

IBM ES/9370 Information System

MANAGEMENT SUMMARY

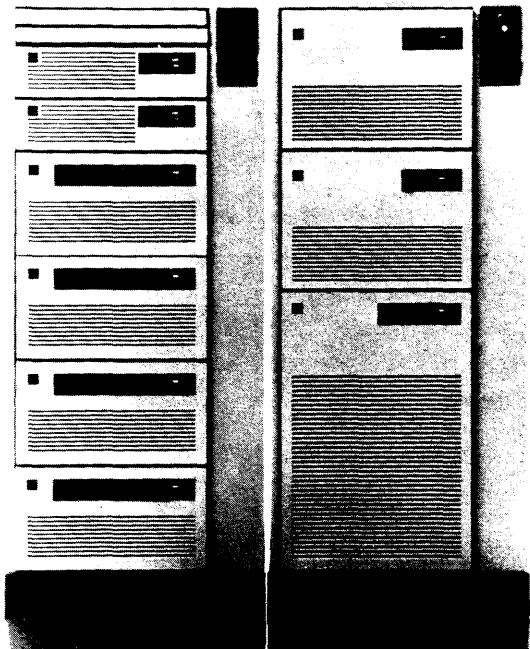
UPDATE: IBM has announced three new Enterprise System/9370 models that offer up to double the price/performance of current models. In addition, more than 400 ES/9370 application program families are now available for a wide spectrum of industries—twice the number offered at the beginning of 1988.

The application families now span business needs ranging from the health care industry to manufacturing to higher education and are provided by IBM, IBM Business Partners, and other software companies.

The latest announcements underscore IBM's commitment to the ES/9370 and to providing more business solutions for the customers it was designed to support. IBM also has pledged to continue expansion of the ES/9370's application base and its hardware performance range.

Introduced in October 1986, the ES/9370 is IBM's smallest line of System/370 architecture processors. Typical users are departments within large companies, scientific/technical customers running compute-intensive applications, users of distributed System/370 applications, or those requiring connection to non-IBM systems.

The 9370 delivers mainframe-class performance in a low-cost, compact package. It offers price/performance in the range of IBM's Application System/400 (AS/400) and is significantly more powerful than the AS/400's predecessor.



IBM's 9377 Model 90, the top-of-the-line 9370 Information System, rivals the lower end IBM 4381 systems in processing power. It supports up to 384 local workstations and can attach a maximum of 7742G bytes of DASD storage.

The compact IBM 9370 system maintains full compatibility with IBM System/370 (S/370) architecture-based systems. Designed as a departmental system, the 9370 is primarily intended to run VM/SP, IBM's leading end-user, interactive operating system for S/370 machines. The 9370 also supports Ethernet, IBM Token-Ring, and SNA networks.

MODELS: 9373 Models 20 and 30; 9375 Models 40, 50, and 60; and 9377 Models 80 and 90.

CONFIGURATION: From 4M bytes to 16M bytes of main memory, from 368M bytes to 7742G bytes of disk capacity, and up to 384 workstations.

PRICE: \$31,000 to \$190,000 (base system prices).

CHARACTERISTICS

MANUFACTURER: International Business Machines Corp. (IBM), Old Orchard Road, Armonk, New York 10504. Contact your local IBM representative.

CANADIAN ADDRESS: IBM Canada Ltd., Markham, 3500 Steeles Avenue East, Markham, Ontario L3R 2Z1. Telephone (416) 474-2111.

MODELS: 9373 Models 20 and 30; 9375 Models 40, 50, and 60; and 9377 Models 80 and 90.

DATA FORMATS

BASIC UNIT: An eight-bit byte. Each byte can represent one alphanumeric character, two BCD digits, or eight binary bits. Two consecutive bytes form a "halfword" of 16 bits, while four consecutive bytes form a 32-bit "word."

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

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

INSTRUCTIONS: Two, four, or six bytes in length, specifying zero, one, or two memory addresses, respectively.

The 9370 processors employ the S/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

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TABLE 1. SYSTEM COMPARISON

MODEL	9373 Model 20	9373 Model 30	9375 Model 40	9375 Model 50
SYSTEM CHARACTERISTICS				
Date announced	October 1986	September 1988	October 1986	September 1988
Date first delivered	Third-Quarter 1987	September 1988	Fourth-Quarter 1987	September 1988
Field upgradable to	Not applicable	9375 Models 50, 80	9375 Model 60*	9375 Models 80, 90
Relative performance	1.0	2.5	1.0-1.4	2.4
Number of processors	1	1	1	1
Cycle time, nanoseconds	Not specified	Not specified	Not specified	Not specified
Word size, bits	32	32	32	32
Operating systems	VM/SP, IX/370, VSE/SP	VM/SP, IX/370, VSE/SP	VM/SP, IX/370, VSE/SP	VM/SP, IX/370, VSE/SP, MVS/SP
MAIN MEMORY				
Type	1 megabit	1 megabit	1 megabit	1 megabit
Minimum capacity, bytes	4M	4M	8M	8M
Maximum capacity, bytes	16M	16M	16M	16M
Increment size, bytes	4M, 8M, 16M	4M, 8M, 16M	8M, 16M	8M, 16M
Cycle time, nanoseconds	Not specified	Not specified	Not specified	Not specified
BUFFER STORAGE				
Minimum capacity	Not applicable	Not applicable	Not applicable	Not applicable
Maximum capacity	Not applicable	Not applicable	Not applicable	Not applicable
Increment size	—	—	—	—
INPUT/OUTPUT CONTROL				
Number of channels:				
Byte multiplexer	0	0	0	0
Block multiplexer	0	0	0	0
Word	0	0	0	0
Other	2	2	4	4

*The 9375 Models 40 and 60 can be converted to the 9377 Model 90; the conversion requires a processor cage swap to add a second rack.

➤ sors, System/36 (S/36) and System/38 (S/38)—non-System/370-compatible office systems being replaced by the AS/400. It is more powerful and less costly than the 4361, IBM's previous office-level System/370 (S/370)-architecture system, and it is also less costly although not as powerful as the IBM 4381, the entry point for high-performance S/370 computing.

Besides delivering better cost-effectiveness and greater price/performance than IBM's other departmental and distributed processing solutions, the 9370 provides greater functionality. For example, the 9370 supports several types of database management systems; in contrast, the S/36 cannot support a DBMS. Furthermore, the 9370 delivers a much improved communications architecture compared to other IBM departmental processors. At present, the S/36, S/38, and AS/400 are equipped with SNA and Token-Ring LAN communications facilities only, thus limiting their distributed processing functionality. The 9370 also supports the IEEE 802.3-recommended Ethernet LAN. The de facto industry-standard Ethernet network offers a wider connectivity range than the Token-Ring, supporting a variety of systems from many vendors.

One of the 9370's most important advantages is its software compatibility with IBM S/370-architecture systems such as the 4381 superminicomputers and 3080 and 3090 mainframes, in selected environments such as VM. The S/3X and AS/400 systems do not offer S/370 compatibility, placing them at a disadvantage in terms of application development and distributed processing within the host-based S/370 environment.

➤ instructions," usable only by the operating system, handles input/output (I/O) and various hardware control functions.

Also standard are extended-precision floating-point, dynamic address translation, and Virtual Telecommunications Access Method (VTAM) instructions.

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

MAIN STORAGE

STORAGE TYPE: One-megabit chips.

CAPACITY: Please refer to Table 1.

CYCLE TIME: Vendor information unavailable.

CHECKING: Single-bit errors are detected and corrected automatically, and multiple-bit errors are detected.

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

RESERVED STORAGE: Similar to S/370 reserve storage characteristics. Main memory is reserved for interrupt routines, program status words, CPU timer logout area, machine-check interrupt code, and register save area.

➤ Key-controlled storage protection provides both store and fetch protection, preventing unauthorized central storage access or information modification. Store protection prevents the main storage contents from being altered by storage addressing errors in programs or input from I/O devices. Fetch protection prevents the unauthorized fetching of data and instructions from main storage. Up to 15 programs and their associated main storage areas can be protected at one time. A seven-bit storage key, acting as a

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TABLE 1. SYSTEM COMPARISON (Continued)

MODEL	9375 Model 60	9377 Model 80	9377 Model 90
SYSTEM CHARACTERISTICS			
Date announced	October 1986	September 1988	October 1986
Date first delivered	Third-Quarter 1987	September 1988	Fourth-Quarter 1987
Field upgradable to	Not applicable*	Not applicable	Not applicable
Relative performance	2.2-3.0	3.9	4.5-5.2
Number of processors	1	1	1
Cycle time, nanoseconds	Not specified	Not specified	Not specified
Word size, bits	32	32	32
Operating systems	VM/SP, IX/370, VSE/SP, MVS/SP	VM/SP, IX/370, VSE/SP, MVS/SP	VM/SP, IX/370, VSE/SP, MVS/SP
MAIN MEMORY			
Type	1 megabit	1 megabit	1 megabit
Minimum capacity, bytes	8M	8M	8M
Maximum capacity, bytes	16M	16M	16M
Increment size, increment	8M, 16M	8M, 16M	8M, 16M
Cycle time, nanoseconds	Not specified	Not specified	Not specified
BUFFER STORAGE			
Minimum capacity	16KB	0	16KB
Maximum capacity	16KB	0	16KB
Increment size	0	0	0
INPUT/OUTPUT CONTROL			
Number of channels:			
Byte multiplexer	0	0	0
Block multiplexer	0	0	0
Word	0	0	0
Other	4	4	6

*The 9375 Models 40 and 60 can be converted to the 9377 Model 90; the conversion requires a processor cage swap to add a second rack.

IBM's range of AS/400 machines provide processing capabilities from entry-level systems to low-end 3090s, but without any S/370 compatibility. IBM is counting on the 9370 to provide the S/370-architecture compatibility and the AS/400 for growth potential within the S/3X line. Both lines are expected to deliver the top-to-bottom, entry-level-to-mainframe application portability and distributed processing that have enabled competitors such as Digital Equipment to cut seriously into IBM's medium-scale systems marketplace share.

Since announcing the 9370, IBM continually moves to ensure its success within the midrange system marketplace. To increase competitiveness and functionality, IBM has enhanced its 9370 products by introducing improved communications and networking offerings and peripheral devices.

Significant communications and networking announcements include release of Advanced Communication Function/Virtual Telecommunications Access Method (ACF/VTAM), release of NetView, introduction of VM/Distributed Systems Node Executive (DSNX), introduction of NetView Network Definer, IBM Token-Ring Local Area Network (LAN) enhancements, and X.25 support. These products add connectivity and network management functions to the IBM distributed systems networking solution.

With the additional processor models, IBM continues its commitment to the 9370 line by providing a significant growth path. From the smallest 9370 Model 20 to the top-of-the-line 3090-600S mainframe, users have a 200-fold growth range in System/370 products.

security lock, protects each 4-kilobyte block of storage. Key-controlled protection is standard on all S/370-based machines.

CENTRAL PROCESSOR

The six 9370 processors support the performance enhancements of Extended Control Program Support (ECPS) for the Virtual Machine/System Product (VM/SP) operating system (ECPS:VM), as well as assists for the Interactive Executive for System/370 (IX/370) operating system. The 9375 Model 60 and the 9377 Model 80/90 processors support ECPS:MVS, for the Multiple Virtual Storage/System Product (MVS/SP) operating environment.

The 9370 processors differ from one another primarily in physical packaging, performance, and number of attachable devices. Each processor is a rack-mountable, modular unit. Memory and integrated I/O controllers are packaged on logic cards. On the 9373 and 9375 processors, these cards fit into slots inside the processor unit. On the 9377 processors, memory cards fit into slots inside the processor unit, but the integrated I/O controllers reside in slots in a separate I/O card unit, which may be mounted in the same or an adjacent rack enclosure. The cards are flat—7.64 inches by 8.12 inches by 0.64 or 0.68 inch (191 mm. by 203 mm. by 16 or 27 mm.) and are enclosed in protective casings.

The entry-level 9373 Model 20 includes a floating-point facility to speed execution of floating-point instructions.

The three 9375 processors (Models 30, 40 and 60) are the 9370 family's intermediate systems. In all 9375 models, a high-performance arithmetic unit provides hardware support for single- and double-precision floating-point operations. This facility contains eight 64-bit floating-point registers and provides hardware for addition, subtraction, multiplication, division, and square root functions.

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➤ The enhanced ACF/VTAM Release 3 improves cross-system connectivity and makes it easier to implement and manage distributed applications. ACF/VTAM Release 3 provides peer-to-peer communications among SNA Physical Unit Type 2.1 (PU2.1) devices. It enables distributed IBM VM-, MVS-, and VSE-based S/370-architecture systems to communicate with one another; with distributed AS/400, IBM S/3X, Series/1, and System/88 minicomputers; with distributed PC and PS/2 microcomputers; and with other non-IBM SNA-compatible systems, without host assistance.

ACF/VTAM Release 3 avoids host intervention in system-to-system communications, thereby reducing the complexities and performance degradations experienced when interconnecting systems, sharing resources, uploading and downloading files, and passing data between programs.

ACF/VTAM Release 3 also reduces network management tasks. It provides the routines for automating network configuration management tasks, thus freeing the communications programming and operations staff from the time-consuming programming tasks associated with configuring and reconfiguring networks. It also provides facilities for reducing the communications programming necessary to recover from a system crash or communications error.

NetView Release 2 and VM/DSNX, a new VM-based software product, reduce network management expenses by providing centralized system and network management. NetView Release 2 permits departmental and distributed 9370 systems to run virtually unattended, with almost all network and systems management being performed by a central operations staff. VM/DSNX provides for centralized software development, implementation, and maintenance through the SNA network to distributed 9370 systems and other VM-based processors, further enhancing the customers' ability to run distributed VM-based systems unattended. Using products that perform centralized system and network management reduces staffing requirements for running the distributed system and the skill levels necessary to maintain and operate a distributed processor.

VM-based networks can be built and maintained in a more time-effective manner with the NetView Network Definer. The Netview Network Definer requires less effort and skill to build and maintain VM-based SNA networks—an important feature in the 9370's target VM environment.

With the enhancements made to the VSE operating system and ACF/VTAM, the VSE-based 9370 now can function on IBM's Token-Ring LAN. Previously, only a 9370 running VM/IS or VM/SP had this capability. The Token-Ring LAN provides a common communication path among distributed IBM and non-IBM information systems and workstations. By providing the VSE-oriented 9370 systems with the Token-Ring LAN's communica-

➤ The 9377 Model 90—the top-of-the-line 9370 processor—provides 2.1 times the commercial throughput of the 9375 Model 60; in compute-intensive or engineering/scientific applications, the 9377 delivers 1.9 times the 9375 Model 60's throughput in short-precision floating-point operations and 2.0 times its throughput in long-precision floating-point functions.

Each 9370 CPU includes a cable-attached Processor Console, which uses a specially configured IBM PC. The console initializes and monitors the system; analyzes machine checks; handles errors; supports manual operations; aids in problem determination; supports the automatic/secure power control feature of the systems' 9309 rack, which allows automatic or remote system start-up, shutdown under operating system control, and automatic restart after a power outage; and 3270 display emulation, which lets the console be attached to a Work Station Subsystem Controller or a 3274 Control Unit to serve as a user workstation.

Other standard 9370 features include automatic restart after power failures and time-of-day clock and calendar.

The 9375 Model 60 incorporates a microinstruction store containing a translation lookaside buffer (TLB) and a 16 kilobyte high-speed buffer storage that acts as a smaller and faster subset of processor storage.

The 9377 Model 90 includes 8 kilobytes of microinstruction storage that holds complex and less frequently used microinstructions. Frequently used microinstructions are executed directly in hardware.

The 9370 processors incorporate 16 general-purpose registers.

Three types of addresses are recognized: absolute, real, and logical. The dynamic address translation facility, 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 16-megabyte virtual storage space.

Translation between the virtual and real addresses is accomplished by a hardware-implemented table-lookup procedure that accesses tables in main storage which are operating system created and maintained. The translation process is sped up by the TLB, a group of high-speed registers, which holds recently referenced virtual storage addresses and their real storage equivalents. The 9373 and 9375 translation lookaside buffers can hold addresses for 512 kilobytes of processor storage; the buffer on the 9377 can hold addresses for up to 128 kilobytes.

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.

SPECIAL FEATURES: A hardware floating-point accelerator in the 9377 executes add, subtract, multiply, divide, and square root long- and short-precision floating-point instructions. A High Accuracy Arithmetic (ACRITH) facility for solving problems in numerical analysis with verified accuracy and verified results is also standard. The ACRITH consists of 20 arithmetic instructions that supplement those in the S/370 floating-point instruction complement.

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➤ tions facilities, IBM is increasing distributed processing functionality through increased access to many application environments. In addition, system interconnectivity expenses are reduced through the Token-Ring LAN's cabling, connection, and communications carrier schemes.

The X.25 protocol addition to the 9370 communication and networking architecture extends distributed data processing functions. It permits the 9370 to communicate with those information systems using networks based on the International Organization for Standardization's Open Systems Interconnect (OSI) standards or the U.S. Department of Defense's (DOD's) networking recommendations (the DDN network).

By adding ACF/VTAM Release 3 and IBM Token-Ring LAN support for the VSE operating system, IBM can better meet users' networking requirements at the departmental level of organizational processing. They reduce the complexities, expenses, efforts, and skills required for having departmental and distributed processors communicate with one another and with the host and provide for greater connectivity options.

Furthermore, the ACF/VTAM, NetView, VM/DSNX, and NetView Network Definer additions to the SNA network make IBM's distributed processing network more competitive with other networking solutions such as Digital Equipment's DECnet, a decentralized (or peer-to-peer) network.

The 9370's competitiveness and capabilities are further increased with the availability of higher density DASD drives and higher performance DASD controllers. The 3990 Storage Controller increases overall system performance because it is 30 percent more powerful than its predecessor, the 3880 Storage Controller. The high-density 3380 DASD increases the 9370's on-line storage capacity, thus allowing larger databases and work loads.

COMPETITIVE POSITION

IBM positions its 9370 Information System against the MicroVAX and VAX 8000 systems from Digital Equipment, its chief rival within the medium-scale marketplace. The 9370 Model 20 is positioned against the Digital Equipment MicroVAX II and the VAX 8250. The 9375 Model 40 competes with the Digital Equipment VAX 8250 and VAX 8350, the 9375 Model 60 with the VAX 8350 and VAX 6210, and the 9377 Model 90 with the VAX 6220 and the VAX 8550.

The 9370 remains competitive with the VAX 8000 line in functionality. As previously stated, IBM communications and networking products enable IBM to present a distributed 9370 processing solution that is competitive with Digital Equipment's DECnet, the distributed processing solution for its VAX systems. With the new connectivity and network management functions additions, SNA will deliver the same level of network functionality as Digital

➤ **PHYSICAL SPECIFICATIONS:** Environmental characteristics for 9370 models are as follows:

	Temperature— degrees F (C)		Relative Humidity (%)	
9373—50 to 105 (10.0 to 40.6)			8 to 80	
9375—50 to 90 (10.0 to 32.2)			8 to 80	
9377—60 to 90 (15.6 to 32.2)			8 to 80	
	Height (in.)	Width (in.)	Depth (in.)	Weight (lb.)
9373	14 (35.6 cm.)	19 (48.3 cm.)	28 (71.1 cm.)	132 (60 kg.)
9375	28 (71.1 cm.)	19 (48.3 cm.)	31 (78.2 cm.)	280 (127 kg.)
9377	28 (71.1 cm.)	19 (48.3 cm.)	31 (78.2 cm.)	268 (122 kg.)

The 9370 processors are housed in IBM's 9309 Rack Enclosure, which comes in Models 1 and 2; any of the processors can be mounted in either model. Model 1 stands 39.3 inches (1 m.) high; Model 2 is 62.9 inches (1.6 m.).

The 9370 processors and the 9309 Rack Enclosure use single-phase power. All processor models can operate on 220 V power. The 9373 processor Model 20 can also operate on 120 V power; the 9309 Rack Enclosure Model 1 can be ordered with either power supply module.

The 9377 processors' logic is housed in an air-cooled thermal conduction module (TCM). Raised-floor construction and special electrical and plumbing facilities are not required.

INPUT/OUTPUT CONTROL

The 9373 processors include two internal I/O buses; the system provides an estimated aggregate I/O capacity of up to 11 megabytes per second. I/O slots for attachment of up to seven card features are provided inside the processor unit.

The two 9375 processor models each have four I/O buses. Each system provides an estimated aggregate I/O capacity of up to 22 megabytes per second. Up to 17 card features can be configured in the processor unit's available I/O slots.

The 9377 processor accommodates from two to six buses; depending on the configuration chosen, the number of available I/O card slots ranges from 10 to 54. The 9377 processor offers an estimated aggregate I/O capacity of up to 39 megabytes per second.

The 9370 processors have an integrated I/O control structure. All integrated I/O is compatible with the S/370 I/O control structure of channel and control unit.

The 9370 I/O controller is used to attach I/O devices to the 9370 processor. An I/O controller consists of the following components:

- An I/O processor (IOP). The IOP provides the means to handle I/O commands from the CPU and pass data to system memory. It communicates with the CPU over the internal I/O bus.
- An I/O adapter (IOA). The IOA provides the control mechanisms and channels needed for transferring data between the IOP and I/O device. It communicates with the devices over the respective external interface.

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TABLE 2. MASS STORAGE

MODEL	9332 DASD	9335 DASD	3370 DASD	3375 DASD
Cabinets per subsystem	1 to 4	1 to 4	16 to 32	16 to 32
Disk packs/HDAs per cabinet	1 fixed	1 fixed	1 HDA	1 HDA
Capacity, bytes	368M	824M	571.0M-729.8M	819.7M
Tracks/segments per drive unit	—	—	—	—
Average seek time, msec.	23 to 25	18	19	19
Average access time, msec.	32.6 to 34.6	26.28	29.1	29.1
Average rotational delay, msec.	9.6	8.28	10.1	10.1
Data transfer rate	2.6MB per sec	3.0MB per sec	1.86MB per sec	1.86MB per sec
Controller model	Integrated	Model A1 Device Controller	3880-1, -2, or -4	3880-1, -2, or -4
Comments	Attaches to 9370 DASD/Tape Subsys- tem Controller.	Model A1 attaches to 9370 DASD/Tape Subsystem Controller.	Model A units include logic and power for up to three B units.	Model A1 includes logic and power for up to three B1 units or two B1 units and one D1 unit.

Note: A dash (—) in a column indicates that the information is unavailable from the vendor.

➤ Equipment's DECnet—i.e., peer-to-peer communications that reduces system interconnection complexities, connection costs, and network management complexities and expenses.

It should be noted that the products that enable SNA to support peer-to-peer communications across the entire network are not readily available. These products will be delivered in approximately six months; thus, the new SNA facilities do not readily solve IBM customers' networking problems. Even so, these new SNA products will encourage those customers looking for peer-to-peer distributed system solutions to consider the 9370 and IBM's SNA products, since they deliver the same level of functionality as DECnet.

A major advantage that the VAX 8000 systems have over the 9370 is their length of time on the market. The Digital Equipment VAX systems are a proven success for departmental and distributed processing. The 9370 systems, on the other hand, are not fully market tested—they have not been around long enough to determine their effectiveness in departmental and distributed processing.

Digital Equipment's VAX 8000 line has already accumulated a substantial midrange systems market share, and IBM faces a difficult challenge in displacing the VAX 8000s. Customers will not be willing to part with their VAXs, even in an IBM environment. Such a migration would be costly since hardware, software, and communications investments are lost. Most of IBM's sales will be in those IBM processing arenas that have yet to invest in Digital Equipment VAX 8000s—the software compatibility with certain IBM mainframe environments would be a definite attraction.

In addition to competing against Digital Equipment for sales within the medium-sized system marketplace, IBM is competing from within. Sales of 9370 systems will be limited because IBM is selling against itself at both the low and high ends of the medium systems scale. That is, IBM is using both the System/36 and AS/400, and the 9370 to address small-scale business, office, and departmental computing. Customers neither requiring nor antic-

➤ The IOP and IOA may be combined on a single card, or they may exist on multiple cards. In multiple-card configurations, the IOP is on one card and the IOAs are on one or more additional cards.

Those I/O controllers classified as I/O subsystem controllers directly attach I/O device units without using separate control units for I/O device control and data transfer. The I/O channel attaches I/O devices through separate control units.

The 9370 employs four principal types of I/O controllers:

- DASD/Tape Subsystem Controller.
- Work Station Subsystem Controller.
- System/370 Block Multiplexer Channel.
- Communications Subsystem Controller.

The *DASD/Tape Subsystem Controller* attaches IBM's 9332 and 9335 Direct Access Storage Device (DASD) disk products and 9347 magnetic tape units to the 9370 processor. This controller employs the IBM Intelligent Peripheral Interface (IPI) Level 3 standard interface, which conforms to the American National Standards Institute (ANSI) standard for IPI Level 3.

The DASD/Tape Subsystem Controller combines the IOP and IOA functions on a single card. It is supported by the VM/SP, VSE/SP, and IX/370 operating environments.

The *Work Station Subsystem Controller* allows attachment of IBM 3270-type devices (such as PCs, display stations, and printers) and OEM devices for special-purpose applications such as factory or laboratory automation, data acquisition, process control, and communications. Attachable 3270-type devices include the 3178, 3180, 3191, 3192, 3193, and 3278 Display Stations; 3179, 3279, and 3192 Color Display Stations; 3194 Advanced Function Color Display; 3290 Information Panel; 5150, 5160, 5170, 5371, and 5373 PC microcomputers; 8530, 8540, 8560, and 8580 PS/2 microcomputers; and 3262, 3268, 3287, 4224, 4234, 4245, and 4250 printers. Both the 3270-type and the OEM devices attach either directly or through 3299 Terminal Multiplexers.

OEM devices must be attached to the Work Station Subsystem Controller through an appropriate, customer-supplied OEM adapter; the adapter must perform control functions and protocol conversion between the Work Station Subsystem Controller and the appropriate industry

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TABLE 2. MASS STORAGE (Continued)

MODEL	3380 D and E	3380 J and K	3380 CJ2
Cabinets per subsystem	1 to 4	1 to 8	1 to 4
Disk packs/HDAs per cabinet	2	2	1
Capacity	2520/5040MB	2520/7560MB	1260MB
Tracks/segments per drive unit	—	—	—
Average seek time, msec.	15/17	12/16	12
Average access time, msec.	23.3/25.3	20.3/24.3	20.3
Average rotational delay, msec.	8.3	8.3	8.3
Data transfer rate	3.0MB/sec	3.0 or 4.5MB/sec	3.0MB/sec
Controller model	3880/3990	3880/3990	Direct attachment
Comments	Models AD4, BD4, AE4, BE4	Models AJ4, BJ4, AK4, BK4	CJ2 can control up to three BJ4 or BK4 drives.

Note: A dash (—) in a column indicates that the information is unavailable from the vendor.

▷ ipating 9370 performance and functionality will purchase the less expensive System/36 or AS/400, thus reducing 9370 sales revenue.

According to IBM performance figures, the 9370 also overlaps the 4381. The 9377 Model 90 and the 4381 Model Group 21 both function within the same performance range. Although the 9370 offers a better price/performance ratio and outperforms the 4381 Model Group 21 in engineering/scientific computing and commercial processing, users will select the entry-level 4381s if they anticipate the need to expand computing and processing beyond the 9377 Model 90's performance and functionality levels. The entry-level 4381 models provide customers with entry points into IBM's high-performance computing realm. With it, customers are provided a cost-effective migration path to higher performance systems within and beyond the 4381 family.

Even with better price/performance than the entry-level 4381, the 9370 Model 90 does not provide a cost-effective migration path to higher performance computing. The move from a 9370 Model 90 to a 4381 requires a processor box swap, a more costly move than an upgrade for an entry-level 4381.

ADVANTAGES AND RESTRICTIONS

One of the most significant 9370 advantages is its communications and networking scheme. It delivers a much-improved communications architecture when compared to other IBM departmental offerings, such as the S/36 and S/38, and even the AS/400 at this point. Ethernet, Token-Ring Network, and SNA deliver the openness required in departmental processing. The Ethernet and the Token-Ring LANs provide the connectivity solutions that permit IBM and non-IBM systems and workstations to communicate and share resources with one another.

Particularly important within the 9370's communication scheme is its Ethernet connectivity. Ethernet LANs are one of the most popular schemes for linking information systems and workstations, especially at the department level—cases in point being Digital Equipment's Ethernet ▷

▶ standard. An example is IBM's Serial OEM Interface (SOEMI), which supports Multibus and other devices.

The Work Station Subsystem Controller comprises two cards. One contains the Work Station Processor, the other contains the Work Station Adapter. Each installed Work Station Subsystem Controller requires two card slots.

The Work Station Adapter has six coaxial ports for workstation or OEM adapter attachment. Each port supports one workstation or OEM adapter.

For greater device attachment, terminal multiplexers such as IBM's 3299 can be attached to four of the ports; each multiplexer can support up to eight stations or OEM adapters, allowing configuration of 32 devices per controller. However, if the multiplexers are attached to four of the ports, the other two Work Station Adapter ports cannot be used.

The Work Station Subsystem Controller is supported by the VM/SP and Virtual Storage Extended/System Package (VSE/SP) operating environments. The SOEMI is supported by VM/SP and VSE/SP through the IBM/SOEMI Access Method software facility.

The *System/370 Block Multiplexer Channel (BMPX)* allows attachment of one to eight control units for both IBM and non-IBM DASD, tapes, displays, printers, and other devices. Attachable I/O subsystems include:

- The 3880 Storage Control Unit, which controls IBM's 3370, 3375, and 3380 DASD.
- The 3430 Model A1 Magnetic Tape Subsystem.
- The 5080 Graphic System.
- The IBM 3270 Information Display System.
- The 3800 Printing Subsystem.

The single-card BMPX allows several I/O devices to operate concurrently at high speeds. Devices attached to the BMPX that cannot employ block multiplexing (such as IBM's 3420 magnetic tape unit) will act as if they were attached to a selector channel. The BMPX can operate in data streaming mode for attaching high-speed DASD like the 3380. Data streaming permits a data rate of up to 3 megabytes per second and cable lengths of up to 400 feet (122 meters) between the 9370 and the last control unit.

The System/370 BMPX allows the 9373 to attach devices with transfer rates of up to 1.5M bytes per second; the 9375 and 9377 can attach 1.5M, 1.9M, and 3M byte-per-second devices. ▶

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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.
9347	9	1600	PE	25 or 100	40,000-160,000
1589	9	1600	PE	75	120,000
	9	6250	GCR	75	468,000
3422	9	1600	PE	125	200,000
	9	6250	GCR	125	780,000
3430	9	1600	PE	50	80,000
	9	6250	GCR	50	312,500
3480	18	38,000 bytes/inch	—	79	3,000,000
Printers	Printing Speed	Print Positions	Horizontal Spacing, Chars./Inch	Vertical Spacing, Lines/Inch	Form Size, Inches
3262: Model 3	650 lpm	132	10	6 or 8	3.5 to 16.0 wide, 6 to 14 long
Model 13	325 lpm	132	10	6 or 8	3.5 to 16.0 wide, 6 to 14 long
3268 Models 2 & 2C	340 cps	132	10.0 or 16.7	3, 4, 6, or 8	16 wide, continuous
3287: Models 1 & 1C	80 cps	132	10	6 or 8	3 to 14 $\frac{7}{8}$ wide
Models 2 & 2C	120 cps	132	10	6 or 8	3 to 14 $\frac{7}{8}$ wide
3812	12 ppm	—	Variable	Variable	7.0 to 8.5 wide, 10.1 to 14.0 long
3820	20 ppm	—	10, 12, other	Variable	Up to 8.5 wide, up to 14.0 long
4224	200 to 400 cps	—	10, 12, 15	6 or 8	3 to 15 wide
4234 Model 1	120 to 410 lpm	—	10, 15	3, 4, 6, or 8	Up to 16 wide, up to 14 long
4245: Models 12 & D12	1,200 lpm	132	10	6 or 8	3.5 to 22.0 wide, 3 to 24 long
Models 20 & D20	2,000 lpm	132	10	6 or 8	3.5 to 22.0 wide, 3 to 24 long
4248 Model 2	2,200 to 4,000 lpm	132 std.; 168 opt.	10	6 or 8	3.5 to 18.0 wide, 3 to 17 long
4250	1.5 to 2.5 ppm average	—	Variable	Variable	Up to 12.99 wide
5210: Model G1	40 cps	—	10, 12, 15	3.4 to 8.0	Up to 15.4 wide
Model G2	60 cps	—	10, 12, 15	3.4 to 8.0	Up to 15.4 wide

Note: A dash (—) in a column indicates that the information is unavailable from the vendor.

➤ facilities for VAX minicomputers, MicroVAX, and VAX workstations and Data General's Ethernet facilities for Eclipse MV minicomputers.

The SNA networking facilities running on the 9370 permit it to serve as either a host or remote system within the SNA network. Permitting distributed IBM and non-IBM systems to gain access to MVS and VM resources is essential within the departmental and distributed processing

➤ The BMPX is supported by the VM/SP, VSE/SP, IX/370, and MVS/SP operating environments.

The *Communication Subsystem Controllers* handle remote workstation support, computer-to-computer linking, public data network connectivity, private network attachment, digital private branch exchange/computerized branch exchange (PBX/CBX) interfacing, ASCII device communications, and Ethernet and Token-Ring local area network (LAN) interfacing. A detailed discussion of the Communication Subsystem Controllers is found in this report's "COMMUNICATIONS CONTROL" subsection.

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▷ scheme, where such systems are frequently called upon to access applications, files, and data residing on MVS- and VM-based hosts.

A significant component within SNA is the LU6.2 and PU2.1 support facility for peer-to-peer communications. This facility reduces the complexities and performance degradations experienced when interconnecting systems, sharing resources, uploading and downloading files, and passing data between programs. It also reduces the application development effort for writing distributed processing applications.

By employing this communications support facility, distributed VM, VSE, and MVS systems can establish intercommunications without experiencing the complexities caused by host intervention. Furthermore, applications in VM, VSE, and MVS environments can establish communications with those LU6.2-based applications on IBM minicomputers, special-purpose processors, and microcomputers without incurring major interfacing difficulties.

Another 9370 advantage is its configurability. The 9370 delivers a flexible operating environment for commercial, office, engineering/scientific, and industrial computing. End users select the operating system that best suits application needs and task handling requirements. The VM/IS and VM/SP offerings are best suited for interactive processing in departmental and workgroup environments. AIX/370, based on the UNIX System V operating system developed and licensed by AT&T, is employed where UNIX System V functionality is required. The VSE/SP offering is designed primarily for intensive batch and on-line transaction processing in either a centralized or distributed environment. The MVS/SP product is designed to handle the system control programming functions in a large user community.

Although the 9370 supports MVS/SP, it does not support MVS/XA, the MVS-based operating system designed for high-end, S/370-type systems. Therefore, application portability between the 9370 and high-end S/370 architecture is limited.

Even though MVS/SP and MVS/XA are compatible, applications cannot be ported directly from one to the other. Applications being moved between the MVS/SP and MVS/XA environments must be modified to run in the new environment. Such a move requires additional application development expenditures.

When required, more than one operating system can run on the 9370. The VM/SP offering contains the system programming controls that permit it to run AIX/370, VSE/SP, MVS/SP, and VM/SP. Also, VM/SP can accommodate SVS/VSE and OS/VS1, the primary operating systems of the old 4361, thereby providing 4361 installations with a migration path to the 9370.

VM/SP runs the guest operating systems concurrently so that application processing or application development ▷

► CONFIGURATION RULES

The 9309 Rack Model 1 can hold 19 Electronic Industries Association (EIA) standard RS-310-B units; 1 EIA unit is equal to 1.75 inches (4.4 cm.). Model 2 can accommodate 32 EIA units. The number of EIA units required by each rack-mountable 9370 device is shown in the following table.

<u>Device</u>	<u>EIA Units</u>
9373 Processor	8
9375 Processor	16
9377 Processor	16
9377 Processor I/O Card Unit	8
9335 A01 DASD Controller	3
9335 B01 DASD	6
9332 DASD	3
9347 Magnetic Tape Unit	5

The 9373 Processor has one card enclosure that holds the processor logic, storage, and I/O controller cards; the enclosure has seven slots for the I/O controller cards. The single I/O bus on the 9373 Processor can accommodate up to four I/O controllers. The maximum number of each controller supported is as follows:

- Up to two DASD/Subsystem Controllers.
- Up to two Work Station Subsystem Controllers.
- Up to two Communications Subsystem Controllers.
- One System/370 Block Multiplexer Channel.

The 9375 Processor employs two card enclosures. The basic enclosure holds the processor logic and storage cards and provides 5 slots for I/O controller cards; the expansion enclosure, positioned below the basic enclosure, has 12 slots for I/O controller cards.

The 9375 permits configuration of up to four I/O buses, to which 16 I/O controllers can be attached. The 9375 supports the following maximums for each controller:

- Up to four DASD/Tape Subsystem Controllers.
- Up to six Work Station Subsystem Controllers.
- Up to four Communications Subsystem Controllers.
- Up to two System/370 Block Multiplexer Channels.

The 9377 Processor has one enclosure. The lower half holds the processor logic module. The upper half holds the I/O card unit connection and storage cards. I/O controller cards are in separate I/O card units. I/O card units can be in the same rack as the processor, or in another rack. The 9377 Processor can have up to six I/O buses, to which a maximum of 16 I/O controllers can be attached. The number of each controller that can be supported is as follows:

- Up to 12 DASD/Tape Subsystem Controllers.
- Up to 12 Work Station Subsystem Controllers.
- Up to 12 Communications Subsystem Controllers.
- Up to 16 System/370 Block Multiplexer Channels.

I/O card units with either one or two internal buses are available for the 9377. A card unit with one internal I/O bus can hold 11 DASD/Tape Subsystem Controller, Work ▷

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TABLE 4. TERMINALS

MODEL	3178	3179 Model G	3180	3191 Models A & B	3191 Models E & F	3192 Models C & D
DISPLAY PARAMETERS						
Max. chars./screen	1,920	1,920, 2,560	1,920, 2,560, 3,440, or 3,564	1,920	1,920 or 2,560	1,920 to 3,564
Screen size (lines x chars.)	24 x 80	24 x 32 x 80	24 x 80, 32 x 80, 43 x 80, or 27 x 132	24 x 80	24 or 32 x 80	24 x 80 to 27 x 132
Symbol formation	7 x 14 dot matrix	720 x 384 pixels, APA Color	9 x 11 dot matrix	7 x 14 dot matrix	Not specified	Not specified
Character phosphor	Green		Not specified	Green or amber-gold	Green or amber-gold	Color (Model C); green (Model D)
Total colors/no. simult. displayed	Not applicable	8	Not applicable	Not applicable	Not applicable	7 (Model C)
KEYBOARD PARAMETERS						
Style	Typewriter, data entry	Typewriter, APL	Typewriter, data entry, or typewriter/APL	Typewriter	122-key typewriter, 102-key typewriter, or 104-key typewriter	Typewriter or enhanced typewriter
Character/code set	94 EBCDIC	EBCDIC/APL	Not specified	94	Not specified	94
Detachable	Yes	Yes	Yes	Yes	Yes	Yes
Program function keys	10 or 24	24 standard	Not specified	24	24	24 standard
OTHER FEATURES						
Buffer capacity	Not specified	Not specified	Not specified	Not specified	Not specified	Not specified
Tilt/swivel	Standard	Standard	Standard	Standard	Standard	Standard
Graphics capability	No	Standard	—	—	—	No
TERMINAL INTERFACE						
	Work Station Subsystem Controller; 3274 Control Unit	Work Station Subsystem Controller; 3274 Control Unit	Work Station Subsystem Controller; 3274 Control Unit	Work Station Subsystem Controller; 3174 or 3274 Control Unit	Work Station Subsystem Controller; 3174 or 3274 Control Unit	Work Station Subsystem Controller; 3174, 3274, or 3276 Control Unit

Note: A dash (—) in a column indicates that the information is unavailable from the vendor.

▷ taking place under a particular environment is not disturbed. Users under each operating environment have continual access to applications and services within that domain.

Installations configure more than one operating system on a 9370 to satisfy application development and execution requirements. The multiple operating system structure simplifies application system migration, preserves existing applications, widens the application base, and increases operational capabilities. For example, an installation would run AIX/370 as a guest under VM/SP to gain access to UNIX application development tools and applications; run VSE/SP under VM/SP to meet transaction processing requirements; and, at the same time, run VM/SP itself to gain access to business professional productivity tools and office automation facilities. As another example, an installation would run OS/VS1 from the 4361 system under VM/SP until the OS/VS1 applications have been converted over to the formats needed for running under VM/SP.

IBM has reduced the data processing skills needed to run a 9370 installation. The VM and VSE system offerings are bundled into packages that simplify operating environment software installation. The VM/IS version of VM/SP, for instance, includes all the functions of VM/SP, but reportedly does not require anywhere near the 44 hours of system programmer time that VM/SP requires in its non-integrated version.

Additionally, VM/IS and VSE/SP incorporate tools that simplify system operation and maintenance. Facilities are

▷ Station Subsystem Controller, or Communications Subsystem Controller cards. A unit with two internal buses can hold 10 cards, supporting all aforementioned controller types, plus the System/370 Block Multiplexer Channel.

The maximum configuration of I/O card units for the 9377 Processors can be one of the following:

- One dual-bus unit and four single-bus units.
- Three dual-bus units.
- Two single-bus units and two dual-bus units.

The 9375 Model 40 can be field upgraded to the 9375 Model 60 processor through a simple card exchange. Either 9375 model can be converted to the 9377 Model 90; the conversion requires a processor cage swap, because a second rack must be added.

WORKSTATIONS: The 9370 supports the 3270 Information Display System and IBM's ASCII-oriented display stations. In addition, IBM PC, PS/2, and 75XX Industrial Computer microcomputers can be attached to the 9370. (Microcomputer connectivity requires the appropriate terminal emulation and microcomputer support software.)

The Work Station Subsystem Controller provides for local attachment of 3270-type devices, PC microcomputers, PS/2 microcomputers, and 75XX microcomputers. In addition, IBM terminal subsystem controllers such as the 3174 and 3274 provide for 3270-device and microcomputer connectivity. The IBM 3174 and 3274 connect to the 9370 through a System/370 Block Multiplexer Channel port, a Telecommunications Subsystem Controller port, or an IBM 37XX communication processor, which attaches to the System/370 Block Multiplexer Channel or IBM 372X communication processor.

▷ Besides supporting 3174-, 3274-, and 37XX-based terminal attachment, the Telecommunications Controller also sup-

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TABLE 4. TERMINALS (Continued)

MODEL	3192 Model G	3193 Models 1 & 2	3194 Model D	3194 Model H	3278 Models 2, 3, 4, & 5	3290 Models 220, 230, & T30
DISPLAY PARAMETERS						
Max. chars./screen Screen size (lines x chars.)	1,920 or 2,560 24 or 32 x 80	3,840 48 x 80	3,440 43 x 80	1,920 24 x 80	960 to 3,564 12 x 80 to 27 x 132	9,920 62 x 160
Symbol formation	Not specified	11 x 24 dot matrix (total character box)	Not specified	Not specified	7 x 9 or 7 x 8 dot matrix	5 x 8 dot matrix
Character phosphor	Red, green, blue, yellow, turquoise, white on black	White on black	Monochrome	Color on dark	White	Amber gas plasma
Total colors/no. simult. displayed	7	Not applicable	Not applicable	Not specified	Not applicable	Not applicable
KEYBOARD PARAMETERS						
Style	Typewriter or IBM Enhanced	Typewriter	Typewriter or IBM Enhanced	Typewriter or IBM Enhanced	Typewriter, data entry	Typewriter, data entry
Character/code set	94	EBCDIC	Not specified	94	94 EBCDIC	EBCDIC
Detachable	Yes	Yes	Yes	Yes	Yes	Yes
Program function keys	24 standard	24 standard	Not specified	12 or 24	12 standard	24 standard
OTHER FEATURES						
Buffer capacity	Not specified	Not specified	Not specified	Not specified	Not specified	24K bytes
Tilt/swivel	Standard	Standard	Standard	Standard	Standard	Tilt standard
Graphics capability	Not specified	Images	—	High-resolution images	No	No
TERMINAL INTERFACE						
	Work Station Subsystem Controller; 3174 or 3274 Control Unit	Work Station Subsystem Controller; 3174 or 3274 Control Unit	Work Station Subsystem Controller; 3174 or 3274 Control Unit	Work Station Subsystem Controller; 3174 or 3274 Control Unit	Work Station Subsystem Controller; 3274 Control Unit	Work Station Subsystem Controller; 3274 Control Unit

Note: A dash (—) in a column indicates that the information is unavailable from the vendor.

➤ available for reducing the time required to perform problem diagnosis and service routines.

Furthermore, VSE/SP and VM/IS packages offer system interfaces that simplify administrator, operator, and end-user system interaction. These interfaces feature consistent access to system functions, menu- and prompt-driven dialogs, system-guided operations, and on-line help and referencing facilities. They can reduce learning times and skill levels required for administrators, operators, and general users to manage and use the system.

As an option, customers can off-load system control programming to a remote site, thus eliminating system operations concerns. The remote programming site performs system and application start-ups and shutdowns, system operations, performance monitoring, problem diagnosis, and corrective actions.

The IBM-supplied customer/product support services also reduce system management complexities. For a fee, IBM will perform remote system programming for the VM/IS system; provide telephone consulting; provide remote on-line problem diagnosis and off-line analysis; apply micro-code changes from the remote site; and conduct preinstallation planning, installations, and postinstallation support.

All these ease-of-use facilities and centralized system management features are of primary importance in the departmental processing environment, where lower overhead is a necessity.

➤ ports the direct attachment of remote 3270-compatible workstations, ASCII devices, and IBM printer subsystems such as the 3800 and 3820.

The ASCII Subsystem Controller, a type of Communication Subsystem Controller, provides connectivity for ASCII devices. In addition, the 7171 ASCII Device Attachment Unit can be used for ASCII device attachment. A System/370 Block Multiplexer Channel is required to configure a 7171 on the 9370.

Furthermore, IBM Token-Ring and IEEE 802.3 Ethernet networks can be used to connect workstations to the 9370.

The primary support devices for 9370 workstations are the Work Station Subsystem Controller and the ASCII Subsystem Controller. As previously stated, the 9373 supports up to 2 Work Station Subsystem Controllers; the 9375 supports up to 6 and the 9377 supports up to 12. Up to 2 ASCII Subsystem Controllers can be configured on the 9373; up to 4 can be configured on the 9375; and 12 can be configured on the 9377.

IBM does not provide specific ranges for the number of simultaneously active users supported on each 9370 model; that figure varies with the system's work load and actual user activity levels. The company does state that the 9373 can support 20 continuously active users; 100 such users can be supported by the 9377. Assuming that some users are only sporadically active, the 9373 can support over 50 users and the 9377 over 200.

DISK STORAGE: The 9370 supports the 368M-byte 9332 and the 824M-byte 9335 DASD fixed disk drives through the DASD/Tape Subsystem Controller. The drives have physical capacities of 400.6M bytes and 855.8M bytes, respectively; because the 9370 processor reserves some of the disk for system use, 368M bytes and 824M bytes are the drives' respective usable capacities. The 9335 A1 Device Function Controller can support up to four 9335 B1 DASDs.

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▷ Another advantage of the 9370 is its compatibility with System/370-based superminicomputers and mainframes. The 9370's hardware and software compatibility with the 4381, 3080, and 3090 systems makes it valuable as a departmental or distributed system. Because of software compatibility between the 9370 and higher performance S/370-class machines, VM, MVS, VSE, and AIX/370 applications can be moved to, or down from, the same environments on 370-based mainframes or 370-based superminicomputers.

Furthermore, the 9370 maintains hardware compatibility with the System/370-type mainframes and superminicomputers. The System/370 Block Multiplexer Channel-attached peripheral storage subsystems, workstations, printers, and specialized I/O systems; the 3270-type terminals and printers; and the 37XX communication processors employed on the 9370 models can be moved over to higher performance S/370-based models, thus preserving investments in peripheral subsystems and devices.

Although the 9370 is compatible with IBM's more powerful 4381 and 30XX systems, it still lacks full compatibility with the S/36, S/38, and AS/400—significant systems in the midrange system marketplace. No direct software compatibility exists between the 9370 and S/3X and AS/400 systems.

Solving the problem of top-to-bottom compatibility will not begin until at least 1989, when IBM delivers additional products conforming to the company's Systems Application Architecture (SAA). This will permit applications conforming to a specific set of standards to run on any IBM system. It could take several years before fully functional, SAA-compatible facilities become generally available.

Although the 9370, S/3X, and AS/400 operating environments are incompatible, the 9370 does provide more of a bridge between the S/3X and AS/400 machines and the S/370-class systems than 4361, the previous entry-level S/370-based machine. S/3X users who want to move up to a S/370-class machine can continue to use some of their peripherals, rather than start over with new storage devices and workstations in addition to new processors. For example, the 9332 and 9335 DASD devices and the 3178 display stations employed on the S/36 Model 5362 or 5360 can be carried over to the 9370 during a system migration. □

► At least one DASD/Tape Subsystem Controller must be configured on a 9370 when any I/O controller other than the System/370 Block Multiplexer Channel is used. As previously stated, the 9373 supports up to 2 DSAD/Tape Subsystem Controllers, the 9375 supports up to 4, and the 9377 supports up to 12. The configuration options on the DASD/Tape Subsystem Controller are as follows:

- One to four 9332-400 DASD.
- One to four 9332-400 DASD and one 9347 magnetic tape unit.

- One 9335 A1 and one to four 9335 B1 DASD.
- One 9347 magnetic tape unit.

The 9370s also support high-speed and -capacity disk drives and controllers through the System/370 Block Multiplexer Channel.

MAGNETIC TAPE: The 9370 supports the 9347 streaming tape drive through the DASD/Tape Subsystem Controller. Higher speed and higher capacity tape devices can be configured using the System/370 Block Multiplexer Channel.

PRINTERS: Printers can be attached to the 9370 through the Work Station Subsystem Controller, Telecommunications Subsystem Controller, System/370 Block Multiplexer Channel, ASCII Subsystem Controller, and IBM 3270 control devices.

OTHER: The 3737 Remote Channel-to-Channel Unit is a standalone control unit that allows System/370-type hosts to communicate with each other over unlimited distances via public or private T1 facilities at speeds up to 1.5M bits per second (bps). Communications between host systems is supported by the VTAM channel-to-channel program. The 3737 is transparent to the host, requiring no host modifications and allowing the hosts to communicate with each other as though they were channel-to-channel (CTC) connected. The MVS, VSE, and VM operating systems view the 3737 as a (local) channel-to-channel adapter (CTCA). The 3737 attaches to the 9370 and another System/370-type processor via a System/370-type block multiplexer channel.

The 9370 attachment to the IBM 3088 Multisystems Channel Communications Unit provides high-speed communications with 4300, 3080, and 3090 processors and other 9370 processors. The 3088, a standalone I/O controller, provides the capabilities for interconnecting up to eight processor channels.

The 9370 can be up to 800 feet from the 3088. The interprocessor cable attaches to the System/370 Block Multiplexer Channel and the 3088's interface. The 3088 is compatible with CTCAs.

The 3044 Fiber Optic Extender Link permits low- and medium-speed peripheral subsystem control units, switching units, and CTCAs to be positioned farther "down the line" for the purpose of reducing central processing complex floor space requirements and peripheral connectivity costs. With this link extender, I/O equipment such as terminals and printers can be placed farther away from the host system without employing the costly communications equipment needed for connectivity. Employing fiber optic cable for peripheral subsystem connectivity increases data throughput and improves communication channel reliability, availability, and integrity as compared to traditional peripheral subsystem connectivity cables and buses.

The 3044 Fiber Optic Extender Link consists of two units that are connected by up to 1.2 miles (or 2 km.) of fiber optic cable. The 3044 Model C01 attaches the processor channel to one end of the fiber optic cable. The 3044 Model D01 connects the other end to the "remote I/O control unit."

The 9370 attachment to the 3814 Switching Management System permits the 9370 to share channel-attached devices with other System/370-type processors. The peripheral device sharing capabilities minimize the number of I/O devices required for peak demand and critical device backup, reduce the impact from device failures, and minimize the

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► complexities of data processing operation control by providing greater configurations security.

MASS STORAGE

Please refer to Table 2 for information about disk devices.

INPUT/OUTPUT UNITS

Please refer to Table 3 for information about tape and printer devices.

TERMINALS

Please refer to Table 4 for information about terminal devices.

COMMUNICATIONS CONTROL

The 9370 employs four principal Communications Subsystem Controllers: the Telecommunications Subsystem Controller, the ASCII Subsystem Controller, the IBM Token-Ring Subsystem Controller, and the IEEE 802.3 Local Area Network Subsystem Controller. All four subsystems are based on the same communications processor card, plus one or more communications adapter cards and the appropriate specific subsystem microcode. As previously mentioned, the 9373 supports up to 2 of these controllers, the 9375 supports up to 4, and the 9377 accommodates up to 12.

The *Telecommunications Subsystem Controller* allows attachment of local communications lines to the 9370 or allows the 9370 to be attached to public networks. The controller permits attachment of two types of adapters: the Multi-Protocol Two-Line Adapter and the Asynchronous Four-Line Adapter. The adapter configuration options for this controller are as follows:

- One to three Four-Line Adapters.
- One to three Two-Line Adapters.
- A combination of up to three Two-Line and Four-Line Adapters.

The Telecommunications Subsystem Controller supports the following types of line interfaces:

- EIA RS-232-C/CCITT V.24/V.28, supporting asynchronous, BSC, and SDLC protocols at line speeds from 75 bps to 19.2K bps.
- EIA RS-422-A/CCITT V.11, supporting asynchronous, BSC, BSC/SDLC, and SDLC protocols at line speeds from 75 bps to 64K bps.
- EIA RS-366/CCITT V.25, supporting asynchronous, BSC, and SDLC protocols at line speeds from 75 bps to 19.2K bps.
- CCITT V.35, supporting BSC and SDLC protocols at line speeds from 2.4K bps to 64K bps.
- CCITT X.21, supporting SDLC, HDLC, and X.25 protocols at line speeds from 600 bps to 64K bps.

The maximum number of lines supported by one Telecommunications Subsystem Controller depends upon the combination of protocols and line speeds selected and the

number of I/O slots available. The controller is supported by the VM/SP and VSE/SP operating environments.

The *ASCII Subsystem Controller* supports up to 16 ASCII devices operating at 50 bps to 19.2K bps in full-duplex mode either on local lines without modems or on switched and leased communications lines with modems. The controller comprises a Communications Processor and up to four Asynchronous Four-Line Adapter cards.

Three modes of operation—ASCII support, ASCII/3270 conversion, and ASCII/3270 transparent mode—are available. In ASCII mode, all attached ASCII devices appear to software as native devices; this mode is supported by the IX/370 operating system. In addition to IX/370, the Telecommunications Subsystem Controller is supported by the VM/SP and VSE/SP environments.

The ASCII Subsystem Controller's asynchronous adapter can be connected to a Rolm Computer Branch Exchange (CBX) through a Rolm DataCom Module (DCM) or Data Terminal Interface (DTI).

The *IBM Token-Ring Subsystem Controller* provides access to a 4M bps baseband IBM Token-Ring Network compatible with the IEEE 802.5 standard for interconnecting information processing equipment. The network uses the IBM cabling system, including Type 3 (telephone twisted pair) specified media, for physical interconnection; it employs a token-ring access protocol for network traffic control. The two-card Token-Ring Subsystem Controller comprises a Communications Processor and a Token-Ring Adapter. The adapter provides both a physical link and access control to the IBM Token-Ring Network; programming support must be equivalent to the International Organization for Standardization's (ISO's) Open Systems Interconnection (OSI) Layer 3 and above.

The IBM Token-Ring Subsystem Controller is supported by either the VM/SP or VSE operating system and the Transport Control Protocol/Internet Protocol (TCP/IP).

The *IEEE 802.3 Local Area Network (LAN) Subsystem Controller*—comprising a Communications Processor card and an IEEE 802.3 LAN Adapter card—is used for communicating with other 9370 Information Systems, other vendors' systems, and workstations using the IEEE 802.3 standard or the Ethernet LAN; it provides both a physical link and access control. This controller supports a network with a transmission speed of 10M bps using Carrier Sense Multiple Access with Collision Detection (CSMA/CD). Programming support for the LAN adapter must be equivalent to OSI Layer 3 and above.

The LAN Subsystem Controller is supported by VM/SP and TCP/IP.

The System/370 Block Multiplexer Channel, Telecommunications Subsystem Controller, and the 9370-based LAN controllers permit attachment of many other IBM communications devices, including the 3174 *Subsystem Control Unit* and the 3274 *Control Unit*; the 3299 *Terminal Multiplexer*; and the 3720 and 3725 *Communications Controllers*. For details on those devices, refer to *Datapro Reports on Data Communications*.

SOFTWARE

OPERATING SYSTEMS: All 9370 systems run under IBM's VM/SP, VSE/SP, and IX/370 operating systems. The IX/370 is supported only under control of VM/SP. The MVS/SP operating system is supported only on the 9375 Model 60 and the 9377 Model 90, enabling users to ►

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- develop applications on a host system and transport them, without changes, to distributed workgroup locations.

VM/Integrated System (VM/IS) is IBM's preferred delivery vehicle for the interactive *VM/SP* operating environment in departments and end-user workgroups.

VM/IS comprises the following components:

- **VM/SP.** This function, for basic system control and data management, manages the real system resources of processor time, real storage, and I/O devices, making them available to all VM users at the same time. It provides an interactive computing environment for general problem solving and program development. An editor and an interpretive language are also included.

VM/SP accommodates IBM guest operating systems, including VSE/SP, MVS/SP, other VM/SP releases, and IX/370, for purposes such as application testing and execution of applications restricted to specific environments.
- **VM Batch Subsystem.** This function controls background execution of user processes.
- **VM Directory Maintenance.** This utility provides interactive facilities that enable the system administrator to manage the VM system directory.
- **VM Interactive Productivity Facility (IPF).** This provides a simplified interface to the VM system and an interface that allows addition of user-written or IBM programs to the system.
- **VM/IS Productivity Facility (VM/IS PF).** This product provides end-user menus containing task-oriented, introductory, and navigational dialogs leading to other programs' functions in VM/IS. VM/IS PF uses underlying products' functions like IPF without duplicating or changing them.
- **Interactive System Productivity Facility (ISPF).** A dialog manager, this product controls the flow of the end-user interface provided by VM/IS. Programmers can use ISPF to produce interactive applications with menu-driven dialogs and dialog functions.
- **VM File Storage Facility (FSF).** This tool allows users to share data files with other VM users, store and retrieve files, send them to other users, and perform other file management functions.
- **VM Real-Time Monitor (RTM).** This provides performance monitoring and statistical analysis presented in realtime on any VM/IS-supported monitor.
- **VM Performance Monitor Analysis Program (VM MAP).** This utility provides reports and graphics on performance and use of a running VM system. VM MAP requires the general support routines contained in another integral product, PL/1 Transient Library.
- **Document Composition Facility/Foreground Environment Feature (DCF/FEF).** This is a facility for text document production. A document formatted by DCF can be printed, displayed, or used as input to other text documents.
- **Graphical Data Display Manager (GDDM).** This facility is a host system program for creating, showing, and storing pictures, including graphics, images, and numerics. GDDM drives displays, printers, plotters, and scanners. Another GDDM product included in VM/IS is GDDM/

Graphics Presentation Function (GDDM/GPF), which provides methods for producing business and other charts.

Nine optional applications packages are available for VM/IS, providing 33 licensed programs. The packages are:

- **Text Office Support (TXTO).** This package includes IBM's Professional Office System (PROFS), which provides facilities for mail handling, appointment scheduling, and document, memo, graphics, business forms, and report preparation; IBM's DisplayWrite/370 document processing facility; and IBM's Application Support (AS), which provides facilities for business data access, data and text integration, exchange and display management, mathematical and statistical analysis, business graphics, and business planning and modeling.
- **Engineering/Scientific Problem Development Support (E/SPDS).** This package includes VS Fortran language, debug, and utilities; ISPF/Program Development Facility (ISPF/PDF); Graphics Attachment Support Program (GASP); Graphical Data Query Facility (GDQF); AC-RITH; and Elementary Math Library (EML).
- **APL Language Support (ALS).** This allows use of the APL2 language for development of mathematical and statistical applications.
- **Problem-Solving Languages (PSL).** This provides Basic and Pascal/VS for development of applications addressing business problems.
- **Data Base Query (DBQ).** This facility provides for relational database creation and management. It includes IBM's Structured Query Language/Data System (SQL/DS), Database Edit Facility (DBEDIT), and Query Management Facility/VM (QMF/VM).
- **Intelligent Workstation Support (IWS).** This product allows PC users to take advantage of VM/SP facilities and to transfer files between the PC and the VM host. This product requires that the user obtain additional PC programs, such as PC/VM Bond, for the individual PCs.
- **Networking Support (NTWK).** This serves as an "operating system" for the data communications network. It is comprised of IBM's Advanced Communications Function/Virtual Telecommunications Access Method (ACF/VTAM), Remote Spooling Communications Subsystem (RSCS) Networking, VSE/Virtual Storage Access Method (VSE/VSAM), and NetView communications utility packages.
- **Remote Communications Support.** Comprised of Remote Spooling Communications Subsystem (RSCS) Networking, CVIEW, and PVM, this component provides computer interconnection support for sending and receiving information between sites, logging on to remote sites, and establishing teleconferencing sessions with other users. RSCS Networking controls the transfer of files, messages, and commands. PVM permits users to log on to their system from another system in the network. CVIEW permits VM/SP users to share the same interactive session.
- **Communication Controller Support (COM).** COM is comprised of the Advanced Communications Function/Network Control Program (ACF/NCP), ACF/System Support Program (ACF/SSP), and IBM 3725 Emulation Package (EP3725). It provides SNA networking to those customers with IBM 3725, 3270, and 3705 communications processors. ►

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► **VM/SP System Offering** is a VM package structured for installation and customization on larger 9370 systems. It consists of VM/SP and a set of optional feature program products. With only a few exceptions, all products supported by VM/IS are supported by VM/SP System Offering. However, VM/SP System Offering requires a greater data processing expertise than VM/IS.

Additional products available through VM/SP System Offering include:

- Application development systems such as Application Prototype Environment (APE), Cross System Product/Application Development (CSP/AD), CSP/Application Execution (CSP/AE), CSP/Query (CSP/Q), Interactive Instructional Presentation System (IIPS), and Development Management System/Conversational Monitor System (DMS/CMS).
- OS PL/1 and VS Cobol II compilers, debuggers, and libraries.
- GDDM-Interactive Map Definition (GDDM-IMD), a tool for graphics processing.
- VM Backup Management System (VMBACKUP-MS) and VM Tape Management System (VMTAPE-MS) system control support packages.
- Contextual File Search/370 (CFSearch/370) data/file management tool.
- Printer support packages including the Font Library Service Facility (FLSF), Overlay Generation Language (OGL), Page Printer Formatting Aids/VM (PPFA/VM), Printer Services Access Facility (PSAF), and Printer Services Facility.
- Info Center/1 (IC/1) information management system.
- Document Composition Facility, a text processing package.

VSE/SP is a pregenerated, load-and-go operating system most desirable for departments and end-user workgroups with intensive batch and transaction processing requirements. It is IBM's primary production system for intermediate systems and the operating system base for distributed processing nodes. It replaces IBM's Small Systems Executive/VSE (SSX/VSE) as the VSE entry system for data centers and distributed environments.

VSE/SP includes task-oriented menus, including those to identify and correct on-line transaction failures; intelligent workstation support for IBM PCs and 3270 PCs; virtual address extension, providing up to three virtual address spaces for up to 40M bytes of virtual storage; and system start-up and remote operation control, allowing unattended departmental systems operation.

The VSE/SP product incorporates the following components:

- VSE/Advanced Functions (VSE/AF), for basic system control.
- ACF/VTAM and Basic Telecommunications Access Method-Extended Support (BTAM-ES), for workstation and network control. They support attachment of local and remote workstations and processors; VTAM also supports channel-to-channel attachment.
- VSE/Interactive Computing Control Facility (VSE/ICCF) and Customer Information Control System

(CICS/DOS/VS) for interactive system control and transaction processing, respectively.

- VSE/Priority Output Writers, Execution Processors, and Input Readers (VSE/Power) for spooling, networking, and remote job entry control.
- VSE/VSAM and VSE/VSAM Space Management Feature, for data management; they control data storage and access to DASD and also manage DASD space.
- Three utilities: VSE/VSAM Backup and Restore Feature; VSE/Fastcopy; and Data Interfile Transfer, Testing, and Operations Utility (Ditto).

Optional products for VSE/SP are available in the following areas:

- Business professional applications, including Distributed Office Support System (DISOSS), DisplayWrite/370 (DW/370), Personal Services/370 (PS/370), and Decision Support/VSE (DS/VSE).
- Application development, including DOS/VS Cobol, DOS PL/1, DOS/VS RPG II, and Cross System Product/Application Development (CSP/AD).
- Database management and query, including the hierarchical DBMS product Data Language/One DOS/VS (DL/1 DOS/VS), the relational SQL/DS, Query Management Facility/VSE (QMF/VSE), and DOS/VS Sort/Merge II.
- Systems networking and distributed data processing, including Distributed Systems Executive (DSX), ACF/VTAM, ACF/NCP, and Network Communications Control Facility (NCCF).

IX/370 is IBM's implementation of AT&T's UNIX System V operating system. It is a multiuser, multitasking operating system that runs as a guest under VM/SP. *IX/370* includes the Bourne Shell command language and provides virtual addressing, a hierarchical file system, file and logical record locking, full-screen file editing, and on-line reference documentation. The block size of *IX/370* files is 4096 bytes.

Another feature is multiple *IX/370* system support, which allows several *IX/370* subsystems to coreside on the same processor. The subsystems operate independently of one another.

IX/370 provides the full set of UNIX programmer-productivity tools, such as the Source Code Control System (SCCS) and symbolic debugger. A full set of UNIX text processing tools is also provided. For message and file transfer, the mail and UNIX-to-UNIX copy (uucp) facilities are provided. Interactive Systems Corporation's INmail and INnet programs are provided as electronic mail facilities for communications among computers in a network.

The local/remote file transfer support facilities of *IX/370* allow users to send files to, and receive files from, other users in an RSCS network. In particular, these facilities allow *IX/370* users to receive files sent by an IBM Conversational Monitor System (CMS) user, an MVS/Time Sharing Option (MVS/TSO) user, or any other *IX/370* user. Similarly, an *IX/370* user can send files to any other user accessible through the RSCS network.

MVS/SP is used only on the 9375 Model 60 and the 9377 Model 90, primarily where operating system compatibility with a central computer is required for transporting program packages between the host and distributed systems. ►

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► MVS/SP does not support fixed-block architecture DASD, such as the 9332 and 9335; it also lacks support for any of the 9370's integrated I/O controllers. All I/O devices must be attached through standard System/370 Block Multiplexer Channels and control units.

PROGRAMMING LANGUAGES: Languages available for the VM, VSE, and MVS operating environments include VS Fortran, PL/1, Cobol, and RPG II. Available for the VM and MVS environments only are APL2, Pascal/VS, and Basic. Lisp/VM is available for VM only.

DATA BASE MANAGEMENT SYSTEM: *Structured Query Language/Data System (SQL/DS)*, designed for use with VM/SP and VSE systems, is a relational DBMS with integrated query and report writing facilities. It is broadly compatible with IBM's DB2 product in MVS environments. In the VM environment, SQL/DS provides remote relational access support, allowing users on one CPU to access an SQL/DS database on another locally or remotely connected CPU. For VSE, SQL/DS provides an extract facility that enables users of IBM's DL/1 DOS VS to select portions of DL/1 DOS/VS data and copy them into SQL/DS tables.

Data Language/1 (DL/1), also called DL/1 DOS/VS, is intended for the VSE environment, for applications with complex processing requirements and highly structured, fixed data relationships; it complements the relational SQL/DS product. An adjunct product, Query.DL/1, provides a simplified facility for making queries against DL/1 databases.

Database 2 (DB2), for the MVS/SP environment, is intended for applications with dynamic requirements and data structures. Multiple users can concurrently access and change data within the same DB2 table; data remains consistent not only within the database, but also as it is perceived by each user. This product uses SQL for programming in either high-level language or interactive mode; the same syntax is used to define and control the system.

Information Management System/VS Data Base Facility (IMS/VS-DB) is a full-function database management system (DBMS) used to create an environment for complex applications like transaction processing; it runs under MVS operating systems. It is most often combined with either IMS/VS-DC or CICS/VS (see the "COMMUNICATIONS" subsection below) to achieve a complete database/data communications system. IMS/VS-DB executes as an application and interfaces between user application programs and databases.

DATA COMMUNICATIONS: IBM offers a range of communications products for the VM, VSE, and MVS environments. Key products are described in the following paragraphs; those provided as integral or optional facilities for specific operating systems are mentioned in this "SOFTWARE" section.

The 9370 participates in IBM's *Systems Network Architecture (SNA)*. The base for major communications subsystems in the VM, VSE, and MVS environments, ACF/VTAM (together with ACF/NCP, when applicable), provides a network operating system. The network operating system functions are analogous to those of a host operating system for resource sharing and logical handling of user requests.

ACF/VTAM supports concurrent execution of multiple telecommunications applications and controls the sharing of telecommunications resources among the programs in one or more systems. It supports logically direct data transmission between application programs and terminals in

session and supports data transfer between two application programs residing in the same system or in distributed systems.

ACF/VTAM, working in conjunction with ACF/NCP, supports peer-to-peer communications among SNA nodes; that is, programs residing on distributed systems can communicate with one another without host application assistance.

Advanced Program-to-Program Communications (APPC) is provided by the VTAM Application Program Interface (API). The API allows S/370-type applications using LU6.2 sessions to communicate over an SNA network with APPC applications running on the following: S/370-architecture mainframes and intermediate-sized processors; IBM System/36, System/38, and Series/1 minicomputers; IBM System/88 fault-tolerant/on-line transaction processors; the IBM RT PC workstation; the IBM PC and PS/2 microcomputers; and other manufacturers' systems which support LU6.2 communications.

ACF/NCP resides in the IBM 372X Communication Controller and provides physical communications network management. It controls attached lines and terminals, performs error recovery, and routes data through the network. It communicates with the host through ACF/VTAM, or, in the case of a remote 372X, through another ACF/NCP.

The *Non-SNA Interconnection* network program allows the connection of BSC-oriented remote job entry (RJE) workstations to a 37XX communications processor. The *Network Terminal Option* allows non-SNA terminals to access ACF/VTAM-based applications.

The *X.25 NCP Packet Switching Interface (X.25 NPSI)* allows ACF/NCP users to communicate over packet switched data networks that have interfaces complying with CCITT Recommendation X.25 (1980 and 1984). This product allows SNA host processors to communicate with either SNA or non-SNA equipment over such networks.

The *Distributed Systems Executive (DSX)*, a network program for VSE- and MVS-based host systems. It helps the central site plan, schedule, and track the distribution of data and software among SNA network nodes. It provides centralized support and control for resource distribution between the host and selected SNA nodes, maintains control over software maintenance at the remote site, allows the scheduled distribution of node software, distributes data between the host and nodes, initiates processing at the nodes and host, and provides wider security coverage.

The *VSE/Distributed Systems Node Executive (DSNX)*, a network program for VSE-based systems, supports the central site management of a distributed systems network. VSE/DSNX is installed at the remote site to receive and to implement software and data objects received from the VSE- or MVS-based host which is running DSX.

Like VSE/DSNX, *VM/DSNX* provides support for the central site management of a network of distributed systems. VM/DSNX is installed at the remote site to receive and to implement software and data objects. It also provides limited function for distributing objects from the VM-based central site to distributed VM-based systems.

NetView, a product for VM, MVS, and VSE environments, is a network management program that provides a cohesive set of SNA host network management services. Fully compatible with IBM's SNA network management architecture, NetView performs the network management functions of NCCP, Network Logical Data Manager (NLDM), and Network Problem Determination Application (NPDA), and

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► functions of the program offerings VTAM Node Control Application (VNCA) and Network Management Productivity Facility (NMPPF).

NetView contains the following components:

- **Command facility.** This component provides command, messaging, and other capabilities for executing network management functions. The facility supports single-domain, multiple-domain, or interconnected SNA networks which allow system operations to be centralized at a single location or distributed at different points.
- **Session monitor.** This component gathers information on session activities for performance evaluation, system tuning, and system accounting.
- **Hardware monitor.** This component collects and displays alerts, events, and statistical data to assist in identifying failing network resources, determine probable cause, and recommend action for specific problems related to alerts and events.
- **Status monitor.** This component allows the operator to view the status of all domain resources.
- **On-line Help facility.** This component provides operator information without requiring operation reference library use.
- **Help Desk Facility.** This component is an on-line guide that provides problem diagnosis and network operation techniques.
- **Network Log and Data Set Browse.** This facility stores network messages and permits the operator to review the messages. Through user specification, messages being flagged by an "important message indicator" may be color coded or highlighted to designate severity, type, or source.

The *NCCF*, which operates as an application program under ACF/VTAM, provides the network operator with functions for controlling a communications network. It also provides services for IBM or user-written network management programs.

The *NLDM* and the *NPDA* are *NCCF* applications which collect session-related information that is useful for identifying and isolating network problems.

The *Network Performance Monitor (NPM)* aids network support personnel in managing the performance and growth of VTAM-based networks. The *Network Design and Analysis (NETDA)* is an interactive program product designed to assist customers in the definition, performance analysis, and optimization of SNA networks.

The *Routing Table Generator (RTG)* assists users in defining networks and routing tables. The *NetView Network Definer*, a NetView application, assists users in building and maintaining definition tables for VM-based SNA networks. The *Teleprocessing Network Simulator (TPNS)* tests on-line application programs, communications access methods, control programs, subsystems, and networks.

VM/Conversational Monitor System (VM/CMS), in conjunction with the VM operating system, provides an interactive computing system; it can also be used as a base for interactive applications. It provides full timesharing in either a distributed system or a centralized environment with a dedicated processor, or in conjunction with other operating systems.

The *Customer Information Control System (CICS)* is a general-purpose data communications monitor for terminal-oriented transaction processing applications in VSE and MVS environments. It interfaces among user-written application programs, transaction processing access methods (such as ACF/VTAM), and database managers (such as DB2 in MVS). The user can generate a CICS/VS system configuration applicable to specific needs and define the system's execution environment.

IMS/VS-Data Communications (IMS/VS-DC) is a data communications management system that supports multiple terminal-oriented applications using a common database in the MVS environment. Among other features, it provides support for SNA and SDLC terminals and allows simplified migration to SNA. *IMS/VS-DC* is generally used in conjunction with *IMS/VS-DB* (see the "DATABASE MANAGEMENT SYSTEM" subsection above).

UTILITIES: Utility and special functions for the 9370 systems are handled through intrinsic operating system capabilities and through specialized software products supplied with the operating systems. Those adjunct facilities are listed in the "Operating System" subsection above.

OTHER SOFTWARE: *Professional Office System (PROFS)*, for the VM/SP environment, provides distribution services, such as document transfer; library services, such as storage and retrieval of notes, documents, and statistics; personal services, such as calendaring and appointment scheduling; final-form and revisable-form document interchange with *DISOSS* users; and an integrated interface to *DisplayWrite/370* as an additional document preparation facility.

Distributed Office Support System (DISOSS) runs under MVS or VSE in IBM's CICS environment. It allows users to exchange text, data, and images through electronic mail and central filing. A *DISOSS-PROFS* bridge supports the exchange of both final-form and revisable-form documents with VM-based systems. *DISOSS* provides distribution and library services, personal services, and an Application Program Interface (API) that interfaces *DISOSS* and user-written CICS applications. Together with *DISOSS*, *Personal Services/370 (PS/370)* provides office system functions on a 3270, 3270-PC, 3270-PC AT, or 3270-PC AT/G or /GX display terminal. Operating as a CICS/VS application, *PS/370* supports *DisplayWrite/370*.

DisplayWrite/370, operating in the MVS and VSE environments, provides a full-screen text editor/formatter supporting the 3270 Information Display System and the 3270-PC display terminal.

A range of proprietary commercial, office, engineering/scientific, and industrial applications is available for the VSE, VM, and MVS operating environments. The 9370 supports any S/370 applications program, provided that it is not time dependent; does not require the presence of system facilities (such as storage capacity, I/O equipment, or optional features) when the facilities are not included in the configuration; and does not require the absence of system facilities when the facilities are included in the configuration. (For example, the program must not depend on interruptions caused by invalid operation codes.)

With the 9370's announcement, IBM began selling the *SolutionPac* software series. *SolutionPacs* are predefined software packages comprising predetermined combinations of the following elements:

- Integrated, pregenerated system and application software.

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- ▶ • Snap-on application software for standard operating environments.
- Customized or fixed pricing for the following services:
 - Application integration and customization services.
 - Design, installation, and education services.
 - Maintenance services, including a single point of contact for the total offering.
- Application competency center support.
- Customer support telephone service.

PRICING AND SUPPORT

POLICY: The 9370 systems are available for sale or monthly rental. During the first six months following installation, 50 percent of the monthly rental charges may be applied as a credit toward the machine's purchase, not to exceed 50 percent of the price applicable at the time of purchase. Volume purchasing is available under the Volume Procurement Amendment (VPA) to Agreement for Purchase of IBM Machines. Term leases and installment payment plans are available through IBM Credit Corporation.

Discounts are available for purchasers aggregating required quantities of System/36, System/38, 9370, and 4300 processors.

A 25 percent educational allowance is available to qualifying institutions in accordance with IBM's Educational Allowance Amendment. The educational allowance may not be added to any other discount or allowance.

VM, VSE, and cross-system licensed software products are subject either to a onetime charge or to a monthly license charge. The onetime charge varies according to the target machine's processor group. IBM has defined four processor groups—10, 20, 30, and 40—for 370-based machines; 9373 Model 20 and 9375 Model 40 belong to Processor Group 10, while 9375 Model 60 and 9377 Model 90 belong to Processor Group 20. Graduated group-to-group and version-to-version upgrade charges also apply. Volume discounts are available for onetime-charge products, starting with a quantity of three.

SUPPORT: The 9370 systems are covered by a one-year warranty and are eligible for IBM On-Site Repair. Service is provided by IBM's National Service Division.

The 9370 processors are designated customer setup (CSU) equipment. Processors and rack-mountable devices or features ordered with the IBM 9309 Rack Enclosure are factory installed. The customer is responsible for determining system configuration requirements, unpacking the processor or the rack assembly, positioning the processor or the rack enclosure in the prescribed location, setting up stabilizing hardware, routing power and signal cables, and performing a device operational checkout.

Step-by-step instructions lead the customer through the processor console and rack-mounted units setup, as well as through connection to external units and communications facilities. Some system elements, such as S/370 channel-attached I/O devices, require installation by IBM service personnel.

IBM 9370 systems are in IBM's maintenance plan group D. The minimum maintenance service period is nine consecutive hours between 7 a.m. and 6 p.m., Monday through Friday. Charges for maintenance coverage outside this pe-

riod are based upon minimum monthly maintenance charge (MMC) percentages added to the MMC.

IBM also has a Corporate Service Amendment to the IBM Maintenance Agreement providing discounts on service for qualifying systems and network customers.

For users without a maintenance contract or requiring maintenance beyond contracted hours, the 9370 comes under IBM Hourly Service Rate Classification 2. The per-call charge during regular hours is \$158 per hour; outside regular hours, the charge is \$180 per hour.

IBM's Customer Assistance Group can be contacted to help determine and resolve system problems. This group provides step-by-step guidance through a problem determination activity requiring trained personnel to interpret results.

The SDLC communications adapter in the 9370 processor console allows attachment of an external modem to provide data link communications with a remote IBM service system. Remote IBM service personnel can perform on-line system diagnosis; logout data stored on the processor console can be transferred and saved at the remote IBM support site for later off-line analysis. IBM support personnel can also apply microcode corrections to the system from the remote site.

EDUCATION: IBM offers a range of technically and conceptually oriented training programs covering a variety of subjects, from large-system operating environments to information systems use and management. Educational methods include classroom instruction, self-study, program offerings (computer-based training products running on the 9370 and other systems), and technical update videotapes. Courses are usually given at IBM Education Centers nationwide; some are held at IBM branch offices and, by special arrangement, at user sites.

IBM offers a range of systems, applications, and operations courses for the VSE/SP, MVS, and VM environments; courses on communications systems, database management systems, and distributed processing, among other subjects, are also offered.

TYPICAL CONFIGURATIONS: The following are small, medium, and large 9370 system configurations. More detailed pricing of hardware components and available software is included in the price list that follows.

9373 Model 20:

9373 Model 20 CPU with 4M bytes of main memory	\$ 31,000
4MB of additional memory	10,000
9309 Rack Model 2	3,000
Two DASD/Tape Subsystem Controllers	6,000
9335 A1 Device Function Controller	8,500
9335 B1 824M-byte DASD fixed disk drive	21,250
9347 1600 bpi streaming tape drive	7,900
Workstation Subsystem Controller	4,200
Three 3299 terminal multiplexers	2,385
Eight 3179 Model G color display stations	22,360
16 3191 Model A10 monochrome display stations	20,720
4234 Model 1 410-lpm dot band printer	8,800
VM/IS Base (Release 5)	28,200

TOTAL PURCHASE PRICE: \$174,315

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► **9375 Model 40:**

9375 Model 40 CPU with 8M bytes of main memory	\$ 65,000
8MB of additional memory	20,000
Two 9309 Racks Model 2	6,000
Two DASD/Tape Subsystem Controllers	6,000
9335 A1 Device Function Controller	8,500
Three 9335 B1 824M-byte DASD fixed disk drives	63,750
9347 1600 bpi streaming tape drive	7,900
Two Workstation Subsystem Controllers	8,400
Six 3299 terminal multiplexers	4,770
16 3179 Model G color display stations	44,720
16 3191 Model A10 monochrome display stations	20,720
16 3270 PC Model 5371	96,800
4245 Model D20 2,000-lpm band printer	35,000
VM/IS Base (Release 5)	28,200
TOTAL PURCHASE PRICE:	\$415,760

9377 Model 90:

9377 Model 90 CPU with 8M bytes of main memory	\$ 190,000
8MB of additional memory	20,000
Two 9309 Rack Model 2	6,000
I/O card unit adapter (#5000)	4,200
Two card units (#5010)	15,400
System/370 Block Multiplexer Channel	6,000
3880 Model 3 storage controller	60,270
3380 Model AE4 5.04G-byte DASD fixed disk drive	122,480
3480 Model A22 tape control unit	65,430
3480 Model B22 cartridge tape drive	43,120
Four Workstation Subsystem Controllers	16,800
16 3299 terminal multiplexers	12,720
48 3179 Model G color display stations	134,160
48 3191 Model A10 monochrome display stations	62,160
32 3270 PC Model 5371	193,600
3820 20-ppm laser printer	28,350
4248 Model 1 3,600-lpm band printer	75,000
VM/SP System Offering	7,740
TOTAL PURCHASE PRICE:	\$1,063,430

EQUIPMENT PRICES

	Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)	Monthly 2-Year Lease Charge (\$)*
9370 PROCESSORS				
9373-020 Processor with 4MB of main memory	31,000	225	3,100	NA
9373-030 Processor with 4MB of main memory	37,000	265	3,700	NA
9375-040 Processor with 8MB of main memory	65,000	280	6,500	NA
9375-050 Processor with 8MB of main memory	58,000	350	5,800	NA
9375-060 Processor with 8MB of main memory	93,000	350	9,300	NA
9377-080 Processor with 8MB of main memory	142,000	520	14,200	NA
9377-090 Processor with 8MB of main memory	190,000	550	19,000	NA
CPU OPTIONS				
4000 Automated Power Controls	840	NA	89	NA
MEMORY OPTIONS				
4002 4MB Memory Addition for 9373 Processor	10,000	NA	1,070	NA
4101 4 to 8MB base charge for 9373 Processor Upgrade	10,000	NA	1,070	NA
4008 8MB Memory Addition for 9373 or 9375 Processor	20,000	NA	2,000	NA
4108 8MB Memory Addition for 9377 Processor	20,000	NA	2,140	NA
I/O OPTIONS				
5000 I/O Card Unit Adapter	4,410	NA	471	NA
5010 I/O Card Unit	8,085	NA	864	NA
5020 I/O Card Unit	11,865	NA	1,265	NA
5030 I/O Expansion feature	10,600	NA	1,060	NA
6001 Channel power sequence and control (2)	1,680	NA	179	NA
6003 System/370 block multiplexer channel	6,300	NA	674	NA
6010 9370 DASD/Tape Subsystem Controller	3,000	NA	321	NA
6020 9370 Work Station Subsystem Controller	4,410	NA	471	NA

*Rental/lease prices include equipment maintenance.

**Annual maintenance fee.

NA—Not applicable.

NC—No charge.

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		Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)	Monthly 2-Year Lease Charge (\$)*
COMMUNICATIONS/NETWORKING OPTIONS					
6030	Telecommunications Subsystem Controller	2,400	NA	240	NA
6031	Multi-Protocol Adapter for Telecommunications Subsystem Controller	1,200	NA	128	NA
6032	Asynchronous Adapter for Telecommunications Subsystem Controller	866	NA	92	NA
6034	IBM Token-Ring Adapter	1,950	NA	208	NA
6035	IEEE 802.3 Adapter	2,835	NA	302	NA
3299	Terminal Multiplexer	795	NA	NA	NA
3720	Communications Controller (a front-end communications processor)				
	Model 1: Local Base	36,500	2,605	2,090	NA
	Model 2: Remote Base	26,000	1,855	1,705	NA
	Model 11: Local Base & TR	42,500	3,305	2,135	NA
	Model 12	33,000	2,285	1,750	NA
3721	Expansion Unit				
	Model 1	16,000	NA	1,145	NA
	Model 2	22,500	NA	1,605	NA
3275	Communications Controller (a front-end communications processor)				
	Model 1	75,000	**2,795	4,020	NA
	Model 2	60,500	**2,495	3,030	NA
3726	Communications Control Console	32,000	42	1,710	524
3227	Operator Console	2,390	27	196	336
HARDWARE OPTIONS					
9309	Rack Enclosure				
	Model 1: 1.0 Meter	2,500	4	250	NA
	Model 2: 1.6 Meter	3,000	4	300	NA
	120-V Power Supply for Model 1	NC	NC	NC	NC
MASS STORAGE					
3370	Direct Access Storage Device				
	Model A1: Single Disk Drive; 571.3MB	35,480	173	1,851	1,575
	Model B1: Add-on Single Disk Drive for attachment to Model A1	26,600	129	1,387	1,180
	Model A12: 729.8MB; contains logic and power for up to three Model B2 units	35,480	139	2,405	NA
	Model B12: connects to a 3370 Model A2	26,600	105	1,800	NA
	8150 String Switch for 3370 A1 and A2; 2-year lease price applies to A1 string switch only	3,830	2	181	154
3375	Direct Access Storage; 819.7MB per drive:				
	Model A1: contains logic and power for up to three Model B1 units	24,730	144	1,851	1,575
	Model B1: connects to a 3375 Model A1	18,700	109	1,486	1,265
	Model D1: provides dual controller function in a 3375 string; requires one Model A1 and two Model B1s	23,590	133	1,763	1,500
	4951 Model D1 Attachment for Model A1	2,590	6	102	87
	4952 Model D1 Attachment for Model B1	NC	NC	NC	NC
	8150 String Switch Feature for 3375 A1	3,795	2	181	154
3380	Direct Access Storage; 2.52 billion bytes per unit:				
	Model AD4: 2.52GB Extended Capability drive; attaches to 3880 Model 3 or 23 storage directors	88,780	295	5,105	NA
	Model AE4: 5.04GB Extended Capability drive; attaches to 3880 Model 3 or 23 storage directors	124,480	295	7,590	NA
	Model BD4: 2.52GB Extended Capability drive; can be attached to AD4, AE4, BE4, or another BD4	64,440	215	3,715	NA
	Model BE4: 5.04GB Extended Capability drive; can be attached to AD4, AE4, BD4, or another BE4	98,140	215	6,190	NA
3880	Storage Control; includes two storage directors:				
	Model 1: each storage director can attach up to four 3350 A2/A2F, 3370 A1, or 3375 A1 or D1 in any combination	60,270	176	4,124	3,510
	Model 2: provides one storage director for 3350, A2/A2F, 3370 A1, or 3375 storage and one for 3380 storage	60,270	176	4,124	3,510
	Model 3: provides two storage directors for 3380 storage	60,270	176	4,124	3,510
	Model 4: provides one storage director which can attach up to four 3375 Model A1s	30,000	83	2,370	NA
	Model E21: same as D21, but with 16 megabytes	165,400	600	11,300	NA

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**Annual maintenance fee.

NA—Not applicable.

NC—No charge.

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	Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)	Monthly 2-Year Lease Charge (\$)*
MASS STORAGE (Continued)				
Model G21: same as D21, but with 32 megabytes	237,400	650	15,970	NA
Model H21: same as D21, but with 48 megabytes	309,400	700	20,640	NA
Model J21: same as D21, but with 64 megabytes	381,400	750	25,310	NA
Model D23: includes two cache storage directors for 3380; 8 megabytes	129,400	575	8,965	NA
Model E23: same as D23, but with 16 megabytes	165,400	600	11,300	NA
Model G23: same as D23, but with 32 megabytes	237,400	650	15,970	NA
Model H23: same as D23, but with 48 megabytes	309,400	700	20,640	NA
Model J23: same as D23, but with 64 megabytes	381,400	750	25,310	NA
6148 Remote Switch Attachment	NC	NC	NC	NC
6149 Remote Switch Attachment, additional	NC	NC	NC	NC
6150 Remote Switch Attachment for Eight-Channel Switch	NC	NC	NC	NC
6550 Speed Matching Buffer for 3380	9,705	40	597	508
6560 Speed Matching Buffer	11,420	40	518	441
8160 Two-Channel Switch	3,850	5	241	NA
8170 Two-Channel Switch Pair	6,225	11	421	358
8171 Two-Channel Switch Pair, additional	16,610	39	1,136	967
8172 Eight-Channel Switch	22,850	54	1,563	1,330
9332 368MB Rack Mounted DASD	14,000	27	1,400	NA
9335 824MB DASD	21,250	50	2,125	NA
MAGNETIC TAPE EQUIPMENT				
3420 Magnetic Tape Units:				
Model 3: 120,000 bytes/sec at 1600 bpi; 75 ips	13,120	248	768	645
Model 4: 470,000 bytes/sec at 6250 bpi; 75 ips	16,870	248	1,075	903
Model 5: 200,000 bytes/sec at 1600 bpi; 125 ips	17,600	272	1,035	869
Model 6: 780,000 bytes/sec at 6250 bpi; 125 ips	19,710	272	1,235	1,037
Model 7: 320,000 bytes/sec at 1600 bpi; 200 ips	19,710	326	1,225	1,029
Model 8: 1250 bytes/sec at 6250 bpi; 200 ips	21,860	401	1,465	1,231
6420 6250 bpi Density Feature (for 3420 Models 4, 6, and 8)	1,760	68	95	80
6425 6250/1600 bpi Density Feature (for 3420 Models 4, 6, and 8)	2,425	90	138	116
6631 Single Density Feature (for Models 3, 5, and 7)	3,155	68	162	136
3550 Dual Density Feature (for Models 3, 5, and 7)	4,075	113	211	177
6407 7-Track Feature (for Models 3, 5, and 7)	3,155	98	162	136
3422 Magnetic Tape Unit:				
A1 drive and control unit	40,480	440	2,460	NA
B1 magnetic tape unit	19,690	181	1,165	NA
3020 Data Streaming Feature	1,730	32	111	NA
3005 Two-Channel Switch	3,575	4	167	NA
3010 Two Control Unit Switch (Communicator), primary	8,085	19	387	NA
3015 Same as 3010, but secondary	5,775	19	282	NA
3430 Magnetic Tape Subsystem:				
Model A1: Tape Unit and Control	33,400	251	2,575	NA
Model B1: Tape Unit only	16,900	176	1,365	NA
4991 Multiple Drive Attachment	600	5	42	NA
3480 Magnetic Tape Subsystem:				
Model A22 Control Unit	65,430	423	4,605	NA
Model B22 Magnetic Tape Unit	43,120	264	3,015	NA
1511 First Channel Attachment	5,785	21	357	NA
1512 Second Channel Attachment	5,785	21	357	NA
1513 Third Channel Attachment	5,785	21	357	NA
3803 Tape Controller:				
Model 1: for 3420 Models 3, 5, 7	22,740	158	1,335	1,121
Model 2: for 3420 Models 3 through 8 drives	30,300	218	1,945	1,634
5310 9-Track NRZI Feature (permits connection of 800 bpi drives to 3803-2)	3,385	2	170	143
6320 7-Track NRZI Feature (permits connection of 800 bpi drives to 3803-2; 5310 is prerequisite)	1,665	2	85	71

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NA—Not applicable.

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	Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge*	Monthly 2-Year Lease Charge (\$)*
MAGNETIC TAPE EQUIPMENT (Continued)				
Multiple Tape Control Switches (for switching up to sixteen 3420 tape drives among up to four 3803 control units):				
1792 for 2 Tape Controls	6,740	14	354	297
1793 for 3 Tape Controls	8,600	23	459	385
1794 for 4 Tape Controls	10,110	23	537	451
6148 Remote Switch Attachment	1,000	NA	51	43
8100 Two-Channel Switch	5,060	7	262	220
9347 Magnetic Tape Unit—40,000 bytes/sec at 100 ips; 1600 bpi or 160,000 bytes/sec at 25 ips; 1600 bpi	7,900	78	790	NA
6010 DASD/Tape Controller	3,000	NA	300	NA
PRINTERS				
3262 Line Printer:				
Model 1: 650 lpm	15,040	203	806	686
Model 3: 650 lpm (3274)	15,040	203	806	686
Model 11: 325 lpm	12,620	148	592	504
Model 13: 325 lpm (3274)	12,620	148	592	504
3268 Printer				
Model 2	7,500	76	498	424
Model 2C	8,990	102	677	NA
3287 Serial Printer:				
Model 1: 80 cps	4,830	41	348	296
Model 2: 120 cps	5,150	52	426	362
Model 1C: 4 colors; 80 cps	5,210	46	431	367
Model 2C: 4 colors; 120 cps	5,530	57	506	431
1120 APL/Text	165	1	NA	NA
3610 Extended Character Set Adapter	429	3	NA	NA
3880 Extended Print Buffer	198	1	NA	NA
4110 Friction Feed Paper Handling	151	1	NA	NA
8330 3271/3272 Attachment for Models 1 and 2	860	3	NA	NA
8331 3274/3276 Attachment for Models 1 and 2	165	1	NA	NA
8700 Variable-Width Forms Tractor	151	1	NA	NA
3812 Nonimpact tabletop page printer Model 1	8,235	126	NA	NA
3060 bisync communication feature for VM attachment	250	NA	NA	NA
3820 Laser page printer				
Model 1	28,350	310	1,845	NA
3005 pattern storage memory 256KB	1,050	10	61	NA
3010 pattern storage memory 512KB	1,700	20	102	NA
3020 pattern storage memory 1024KB	3,000	40	184	NA
3025 pattern storage memory 2048KB	6,000	80	368	NA
3030 pattern storage memory 3072KB	9,000	120	552	NA
3035 control storage memory 128KB	750	10	46	NA
3055 System/370 channel interface attachment	2,600	40	164	NA
4224 Printer				
Model 1C2	6,700	50	NA	NA
Model 1E2	6,500	45	NA	NA
Model 101	4,200	30	NA	NA
Model 102	6,000	40	NA	NA
2C2—400 cps max.; expanded storage and color	6,700	50	NA	NA
2E2—400 cps max.; expanded storage	6,500	45	NA	NA
201—200 cps maximum	4,200	30	NA	NA
202—400 cps maximum	6,000	40	NA	NA
3C2—400 cps Color Printer	6,700	50	NA	NA
301—200 cps Printer	4,200	30	NA	NA
302—400 cps Printer	6,000	40	NA	NA
4234 Dot Band Printer				
Model 1	8,800	85	NA	NA

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 NC—No charge.



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		Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)	Monthly 2-Year Lease Charge (\$)*
PRINTERS (Continued)					
4245	Band Printer				
	Model 12: 1,200 lpm	31,000	250	2,050	NA
	Model D12: 1,200 lpm	31,000	250	2,050	NA
	Model 20: 2,000 lpm	35,000	400	2,340	NA
	Model D20: 2,000 lpm	35,000	400	2,340	NA
4248	Printer, Model 2; 2,200/3,200/4,000 lpm; 132 print positions	75,000	800	6,205	NA
	3751 Additional 36 Print Positions (plant installation)	10,000	110	615	NA
	3753 Additional 36 Print Positions (field installation)	15,000	110	615	NA
4250	Nonimpact Printer, Model 1; 600 by 600 dots per square inch	21,000	190	1,520	NA
5210	Printer				
	Model G1	5,420	63	NA	NA
	Model G2	5,835	69	NA	NA
WORKSTATIONS/TERMINALS					
3178	Monochrome Display Station:				
	Model C10: 75-key keyboard	1,040	NA	NA	NA
	Model C20: 87-key keyboard	1,095	NA	NA	NA
	Model C30: 87-key keyboard	1,095	NA	NA	NA
	Model C40	1,095	NA	NA	NA
3179	Color Graphics Display Station				
	Model G1	2,795	NA	NA	NA
	Model G2	2,795	NA	NA	NA
3191	Monochrome Display Station				
	Model A10: 122-key keyboard, green display	1,295	NA	NA	NA
	Model A20: 102-key keyboard, green display	1,295	NA	NA	NA
	Model A30: 104-key keyboard, green display	1,295	NA	NA	NA
	Model B10: 122-key keyboard, amber-gold display	1,295	NA	NA	NA
	Model B20: 102-key keyboard, amber-gold display	1,295	NA	NA	NA
	Model B30: 104-key keyboard, amber-gold display	1,295	NA	NA	NA
3192	Color Display Station				
	Model C10: 122-key keyboard	1,895	NA	NA	NA
	Model CD0: same as Model C10, except 3-year warranty	2,045	NA	NA	NA
	Model C20: 102-key keyboard	1,895	NA	NA	NA
	Model CE0: same as Model C20, except 3-year warranty	2,045	NA	NA	NA
	Model C30: 104-key keyboard	1,895	NA	NA	NA
	Model CF0: same as C30, except 3-year warranty	2,045	NA	NA	NA
	Model D10: 122-key keyboard	1,795	NA	NA	NA
	Model DD0: same as D10, except 3-year warranty	1,895	NA	NA	NA
	Model D20: 102-key keyboard	1,795	NA	NA	NA
	Model DE0: same as D20, except 3-year warranty	1,895	NA	NA	NA
	Model D30: 104-key keyboard	1,795	NA	NA	NA
	Model DF0: same as D30, except 3-year warranty	1,895	NA	NA	NA
	Model G10: 122-key keyboard	2,795	NA	NA	NA
	Model GD0: same as G10, except 3-year warranty	2,995	NA	NA	NA
	Model G20: 122-key typewriter or APL2 keyboard	2,795	NA	NA	NA
	Model GE0: same as G20, except 3-year warranty	2,995	NA	NA	NA
	Model G30: 104-key keyboard	2,795	NA	NA	NA
	Model GF0: same as G30, except 3-year warranty	2,995	NA	NA	NA
	Model G40: 104-key typewriter or APL2 keyboard	2,795	NA	NA	NA
	Model GG0: same as G40, except 3-year warranty	2,995	NA	NA	NA
3193	Monochrome Display Station				
	Model 1: 122-key keyboard	2,495	NA	NA	NA
	Model 2: 102-key keyboard	2,495	NA	NA	NA
3194	Color Display Station				
	Model H20: 102-key keyboard	2,895	NA	NA	NA
	Model H50: 122-key keyboard	2,895	NA	NA	NA

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		Purchase Price (\$)	Monthly Maint. (\$)	Monthly Rental Charge* (\$)	Monthly 2-Year Lease Charge (\$)*
WORKSTATIONS/TERMINALS (Continued)					
3278	Monochrome Display Station				
	Model 2	1,572	10	109	93
	Model 3	1,716	11	133	113
	Model 4	1,804	12	136	116
	Model 5	2,060	13	160	136
3290	Information Panel				
	Model 220	6,500	**288	NA	NA
	Model 230	6,500	**288	NA	NA
	Model T30	9,300	**360	NA	NA
	3210—Display Panel	3,600	NA	184	NA
	4370—Data/Typewriter Keyboard	440	NA	24	NA
	4731—APL Typewriter	440	NA	24	NA
	4830—Numeric Keypad	250	NA	12	NA
	4831—Program Function Keypad	250	NA	12	NA

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 NC—No charge.

SOFTWARE PRICES

	Initial Charge		Monthly Charge		Licensed Program Support Charge (\$)
	Basic License Charge (\$)	DSLO License Charge (\$)	Basic License Charge (\$)	DSLO License Charge (\$)	
Onetime charges are based on the processor group to which the system belongs. The 9373-20 and 9375-40 belong to Processor Group 10. The 9373-30, 9375-50, and 9375-60 belong to Processor Group 15. The 9377-80 belongs to Processor Group 18, and the 9377-90 belongs to Processor Group 20.					
5664-167	VM/SP				
	Group 10	7,740	5,805	500	375
	Group 20	13,540	10,155	500	375
	Upgrade—Group 10 to Group 20	5,800	4,350	NA	NA
5664-280	ACF/VTAM V3 (VM/SP)				
	Group 10	11,235	19,660	1,175	880
	Group 20	19,600	14,725	1,175	880
	Upgrade—Group 10 to Group 20	8,425	6,310	NA	NA
5664-283	VM/IS PF				
	Group 10	1,140	1,025	107	NA
	Group 20	2,000	1,800	107	NA
	Upgrade—Group 10 to Group 20	860	775	NA	NA
5664-301	VM/IS (Release 5)				
	Group 10	28,200	22,990	2,381	NA
	Group 20	49,365	40,243	2,381	NA
	Upgrade—Group 10 to Group 20	21,145	17,253	NA	NA
5664-301	System Base				
	Group 10	13,575	10,175	851	NA
	Group 20	23,765	17,805	851	NA
	Upgrade—Group 10 to Group 20	10,190	7,760	NA	NA
	Real Time Monitor				
	Group 10	400	400	50	NA
	Group 20	700	700	50	NA
	Upgrade—Group 10 to Group 20	300	300	NA	NA
	VMMAP				
	Group 10	1,600	1,600	270	NA
	Group 20	2,800	2,800	270	NA
	Upgrade—Group 10 to Group 20	1,200	1,200	NA	NA
	PL1				
	Group 10	440	320	37	NA
	Group 20	775	565	37	NA
	Upgrade—Group 10 to Group 20	335	245	NA	NA

*The figure to the right of the slash is a Monthly Multiple Licensed Support Charge.
 NA—Not applicable.

