IBM ES/9370 Information System

In this report:

Product Summary

Editor's Note
Since our last report, IBM announced plans to replace its Enterprise System (ES)/9370 family and all System/370-based systems, with 390-based models. The ES/9370, however, continues to be marketed. All active models—comprised of four machine types and nine models—are included in this update.

Description
The ES/9370 family of System/370 architectured systems supports diverse users and applications. It offers modularity, flexibility, openness, and performance associated with superminis, and competes for departmental computing in mainframe and supermini markets.

Strengths
Ethernet capabilities improve communications compared to other IBM departmental offerings. ES/9370 configurability provides a flexible operating environment for commercial, office, engineering/scientific, and industrial computing.

Limitations
Compatible with the 4381 and 30XX systems, the ES/9370 lacks full compatibility with the AS/400. Applications cannot be ported from one environment to another since MVS/SP is supported, while MVS/XA is not.

Competition
IBM competes with Digital Equipment, Hewlett-Packard, Harris, Bull, NCR, Prime, and Unisys.

Vendor
IBM Corporation
Old Orchard Road
Armonk, NY 10504
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(416) 474-2111

Price
$31,090 to $224,330.

GSA Schedule
Yes.

—By Marlene H. Schulke
Associate Editor/Analyst

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Analysis

Product Strategy

IBM's overall strategy is to develop its business mainframe product lines in such a way that they can also compete for distributed processing and engineering/scientific applications, without loss of compatibility. All IBM System/370 (S/370)-based systems, including the 9370 family, conform to this plan. Although IBM has not officially removed them from the market, S/370-based systems will be replaced by the System/390 (S/390)-based models. The currently marketed ES/9370 model groups include the entry-level 9371, the 9373, the 9375, and the high-end 9377.

The entry-level 9371 comprises three models. Models 10 and 12 use IBM's Micro Channel Architecture with an Intel 80386 I/O processor for controlling selected I/O devices. The 9371 Model 14 combines the capabilities of both a S/370 processor and a PS/2 processor allowing the additional option of running DOS or OS/2 applications. The remaining three model groups are compatible using the same series of adapters, and attaching to the same I/O devices.

All 9370 model groups can operate as hosts or as distributed systems. They have a memory capacity of 16M bytes, and a technology that does not require special air-conditioning or flooring, a must for distributed departmental computers.

The ES/9370 Series is targeted at widely different audiences. Its S/370-compatible architecture allows competition in the entry-level mainframe area. Targeted "natural markets" for the 9370 include:

- Distributed processing for S/370 mainframes.
- AFP remote print servers.
- Mixed vendor connectivity situations.
- Distributed PROFS.
- CAD/CAM departmental applications.
- SPPX/8000 migration.

- 4300 migration.

Scientific and engineering users are targets of special interest to IBM. The 9370's modular packaging, open architecture, computational capabilities, and price structure are competitive with those found in both the business and the scientific supermini markets.

Users in this environment with requirements for small systems with a high degree of computational accuracy and validity, or for specialized machine interfacing, would be offered the ES/9370 with VM. Those needing higher performance, a large memory and longer precision for lengthy calculations would be offered the 9377-80 or 9377-90 with MVS or VM. Small commercial processing installations would be offered VSE or VM.

Users wanting a host for a rapidly growing communications and database environment, or a mainframe for an environment that is developing a great deal of complexity, would be offered MVS running on the high-end models. Users migrating from old DOS or DOS/VS should be aware that byte multiplexer channels are not supported on the ES/9370.

Background

Introduced in October 1986, the 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 S/370 applications, or those requiring connection to non-IBM systems.

The ES/9370 delivers mainframe-class performance in a low-cost, compact package. The 9370's hardware and software compatibility with the 4381 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.

The ES/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;

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Company Profile
IBM Corporation

Corporate Headquarters
Old Orchard Road
Armonk, NY 10504
Contact your local IBM
representative.

In Canada
IBM Canada Ltd.,
Markham
3500 Steeles Avenue E.
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Offices located in other
cities throughout Canada.

Officers
Chairman/CEO: John
Akers
Vice Chairman: Jack D.
Kuehler
Sr. VP/Gen. Mgr.: Terry
Lautenbach

Company Background
Year Founded: 1914
No. Employees: 400,000
worldwide

One of the oldest manu-
facturers of computing
equipment in the world,
IBM started out as a small
company manufacturing
clocks for industrial use
and then graduated into
the punched card equip-
ment business. Today, it
is one of the leading in-
dustrial corporations by
sales volume and has

dominated the computer
industry for over 30 years.

Business Overview
IBM designs, manufac-
tures, markets, and ser-
vices mainframe
computer systems and
associated peripherals;
minicomputer systems
and peripherals;
microcomputer/personal
computer systems; com-
puter system software;
data communication con-
trollers and terminals;
other communication
products such as mo-
dems, voice response
systems, and voice mes-
saging systems; local
area network communica-
tions products; and office
typewriters. In addition,
IBM provides specialized
products and services.

For many years, IBM has
"gone it alone" when it
came to providing its us-
ers with support software.
Since the introduction of
the PC and subsequent
mainframe products, IBM
has established a pro-
gram of Business Part-
ners and Cooperative
Software Suppliers. By
enlisting independent
software suppliers to use
IBM methodologies and
technologies, IBM is now

able to provide its users
with a wide range of truly
outstanding software
products which it will sup-
port along with the sup-
plier.

With the introduction of its
Enterprise System/9000
series of processors, IBM
has established a viable
growth path for both its
midrange and large-scale
computer users, allowing
for the smooth transition
from their existing envi-
ronments at a pace to be
determined by the cus-
tomer. IBM has truly be-
come a customer-
oriented company.

Along with this foresight-
edness, IBM has finally
realized it has to cut back
on unproductive ventures.
In addition to adjusting
prices on certain poor
sellers, IBM has decided
to rid itself of its type-
writer and keyboard busi-
ness, labeling them "low
technology" businesses.
IBM has also instituted a
Management Decentrali-
zation program in Europe
which has resulted in re-
ducing its Paris headquar-
ters staff and relocating
functions to Germany,
England, and Italy.

Financial Profile
After a slow start, IBM
came on strong at the end
of the fiscal year. Fourth
quarter revenue was up
12.7 percent to $23.1 bil-
lion. Quarterly net income
was $2.5 billion, up 316

percent from last year's
$591 million for the com-
parable period. Even con-
sidering that last year's
net income for the compa-
rable quarter was de-
pressed by a huge
onetime restructuring
charge, the increase was
impressive. Product sales
for the quarter increased
8 percent.

For fiscal year 1990, an-
nual profit rose 60.2 per-
cent to $6 billion, on
revenue up 10.1 percent
to $69 billion. Revenue
from international opera-
tions totaled $41.9 billion,
up 13.3 percent from
1989. This was the first
time in the company's his-
tory that non-U.S. reve-
nue growth surpassed
growth in U.S. sales.

Management Statement
According to IBM man-
agement, "People and
information are the heart
and lifeblood of any busi-
ness enterprise. Providing
these people with access
to the information they
need by means of readily
available and easy-to-use
computing resources is
the challenge and mission
of IBM."

Regarding some of its
plans for the future, IBM
has indicated that it's
plans for future main-
frames include the capa-
bility of acting as servers
in an open network envi-
ronment.

and the 37XX communication processors em-
ployed on the 9370 models can be moved over to
higher performance S/370-based models, thus pre-
serving investments in peripheral subsystems and
devices.

The ES/9370 offers price/performance in the
range of IBM's Application System/400 (AS/400)
and is significantly more powerful than the AS/
400's predecessors, System/36 (S/36) and
System/38 (S/38), the non-System/370-compatible

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Table 1. System Comparison

Model	9371-10	9371-12	9371-14	9373-25	9373-30
System Characteristics					
Min/Max Memory (bytes)	4M/16M	4M/16M	4M/16M	4M/16M	4M/16M
Expansion Increments (bytes)	4M	4M	4M	4M/8M	4M/8M
Min/Max Storage (bytes)	590M/1.7G	590M/1.7G	590M/1.7G	368M/13.1G	368M/13.1G
Number of Processors	1	1	1-2	1	1
Number of Terminals	—	—	—	192	192
Date First Installed	3/90	3/90	3/90	5/89	2/89
Operating Systems	VM/SP, VSE/SP, IX/370	VM/SP, VSE/SP, IX/370	VM/SP, VSE/SP, IX/370, DOS, OS/2	VM/SP, VSE/SP, IX/370	VM/SP, VSE/SP, IX/370
Central Processing Unit & Memory					
Computer Type	1M-bit	1M-bit	1M-bit	1M-bit	1M-bit
Processor Model	Proprietary 9371	Proprietary 9371	Proprietary 9371	Proprietary 9371	Proprietary 9371
Cache Memory (bytes)	0	0	0	0	0
Purchase Price					
Basic Configuration ($)	31,090	38,370	37,330	28,110	41,610
Memory/Storage Included (bytes)	4M/590M	4M/590M	4M/590M	4M/368M	4M/368M

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

office systems replaced by the AS/400. It is more powerful and less costly than the 4361, IBM's previous office-level S/370-architecture system. The 9370 is also less costly than, although not as powerful as, the IBM 4381, which is 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 ES/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.

The 9370 is software compatible in selected environments, such as VM, with IBM S/370-architecture systems, such as the 4381 supermini-computers and 3080 and 3090 mainframes. It is not, however, fully compatible with the S/36, S/38, and AS/400—significant systems in the midrange system marketplace. 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.

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 the 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.

Since announcing the 9370, IBM moved to ensure its success within the midrange system marketplace. Competitiveness and functionality were increased by introducing improved communications, networking offerings, and peripheral devices. Today, IBM's S/390-based products will continue to expand its position in the midrange market.

Competitive Position

IBM is considered a major force in any computer market in which it competes, so its list of competitors is long. In the midrange market, IBM sells against Digital Equipment Corp., Hewlett-Packard, Prime, Wang, Tandem, Stratus, Unisys, and others.

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Table 1. System Comparison (Continued)

Model	9375-50	9375-60	9377-80	9377-90
System Characteristics				
Min/Max Memory (bytes)	8M/16M	8M/16M	8M/16M	8M/16M
Expansion Increments (bytes)	4M/8M	4M/8M	8M	8M
Min/Max Storage (bytes)	368M/26.2G	368M/39.6G	368M/39.6G	368M/39.6G
Number of Processors	1	1	1	1
Number of Terminals	192	192	384	384
Date First Installed	2/89	7/87	2/89	7/87
Operating Systems	VM/SP, VSE/SP, IX/370	VM/SP, VSE/SP, IX/370, MVS/SP	VM/SP, VSE/SP, IX/370	VM/SP, VSE/SP, IX/370, MVS/SP
Central Processing Unit & Memory				
Computer Type	1M-bit	1M-bit	1M-bit	1M-bit
Processor Model	Proprietary 9371	Proprietary 9371	Proprietary 9371	Proprietary 9371
Cache Memory (bytes)	0	16K	0	16K
Performance Characteristics				
MIPS	—	3	—	5
Purchase Price				
Basic Configuration ($)	65,220	80,970	159,650	224,300
Memory/Storage Included (bytes)	8M/368M	8M/368M	8M/368M	8M/368M

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

IBM positions its ES/9370 Information System against the MicroVAX and VAX 4000 and 6000 systems from Digital Equipment Corp., its chief rival within the medium-scale marketplace.

The ES/9370 remains competitive with the VAX line in functionality. The IBM communications and networking products enable IBM to present a distributed 9370 processing solution that is competitive with Digital's DECnet, the distributed processing solution for its VAX systems. With the addition of new connectivity and network management additions, SNA will deliver the same level of network functionality as Digital's DECnet—i.e., peer-to-peer communications that reduces system interconnection complexities, connection costs, and network management complexities and expenses.

SNA networking facilities running on the 9370 permit it to serve as either a host or a remote system within the SNA network. These facilities encourage 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.

Digital's VAX Series line has accumulated a substantial midrange systems market share due to its length of time on the market, and IBM faces a difficult challenge in displacing the VAX. 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 VAXs—the software compatibility with certain IBM mainframe environments would be a definite attraction.

In addition to competing with Digital for sales within the medium-sized system marketplace, IBM is competing from within. Sales of ES/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 RS/6000 and AS/400, as well as the ES/9370, to address small-scale business, office, and departmental computing. Customers neither requiring nor anticipating 9370 performance and functionality will purchase the less expensive RS/6000 or AS/400, thus reducing 9370 sales revenue.

According to performance figures provided by IBM, the ES/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.

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Table 2. Mass Storage Devices

Model	3380	3390	9332	9335
Type	Fixed	Fixed	Fixed	Fixed
Size (inches)	—	10	10	14
Formatted Capacity (bytes)	7.56G	22.7G	368M	824M
Interface/Controller	3880-3 or -23	DASD	DASD/Tape Subsystem	DASD/A01 Device Function Controller
Drives per Subsystem/Controller	8-16	—	4	4 per A01
Number of Usable Surfaces	—	—	8	6
Number of Sectors or Tracks per Surface	15 sectors	15 sectors	3,926 tracks	1,349 tracks
Bytes per Sector or Track	47,476/track	56,664/track	512/sector	512/sector
Average Seek Time (ms.)	15	9.5/12.5	23-25	18
Average Rotational/Relay Time	8.3	7.1	8.28	9.6
Average Access Time (ms.)	24.3	16.6	26.28	32.6 - 34.6
Data Transfer Rate (bytes/sec)	4.5M	4.2M	2.5M	3.0M
Purchase Price ($)	92,220	114,000/294,500	12,860	19,510

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

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 ES/9370 Model 90 to a 4381 requires a processor box swap, a more costly move than an upgrade for an entry-level 4381. With IBM's announcement of the ES/9000, upgrades from existing ES/9370 systems to System/390 Models 130, 150, or 170 became available. These upgrades also require substantial changes to the existing systems which may not be considered cost effective for the customer.

Sales and Distribution

IBM markets its products through direct and indirect channels. Direct sales are conducted from sales offices in all major cities in the United States and Canada, or internationally by IBM World Trade subsidiaries. Indirect sales channels involve selected IBM products (mainly small systems) which are available through selected retail outlets. The corporation also uses independent firms as an aid to the direct sales force.

Decision Points

Strengths

Compatibility
The ES/9370 series, and its upward compatible 4381/3090 series, is the start of a tremendous standardization effort that will help to tie together a host of noncompatible IBM environments. There are a variety of 9370 features which facilitate the hosting of compatible distributed processing configurations. The concept of user-friendly departmental distributed systems is further supported by the pricing structure, which provides lower-priced, pregenerated packages of the most common program sets, and, in the VM environment, provides low-cost, simple maintenance price packages.

Drawing on the largest single software base in the world, the 9370 is a highly compatible heir to the S/370, but IBM and a host of third-party software developers are both constantly adding to the applications available for this series.

Communications
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, S/38, and the AS/400. Ethernet, Token-Ring Network, and SNA deliver the openness required in departmental processing. The Ethernet and the Token-Ring LANs provide the

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Table 3. Workstations

Model	3180	3191	3192	3193	3194	3278
Display Parameters						
Max. Chars./Screen	1,920, 2,560, 3,440, 3,564	1,920	1,920 or 2,560	3,840	1,920	1,920 or 2,560
Screen Size (lines x chars.)	24 x 80, 32 x 80, 43 x 80, 27 x 132	24 x 80	24/32 x 80	48 x 80	24 x 80	24/32 x 80
Tilt/Swivel Screen	Standard	Standard	Standard	Standard	Standard	Standard
Symbol Formation	9 x 11 dot matrix	7 x 14 dot matrix	—	—	—	—
Character Phosphor	—	Green or amber-gold	Red, green, blue, yellow, turquois, white on black	White on black	Color on dark	Color on dark
Total Colors/No. Simult. Displayed	NA	NA	7	NA	NA	7
Keyboard Parameters						
Style	Typewriter, Data Entry, or Typewriter/APL	Typewriter	Typewriter or IBM enhanced	Typewriter	Typewriter, or IBM enhanced	Typewriter or Data Entry
Character/Code Set	—	94	94	—	94	—
Detachable	Yes	Yes	Yes	Yes	Yes	Yes
Program Function Keys	—	24	24	24	12 or 24	—
Terminal Interface	Workstation Subsystem Controller, 3274 Control Unit	Workstation Subsystem Controller, 3174 or 3274 Control Unit	Workstation Subsystem Controller, 3174 or 3274 Control Unit	Workstation Subsystem Controller, 3174 or 3274 Control Unit	Workstation Subsystem Controller, 3174 or 3274 Control Unit	Workstation Subsystem Controller, 3274 Control Unit
Purchase Price ($)	2,195-2,580	500-816	1,870-2,045	3,630	2,570-3,615	1,440-1,995

NA—Not applicable.
Note: A dash (—) in a column indicates that the information is unavailable from the vendor.

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's Ethernet 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 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

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Table 4. Printers

Model	3812	3820	4224	4234	4245	4248
Type	Nonim-pact (LED)	Laser	Dot Matrix	Dot Band	Band	Band
Speed	12 ppm	22 ppm	200/400/ 600 cps	410 lpm	1,200/ 2,000 lpm	2,200/ 3,200/ 4,000 lpm
Bidirectional Printing	NA	NA	Yes	NA	NA	NA
Paper Size	7 to 8.5 inches wide, 10.1 to 14 inches long	Up to 8.5 inches wide, up to 14 inches long	3 to 15 inches wide	Up to 16 inches wide, 14 inches long	3.5-22 inches wide, 3-24 inches long	3.5-22 inches wide
Character Formation	Electro-photo-graphic	Full	Up to 12 x 13 dot matrix	Dot matrix	Full	Full
Horizontal Character Spacing (char./inch)	Variable	Variable	10, 12, 15; 11.5 op-tional	10 or 15	10	Variable
Vertical Line Spacing (char./inch)	Variable	Variable	6 or 8	3, 4, 6, or 8	6 or 8	Variable
Character Set	Variable Fonts (62 standard)	Variable Fonts (Prestige Elite stan-dard)	—	—	48-124	Variable Fonts
Controller/Interface	Telecom-Subsys-tem Controller; S/370 Block Multi-plexer	Telecom-Subsys-tem Controller; S/370 Block Multi-plexer	Worksta-tion Sub-system Controller	Worksta-tion Sub-system Controller	S/370 Block Multiplex-er Chan-nel	S/370 Block Multiplex-er Chan-nel
Printer Dimensions (inches) (h x w x d)	15 x 27 x 19	47 x 60 x 26.5	10.5 x 25.3 x 14.0	37.75 x 26.0 x 30.25	—	—
Graphics Capability	240 x 240 dpi	240 x 240 pixels	144 x 144 dpi	No	No	No
Purchase Price ($)	10,790	37,460	5,040-8,595	10,560	36,590-42,170	88,560

NA—Not applicable.
Note: A dash (—) in a column indicates that the information is unavailable from the vendor.

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.

Configurability
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 online 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.

Scientific users will be interested in two standard features that support mathematics, scientific, and engineering applications. The ACRITH facility specifies the degree of validity of various computations, and relieves the user of many

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Table 5. Magnetic Tape Equipment

Model	3490-A01	3490-A02	3490-B02	3490-B04	9347
Type	Cartridge	Cartridge	Cartridge	Cartridge	Streaming
Format					
Number of Tracks	18	18	18	18	—
Recording Density (bits per inch)	38K	38K	38K	38K	1600
Characteristics					
Controller Model	3480-A22 (per S/370 Block Mux Channel)	3480-A22 (per S/370 Block Mux Channel)	3480-A22 (per S/370 Block Mux Channel)	3480-A22 (per S/370 Block Mux Channel)	DASD/Tape Subsystem Controller
Drives per Controller	2-8	2-8	2-8	2-8	1
Storage Capacity (bytes)	200M	200M	200M	200M	44M
Tape Speed (inches per second)	79	79	79	79	25/100
Data Transfer Rate (units per second)	3M bytes	3M bytes	3M bytes	3M bytes	160K bytes (streaming), 40K bytes (nonstreaming)
Streaming Technology	Yes	Yes	Yes	Yes	Yes
Switch Selectable	Yes	Yes	Yes	Yes	NA
Purchase Price ($)	56,460	106,450	65,520	102,800	9,320

mathematical analysis tasks. The SOEMI serial interface and supporting software provide one means of attaching non-IBM devices. Non-IBM workstations and systems can be attached to a (VM) 9370 using the protocol TCP/IP or with Business Partner solutions such as Interlink, Flexlink, Forest, Mitek, or JNet.

Customer Support

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 microcode changes from the remote site; and conduct preinstallation planning, installations, and postinstallation support.

Operating System Support

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 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 installations. 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 nonintegrated version.

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

Limitations

Rental Prices

Rentals are very high for the ES/9370 family relative to purchase prices, breaking even at 10 months. This is an even higher relative price than the 4300 series.

Compatibility

The ES/9370's integrated DASD (9332 and 9335) and integrated tape (9374) cannot be attached to 4381 and 3090 systems.

No direct software compatibility exists between the 9370 and S/3X and AS/400 systems. Solving the problem of top-to-bottom compatibility began in 1989 when IBM delivered additional products conforming to the company's Systems Application Architecture (SAA). This permits applications conforming to a specific set of standards to run on any IBM system. Fully functional, SAA-compatible facilities are becoming generally available.

Commercial Image

Although 9370 systems are designed to be excellent scientific systems, the primary image IBM has evolved from past strengths is that of a commercial vendor. The heavy scientific thrust is relatively recent, which is bound to be reflected in the expertise of the support staff.

Operating System Support

Entry-level 9370 users must use VM or VSE, but 4381 and 3090 users find MVS/XA far more appropriate. Many users want to convert directly to XA without a non-XA MVS intermediary step. Users who want to change to MVS on the 9370 can only go to the non-XA version.

Although the 9370 supports MVS/SP, the MVS-based operating system designed for high-end, S/370-type systems. ESA and XA are not supported; therefore, MVS/XA, MVS/ESA, and VM/XA cannot be used (as they are on the 4381 and 3090 processors). 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. Therefore, application portability between the 9370 and high-end S/370 architecture is limited. It is IBM's intent to provide ESA capability on future 9370-like rack-mounted, air cooled, S/370 processors.

Future Directions

As previously stated, the ES/9370 family is being replaced by the ES/9000 family. Nine 9370 models are currently available and supported. ES/9370 customers can upgrade their systems to the ES/9000 (System/390) Models 130, 150, and 170, but this will involve substantial changes to the existing systems.

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Characteristics

Systems Overview

The IBM ES/9370 is a compact system that maintains full compatibility with IBM System/370 (S/370) architecture-based systems. It offers higher price/performance and cost-effectiveness than other entry-level S/370 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. Also, the 9370 supports Ethernet, IBM Token-Ring, and SNA networks.

Four machine types and nine models are available; 9371 Models 10, 12, and 14; 9373 Models 025 and 030; 9375 Models 050 and 060; 9377 Models 080 and 090. Main memory ranges between 4M bytes to 16M bytes. Disk capacity is 368M bytes to 39.6G bytes. Up to 384 workstations are supported. Entry-level pricing starts at $31,090 for the low-end 9371 Model 10 and increases to $224,330 for the high-performance 9377 Model 090.

Specifications

The ES/9370 data formats include an eight-bit byte basic unit. 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."

Its fixed-point operands can range from 1 to 16 bytes (1 to 31 digits plus sign) in decimal mode; one halfword (16 bits) or one word (32 bits) in binary mode. Floating-point operands are one word consisting of a 24-bit fraction and 7-bit hexadecimal exponent, in "short" format; two words, consisting of a 56-bit fraction and 7-bit hexadecimal exponent, in "long" format; or four words, in "extended precision" format.

Instructions are 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 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 is the Extended Binary-Coded Decimal Interchange Code (EBCDIC).

Main Storage

The 9370 main memory employs one-megabit chips. The 9371 and 9373 models support 4M, 8M, or 16M bytes of main storage; the 9375 and 9377 models support either 8M or 16M bytes. Single-bit errors are detected and corrected automatically, and multiple-bit errors are detected. The Store and Fetch Protection features guard against inadvertent overwriting or unauthorized reading of data in specified storage blocks and are standard in all models.

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

Only the 9375 Model 60 and the 9377 Model 90 include 16K bytes of cache memory.

Central Processor

The 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 9371, 9373, and 9375 processors, these cards fit into slots inside the processor unit. The 9371 Model 14 also uses a PS/2 Intel 80386 processor. On the 9377 processors, the 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 9375 processor models (50 and 60) are the 9370 family's intermediate systems. In all 9375 models, a high-performance arithmetic unit provides hardware

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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, and division as well as for square root functions.

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.

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.

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.

Control Storage

The 9371 provides additional I/O processor storage to allow the elimination of addressing restrictions. The 9375 Model 60 incorporates a microinstruction store containing a translation lookaside buffer (TLB) and a 16K-byte high-speed buffer storage that acts as a smaller and faster subset of processor storage.

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

Registers and Addressing

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 16M-byte 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 9371, 9373, and 9375 translation lookaside buffers can hold addresses for 512K bytes of processor storage; the buffer on the 9377 can hold addresses for up to 128K bytes.

Input/Output Control

The 9371 models use the IBM Micro Channel bus. An I/O Processor allows selected Micro Channel attached devices to operate like a S/370 channel attached device operating on a S/370 channel.

The 9373 processor includes two internal I/O buses; the system provides an estimated aggregate I/O capacity of up to 11M bytes 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 22M bytes 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 39M bytes 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.

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.

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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; PC and 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 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 3380 and 3390 DASD.

- The 3490 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 datastreaming mode for attaching high-speed DASD like the 3380. Datastreaming permits a data rate of up to 3M bytes 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.

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.

Configuration Rules

The 9371 Model 10 S/370 processor has one system board and three I/O slots; the Model 12 has two system boards and 10 I/O slots; the Model 14 provides the equivalent of a Model 10 and a PS/2 in one physical enclosure. There are three S/370 I/O slots, eight PS/2 I/O bus slots, and six internal DASD bays. Two of the internal DASD bays are occupied by the two DASD provided as a standard feature for the S/370.

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.

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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 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 50 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.

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.

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 two DASD/Tape Subsystem Controllers, the 9375 supports up to four, 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. See Table 4 for printer specifications.

Mass Storage
Information on available 9370 mass storage devices can be found in Table 2.

Input/Output Units
For information on available input/output units, please refer to Table 3 (Workstations), Table 4 (Printers), and Table 5 (Magnetic Tape Equipment).

Communications Control
The 9370 employs four principal Communications Subsystems 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. The 9371 and the 9373 support 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 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*.

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 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.

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- VM Directory Maintenance. This utility provides inter-active 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); ACRITH; 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.

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

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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 uucp (UNIX-to-UNIX copy) 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,

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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. 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.

Database Management Systems

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 to achieve a complete database/data communications system. IMS/VS-DB executes as an application and interfaces between user application programs and databases.

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.

Communications

IBM offers a wide 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

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

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 time-sharing 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.

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.

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Office Automation

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.

Applications

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.

- 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

Pricing

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, 15, 18, and 20—for 370-based machines; 9371s and the 9373 Model 25 belong to Processor Group 10, while 9373 Model 30, 9375 Model 50, and 9375 Model 60 belong to Processor Group 15. 9377 Model 80 belongs to Processor Group 18, and 9377 Model 90 belongs 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,

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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 period 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.

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.

Training

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.

Prices for specific popular configurations and applicable monthly maintenance and rental charges follow.

Equipment Prices

		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge ($) (1)
9370 Processors				
9371-10	Processor with 4MB of main memory	31,090	200	NA
9371-12	Processor with 4MB of main memory	38,370	250	NA
9371-14	Processor with 4MB of main memory	37,330	275	NA
9373-025	Processor with 4MB of main memory	28,110	237	3,905
9373-030	Processor with 4MB of main memory	41,610	272	4,160
9375-050	Processor with 8MB of main memory	65,220	378	6,520
9375-060	Processor with 8MB of main memory	80,970	389	11,730
9377-080	Processor with 8MB of main memory	159,650	642	15,960
9377-090	Processor with 8MB of main memory	224,300	698	23,990
CPU Options				
4000	Automated Power Controls	944	NA	98
MEMORY Options				
4002	4MB Memory Addition for 9373 Processor	4,500	NA	480
4101	4MB to 8MB base charge for 9373 processor upgrade	4,500	NA	480
4008	8MB Memory Addition for 9373 or 9375 Processor	9,000	NA	960
4108	8MB Memory Addition for 9377 Processor	9,000	NA	960

(1) Rental/lease prices include equipment maintenance.
NA—Not applicable.
NC—No Charge.

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		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge ($) *(1)*
I/O Options				
5000	I/O Card Unit Adapter	4,995	NA	528
5010	I/O Card Unit	9,080	NA	971
5020	I/O Card Unit	13,330	NA	1,410
5030	I/O Extension Unit	11,910	NA	1,185
6001	Channel power sequence and control	1,880	NA	199
6003	System/370 block multiplexer channel	7,080	NA	757
Communications/Networking Options				
6031	Multi-Protocol Adapter for Telecommunications Subsystem Controller	1,345	NA	143
6032	Asynchronous Adapter for Telecommunications Subsystem Controller	973	NA	101
6034	IBM Token-Ring Adapter	2,085	NA	232
6035	IEEE 802.3 Adapter	3,180	NA	339
Hardware Options				
9309	Rack Enclosure			
	Model 1; 1.0 Meter	2,945	4	314
	Model 2; 1.6 Meter	3,535	4	377
	120-V Power Supply for Model 1	NC	NC	NC
Mass Storage				
3390	Direct Access Storage Device			
	Model B14: DASD Disk Drive	96,350	150	4,975
	Model B2C: DASD Disk Drive	294,500	430	15,180
3380	Direct Access Storage; 2.52 billion bytes per unit:			
	Model AJ4; 2.52GB Extended Capability drive; attaches to 3880 Model 3 or 23 storage directors	92,220	261	5,200
	Model AK4; 5.04GB Extended Capability drive; attaches to 3880 Model 3 or 23 storage directors	143,900	261	7,960
	Model BJ4; 2.52GB Extended Capability drive; can be attached to AJ4, AK4, BK4, or another BJ4	66,350	191	3,735
	Model BK4; 5.04GB Extended Capability drive; can be attached to AJ4, AK4, BJ4, or another BK4	118,050	191	6,505
3990	Storage Control			
	Model 001, no cache	47,230	154	2,700
	Model Q03, 256MB cache	722,050	1,317	58,540
9332	368MB Rack Mounted DASD	12,860	27	1,610
9335	824MB DASD	19,510	67	2,450
Magnetic Tape Equipment				
3490	Magnetic Tape Subsystems:			
	Model A01: 38K bpi, 79 ips, 3M bps	56,460	329	NA
	Model A02: 38K bpi, 79 ips, 3M bps	106,450	658	NA
	Model B02: 38K bpi, 79 ips, 4.5M bps	65,520	520	NA
	Model B04: 38K bpi, 79 ips, 4.5M bps	102,800	815	NA
9347	Magnetic Tape Unit-40,000 bytes/sec. at 100 ips; 1600 bpi/160,000 bytes/sec at 25 ips; 1600 bpi	9,320	931	98
9348	Magnetic Tape Unit: Model 012 - Compact 1600/6250 bpi	22,000	165	NA

(1) Rental/lease prices include equipment maintenance.
NA—Not applicable.
NC—No Charge.

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		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge ($) (1)
Printers				
3812	Nonimpact tabletop page printer Model 1	10,790	132	NA
3816	Laser page printer			
	Model 01D	23,470	180	NA
	Model 01S	18,010	154	NA
3820	Laser page printer			
	Model 001	37,460	413	2,360
3825	Laser page printer			
	Model 001	147,400	1,972	9,455
4019	Laser page printer			
	Model E01	1,495	NA	NA
	Model 001	2,395	NA	NA
4201	Proprinter			
	Model 002	449	NA	NA
	Model 003	599	NA	NA
4202	Proprinter XL			
	Model 002	579	NA	NA
	Model 003	799	NA	NA
4224	Printer			
	Model 1C2	8,040	52	NA
	Model 1E2	7,805	47	NA
	Model 1E3	8,595	58	NA
	Model 1OY	7,195	42	NA
	Model 1OZ	5,040	30	NA
	Model 101	5,040	30	NA
	Model 102	7,195	42	NA
	2C2-400 cps max.; expanded storage and color	8,040	52	NA
	2E2-400 cps max.; expanded storage	7,805	47	NA
	2E3-400 cps max.; expanded storage	8,595	58	NA
	201-200 cps maximum	5,040	30	NA
	202-400 cps maximum	7,195	42	NA
	3C2-400 cps Color Printer	7,195	42	NA
	3E3-400 cps Color Printer	8,595	58	NA
	301-200 cps Printer	5,040	30	NA
	302-400 cps Printer	7,195	42	NA
4234	Dot Band Printer			
	Model 00Z	10,560	89	NA
	Model 01Z	14,900	123	NA
4245	Band Printer			
	Model 12; 1,200 lpm	36,590	304	2,570
	Model D12; 1,200 lpm	36,590	304	2,570
	Model T12; 1,200 lpm	36,590	304	2,570
	Model 20; 2,000 lpm	42,170	488	2,805
	Model D20; 2,000 lpm	42,170	488	2,805
	Model T20; 1,200 lpm	42,170	488	2,805
4248	Printer, Model 2; 2200/3200/4000 lpm; 132 print positions	88,560	848	7,825
	3751 Additional 36 Print Positions (plant installation)	11,800	116	774
	3753 Additional 36 Print Positions (field installation)	11,800	116	774
6262	Impact Line Printer			
	Model A12: 1,200 lpm	25,650	224	1,695
	Model D22: 2,200 lpm	44,340	374	2,950

(1) Rental/lease prices include equipment maintenance.
NA—Not applicable.
NC—No Charge.

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		Purchase Price ($)	Monthly Maint. ($)	Monthly Rental Charge ($) (1)
Workstations/Terminals				
3151	Monochrome Display Station	544	NA	NA
3164	Color Graphics Display Station	1,540	NA	NA
3180	Monochrome Display Station	2,455	NA	NA
3192	Color Display Station			
	Model C10; 122-key keyboard	1,730	NA	NA
	Model CD0; same as Model C10, except 3-year warranty	1,870	NA	NA
	Model C20; 102-key keyboard	1,730	NA	NA
	Model CE0; same as Model C20, except 3-year warranty	1,870	NA	NA
	Model C30; 104-key keyboard	1,730	NA	NA
	Model CF0; same as C30, except 3-year warranty	1,870	NA	NA
	Model F10; 122-key keyboard	1,885	NA	NA
	Model FD0; same as D10, except 3-year warranty	2,045	NA	NA
	Model F20; 102-key keyboard	1,885	NA	NA
	Model FE0; same as D20, except 3-year warranty	2,045	NA	NA
	Model FF0; 104-key keyboard	2,045	NA	NA
3193	Monochrome Display Station			
	Model 1; 122-key keyboard	3,630	NA	NA
	Model 2; 102-key keyboard	3,630	NA	NA
3194	Color Display Station			
	Model H20; 102-key keyboard	3,405	NA	NA
	Model H10; 122-key keyboard	3,405	NA	NA
3278	Monochrome Display Station			
	Model 1	1,440	10	143
	Model 2	1,520	10	148
	Model 3	1,655	11	182
	Model 4	1,740	12	186

(1) Rental/lease prices include equipment maintenance.
NA—Not applicable.
NC—No Charge.

Software Prices

		Basic License Charge ($)
Onetime charges are based on the processor group to which the system belongs. 9371s and the 9373-25 belong to Processor Group 10. 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. Low and high prices are given for the software prices listed below.		
Operating Systems:		
5660-292	DPPX/370 Distributed Processing Operating System:	
	Group 10	30,580
	Group 20	71,380
5664-167	VM/SP R6:	
	Group 10	8,215
	Group 20	22,260
5666-345	VSE/SP V3:	
	Group 10	3,605
	Group 20	9,260

Datapro Reports on
Minicomputers

IBM ES/9370
Information System

M11-504-425

Computers

		Basic License Charge ($)
5666-301	VSE/Advanced Functions V2:	
	Group 10	4,510
	Group 20	11,570
5665-XA3	MVS/DFP V3 R1.1:	
	Group 18	66,060
	Group 20	66,060
5664-301	VM/IS:	
	Group 10	27,770
	Group 20	63,760
5713-AFL	AIX/370:	
	Group 10	30,950
	Group 20	58,460

Languages:

5668-767	VS Pascal Compiler and Library:	
	Group 10	5,155
	Group 20	12,030
5709-025	Ada Compiler (VM/CMS):	
	Group 10	19,300
	Group 20	34,390
5709-026	Ada Compiler (MVS):	
	Group 18	85,230
	Group 20	85,230
5660-299	DPPX/370 Cobol II Facility (DPPX/370 environment):	
	Group 10	10,150
	Group 20	21,660
5668-903	VS Fortran IAD:	
	Group 10	2,880
	Group 20	7,675
5668-910	OS PL/1 Version 2 Compiler/Library:	
	Group 15	8,935
	Group 18	13,400
5688-039	C/370 Library:	
	Group 10	1,605
	Group 20	3,670
5688-040	C/370 Compiler:	
	Group 10	3,450
	Group 20	7,870
5668-958	VS Cobol Compiler/Library/Debug:	
	Group 10	12,860
	Group 20	30,040
5668-996	Basic (VM/SP):	
	Group 10	2,405
	Group 20	5,615
5668-805	VS Fortran Library:	
	Group 10	2,055
	Group 20	4,815
5668-806	VS Fortran Compiler/Library/IAD:	
	Group 10	7,730
	Group 20	18,040
5668-899	APL2:	
	Group 10	6,415
	Group 20	11,230
5734-CB4	Cobol Interactive Debug:	
	Group 10	2,895
	Group 20	8,980
5668-962	OS Assembler H:	
	Group 10	1,725
	Group 20	4,040
5746-RG1	DOS/VSE RPG II:	
	Group 10	1,645
	Group 20	4,235
5734-LM4	OS PL/1 Resident Library:	
	Group 10	491
	Group 20	1,520
5706-236	Prolog for 370 (Development):	
	Group 10	6,710
	Group 20	7,835

		Basic License Charge ($)
5688-137	Optimization Subroutine Library (MVS, VM, AIX/370):	
	Group 10	11,730
	Group 20	22,910
5684-124	VM REXX Compiler for CMS:	
	Group 10	1,870
	Group 20	4,260
5740-CB1	OS/VS Cobol Compiler and Library:	
	Group 10	2,815
	Group 20	8,760
5746-CB1	Cobol Compiler and Library:	
	Group 10	1,890
	Group 20	4,420

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