps communications line, a 3278-2A Console/Keyboard, and systems software. Purchase price is $141,378; 2-year lease, $3,572 per month; monthly maintenance, $530.50; and system control program support, $200 per month.

TYPICAL 4341 SYSTEM: Includes a 4341 Processor with 2,097,152 bytes of main memory; a 3203 Model 5 Printer; two 3370 DASD's (1,140 megabytes); four 3340 DASD's (280 megabytes); a 3880 Storage Control; a card reader; a card punch; a 3278-2A Console/Keyboard; and systems software. Purchase price is $644,545; 2-year lease, $16,707 per month; monthly maintenance, $2,420; and system control program support, $570 per month.■

EQUIPMENT PRICES**

			Purchase Price	Monthly Maint.	Monthly Rental Charge*	Monthly Lease Charge (2-Year Lease)*
PROCESSORS						
4331 I1		Processor with 524,288 bytes of main memory	$ 65,000	$150.00	$1,862	$1,585
4331 J1		Processor with 1,048,576 bytes of main memory	72,500	160.00	2,086	1,775
4341 K1		Processor with 2,097,152 bytes of main memory	245,000	475.00	7,021	5,975
4341 L1		Processor with 4,194,304 bytes of main memory	275,000	515.00	7,902	6,725

PROCESSOR FEATURES & CHANNELS

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

Model 4331:

			Purchase Price	Monthly Maint.	Monthly Rental Charge*	Monthly Lease Charge (2-Year Lease)*
	1001	Adapter Power Prerequisite	2,400	7.00	71	60
	1002	Adapter Logic Prerequisite	4,400	12.00	129	110
	1901	Control Store Expansion; 65,536 bytes	5,100	34.00	150	128
	2001	Display/Printer Adapter Expansion	1,215	1.50	32	27
	3201	DASD Adapter; for 3310/3340/3370	3,600	3.50	106	90
	3401	Diskette Drive; reads IBM Type 1 Diskettes	3,520	18.50	103	88
	3898	External Signals; for external interrupt	300	0.50	9	8
	3901	5424 Adapter	6,600	8.50	9	8
	3950	1401/1440/1460 Compatibility	—	—	—	—
	4910	8809 Mag Tape Unit Adapter	3,600	3.50	106	90
	5248	Byte Multiplexer Channel	3,520	1.50	103	88
	5531	Power Interface	2,200	1.00	65	55
	5532	Power Interface, Additional	1,100	1.00	33	28
	5550	Printer-Keyboard Mode	—	—	—	—
	6305	System/3 Data Import	—	—	—	—
	7851	3340 Direct Attachment	—	—	—	—
	7901	2311/2314/2319/3310 Direct-Access Storage Compatibility	—	—	—	—
	8701	ECPS:VM/370	—	—	—	—

Model 4341:

			Purchase Price	Monthly Maint.	Monthly Rental Charge*	Monthly Lease Charge (2-Year Lease)*
	1850	Channel-to-channel adapter	21,000	23.50	617	525
	1870	Block multiplexer channels, additional; group of three	16,150	5.00	475	404
	1890	Channel control unit positions, additional	2,500	8.50	74	63

Console, 4331 or 4341:

			Purchase Price	Monthly Maint.	Monthly Rental Charge*	Monthly Lease Charge (2-Year Lease)*
3278	2A	CRT display/keyboard	2,680	21.50	79	67
	4633	75-key operator console keyboard (4341)	560	6.00	16	14
	4631	75-key operator console keyboard with I/O interface (4341)	1,160	6.50	34	29
	4632	Same as 4631 without I/O interface (4341)	1,080	6.50	32	27
	4634	Same as 4631 without I/O interface (4331)	1,080	6.50	32	27
	6340	Security keylock	35	—	35	—

PROCESSOR UPGRADES

		Purchase Price	Monthly Maint.	Monthly Rental Charge*	Monthly Lease Charge (2-Year Lease)*
Model I1 to J1		7,500	—	—	—
Model K1 to L1		30,000	—	—	—

MASS STORAGE

			Purchase Price	Monthly Maint.	Monthly Rental Charge*	Monthly Lease Charge (2-Year Lease)*
3310	A1	Single disk drive, 64.5 megabytes; with controller; for 4331 only	12,960	53.00	423	360
3310	A2	Two disk drives, 64.5 megabytes each; with controller; for 4331 only	21,530	90.00	703	598

*Rental/lease prices include equipment maintenance.
**See Report 70C-491-05 for prices of the System/370 peripheral equipment.

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IBM 4300 Series

EQUIPMENT PRICES**

			Purchase Price	Monthly Maint.	Monthly Rental Charge*	Monthly Lease Charge (2-Year Lease)*
MASS STORAGE (Continued)						
3310	B1	Single disk drive, 64.5 megabytes (for attachment to Model A2)	10,260	40.00	335	285
3310	B2	Two disk drives, 64.5 megabytes each (for attachment to Model A2)	18,830	77.00	615	523
		Model A1 to A2 Upgrade	8,570	—	—	—
		Model B1 to B2 Upgrade	8,570	—	—	—
3340		Direct Access Storage Facility; 34.9 or 69.8 MB per drive:				
		Model A2; Two drives plus control	36,000	92.00	1,100	936
		Model B1; One drive	19,800	49.00	615	523
		Model B2; Two drives	25,200	79.00	776	660
3344 B2		Add-on Dual Disk Drive for 3340 Direct-Access Storage Facility; 279.6 MB per drive	39,600	150.00	1,216	1,035
3344 B2F		Add-on Dual Disk Drive for 3340 Direct-Access Storage Facility with 2MB fixed-head storage; 279.6 MB per drive	52,000	210.00	1,598	1,360
4301		Fixed-Head Feature (for 3340 A2 or B2)	1,710	1.50	48	41
6201		Rotational Position Sensing (for 3340 B1)	684	0.50	20	17
6202		Rotational Position Sensing (for 3340 or A2 or B2)	864	0.50	25	21
6148		Remote String Attachment	—	—	—	—
8150		String Switch	7,200	12.00	220	187
3348		Data Module (for 3340 drives):				
		Model 35; 34,944,768 bytes	1,600	Time & mat'l.	59	50
		Model 70; 69,889,536 bytes	2,200	Time & mat'l.	82	70
		Model 70F; 69,889,536 bytes, of which 502,080 are served by fixed heads	4,400	Time & mat'l.	165	140
3370 A1		Add-On Single Disk Drive, for 4331 or 4341; 571.3 megabytes	35,100	120.00	1,058	900
3370 B1		Add-On Single Disk Drive for attachment to Model A1; 571.3 megabytes	23,400	90.00	705	600
8150		String Switch	3,900	1.50	118	100
3880 1		Storage Control; for 4341 only	62,350	160.00	1,704	1,450
8170		Two-Channel Switch; for 4341 only	6,450	10.00	176	150
MAGNETIC TAPE EQUIPMENT						
8809		Magnetic Tape Units (for 4331 only):				
	1A	First drive; connects to the I/O attachment feature of the 4331	10,440	48.00	341	290
	2	Second, fourth, or sixth drive that attaches to Model 1A or 3	9,270	43.00	303	258
	3	Third or fifth drive that attaches to Model 2	10,440	48.00	341	290
PRINTERS						
3203	5	Line Printer, 1200 lpm	38,320	340.00	1,475	1,255
3289	4	Line Printer, 230 to 400 lpm (print speed is character set-dependent)	13,250	179.00	556	473
	5821	48-char. EBCDIC Print Belt	160	—	—	—
	5822	64-char. EBCDIC Print Belt	160	—	—	—
	5823	94-char. EBCDIC Print Belt	160	—	—	—
3262	1	Line Printer; 650 lpm	14,000	150.00	411	350
	5951	0.079-inch char. height	—	—	—	—
	5950	0.095-inch char. height	—	—	—	—
	5940	48-char. EBCDIC Set	170	—	—	—
	5944	64-char. EBCDIC Set	170	—	—	—
	5946	64-char. EBCDIC Set	170	—	—	—
	5948	96-char. EBCDIC Set	170	—	—	—
PUNCHED CARD EQUIPMENT						
5424	A1	Multi-Function Card Unit, 96-col.	7,810	185.00	376	—
	A2	Multi-Function Card Unit, 96-col.	10,340	266.00	565	—
	6510	5424 Multi-Function Card Unit Attachment; for 4331 only	2,670	6.00	60	—
COMMUNICATIONS EQUIPMENT						
Model 4331:						
	1020	Autocall Unit Interface	440	2.00	13	11
	1601	Communications Adapter, base	3,080	1.50	90	77
	3701	EIA/CCITT interface	440	2.00	13	11
	4695	Line Attachment Base; for clocked modems	440	0.50	13	11
	4696	Line Attachment Base; for non-clocked modems	520	0.50	15	13
	4720	High-Speed Modem Adapter	1,320	2.00	35	30

*Rental/lease prices include equipment maintenance.
**See Report 70C-491-05 for prices of the System/370 peripheral equipment.

IBM 4300 Series

EQUIPMENT PRICES**

		Purchase Price	Monthly Maint.	Monthly Rental Charge*	Monthly Lease Charge (2-Year Lease)*
COMMUNICATIONS EQUIPMENT (Continued)					
4781	1200-bps Integrated Modem; non-switched	668	3.50	25	21
4782	1200-bps Integrated Modem; switched; with auto-answer	860	3.50	25	21
4787	Non-switch with switch network; backup, and manual-answer	910	3.50	26	22
4788	Non-switch with switch network, backup, and auto-answer	1,015	4.00	29	25
4801	Local attachment interface	1,100	3.00	29	25
5650	Digital data service adapter	840	2.50	24	20

Model 4331 or 4341:

For complete pricing data on the IBM 3704 and 3705 Communications Controllers, please
see Reports 70D-491-31 and 70D-491-32.

*Rental/lease prices include equipment maintenance.
**See Report 70C-491-05 for prices of the System/370 peripheral equipment.

SOFTWARE PRICES

		One-Time Charge	Monthly Charge (Prior to 1/1/80)	Monthly Charge (After 1/1/80)	Monthly Licensed Program Support Charge	Monthly Additional Licensed Program Support Charge
5746-XE8	VSE/Advanced Functions, Releases 1 and 2	$ —	$ 130	$ —	$ 44	$ 26
5746-RC7	Advanced Communications Function for VTAM Entry ACF/VTAM	—	95	—	56	34
5746-TS1	VSE/Interactive Computing and Control Facility	—	60	—	20	12
5746-CE3	VSE/POWER Releases 1 and 2	—	40	—	12	7
5746-RC9	DOS/VSE Remote Job Entry Workstation	—	75	—	—	—
5746-AM5	VSE/3270 Bisync Pass Through	—	—	100	—	—
5746-AM2	VSE/VSAM Releases 1 and 2; VSE/VSAM Space Management for SAM feature	—	35/20	—	17/7	10/4
5746-AM4	VSE/Fast Copy Data Set Program	300	—	—	—	—
5746-UT3	VSE/Data Interfile Transfer, Testing and Operations Utility (VSE/DITTO)	—	26	—	5	3
5746-XE7	VSE/Access Control—Logging and Reporting	—	35	—	16	10
5746-SA1	VSE/Interactive Problem Control System	—	25	—	5	3
5746-RC5	Basic Telecommunications Access Method Extended Support	—	20	—	5	3
5746-AM3	VSE/IBM System/3-3340 Data Import	1,200	—	—	—	—
—	IBM Systems 1401/1440/1460 Emulator	—	100	—	5	3
5748-XX8	VM/Basic System Extensions	—	125	90	30	18
5748-XE1	VM/System Extensions	—	1,200	—	—	—
5748-XP1	Remote Spooling Communications Subsystem (RSCS) Networking	—	60	—	26	16
5748-XXC	VM/Interactive File Sharing	—	25	—	11	7
5748-XXB	Display Management System/CMS	—	20	—	7	4
5748-XE4	VM/Directory Maintenance	—	70	—	21	13
5748-XT3	VM/CMS-3270 Display Support and Structured Programming Facility	—	275	—	—	—
5748-SA1	VM/Interactive Problem Control System Extension	—	30	—	5	3
5748-MS1	Interactive Productivity Facility	—	30	—	5	3
5746-XX3	CICS/VS/DOS Enhanced	—	—	475	—	—
5740-XX1	CICS/OS/VS Enhanced	—	—	1,000	—	—
5740-XC5	Development Management System/CICS/VS-OS	—	230	—	—	—
5746-XC4	Development Management System/CICS/VS-DOS	—	100	—	—	—
5740-XXF	DB/DC Data Dictionary for OS/VS	—	580	290	—	—
5746-XXC	DB/DC Data Dictionary for DOS/VS	—	580	290	—	—
5746-LM3	DOS FORTRAN IV Library Option 1	—	33	28	5	3
5746-CB1	DOS/VS COBOL Compiler and Library	—	141	125	16	10
5746-LM4	DOS/VS COBOL Library	—	28	23	5	3
5736-PL1	DOS PL/1 Optimizing Compiler	—	210	170	40	24
5736-LM4	DOS PL/1 Resident Library	—	45	40	5	3
5736-LM5	DOS PL/1 Transient Library	—	28	23	5	3
5736-PL3	DOS PL/1 Optimizing Compiler and Library	—	283	233	50	30
5746-RG1	DOS/VS RPG II	—	100	95	5	3
5746-SM2	DOS/VS Sort/Merge (Version 2)	—	135	115	20	12