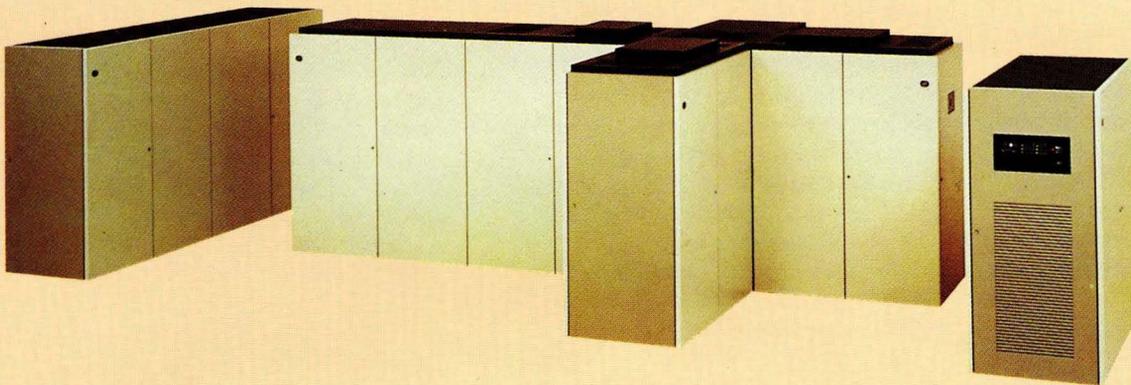# Virtual Machine/Enterprise Systems Architecture operating system

- *A new era begins*

VM is the premier interactive, multi-user operating system from IBM. Virtual Machine/Enterprise Systems Architecture (VM/ESA)[*] represents an evolutionary step in VM, consolidating into a single platform all the advantages of VM/System Product (VM/SP), VM/SP High Performance Option (VM/SP HPO), and VM/Extended Architecture System Product (VM/XA SP).

This VM/ESA platform, combined with powerful enhancements, offers you both interactive and guest environment capabilities . . . advanced workstation connectivity . . . flexible system management . . . and a solid foundation for future growth.

VM/ESA spans the entire range of Enterprise Systems (ES) processors, including the ES/9000[*], a family of powerful processors that offers high performance at a very attractive cost. VM/ESA will also serve as the VM platform for all Systems Application Architecture[*] (SAA[*]) development in the 90s, enhancing its strategic position in future hardware and software development.

A comprehensive solution for interactive users

VM/ESA is a versatile, easy-to-use interactive operating system. It provides a simple command language, full-screen editor, and on-line help menus to satisfy the needs of a wide range of industries and environments.

IBM

The Conversational Monitor System (CMS) serves as the main interface for VM/ESA. CMS is actually an operating system that runs only in a virtual machine. As the name "conversational" implies, CMS provides a two-way conversation between users and the system.

CMS allows users to do such things as develop application programs, create and edit files, execute applications and communicate with other users.

CMS also supports a wide variety of licensed programs that can be ordered separately for application development, numerically intensive computing, office work, and database applications.

Advanced interactive features

VM/ESA can help protect your current investment by offering advanced capacity, system flexibility, and a single platform based on consistent standards. CMS can work with a variety of office applications, as well as help users share data with guest systems. Expanded data storage helps you increase your system's ability to run large applications. A single VM platform supports a wide range of applications, processors, workstations and I/O devices. VM is also based on SAA, a consistent set of IBM guidelines for application development.

VM/ESA also offers a high degree of application flexibility. IBM OfficeVision provides a versatile platform for many office and business applications. System capacity has been enhanced from 2,047MB to 16 Terabytes (TB) and additional data spaces have also been introduced. As a result, the system can use a greater number of variety of applications. In addition, Structured Query Language/Data System (SQL/DS) can help users access and share data from several applications.

Application flexibility is also enhanced with Operating System/Multiple Virtual Storage (OS/MVS). This powerful capability allows MVS/XA macros to be used in assembler applications and allows programmers to take advantage of the productivity benefits of high-level languages. Callable Services Library (CSL) allows application programs written in REXX or other high-level languages to access VM-specific services. CSL can also call SFS functions and provide you with added flexibility in managing and sharing CMS files.

VM/ESA can also help increase user productivity through reduced system complexity, a single VM platform and advanced features such as softcopy publications available online. In addition, XEDIT allows users to browse, update, or create SFS files in a number of directories. Productivity can also be increased with CMS utilities that make the Control Program (CP) and CMS less complex for end users and programmers. Flexible workstation connectivity, simplified data storage management with IBM Data Facility System Managed Storage/VM (DFSMS/VM), and the use of consistent SAA interfaces can also help create a highly integrated, versatile and productive environment.

VM/ESA can help increase system performance through capabilities such as "Data-In-Memory" which reduces response time by keeping frequently used data close to the processor. Performance can also be increased with high-performance data access and Vector Facilities support for numerically intensive environments.

Growth potential is enhanced through the ability to serve more CMS users, enlarged data spaces and a cooperative processing environment connecting workstations and host processing.

A versatile, efficient guest environment

VM/ESA is designed so that other operating systems, called guests, can share the same resources. For example, on most models of the ES/9000 range, you can run an MVS, Advanced Interactive Executive/370 (AIX/370), VSE, or another VM operating system in a virtual machine while sharing the VM system with other users.

This ability allows you to run several guest versions of an operating system to support application development, testing and production environments on the same physical computer. This means you and your staff can use several operating system environments while maintaining a single system.
In addition, the VM/ESA guest environment can work with CMS and take advantage of VM applications across platforms that share SAA guidelines.

A wide range of benefits with guest environments
A VM/ESA system, operating with guest environments, can help provide high-speed throughput, improvements in response time, transparent I/O support, virtual, serial I/O support and 3990-3 Fast

Write support. These capabilities can increase performance and lower system overhead. SQL guest sharing under VSE also offers performance improvements with minidisk caching and Multiple Controlled Data Space (MCDS) capabilities.

Costs can be reduced through improved efficiency with guest environments. Migration, development and testing do not require additions to the physical system. I/O devices can be shared. In addition, VSE under VM/ESA benefits from all the hardware support built-in with VM. This support includes the XA I/O subsystem, Expanded Storage for paging, 3990-3 Fast Write.

The VM/ESA guest environment also offers a great degree of growth flexibility. Multiple images can be added with additional hardware. VM allows VSE to "run" on n-way processors. The guest environment offers larger virtual machines ranging up to 2GB. In addition, VM/ESA supports Multiple Preferred Guest (MPG) mode, so an installation can run several copies of VSE with near-native performance. This provides a realistic implementation of multiple copies of production VSE wherever it is needed.

Workload balancing is enhanced through a number of features including Expanded Storage exploitation and transparent, serial I/O support. VM/ESA also owns channels and the I/O subsystem, so the performance advantages of serial I/O, XA, and the dynamic channel subsystem are available to guests that support these features.

The guest environment also allows test development and migration at any given time. VM facilitates testing by allowing programmers to test a new version in parallel with the production version. Disk sharing is possible between test and production systems. In addition, the Central Processing Unit (CPU) and memory resources needed by the test system are dynamically allocated.

Automatic recovery mechanisms are provided for a V=R machine. Improved access to machine time is also provided without interfering with production systems or introducing a second physical system.

VM/ESA helps improve application enabling through the ability to access data efficiently in the distributed database, SQL/DS data sharing between guest, and advanced 31-bit addressability. VM/ESA also provides access to a wide range of current and new software for more rapid development and online testing. Tools such as XEDIT and REXX help improve the productivity of Application Programmers, System Programmers and Operators who prepare jobs under CMS and submit them to VSE.

Enhanced workstation connectivity
In today's business environments, users need to access, share and distribute information among a variety of locations and across different platforms. VM/ESA helps make this possible with a rich set of options that can help connect users in a highly integrated network. What's more, VM/ESA is based on Systems Network Architecture (SNA), IBM Token-Ring and Ethernet[1] standards, helping to enhance workstation connectivity with a large number of devices and systems.

Advanced synergy
Workstation synergy among users and the system is made possible through a wide array of advanced VM/ESA capabilities. Advanced Program-to-Program Communications (APPC) provides flexible communications among different operating systems in a distributed processing environment.

SFS files, SQL/DS data and OfficeVision/VM[(*)] calendars can also be shared through APPC.

Peer-to-peer connectivity is made easier through the IBM VM Personal Workstation Communication Facility (VM PWSCF). VM PWSCF supports high-speed communications between an Enterprise System/370[(*)] (ES/370[(*)]) processor running VM/System Product (VM/SP) and workstations attached via a Token-Ring local area network (LAN) or channel. VM PWSCF provides the common programming interface to APPC for Operating System/2[(**)] Extended Edition (OS/2[(**)] EE) and Disk Operating System (DOS) programs.

IBM Workstation Data Storage Facility (WDSF) provides key workstation services for backing up, archiving and restoring disk or diskette data files. WDSF allows a VM system to act as a server for workstations and personal computers.

It includes client applications for workstation-based environments including DOS, OS/2, and AIX[(**)] for the RT Personal Computer[(**)] and the RISC System/6000[(**)]. As a client/server solution, WDSF offers value and growth potential to distributed LAN and non-LAN installations, while enhancing and utilising a VM base.

Transmission Control Protocol/Internet Protocol (TCP/IP) provides access to heterogeneous environments, and DECAF enables a remote OS/2 workstation to control another workstation through VM's access to SNA. In addition, CAPM/VM allows workstations to access and control VM cooperative applications and print facilities.

Highlights
VM/ESA system benefits:
- A single interface for the entire processor line, helping to provide an easy-to-use, cost-effective information solution
- A strategic foundation for growth, incorporating enhanced technology, a wide range of processor support, proven applications, and advanced system design
- Improved performance and productivity for a greater return on investment
- Improved enterprise management with versatile management facilities, security support and advanced cooperative processing

VM/ESA interactive environment:
- APPC connectivity
- Transparent Services Access Facility (TSAF) for APPC program communication
- SQL/DS database sharing
- OfficeVision, providing advanced office and business application functions
- 31-bit addressability for increased processing capacity
- CSL, making application programming easier
- CMS utilities, providing a productive, interactive environment
- CRR, helping to supervise data and applications in a distributed environment
- REXX and high-level languages, helping to increase programmer productivity

- DFSMS, simplifying data storage management

VM guest environment:
- Improved performance and reliability for preferred virtual machines
- Start interpretative execution assist to improve preferred virtual machine performance
- V=R recovery, a CP function that lets the V=R machine resume operation after certain CP and hardware failures
- Dynamic channel subsystem, allowing any processor to access any device and any device to interrupt any processor
- Serial I/O architecture, for greater configuration flexibility
- Expanded storage exploitation
- Virtual and shared I/O resources, for greater system efficiency and flexibility
- Multiple preferred guests, allowing an installation to run several copies of VSE with near-native performance
- N-way exploitation for increased processing capacity
- MVS console integration, for streamlined system management
- SQL/DS data sharing
- Distributed database function for improved productivity and application flexibility

PWS connectivity:
- Standards support for SNA, IBM Token-Ring and Ethernet
- APPC communications to help users access and share information
- Peer-to-peer connectivity with VM PWSCF, supporting high-speed communications in a Token-Ring network
- Access to heterogeneous environments through TCP/IP
- Backup/archive capabilities with WDSF/VM

Technical information
Hardware requirements:
- The ESA capability of VM/ESA supports the ESA/370[(*)] and ESA/390[(*)] processor architecture. This includes all models of the IBM ES/3090[(*)], ES/3090-9000T[(*)] and ES/9000 models that support ESA/370 and ESA/390 mode. For VM/ESA to run natively the ESA processors must have SKF.
- A minimum of 4MB of real storage
- One processor unit
- One processor controller or support processor
- One channel subsystem
- One system console
- One printer
- Two Direct Access Storage Devices

- One 6,250 bits-per-inch, nine-track magnetic tape unit, or one IBM 3480 tape subsystem, or one IBM 3490 tape subsystem
- One operator console

Program requirements:
The following IBM licensed programs are required for VM/ESA:
- Assembler H Version 2 (Program number 5668-962) (ESA feature only)
- Environment Record Editing and Printing (EREP/VM) 3.4.2 (Program number 5654-260)
- Device Support Facilities (Program number 5747-DS1) 1.12
- ISPF (Program number 5684-043) V3 R2
- DIRMAINT (Program number 5748-XE4) V1 R4

Learn more about IBM's advanced, interactive operating system
The following publications on VM/ESA are available from IBM:
- VM/ESA General Information (R.1) GC-5440
- VM/ESA General Information (R1.1) GC24-5550
- VM/ESA Introduction GC24-5441

For more information about VM/ESA, talk to your IBM marketing representative today. You'll learn more about the many advantages that VM/ESA can offer businesses like yours.

(**) Registered trademark of the IBM Corporation.

(*) Trademark of the IBM Corporation.

(1) Trademark of the Xerox Corporation.

VM/ESA Guest Benefits

	Guests	MVS	VSE	AIX
Dynamic channel subsystem	●	●	●	●
Serial I/O	●	●		●
Expanded storage exploitation	●	●	●	●
Shared I/O resources	●	●	●	●
Virtual I/O	●	●	●	●
Multiple preferred guests		●	●	●
N-way exploitation		●		●
MVS console integration		●		
SQL/DS data sharing		●	●	
SAA distributed database function		●	●	●

Supported operating systems in virtual machines
This table lists the operating systems that the ESA Feature supports in virtual machines. The ESA Feature supports these operating systems in virtual machines until IBM discontinues program service for them.

Operating System	Version/Release	V=V Virtual Machine[1]	V=R and V=F Virtual Machine[1]
MVS/370(*)	1.3.5 and later releases	AP, UP	AP, UP
MVS/XA	2.1.3 and later releases	UP, MP	UP, MP
MVS/ESA	3.1 and later release	UP, MP	UP, MP
VM/SP	5 and later releases	AP, UP	AP, UP
VM/ESA (ESA Feature)	1.1.0	UP, MP	UP, MP
VM/ESA (370 Feature)	1.1.0	AP, UP	AP, UP
VM/SP HPO	5 and later releases	AP, UP	AP, UP
VM/XA SP	2 and later releases	UP, MP	UP, MP
Advanced Interactive Executive/370 (AIX/370)	Version 1	UP	UP
VSE/AF	Version 2 and later releases	UP	UP
VSE/SP	Version 2, all releases, and Version 3 Release 1	UP	UP
TPF2	2.3 and later	UP	UP

[1] AP — attached processor, UP — uniprocessor, MP — multiprocessor.

[2] The Transaction Processing Facility (TPF) is supported in environments where TPF-specific processor and DASD control unit RPQs are not required. When TPF runs in a V=V machine, the Emulation Program for 37xx communication controllers is not supported.