IBM 4300 Series

MANAGEMENT SUMMARY

Since its introduction in January 1979, the 4300 Series has grown to include 13 model groups. The four newest members of the 4300 processor family are the 4361 Model Groups 4 and 5 and the 4381 Model Groups 1 and 2. The two 4361 processors provide a growth path for entry-level systems using System/370 architecture. The 4381 processors fill the gap between the 4341-12 and the 3083 Model Group E.

Other models within the 4300 Series family include: the 4321, the 4331 Model Group 11, the 4331 Model Group 2, the 4341 Model Group 9, the 4341 Model Group 10, the 4341 Model Group 1, the 4341 Model Group 11, the 4341 Model Group 2 and the 4341 Model Group 12.

The 4300 Series processors offer full System/370 compatibility and significant price/performance ratios. Moreover, incremental main memory is currently offered at less than $10,000 per megabyte.

PROCESSORS AND PERIPHERALS

The 4300 Series central processors can operate either in a System/370-compatible mode or in an extended control program (ECPS) mode; the 4381 processors can operate in a 370-XA mode which was used previously only on the larger systems. ECPS mode takes full advantage of the extensive microcoding available in these machines to reduce operating system overhead and improve system throughput.

The 4331 Model Group 11 falls between the 4321 and the 4331 Model Group 2 in capacity and performance. According to IBM, the 4331 Model Group 11 provides from 1.4 to ➢

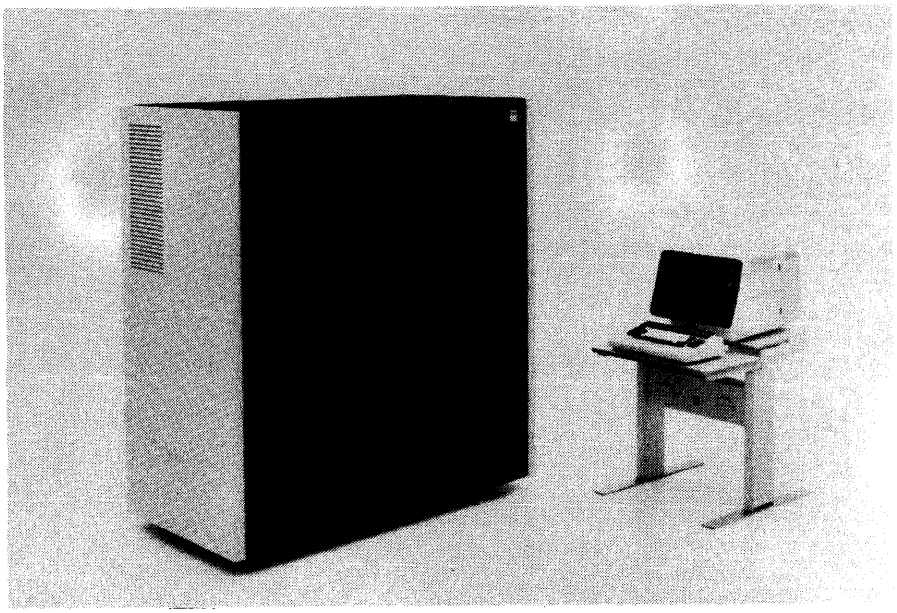
The IBM 4300 Series is a family of upward-compatible medium- to large-scale processors that can perform well as standalone systems, as distributed processing systems, or as nodes in a communications network.

MODELS: 4321, 4331 Model Groups 11 and 2, 4361 Model Groups 4 and 5, 4341 Model Groups 9, 10, 1, 11, 2 and 12, and 4381 Model Groups 1 and 2.
CONFIGURATION: Uniprocessor systems with 1 to 16 megabytes of main memory, 4K to 32K bytes of buffer storage, and up to 12 I/O channels.
COMPETITION: Burroughs B 3900, B 4900, B 5900 and B 6900, Honeywell DPS 8, IPL 4400 Series, Magnuson M80 Series, NCR V-8500 and V-8600 Series, and Sperry 90/60, 90/80, 1100/60, 1100/70 and System 80.
PRICE: Purchase prices for CPUs plus main memory range from $64,000 to $620,000.

CHARACTERISTICS

MANUFACTURER: International Business Machines Corporation, National Accounts Division, 1133 Westchester Avenue, White Plains, New York 10604. Telephone (914) 696-1900. In Canada, 1150 Eglinton Avenue, Don Mills, Ontario. Telephone (416) 443-2111.

MODELS: 4321; 4331 Model Group 11 (Models J11 and K11); 4331 Model Group 2 (Models J2, K2, KJ2, and L2); 4341 Model Group 9 (Models J9, K9, and L9); 4341 Model Group 10 (Models K10 and L10); 4341 Model Group 1 (Models K1 and L1); 4341 Model Group 11 (Models K11, ➤



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

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TABLE 1. CHARACTERISTICS OF THE 4300 SERIES PROCESSORS

	4321	4331 Model Group 11	4331 Model Group 2	4361 Model Group 4	4361 Model Group 5
SYSTEM CHARACTERISTICS					
Date of introduction	November 1981	November 1981	May 1980	September 1983	September 1983
Date of first delivery	March 1982	March 1982	4th quarter 1980	2nd quarter 1984	1st quarter 1984
Relative Performance*	—	—	22	49	66
Principal operating systems	SSX/VSE, VM/370 with CMS	DOS/VSE, VM/370, SSX/VSE	DOS/VSE, OS/VS1 Rel. 7 VM/370 Rel. 6, SSX/VSE	VM/370 with VM/SP, VSE and SSX/VSE, OS/V1	VM/370 with VM/SP, VSE and SSX/VSE, OS/VS1, MVS/370 with MVS/SP and and JES2 or JES3
Purchase price of CPU with min. main storage capacity	$64,000	$82,420	$82,500	$150,000	$200,000
Upgradable to	4331-2	4331-2, 4361-5	4361-5	4361-5	—
MAIN STORAGE					
Storage type	MOS	MOS	MOS	MOS	MOS
Bytes fetched per cycle	4	4	4	—	—
Minimum capacity, bytes	1,048,576	1,048,576	1,048,576	2,097,152	2,097,152
Maximum capacity, bytes	1,048,576	4,194,304	4,194,304	12,852,912	12,852,912
Increment size, bytes	None	1,048,576	1,048,576	2,097,152 or 4,194,304	2,097,152 or 4,194,304
BUFFER STORAGE					
Capacity, bytes	None	4,096	8,192	8,192	16,384
Cycle time, nanoseconds	—	200	200	—	—
Bytes fetched per cycle	—	4	4	—	—
CENTRAL PROCESSOR					
Cycle time, nanoseconds	300 to 1600	200 to 1600	200 to 1600	100	100
Operating modes	ECPS:VSE, System/370	ECPS:VSE, System/370	ECPS:VSE, System/370	ECPS:VSE, System/370	ECPS:VSE, System/370
System/370 mode options	ECPS:VM/370	Basic Control, Extended Control, ECPS:VM/370	Basic Control, Extended Control, ECPS:VM/370	Basic Control, Extended Control, ECPS:VM/370	Basic Control, Extended Control,
Control storage capacity, bytes	131,072	131,072	131,072	16,384	16,384
Data path width, bytes	4	4	4	4 and 8	4 and 8
I/O CHANNELS & ADAPTERS					
No. of byte multiplexer channels	1	1	1	1	1
No. of block multiplexer channels	1	1	2	1 optional	1
No. of high-speed block multiplexer channels	0	0	1	1 or 2	1, 2, or 3
Maximum total no. of channels	2	2	4	4	5
Maximum channel data rates bytes/second:					
Byte multiplexer (byte mode)	—	36,000	36,000	36,000	36,000
Byte multiplexer (burst mode)	—	500,000	500,000	500,000	500,000
Block multiplexer	—	1.25M	1.25M	125,000	125,000
High-speed block multiplexer	—	—	1.86M	186,000 bits/second	186,000 bits/second
Integrated DASD Adapter for 3310, 3370, and/or 3340/3344)	1 standard	1 standard	Optional (1 or 2)	Standard	Standard
Display/Printer Adapter	Standard	Standard	Standard	Standard	Standard
5424 Multi-Function Card Unit Adapter	No	Yes	Optional	No	No
8809 Magnetic Tape Unit Adapter	Standard	Standard	Optional	—	—
Integrated Communications Adapter	8 lines std.	8 lines std.	Optional (8 lines)	8 lines std.	8 lines std.
3704/3705 Communications Controllers	No	Optional	Optional	Optional	Optional
3880 Storage Control (for 3330/3333, 3340/3344, 3350, 3370, 3375, or 3380)	No	No	Optional	Optional	Optional
Channel-to-Channel Adapter	No	No	No	No	No

Relative Performance Ratings are based on an IBM 370/158–3 equaling 45. Data for these figures was gathered by International Data Corporation (IDC).

1.6 times the internal performance of a 4321 for commercial workloads and approximately 2.5 times the internal performance of a 4321 for scientific and engineering workloads. The 4331 Model Group 11 is equipped with 1, 2, or 4 megabytes of main memory, 128K bytes of reloadable control storage plus 12K bytes of read-only control storage, **L11, and M11); 4341 Model Group 2 (Models K2, L2, M2, N2, and P2); 4341 Model Group 12 (Models K12, L12, M12, N12, and P12); 4361 Model Group 4 (Models K4, L4, LK4, M4, and ML4); 4361 Model Group 5 (Models K5, L5, LK5, M5, and ML5); 4381 Model Group 1 (Models L1, M1, and P1); and 4381 Model Group 2 (Models L2, M2, and P2).**

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TABLE 1. CHARACTERISTICS OF THE 4300 SERIES PROCESSORS (Continued)

	4341 Model Group 9	4341 Model Group 10	4341 Model Group 1	4341 Model Group 11	4341 Model Group 2
SYSTEM CHARACTERISTICS					
Date of introduction	October 1982	November 1981	January 1979	November 1981	September 1980
Date of first delivery	March 1983	March 1982	4th quarter 1979	March 1982	2nd quarter 1981
Relative Performance*	24	34	40	50	66
Principal operating systems	DOS/VSE (Adv.) SSX/VSE, OS/VS1 VM/370 MVS/SP, ACP/TPF	DOS/VSE, OS/VS1 Rel. 7, VM/370 Rel. 6, MVS	DOS/VSE OS/VS1 Rel. 7, VM/370 Rel. 6, MVS	DOS/VSE, OS/VS1 Rel. 7, VM/370 Rel. 6, MVS	DOS/VSE, OS/VS1 Rel. 7, VM/370 Rel. 6, MVS
Purchase price of CPU with min. main storage capacity	$81,000	$142,500	$184,500	$211,200	$297,000
Upgradable to	4341-10	4341-11 or -12	4341-11 or -2 or -12	4341-12	4341-12, 4381
MAIN STORAGE					
Storage type	MOS	MOS	MOS	MOS	MOS
Bytes fetched per cycle	—	8	8	8	8
Minimum capacity, bytes	1,048,576	2,097,152	2,097,152	2,097,152	2,097,152
Maximum capacity, bytes	4,194,304	4,194,304	4,194,304	8,388,608	16,777,216
Increment size, bytes	1,048,576 or 2,097,152	2,097,152	2,097,152	2,097,152 or 4,194,304	2,097,152 or 4,194,304
BUFFER STORAGE					
Capacity, bytes	2,048	4,096	8,192	8,192	16,384
Cycle time, nanoseconds	—	Not specified	225	225	120
Bytes fetched per cycle	—	Not specified	8	8	16
CENTRAL PROCESSOR					
Cycle time, nanoseconds	150 to 300	150 to 300	150 to 300	120 to 240	120 to 240
Operating modes	ECPS:VSE, System/370	ECPS:VSE, System/370	ECPS:VSE, System/370	ECPS:VSE System/370	ECPS:VSE, System/370
System/370 mode options	ECPS:VS1, ECPS:VM/370, ECPS:MVS	ECPS:VS/1, ECPS:VM/370, ECPS:MVS	ECPS:VS/1, ECPS:VM/370, ECPS:MVS	ECPS:VS/1, ECPS:VM/370, ECPS:MVS	ECPS:VS/1, ECPS:VM/370, ECPS:MVS
Control storage capacity, bytes	Not specified	Not specified	Not specified	Not specified	Not specified
Data path width, bytes	8	8	8	8	8
I/O CHANNELS & ADAPTERS					
No. of byte multiplexer channels	1 or 2	1 or 2	1 or 2	1 or 2	1 or 2
No. of block multiplexer channels	2, 4, or 5	2, 4, or 5	2, 4, or 5	4 or 5	4 or 5
No. of high-speed block multiplexer channels	0	0	0	0	0
Maximum total no. of channels	6	6	6	6	6
Maximum channel data rates bytes/second:					
Byte multiplexer (byte mode)	16,000 or 22,000	16,000 or 22,000	16,000 or 22,000	16,000 or 22,000	16,000 or 22,000
Byte multiplexer (byte mode)	1.0M or 2.0M	1.0M or 2.0M	1.0M or 2.0M	1.0M or 2.0M	1.0M or 2.0M
Block multiplexer	1.0M, 2.0M, or 3.0M	1.0M, 2.0M, or 3.0M	1.0M, 2.0M, or 3.0M	2.0M or 3.0M	2.0M or 3.0M
High-speed block multiplexer	—	—	—	—	—
Integrated DASD Adapter (for 3310, 3370, and/or 3340/3344)	No	No	No	No	No
Display/Printer Adapter	No	No	No	No	No
5424 Multi-Function Card Unit Adapter	No	No	No	No	No
8809 Magnetic Tape Unit Adapter	No	No	No	No	No
Integrated Communications Adapter	No	No	No	No	No
3704/3705 Communications Controllers	Optional	Optional	Optional	Optional	Optional
3880 Storage Control (for 3330/3333, 3340/3344, 3350, 3370, 3375, or 3380)	Optional	Optional	Optional	Optional	Optional
Channel-to-Channel Adapter	Optional	Optional	Optional	Optional	Optional

**Relative Performance Ratings are based on an IBM 370/158–3 equaling 45. Data for these figures was gathered by International Data Corporation (IDC).*

and 4K bytes of buffer storage. Many features that are optional on the 4331 Model Group 2 are standard on the Model Group 11. The 4331 Model Group 11 can be field-upgraded to a 4331 Model Group 2. Installed 4331 Model Group 1 processors can be upgraded to a 4331 Model Group 11.

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

DATA FORMATS

BASIC UNIT: 8-bit byte. Each byte can represent 1 alphanumeric character, 2 BCD digits, or 8 binary bits. Two

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TABLE 1. CHARATERISTICS of THE 4300 SERIES PROCESSORS (Continued)

	4341 Model Group 12	4381 Model Group 1	4381 Model Group 2
SYSTEM CHARACTERISTICS			
Date of introduction	October 1982	September 1983	September 1983
Date of first delivery	February 1983	3rd quarter 1984	1st quarter 1984
Relative Performance*	76	100	133
Principal operating systems	SSX/VSE, DOS/VSE (Adv.) OS/VS1, VM/370 MVS/SP, ACP/TPF	MVS/370, VM/SP, DOS/VSE with VSE/AF, ACP/TPF, OS/VS1, MVS/XA, VM/XA	MVS/370, VM/SP, DOS/VSE with VSE/AF, VM/XA
Purchase price of CPU with min. main storage capacity	$316,800	$370,000	$500,000
Upgradable to	4381	4381-2	—
MAIN STORAGE			
Storage type	MOS	MOS	MOS
Bytes fetched per cycle	—	—	—
Minimum capacity, bytes	2,097,152	4,194,304	4,194,304
Maximum capacity, bytes	16,777,216	16,777,216	16,777,216
Increment size, bytes	2,097,152 or 4,194,304	4,194,304	4,194,304
BUFFER STORAGE			
Capacity, bytes	16,384	8,192	32,768
Cycle time, nanoseconds	—	—	—
Bytes fetched per cycle	—	—	—
CENTRAL PROCESSOR			
Cycle time, nanoseconds	115 to 230	68	68
Operating modes	ECPS:VSE, System/370	370, 370-XA	370, 370-XA
System/370 mode options	ECPS:VS/1, ECPS:VM/370, ECPS:MVS	ECPS:VS/1, ECPS:VM/370, ECPS:MVS	ECPS:VS/1, ECPS:VM/370, ECPS:MVS
Control storage capacity, bytes	Not specified	—	—
Data path width, bytes	8	8	8
I/O CHANNELS AND ADAPTERS			
No. of byte multiplexer channels	1 or 2	1	1
No. of block multiplexer channels	4 or 5	11	11
No. of high-speed block multiplexer channels	0	—	—
Maximum total no. of channels	6	12	12
Maximum channel data rates bytes/second:			
Byte multiplexer (byte mode)	16,000 or 22,000	—	—
Byte multiplexer (burst mode)	1.0M or 2.0M	2.0M to 3.0M	2.0M to 3.0M
Block multiplexer	2.0M or 3.0M	2.0M	2.0M
High-speed block multiplexer	—	—	—
Integrated DASD Adapter (for 3310, 3370, and/or 3340/3344)	No	No	No
Display/Printer Adapter	No	No	No
5424 Multi-Function Card Unit Adapter	No	No	No
8809 Magnetic Tape Unit Adapter	No	No	No
Integrated Communications Adapter	No	No	No
3704/3705 Communications Controllers	Optional	Optional	Optional
3880 Storage Control (for 3330/3333, 3340/3344, 3350, 3370, 3375, or 3380)	Optional	Optional	Optional
Channel-to-Channel Adapter	Optional	Optional	Optional

**Relative Performance Ratings are based on an IBM 370/158–3 equaling 45. Data for these figures was gathered by International Data Corporation (IDC).*

The 4331 Model Group 2 processor offers twice the performance of the 4321 and a little over one-half the performance of the 4341 Model Group 1. The 4331 Model Group 2 has an 8K-byte buffer storage unit and 1, 2, 3 or 4 megabytes of main memory. The Model Group 2 can be equipped with the same integrated peripheral adapters as the Group 11 processor, plus an optional second DASD Adapter and greatly improved I/O channel capabilities.

consecutive bytes form a "halfword" of 16 bits, while 4 consecutive bytes form a 32-bit "word."

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

FLOATING-POINT OPERANDS: 1 word, consisting of 24-bit fraction and 7-bit hexadecimal exponent, in "short" format; 2 words, consisting of 56-bit fraction and 7-bit

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According to IBM, the 4361 processors are particularly suited for commercial, office, interactive problem solving, and engineering/scientific applications. The new processors provide up to six times the engineering/scientific and up to three times the commercial performance of the 4331 Model Group 2. The 4361 has a main storage capacity of from 2 to 12 megabytes, up to three times that of the 4331. The 4361 uses a bipolar memory chip which stores up to four times the information of memory chips used in the 4331. Separate instruction and I/O processing units provide improved throughput over previous models. In addition to the 4361-4, all models of the 4331 are field-upgradeable to the 4361-5.

The 4341 Model Group 9 is an entry-level 4341 processor that provides an internal performance which is 70 percent of that of the Model Group 10 for commercial and scientific workloads involving equivalent memory and I/O configurations, according to IBM. The 4341 Model Group 9 is available with a 2K-byte buffer and 1, 2 or 4 megabytes of main memory. It can be field-upgraded to a 4341 Model Group 10.

The 4341 Model Group 10 provides approximately 0.85 times the performance of a 4341 Model Group 1 for typical commercial applications or 0.95 times the Model Group 1 for engineering and scientific applications. The 4341 Model Group 10 is available with a 4K-byte buffer and 2 or 4 megabytes of main memory. It can be field-upgraded to a 4341 Model Group 11 or 12.

The 4341 Model Group 1 is available with 2 or 4 megabytes of main memory and an 8K-byte buffer. The internal performance of the 4341 Model Group 1 is up to 1.1 times an equivalently configured System/370 Model 158-3. The Model Group 1 can be field-upgraded to a 4341 Model Group 11, Model Group 2 or Model Group 12.

The 4341 Model Group 11 offers 1.25 times the internal performance of the 4341 Model Group 1. The Model Group 11 is available with an 8K-byte buffer and 2, 4, or 8 megabytes of main memory. It can be field-upgraded to a 4341 Model Group 12.

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

The 4341 Model Group 12 is available with from 2 to 16 megabytes of main memory and 16K bytes of buffer storage. IBM states that the internal performance is up to 15 percent greater than the Model Group 2 for commercial workloads and up to 7 percent greater for scientific workloads.

The top-of-the-line 4381 Models 1 and 2 are available with from 4 to 16 megabytes of main storage capacity and up to 12 I/O channels. The 4381-1 can provide an internal throughput rate of from 1.4 to 1.6 times that of the 4341-2 for commercial workloads and up to 1.7 times that of the

hexadecimal exponent, in "long" format; or 4 words in "extended precision" format.

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

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

MAIN STORAGE

STORAGE TYPE: SAMOS (silicon and aluminum metal oxide semiconductor) process N-channel FET (field effect transistor). The SAMOS process relies on silicon or silicon compounds to enhance gate reliability and to control chip surface leakage. Memory is composed of 64K-bit chips, with four chips mounted on each ceramic substrate. Maximum density is achieved by stacking pairs of substrates to form 8-chip modules. The 4381 uses a 1K X 9 bit bipolar array chip which operates with a 20-nanosecond cycle time. It is used for the microcode control storage and the high-speed buffer in the memory subsystem.

CYCLE TIME: See Table 1.

CAPACITY: From 1,048,576 to 16,777,216 bytes. See Table 1 for capacities of specific models.

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

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

CENTRAL PROCESSORS

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

Microcode is loaded through the system diskette drive. The several diskettes supplied with the system contain field engineering diagnostics, basic system features, and optional system features 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 no-charge Problem Analysis Feature allows 4341 and 4381 users to identify valid hardware problems as the cause of system interruptions. Screen-prompted instructions lead the user through the steps required to solve the problem. Using the Remote Support Facility, service information can be sent to and received from IBM Field Engineering. The Remote Operator Console Facility is used to run a subset of

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TABLE 2. MASS STORAGE

Subsystems	3310 Disk	3330/3333 Disk	3340/3344 Disk	3350 Disk	3370 Disk	3375 Disk	3380 Disk
Cabinets per subsystem	Up to 32	Up to 32	Up to 32	Up to 32	Up to 32	Up to 32	Up to 32
Disk packs/HDAs per cabinet	1 or 2	1 or 2 removable	1 or 2 HDAs	2 HDAs	2	1 HDA	2 HDAs
Capacity, megabytes	129	100 or 200	70/280 per HDA	317.5 per HDA	571.3 to 729.8	819.7	1260 per HDA
Tracks/segments per drive unit	—	7676, 15,352 or 30,704	8352 or 66,816	33,300	—	—	—
Average access time, milliseconds	27	30	25	25	19 to 20	19	16
Average rotational delay, milliseconds	9.6	16.7	10.1	8.4	10.1	10.1	8.3
Data transfer rate, bytes/second	1,031,000	806,000	885,000	1,198,000	1,859,000,000	1,859,000	3,000,000
Controller model	Integrated	3830-2 or 3880-1, -2, or -11	3830-2 or 3880-1, -2,	3830-2 or 3880-1, -2 or -11	3880-1, -2, or -4	3880-1, -2, or -4	3880-2, -3, or -13
Comments		A 3333 can control up to three 3330 units	Fixed-head option available; 3344 attaches to 3340 Model A2	Fixed-head models available Model A2 includes logic & power for up to three B2s or two B2s and one C2 unit	Model A units include logic & power for up to three B units	Model A1 includes logic & power for up to three B1s or two B1s and one D1 unit	Model A4 includes logic & power for up to three B4 units

4341-2 for scientific workloads. The 4381-2 can provide an internal throughput rate of from 1.7 to 2.3 times that of the 4341-2 for commercial workloads and from 2.4 to 3 times that of the 4341-2 for scientific workloads. Despite having approximately double the internal speed of the 4341 Model Group 2, the 4381 requires less space and power, produces less heat and weighs less. A unique air-cooling technique used on the 4381 which was previously developed for use on the 308X Series, termed "impingement cooling," assures adequate cooling without the need for a raised floor. Room temperature air is blown by a fan into an air chamber equipped with ducts or nozzles allowing each module to receive a similar amount of cooling. This type of cooling facilitates the use of an increased-density 64mm module. The 4381-1 is field-upgradeable to a 4381-2.

The 4300 Series processors support most of the System/370, 303X Series, and 308X Series peripheral devices. These peripheral devices include: the 3310 (4321, 4331, and 4361 only), 3330/3333, 3340/3344, 3350, 3370, 3375, and 3380 Direct Access Storage Devices; the 3830 and 3880 Storage Control Devices; the the 3420 Models 3, 5, 7, 4, 6, and 8, 3410/3411 Models 1, 2, and 3, and 3430 and 8809 Magnetic Tape Units; the 1403 Model N1, 1443 Model N1, 3203 Model 5, 3211 Model 1, 3230 Model 2, 3262 Models 1, 5, and 11 (4321, 4331, and 4361 only), 3268, 3287 Models 1, 1C, 2 and 2C, 3289, and the 3800 Models 1 and 3 Printers; and the 1442, 2501, 2520, 2540, 3505, and 5424 Punched Card Equipment.

Problem Analysis from the user installation. The 4381 only, however, is available in six languages other than English.

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

The 4341 and 4381 feature 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 4361 ranges from four to eight bytes wide. Data flow within the 4321 and 4331 is four bytes wide.

On the 4321, 4331 and 4361, the mode of operation is selected at initial program load (IPL) time; on the 4341 and 4381, at initial microcode load (IML) time. One operating mode is the Extended Control Program Support (ECPS:VSE) mode, which utilizes the extensive microcoding facilities of the 4300 to reduce DOS/VSE or SSX/VSE overhead and improve system throughput. Another operating mode, 370 mode, has one option on the 4321, three options on the 4331 and 4361, and three options on the 4341. On the 4321, the ECPS:VM/370 option provides improved system performance with VM/370. This option is recommended for operation in a CMS environment only. On the 4331 and 4361, the Basic Control (BC) option provides for execution of System/360 programs, the Extended Control (EC) option provides for execution of programs that require dynamic address translation facilities, and the ECPS:VM/370 option provides improved system performance with VM/370. On the 4341, the ECPS/VS1 option improves processor performance with OS/VS1, the ECPS:VM/370 option provides improved system perfor-

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All 4300 Series processors require a 3278 Model 2A Display Console or 3279 Model 2C Display Console as the operator console. Both consoles have a 1920-character display and keyboard, for operation and maintenance. Up to three additional consoles or 3287 Printers (for a total of four devices) can be attached to the 4341 or 4381 processors. The Display/Printer Adapter on the 4321, 4331 and 4361 processors can accommodate as many as 15 additional display units or printers.

SOFTWARE

The operating systems available for the 4300 Series processors include: DOS/VS Extended (DOS/VSE), OS/VS1 Release 7, and the Virtual Machine Facility 370 (VM/370) Release 6, OS/VS2 (MVS), SSX/VSE, and MVS/XA.

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

According to IBM, 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 the 4331, 4361 or 4341 processors or in 370 mode.

With VM/370 Release 6, the 4300 user can operate in mixed-mode environments where CMS interactive computing is combined with a guest SCP (DOS/VSE or OS/VS1) on the 4300 processors.

SSX/VSE (Small Systems Executive/VSE) is the principal operating system for the 4321 processors. SSX/VSE is a pregenerated preconfigured subset of DOS/VSE that is designed for users with limited data processing skills. SSX/VSE supports batch or interactive applications on 4321, 4331, 4361 or 4341 processors operating in standalone or distributed environments.

MVS support is provided on the 4361, 4341 and 4381 processors. MVS Release 3.8 with Processor Support 2 provides the required basic SCP code. MVS/SP-JES2 and -JES3 are separately priced products that provide major extensions and enhancements to the MVS Base Control Program plus JES2 and JES3, respectively.

MVS/XA is supported only on the 4381 processors and includes two programs: MVS/SP Version 2 and the Data Facility Product. MVS/XA allows address space sizes to be expanded up to 2000 megabytes.

mance with VM/370, and the ECPS:MVS option allows the 4341 processor to be supported by MVS/SP JES2 and JES3. With the ECPS Expansion Feature, the 4341 Model Group 2 can support concurrent operation of ECPS:MVS and ECPS:VM/370. Two modes of operation are supported on the 4381: 370 mode and 370-XA mode. When the 4381 is operating in 370 mode, support is provided by: MVS/SP JES2 or MVS/SP JES3; VM/SP; DOS/VSE with VSE/AF; and OS/VS1 with Basic Programming Extensions. When operating in 370-XA mode, the 4381 will support MVS/SP JES2 and MVS/SP JES3 and the VM/XA Migration Aid.

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

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

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

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

The design of the 4361 is unique in comparison to the previous 4300 Series processors in that it has three independent processors: the instruction processor, the input/output processor, and the service processor. The instruction processor includes: a high-speed cache buffer; a three port local store; high-speed instruction processing; a 370 instruction buffer; floating point multiply and arithmetic and logic units; a function control element; and control storage. The Input/Output Processor includes: a separate channel processor for independent I/O processing; a data mover buffer; and channels for control unit attachment and integrated I/O adapters. The service processor, which is similar to the

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TABLE 3. INPUT/OUTPUT UNITS

Magnetic Tape Units	Number of Tracks	Recording Density, Bits/Inch	Encoding	Tape Speed Inches/Sec.	Transfer Rate, Bytes/Sec.
3420:					
Model 3	7	556/800	NRZI	75	41,700/ 60,000
	9	800	NRZI	75	60,000
	9	1600	PE	75	120,000
Model 5	7	556/800	NRZI	125	69,500/ 100,000
	9	800	NRZI	125	100,000
	9	1600	PE	125	200,000
Model 7	7	556/800	NRZI	200	111,200/ 160,000
	9	800	NRZI	200	160,000
	9	1600	PE	200	320,000
Model 4	9	1600	PE	75	120,000
	9	6250	GCR	75	470,000
Model 6	9	1600	PE	125	200,000
	9	6250	GCR	125	780,000
Model 8	9	1600	PE	200	320,000
	9	6250	GCR	200	1,250,000
3410/3411*					
Model 1	7	200/556/ 800	NRZI	12.5	2500/6900/ 10,000
	9	800	NRZI	12.5	10,000
	9	1600	PE	12.5	20,000
Model 2	7	200/556/ 800	NRZI	25	500/13,900/ 20,000
	9	800	NRZI	25	20,000
	9	1600	PE	25	40,000
Model 3	7	200/556/ 800	NRZI	50	10,000/ 27,800/ 40,000
	9	800	NRZI	50	40,000
	9	1600	PE	50	80,000
3430	9	1600 or 6250	PE	50	80,000 or 312,500
8809	9	1600	PE	12.5 or 100*	20,000 or 160,000*

*Streaming Mode

COMPETITIVE POSITION

The top-of-the-line 4381 has a total main storage capacity of 16 megabytes which positions the 4300 Series just below the Burroughs B 6900 Series in regard to main storage capacity. The B 6900, in a multiprocessor configuration, can address up to 22.4 megabytes of memory.

The 4300 Series is positioned above the NCR V-8500 Series models which can access up to 8 megabytes of main memory. The 4300 Series is positioned slightly above the

Support Processor on the previous 4300 models, includes: the Problem Finder Facility for detecting and recording recoverable errors; the Remote Operator Console Facility (ROCF); the Remote Service Facility for problem diagnosis performed away from the 4361; and controls for dual diskette drives and system console attachment.

The 4381's design consists of four separate functional units which include: a memory subsystem, an instruction processing unit, a channel subsystem, and a maintenance subsystem. The memory subsystem features: main storage, a high-speed buffer, a swap buffer, and a memory control unit. The instruction processing unit includes: a shifter (to and from

IBM 4300 Series

TABLE 3. INPUT/OUTPUT UNITS (Continued)

Printers	Printing Speed	Print Positions	Horizontal Spacing, Chars./Inch	Vertical Spacing, Lines/Inch	Form Size, Inches
1403 Model N1	1100	132	10	6 or 8	3.5 to 18.75 wide, 22 long
1443 Model N1	240 lpm	120	10	6 or 8	4 to 16¾ wide continuous
3203 Model 5	1200	132	10	6 or 8	3.5 to 20.0 wide, 3.0 to 24.0 long
3211 Model 1	2000	132 std., add'l. 18 opt.	10	6 or 8	3.5 to 18.75 wide, 3.0 to 24.0 long
3230 Model 2	350 to 450 cps	100 to 132	10 to 13⅓	3,4,6 or 8	8½ to 11 wide continuous
3262:					
Model 1	650 lpm	132	10	6 or 8	3.5 to 16 wide, 6 to 14 ling
Model 5	650 lpm	132	10	6 or 8	3.5 to 16 wide, 6 to 14 long
Model 11	325 lpm	132	10	6 or 8	3.5 to 16 wide, 6 to 14 long
3268	340 cps	132	10 or 16.7	3,4,6 or 8	16 wide continuous
3287:					
Model 1 & 1C	80 cps	132	10	6 or 8	—
Model 2 & 2C	120 cps	132	10	6 or 8	—
3289	230 to 400 lpm	132	10	6 or 8	—
3800:					
Model 1	Up to 20,040	136,163, 204	10, 12, 15	6, 8, 12	6.5 to 14.75 wide,
Model 3	Up to 20,040	136, 163, 204	10,12, 15	6, 8, 12	3.5 to 11.0 long

Burroughs 5925 which, in a multiprocessor configuration, has a total main storage capacity of 15 megabytes.

ADVANTAGES AND RESTRICTIONS

The IBM 4300 user can grow within the 4300 family of computer systems. Uniprocessor systems range from 1 to 16 megabytes of main memory which allows the user to buy only what he needs today, and provides the capability to upgrade later.

The 4300 Series can function in a distributed processing environment. A communication network allows the user to link the central and remote sites. The advantage of using a distributed processing system is that it can off-load processing activity and data from the central computer.

The 4300 Series uses the S/370 architecture and software which makes it compatible with the 303X and the 308X. This is advantageous for those users migrating to the larger systems.

memory), a storage address register, an arithmetic logic unit, local storage, control storage, and an instruction buffer. The channel subsystem includes: channel data buffers, a channel operation unit, and standard and optional channels. The maintenance subsystem is similar to the support and service processors on the other 4300 systems and includes: a service processor; a service panel; a power-up microprocessor; direct console attachment; diskette drives; a modem (which connects to the Remote Operator Console Facility and the Remote Service Facility); a direct instruction processor link; and a channel link for operator consoles.

CONTROL STORAGE: All 4300 Series processors except the 4361 utilize reloadable control storage (RCS) to hold the microcode which controls their operations. The RCS is composed of 18K-bit SAMOS-process N-channel FET chips.

On the 4321 and 4331 processors, 131,072 bytes of RCS are standard. The 4331 processors also include 12,288 bytes of read-only control storage. In addition to the RCS, some main memory is required for microcode storage and is therefore unavailable to the user. Approximately 168,000 bytes of main memory are required for microcode and system use on the 4321, and approximately 200,000 bytes are

IBM 4300 Series

TABLE 3. INPUT/OUTPUT UNITS (Continued)

Punched Card Equipment	Columns	Speed Cards/Min.	Input Hopper Capacity	Output Stacker Capacity	Options
1442 Card Read/	80	400 (read); 91-265 (punch)	1200	1300	Card image mode
2501 Card Reader	80	600 or 100	1200	1300	Card image mode
2520 Card Punch	80	300 or 500	1200	1300 (two)	Card image mode
2540	80	800 to 1,000 input 300 output	3,100	1,350 (five)	
3505 Card Reader	80	800 or 1200	3000	1750 (two)	51-col. read, optical mark read, 3525 adapter
5424	96	250 to 500	2,000 (two)	600 (four)	Card sorting possible with multiple-pass sorting technique

IBM's Communications Facility/Host licensed program allows the user to process and route transactions between the host 4300 system and Series/1 systems operating with the IBM Series/1 EDX Communications Facility.

Something to consider when installing the 4341 Model Group 12 is that DOS releases in System/370 mode, will not operate on the 12- and 16-megabyte models except under VM/370. A VSE system can utilize up to but not including 16 megabytes of main memory when the VM linkage enhancements of VSE/AF are specified. Another consideration is that concurrent operation of the ECPS:MVS and ECPS;VM/370 requires the ECPS Expansion Feature (#1601).

USER REACTION

Datapro's 1983 survey of general-purpose computer users yielded responses from 557 IBM 4300 users who had a total of 659 processors installed. Of this total, 181 systems were 4331s and 478 systems were 4341s. The 4331 systems had been in use for an average of 33.7 months; the 4341 systems, for an average of 27.7 months.

The survey respondents represented a wide variety of industries, including manufacturing (155 responses), banking/finance (71 responses), retail/wholesale (69 responses), and education (45 responses).

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

required on the 4331 Model Group 11. On the 4331 Model Group 2, at least 16,348 bytes of main memory are required for microcode storage. The total amount of microcode required is dependent upon the features installed and the functions performed.

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

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

BUFFER STORAGE: Buffer storage is standard on all 4300 Series models except the 4321. Storage capacities range from 4096 to 32,768 bytes, depending on the model. (See Table 1 for the buffer capacities for the individual processor models.) The buffer storage is transparent to all programs and significantly reduces the effective main memory access time. On the 4331, the buffer storage is automatically replenished from main memory in 64-byte units; the 64-byte fetch cycle takes 2.6 microseconds, and the 64-byte store cycle takes 3.1 microseconds.

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

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.

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	Excel.	Good	Fair	Poor	WA*	WA*
Ease of operation	164	335	35	5	3.13	3.26
Reliability of mainframe	455	88	7	2	3.78	3.82
Reliability of peripherals	238	271	36	5	3.40	3.32
Maintenance service:						
Responsiveness	245	272	33	3	3.45	3.34
Effectiveness	234	265	42	4	3.40	3.31
Technical support:						
Trouble-shooting	98	294	129	21	2.88	2.86
Education	62	296	146	27	2.66	2.77
Documentation	54	276	132	24	2.67	2.67
Manufacturers software:						
Operating system	122	353	54	15	3.08	3.06
Compiler & assemblers	143	377	26	1	3.26	3.19
Application programs	35	275	97	13	2.91	2.75
Ease of programming	70	365	84	7	2.96	2.94
Ease of conversion	94	313	86	14	2.91	2.99
Overall satisfaction	123	398	24	2	3.15	3.18

*Weighted Average on a scale of 4.0 for Excellent.

In May, we interviewed three of the survey respondents to gain additional insight into their experiences with the 4300 Series.

The first user interviewed represented an educational institution that had upgraded from an IBM 360 to the 4331. This user said that the conversion went very smoothly; however, a few operating system changes were made at conversion time. He indicated that the system serves them quite well. Future plans include running more application software on the system.

The second user interviewed was a maunfacturer that had converted from an IBM 370 to the 4331. They said that it was a very good changeover. They experienced a few minor problems with the operating software, but IBM solved them very quickly. There was a problem with the power supply on the tape unit controller but it was attended to promptly by IBM field engineers. The manufacturing company representative said that they are very pleased with the system.

The third user interviewed was a retail/wholesale organization that had converted from an IBM 370 to the 4341. They said that the conversion process had gone very smoothly. The operations manager said that it was one of the smoothest conversions he had ever seen with no trouble whatsoever. Recently they have had a few 3370 disk problems but the disk drives were quickly replaced by IBM. Overall, the user was very happy with the equipment.

The users' ratings and comments indicate that they are fairly well satisfied with the 4300 Series processors. Of the 557 respondents, 92 percent said they would recommend the 4300 Series to others, two percent said they would not, and six percent were undecided.□

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

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

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

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

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

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

ENGINEERING SCIENTIFIC ASSIST: This feature, which is standard on the 4341 Model Groups 9, 10, 11, 2, and 12, and on the 4381, is designed to improve the performance of certain mathematical computations such as matrix inversion, decomposition, and multiplication. Engineering Scientific Assist consists of a new multiply-add instruction that reportedly reduces CPU busy time by 30 percent. The assist feature supports only long precision (64-bit) floating point numbers. It is supplied on a microcode diskette and installed as part of the IML process.

ELEMENTARY MATH LIBRARY ASSIST (EML): This assist is available only on the 4381 Model Group 2 and is a standard feature. It improves the speed of calculations for

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single- and double-precision versions of square root functions, exponentiation of natural logarithms and common logarithms.

3838 ARRAY PROCESSOR: This special-purpose scientific processor is available on 4361, 4341 and 4381 systems only. The 3838 processes single-precision floating-point vector operations independently of the host CPU. Three models are available: the Model 1 with 256K bytes of bulk storage, the Model 2 with 512K bytes of bulk storage, and the Model 3 with 1024K bytes of bulk storage. The bulk storage provides independent data storage for up to seven concurrent users. The 3838 subsystem also includes an arithmetic processor with 16K bytes of control storage, a control processor, a data transfer controller, and a channel interface that attaches to a block multiplexer channel on the 4361, 4341 or 4381 host.

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

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

The 3278-2A or 3279-2C connects directly to a 4300 Series processor. On the 4321, 4331 or 4361, connection is via the standard Display/Printer Adapter, which permits connection of the required 3278-2A or 3279-2C plus up to 7 (or 15 with the optional Display/Printer Adapter Expansion) additional devices chosen from the following list: 3278 Display Station Model 2, 3287 Printer Models 1 (80 cps) and 2 (120 cps), 3287 Color Printer Model 1C (80 cps) and 2C (120 cps), 3289 Line Printer Model 4 (400 lpm), and 3262 Line Printer Models 1 (650 lpm) and 11 (325 lpm). These devices may be installed in any combination, except that the number of system printers (3262 Model 1 or 3289 Model 4) may not exceed two. On the 4341 or 4381, up to three optional 3278-2A display consoles, 3279-2C display consoles, or 3287 printers can be added.

INPUT/OUTPUT CONTROL

I/O CHANNELS: The *4321* processor includes one-byte multiplexer channel and one block multiplexer channel which allow input/output devices to be attached to the system.

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

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

The *4331 Model Group 2* processor can have up to four integrated channels: one 5248 Byte Multiplexer Channel, one 1421 Block Multiplexer Channel, one 1422 Additional Block Multiplexer Channel, and one 1431 High-Speed Block Multiplexer Channel.

The 5248 Byte Multiplexer Channel operates at up to 36K bytes per second in single-byte mode and at up to 500K bytes per second in burst mode. The 5248 provides 8 control unit positions and up to 36 subchannels, 4 of which are shared subchannels with up to 16 devices each. The number of subchannels is reduced by one if the Communications Adapter is installed. In addition, each communications line reduces by one the number of subchannels available.

The 1421 and 1422 Block Multiplexer Channels can each accommodate a data transfer rate of up to 1.25 million bytes per second. The 1431 High-Speed Block Multiplexer Channel can handle a data transfer rate of up to 1.86 million bytes per second, permitting the attachment of high-speed peripheral devices such as the 3330/3333, 3340/3344, 3350, and 3370 via control units. If both the 1422 and the 1431 are installed on the same processor, the data transfer rate of the 1422 cannot exceed 600K bytes per second. Each of the block multiplexer channels for the 4331 Model Group 2 provides 8 control unit positions and can be configured with up to 128 nonshared subchannels and up to 16 shared subchannels, each with devices in multiples of 8. (The maximum number of devices is 128.) The high-speed block multiplexer channel and the second DASD Adapter are mutually exclusive.

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

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

The 4361 processors have integrated Direct Access Storage Device/8809 Adapters and High-Speed Block Multiplexer Channels for the attachment of high performance Direct Access Storage Devices, tape and other I/O devices. Model Group 4 can have a maximum configuration of either two DASD/8809 Adapters and one High-Speed Block Multiplexer Channel or one DASD/8809 Adapter and two High-

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Speed Block Multiplexer Channels. Model Group 5 has four possible maximum configurations: four DASD/8809 Adapters; two DASD/8809 Adapters and one High-Speed Block Multiplexer Channel; one DASD/8809 Adapter and two High-Speed Block Multiplexer Channels; or three High-Speed Block Multiplexer Channels. The DASD/8809 Adapters operate at up to 1.86 megabytes per second for the attachment and control of 3310, 3370 Models A1, A2, B1 and B2, and 3340/44 Direct Access Storage Devices, or the 8809 Magnetic Tape Unit. The High-Speed Block Multiplexer Channels include support for the 3880/3380, 337X, 3350, 334X and 333X Direct Access Storage Devices. The data transfer rate is up to 3.0 megabytes per second.

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

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

The aggregate data rate of the two standard block multiplexer channels is six million bytes per second. The aggregate data rate of the five block multiplexer channels including the optional group is 11 million bytes per second. If one of the three optional channels is configured as a second byte multiplexer channel, the aggregate data rate of the remaining four block multiplexer channels is nine million bytes per second. All of the block multiplexer channels support the Data Streaming mode.

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

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

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

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

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

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

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

The *4381 Model Groups 1 and 2* come equipped with six channels: five block multiplexer and one byte multiplexer channels. Four of the block multiplexer channels have data rates of up to 3.0 megabytes per second in data streaming mode. The fifth block multiplexer channel has a data rate of up to 2.0 megabytes per second; this channel may alternatively be selected as a byte multiplexer channel. An additional group of six block multiplexer channels may be installed as an option which increases the maximum aggregate data rate to 22 megabytes per second. The optional channels consist of two two-megabyte and four one-megabyte data streaming block multiplexer channels.

SIMULTANEOUS OPERATIONS: Concurrently with computing, a 4331, 4361, 4341 or 4381 can control one high-speed I/O data transfer operation per block multiplexer channel and one low-speed I/O operation on each subchannel of a byte multiplexer channel. Alternatively, a byte multiplexer channel can operate in burst mode and handle a single higher-speed I/O operation.

CONFIGURATION RULES

IBM enhanced the 4321 with additional features previously available on the 4331 Model Group 1. One DASD Adapter base is now standard. Supported devices include the 3310, 3340/3344 and 3370. One adapter for 8809 tape drives, supporting up to six drives, is standard. A Display/Printer adapter is standard with 16 ports for the attachment of the operator console, line printers, displays and printer terminals. Supported devices include 3278-2A and 3279-2C Operator Consoles, 3278-2 and 3279 Model S2A Display Stations, 3287 Printer Models 1, 2, 1C and 2C, 3262 Line Printer Models 1 and 11, 3289 Line Printer Model 4, 3268 Printer Model 2, and 3230 Printer Model 2.

The 4331 is a highly integrated system, with numerous peripheral adapters mounted in the processor cabinet, including those for 3310, 3370, and 3340 Direct-Access Storage Devices (up to 9000 megabytes per adapter); 8809 Magnetic Tape Units; diskette drive; 5424 Multi-Function Card Unit; and communications adapter. Also available are byte and block multiplexer channels, as described under the "Input/Output Control" heading. The integrated Support

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Processor has a standard Display/Printer Adapter for up to 8 devices, with optional expansion to 16 devices. These devices include a 3278-2A Console, 3278-2 Displays, 3287 Printer Models 1, 2, 1C, and 2C, 3262 Printer Model 1, and 3289 Printer Model 4.

The 4361 processor includes most of those features available with the 4331 with the exception of the 5424 Adapter, 1400 Compatibility and integrated modems for the Communications Adapter.

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

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

MASS STORAGE

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

INPUT/OUTPUT DEVICES

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

4250 PRINTER: A high-resolution, non-impact printer with a printing density of 600 x 600 dots per square inch. The printing time for an 8.5″ x 11″ size page ranges from 1.5 to 2.5 minutes. The 4250 provides the capability of printing and merging text and graphics. The printer uses electro-erosion technology and produces a typeset quality camera-ready masterpage directly from the host computer system.

3814 SWITCHING MANAGEMENT SYSTEM: This facility is designed to aid in the management of complex EDP configurations by providing centralized control of control-unit switching. The 3814 uses an integrated microcode-driven processor and features password authorization, stored configurations, and extensive self-diagnostic functions. As compared to the earlier IBM 2914 Model 1 Switching Unit, the 3814 provides increased capacity, extended functions, and improved reliability. The system is covered in greater detail in Report 70D9-491-20 in Volume 2.

MICR/OCR EQUIPMENT: MICR devices supported on the 4300 Series include models 1255, 1419, and 3890. Each model has an E13B type font. Their speed in documents per minute ranges from 500 to 2400 and the number of stackers ranges from 6 to 36. Document size ranges from 2.5 to 4.17 inches in width and from 4.85 to 8.75 inches in length. Options include a 51-column sort, self-checking numbers, batch numbering, item numbering and microfilming. Optical reading devices supported include models 1287, 1288, 3881 and 3886. Readable fonts include: OCR-A, OCR-B, and OCR-C; 1428; marks; and handprint numeric. Speed in documents per minute range from 96 to 665 and each reader can accommodate from two to three stackers. Document size ranges from 2.25 to 9 inches in width and from 3 to 14 inches in length. Options include serial numbering, expanded symbols, and document counters.

TERMINALS: Numerous IBM display terminals, batch terminals, and typewriter terminals can be connected to a 4300 system in remote and/or local configurations. For details, please refer to Reports 70D1-491-45, 70D2-491-11, and 70D3-491-46 in the Peripherals section of DATAPRO 70 (Volume 2).

COMMUNICATIONS CONTROL

The principal communications control unit for the IBM 4321, 4331 and 4361 is the Integrated Communications Adapter, described below. The programmable 3704 and 3705 Communications Controllers, also described below, are the prime communications devices for the 4341 and 4381 and can also serve as alternatives to the Communications Adapter when more than eight lines must be connected to a 4331 or 4361. Loop Adapters are also available for the 4331 and 4361.

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

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

4331 and 4361 COMMUNICATIONS ADAPTER: This feature is standard on the 4331 Model Group 11 and optional on the Model Group 2. The feature is standard on Model Groups 4 and 5 of the 4361. It provides for the direct attachment of up to eight BSC, start/stop, or SDLC communications lines in any combination. (At any given time, the "any combination" may be two of the three available types.) The aggregate data rate capacity may not exceed 64,000 bits per second. For seven of the eight lines, the data rate per line may not exceed 9600 bps. The eighth line may be a BSC or SDLC high-speed line with data rate of up to 56,000 bps, operating concurrently with other lines provided that the data rate limitations are not exceeded. The adapter operates with start/stop and BSC lines in 2703 compatibility mode. SDLC is supported only by ACF/VTAME operating under DOS/VSE or by ACF/VTAME operating under VM/370 Release 6 with DOS/VSE running as a guest. The communications adapter provides auto answer, auto-poll operation, multipoint station functions, EBCDIC transparent mode for BSC only, and EBCDIC/ASCII code for BSC only.

The eight lines attached to the communications adapter may have these optional features in addition to the high-speed line feature (4720) already mentioned: up to eight line features without internal clock for attachment to external modems with (4695) or without (4696) clock (data circuit-terminating equipment); up to eight line features with integrated 1200-bps modems (nonswitched, 4781; switched with

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auto answer, 4782; non-switched with switched network backup and manual answer, 4787; non-switched with switched network backup and auto answer, 4788); up to eight line features with local attachments (4801); up to eight line features wth digital data service adapters (5650); and autocall unit interfaces for up to two of the installed lines (1020).

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

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

The 4321, 4331 and 4361 have an attachment capability for intelligent workstations. The IBM Displaywriter, IBM Personal Computer and the 3270 Personal Computer Attachment are supported by one of the following: the Integrated Communications Adapter; the 3274 control unit; or the Display/Printer Adapter. On the 4321 and 4331, start/stop attachment requires the Integrated Communications Adapter.

The 4331 and 4361 Communications Adapter supports communications with virtually all of the current IBM terminals, systems, and communications controllers in one or more of the three transmission modes: SDLC, BSC, or start/stop.

4331 and 4361 LOOP ADAPTERS: Provide the capability to attach certain terminals and control units to a 4331 Model Group 2 and Model Group 11, and a 4361 Model Group 4 and Model Group 5, either directly or via a data link. Loop Adapter 1 (feature 4830) and Loop Adapter 2 (4831) provide for direct attachment. The Data Link Adapter (4840) provides remote attachment capabilities for 3843 Loop Control Units. Each Data Link Adapter can be used as a point-to-point or multipoint connection to attach up to four 3843 Loop Control Units.

The following devices can be connected to direct attached loops at 9600 bps or to data link attached loops at 2400, 4800, or 9600 bps: the 3640 Plant Data Communications Terminals, the 8775 Display Terminal Model 1 or 2, the 3287 Printer Model 11 or 12, and the 3274 Control Unit Model 51C and 3276 Control Unit Display Station Models 11 to 14, with their associated terminals (3278 Display Station, 3279 Color Display Station, 3262 Line Printer, 3287 Printer, and 3289 Printer). In addition, the 8775, 3287 Models 11 and 12, and the 3274 control unit and associated terminals can also be attached at 38,400 bps. Up to 80 terminals can be connected to a 4331 Model Group 2 or a 4361 via the Loop or Data Link Adapters.

Cable length for direct attached loops can be up to 1.25 miles (2000 meters) when operating at 38,400 bps or 2 miles (3200 meters) when operating at up to 9600 bps. Data link attached loops can be up to 2 cable miles in length. The 4331 and 4361 support one Loop Adapter 1, one Loop Adapter 2, and up to two Data Link Adapters. The loop and data link adapters are mutually exclusive with the 5424 Adapter.

3705 COMMUNICATIONS CONTROLLER: This programmable front-end network processor can be connected to either a byte or block multiplexer channel on a 4331, 4361, 4341, or 4381 processor.

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

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

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

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

The 3705 Controllers are supported under the VTAM and TCAM access methods. The Advanced Communications Function for NCP, ACF/NCP/VS (and related Systems Support Programs), adds capabilities for multiple-processor environments. An X.25 NCP Packet Switching Interface is now available for use with ACF/NCP/VS. To utilize ACF/NCP/VS, the Advanced Communication Function for VTAM and TCAM is required. ACF/VTAM supports CICS/VS, IMS/VS, Power/VS, JES1/RES, JES2/RJE, TSO, VSPC, SSS, and BTP user programs. ACF/TCAM supports CICS/VS, TSO, SSS, and user programs.

3704 COMMUNICATIONS CONTROLLER: The 3704 is a smaller version of the 3705 that can be connected to a byte multiplexer channel on either a 4331, 4361, 4341 or 4381 processor. The 3704 is available in only four models with a main memory capacity of from 16K to 64K bytes. It can accommodate a maximum of 32 lines, just one-half the capacity of the basic 3705 configuration. The 3704 uses the same software as the 3705, thereby ensuring upward compatibility for economic expansion of a small network into a large one.

3725 COMMUNICATIONS CONTROLLER: The 3725 consists of the Model 1 and the Model 2. It consists of a

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central control unit which operates under control of the Advanced Communications Function/Network Control Program, Emulator Program, or Partitioned Emulator Program. Main storage is available in 512K-, 786K-, or 1024K-byte sizes. It can be attached to either byte or block multiplexer or selector channels on the host processor. Up to six channel adapters are available with two adapters standard in the base frame and four can be added via the 3726 Expansion Unit. With the optional two-processor switch feature, connection can be made to a maximum of eight processors, six of which can operate concurrently. The Maintenance and Operator Subsystem allows for host-independent maintenance. Communication scanners and line interfaces are provided by a transmission subsystem. The scanners are microprocessor-based and can control eight Line Interface Couplers with up to 32 lines. The 3727 Operator Console provides an operator interface to the Maintenance and Operator Subsystem of the 3725.

Model 1 consists of the 3725 Communication Controller and the 3726 Communication Controller Expansion. Up to 256 full-duplex or half-duplex lines may be attached with Model 1. Model 2, however, allows for attachment of up to 24 full-duplex or half-duplex lines. Model 2 is field-upgradeable to Model 1.

4994 ASCII Device Control Unit: The 4994 comprises three models: the A00 which supports up to 16 devices, the B00 which supports up to 32 devices, and the C00 which supports up to 48 devices. In conjunction with its program offering support, Host Loaded Yale ASCII Communications System, the 4994 allows the attachment of ASCII devices to the 4331, 4361, 4341 or the 4381 running VM/CMS. ASCII terminals appear to the host as IBM 3277 terminals. In order to be supported, devices must: perform clear screen or clear to end of screen; provide absolute cursor positioning; and allow characters written to the screen to replace, not overstrike (except APL). Features provided include full-duplex operation between the 4994 and the terminals, type-ahead capability from the terminal and normal keyboard functions. Physical connection is made via EIA RS-232-C or 20 mA current loop.

REMOTE OPERATOR CONSOLE FACILITY (ROCF): The ROCF, an extension of the 4300 Remote Support Facility, is designed to facilitate dial-up and initialization of a remote 4300 Series processor from a real or emulated 3275 Model 2 Display Station at the host site. A network can include a 4300 Series processor with ROCF installed and an IBM System/370, 303X, 308X, or 4300 Series host processor running either of two software products that provide 3275 emulation: the MVS/Operator Communications Control Facility (MVS/OCCF) or the VM/Pass-Through Facility Release 2. MVS/OCCF is designed to operate on any IBM host computer that supports MVS/SP Version 1, while the VM/Pass-Through Facility Release 2 requires the new VM/SP Release 2 program product. No software support is required if a real 3275 Model 2 Display Station is available at the host site or if both the host and the remote systems are 4331 or 4361 processors. In the latter instance, 3275 emulation is performed by microcode in the host 4331 or 4361.

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

After a remote 4300 is initialized from the host, communications control should continue through the existing network facilities of the host processor. ROCF is not designed to perform interactive jobs. On a 4321, 4331 or 4361 system, ROCF suppresses the activities of all devices attached to the Display/Printer Adapter. When MVS/OCCF is used to initialize a remote 4341 or 4381 MVS or DOS/VSE system, continued control can be provided by MVS/OCCF in conjunction with the Network Communications Control Facility. After a remote 4341 or 4381 VM system has been initialized, continued control can be provided by the Programmable Operator Facility of VM/SP Release 2.

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

SOFTWARE

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

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

OPERATING SYSTEMS: The 4300 Series processors are supported by DOS/VSE (a significant expansion of DOS/VS), SSX/VSE (a subset of DOS/VSE), VM/370 Release 6, OS/VS1 Release 7, OS/VS2 (MVS), and MVS/XA (on the 4381 only).

DOS/VSE: This disk-resident operating system is designed to control system resources and job processing and it is a prerequisite for VSE-related program products. DOS/VSE is enhanced by the VSE/Advanced Functions licensed program which provides functional and performance-related capabilities. VSE Performance Tool (VSE/PT) is a software-system monitor for measuring and evaluating the performance of a DOS/VSE system.

DOS/VSE supports 4300 processors operating in System/370 or ECPS:VSE mode; the 4321, however, is supported when operating in ECPS:VSE mode only. The components of DOS/VSE are stored in DASD resident system libraries and can be loaded into main storage when needed. The functions of DOS/VSE include: initial program load; resource management; job control; linkage editing; paging management; library management; data management; system-to-operator communication; system utilities; system serviceability; and debugging aids.

Device support within DOS/VSE includes: the 3330, 3340/3344, 3350, 3375, 3310 and 3370 Direct Access Storage Devices; the 3203, 3211, 3262, 3289, and 3800 printers; the 8809 and 3420 magnetic tape drives; and the 3270, 3600,

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3650, 3660, 3760, 3767, 3770 and 3790 terminals. DOS/VSE requires a minimum of 160K bytes of processor storage.

SMALL SYSTEMS EXECUTIVE/VSE (SSX/VSE): A subset of DOS/VSE, SSX/VSE is a pregenerated, preconfigured operating system designed for use by personnel with limited data processing skills. SSX/VSE supports batch, interactive, and on-line applications on 4321, 4331, 4341 or 4361 processors operating in standalone or distributed environments. Prompts and procedures are provided to aid in installation, operation, program development, and service related activities. According to IBM, a standalone SSX/VSE system can be installed in two hours or less. SSX/VSE Release 3 is a complete, self–contained operating system with no prerequisite software. It is ready for use immediately after installation.

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

The minimum hardware configuration required for the installation and operation of SSX/VSE consists of a 4321, 4331, 4341, or 4361 with one megabyte of main memory, one 3278 Model 2A or 3279 Model 2C System Console, one 3178 or 3278 or 3279 locally attached display station, one 3262, 3289 Model 4, 3203, 3211, or 4245 Line Printer, one 8809, 3411, 3420, or 3430 Magnetic Tape Unit, either two 3310 or one 3370 Direct Access Storage Devices, and the associated integrated I/O adapters.

VM/370: VM/370 Release 6 is an operating environment that manages a computer system's facilities in such a way that each of many users has use of the functional equivalent of a dedicated computer system. The four main components of VM/370 are: Control Program (CP); Conversational Monitor System (CMS); Remote Spooling Communication Subsystem (RSCS); and Interactive Problem Control System (IPCS).

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

Hardware supported under VM/370 includes: the 3340, 3344, 3350, 3375, 3380, 3850, 3310 and 3370 Direct Access Storage Devices; the 3410, 3420 and 8809 magnetic tape drives; the 3270 terminal; and the 3800 printing subsystem.

The *VM/System Product* (VM/SP), Release 3, contains all of the functions currently available in the VM/Basic System Extensions and VM/System Extensions program products, which extend the system control program of VM/370. These Extensions make VM/370 and the Conversational Monitor System (CMS) more flexible and productive and increase the number of devices supported. VM/SP provides the following functions as well: dynamic SCP transition with an IPL; SNA support with VM/VCNA; inter-user communication capability; CMS full screen 3270 editor; additional CMS functions and productivity aids; a command retrieve capability; a trace table recording facility; and SQL/DS Release 2 support. Hardware supported includes: the 3310, 3370, 3375 and 3380 Direct Access Storage Devices and the 3800 Printing Subsystem.

OS/VS1 RELEASE 7: This release of IBM's OS/VS1 operating system provides support for the 4331, 4341, 4361 and 4381 processors in the System/370 mode. OS/VS1 is highly compatible with MVS which makes it a logical interim step for future MVS users. The four major functions of the control program routines of OS/VS1 are: job management through the use of operator commands and job control statements; task management which monitors and controls the entire system; data management which controls all operations associated with input and output devices; and recovery management which attempts to overcome the effects of a processor, channel, or I/O device malfunction. Additional features of OS/VS1 include automatic partition redefinition, dynamic dispatching or time slicing, concatenated procedure libraries, and I/O load balancing. Hardware support includes: the 3270 terminal; the 3340, 3344, 3350, and 3375 Direct Access Storage Devices; and the 3800 Printing Subsystem.

The *OS/VS1 Basic Programming Extensions* provide support for the 4331 and 4341 Model Group 2 processors, the 4341 Model Group 9, 10, 11 and 12 processors, the 4361 Model Groups 4 and 5, the 4381 Model Groups 1 and 2, the 3380 Direct Access Storage unit, the 3375 Direct Access Storage unit, the 3880 Storage Controller Model 13, the 3262 Printer Models 1 and 11, the 4245 printer, and the 3430 Magnetic Tape Subsystem. Additional features include: an enhanced dump facility; VM/VTAM Communications Network Applications support; support for the Data Facility/Device Support program, which provides a new indexed volume table of contents (VTOC) for improved system performance; enhanced 3880 Control Unit Buffer; and support for 4K page sizes.

MVS: MVS is supported on the 4361, 4341 and 4381 processors. These processors can utilize either of two MVS/System Products, MVS/SP-JES2 or MVS/SP-JES3. MVS Release 3.8 with Processor Support 2 provides the required basic SCP code. MVS/SP-JES2 and MVS/SP-JES3 are separately priced products that provide major extensions and enhancements to the MVS Base Control Program plus JES2 and JES3, respectively. IBM has stated that the MVS/System Products will replace the earlier MVS/System Extensions product and serve as the base for future enhancements to MVS, JES2, and JES3. MVS features include: the System Resource Manager (SRM) which provides optimum system resource use; the Job Entry Subsystem (JES2 or JES3) which reduce restart and rerun costs; and the Virtual Input/Output Facility (VIO) which stores temporary data in a buffer. Hardware support includes the 3330, 3340, 3344, 3350, 3375, and 3380 Direct Access Storage Devices and the 3420 Models 4, 6, and 8 Magnetic Tape Units.

MVS/XA: The 4381 processors are the only processors in the 4300 line that support MVS/Extended Architecture (MVS/XA). MVS/XA allows the use of address space sizes beyond the 16-megabyte maximum of MVS/370. The ad-

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dress space sizes can be expanded up to 2000 megabytes, and there can be 32,000 such address spaces simultaneously active. MVS/XA consists of two programs: MVS/SP Version 2 and the Data Facility Product. The Data Facility Product provides data management, device support, program library management, and utility functions. In the process of converting to MVS/XA, the VM/XA Migration Aid permits other operating systems to run with the 370-XA microcode as VM guest operating systems. Such support is also available for VSE and VS1.

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

For additional details on MVS, please refer to Report 70C-491-02 (IBM 308X Series).

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

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

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

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

The Advanced Communications Function/Virtual Telecommunications Access Method (ACF/VTAM) is the base for the major IBM communication subsystems and provides an "operating system" for the network. Its functions are the same as those of a host operating system in terms of resource sharing and logical handling of user requests.

PRICING

POLICY: The 4321 is available for purchase or monthly rental only. IBM offers the 4331, 4361, 4341 and 4381 systems on a purchase, lease, or rental basis. The standard IBM lease or rental contract includes equipment maintenance and entitles the customer to unlimited usage each month. The purchase option accrual equals 40 percent of the monthly charge up to 50 percent of the purchase price.

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

In October 1982, IBM introduced a volume purchase discount plan for the 4300 Series. A discount of 6 percent is offered on the purchase of 5 to 9 4300 Series processors. For quantities of 10 or more, the discount is 9 percent.

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

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

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

For users without a maintenance contract, the 4300 Series is maintained under per-call class 3. Under this class, the per call charge during regular hours is $147 per hour, and during off hours the charge is $170 per hour.

SOFTWARE: IBM 4300 Series users receive the basic DOS/VSE, OS/VS1 Release 7, VM/370 Release 6, or OS/VS2 (MVS) system control programs at no additional cost. All other IBM software, including the DOS/VS Advanced Functions and the SSX/VSE operating system, is priced separately. In addition, basic monthly charges have been established for maintenance of the IBM system control programs and other licensed program products.

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

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

IBM 4300 Series

An alternative to contracted software maintenance is per-call service, charged to the applicable hourly rate. Program service/programming assistance costs $158 per hour during regular hours and $181 per hour at other times. The initial and prime interface for software problems and their solution is the IBM Support Center, described below.

SUPPORT CENTER: The centralized IBM Support Center provides 24-hour, 7-day customer access by telephone (an 800 number is provided). It utilizes the Software Support Facility data base, which incorporates every problem encountered and resolved (or unresolved) by the central support group. The customer is assisted in making out any APAR (program problem report), and he gets advice on temporary fixes or bypasses.

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

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

TYPICAL 4321 SYSTEM: Includes a 4321 Processor with one megabyte of main memory, two 3278-2A Operator Consoles with keyboards, a 3310 DASD Model A2 with attached Model B2 (258 megabytes), two 8809 Magnetic Tape Units, a 650-lpm 3262 Model 1 Printer, and integrated tape and disk adapters. The monthly maintenance charge is $918.50 and the purchase price is $130,516.

TYPICAL 4361 GROUP 5 SYSTEM: Includes a 4361 Model L5 Processor with four megabytes of main memory and one I/O channel, two 3278-2A Operator Consoles with keyboards, a 3310 DASD Model A2 with a Model B2 attached (258 megabytes), four 8809 Magnetic Tape Units, a 2520 Card Read Punch, two 3262 Model 1 Printers, and integrated tape and disk adapters. The monthly rental charge is $19,610, the monthly maintenance charge is $2,235, and the purchase price is $362,910.

TYPICAL 4341 GROUP 12 SYSTEM: Includes a 4341 Model N12 Processor with 12 megabytes of main memory and six I/O channels, two 3278-2A Operator Consoles with keyboards, 3287 Model 2 Console Printer, a 3380 DASD Model A4 (2.5 billion bytes), a 3880 Model 2 Storage Control, eight 3420 Model 3 Magnetic Tape Units (120KBS), a 3803 Model 1 Tape Control, a 2520 Card Read Punch, and two 1200-lpm 3203 Model 5 Printers. The monthly charge on a two-year lease is $33,296, the monthly maintenance charge is $4,837.50, and the purchase price is $892,100.

TYPICAL 4381 GROUP 2 SYSTEM: Includes a 4381 Model L2 Processor with 16 megabytes of main memory and six I/O channels, two 3279-2C Color Display Consoles with keyboards, one 3287 Color Console Printer, one 3380 DASD Model A4 (2.5 billion bytes), one 3880 Model 2 Storage Control, eight 3420 Model 3 Magnetic Tape Units (120KBS), one 3803 Model 1 Tape Control, one 2520 Card Read Punch, and three 1200-lpm 3203 Model 5 Printers. The monthly rental charge is $61,154, the monthly maintenance charge is $4,929.00, and the purchase price is $1,082,560.■