

Virtual Machine/
Enterprise Systems Architecture



General Information

Version 2 Release 4.0

Virtual Machine/
Enterprise Systems Architecture



General Information

Version 2 Release 4.0

Note:

Before using this information and the product it supports, read the information in "Notices" on page 113.

> **Fifth Edition (December 1999)**

This edition applies to Version 2, Release 4, Modification 0 of IBM® Virtual Machine/Enterprise Systems Architecture (VM/ESA®) (product number 5654-030) and to all subsequent releases and modifications until otherwise indicated in new editions.

> This edition replaces GC24-5745-03.

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Preface

This book provides general information about the IBM Virtual Machine/Enterprise Systems Architecture (VM/ESA) licensed program. It discusses the following topics:

- Introduction to VM/ESA
- New functions and enhancements
- Hardware and program requirements
- Overviews of the VM/ESA components, additional facilities, and features
- Library structure and content
- Processor, guest, and device support

Who Should Read This Book

This book is intended for current users of VM products, as well as new users. It provides information to help users evaluate VM/ESA Version 2 Release 4.0 (VM/ESA 2.4.0) and determine the resources necessary to run it. This book is also intended for anyone interested in a general overview or introduction to VM/ESA.

You might use the information in this book if you:

- Plan to install VM/ESA 2.4.0 and want to get acquainted
- Plan to migrate to VM/ESA 2.4.0 from a previous VM system
- Need basic knowledge about VM/ESA for any reason

None of the information in this book is meant to be used as a guide or reference for **using** VM/ESA.

Related Information

You can obtain more information about VM/ESA from the books listed in the VM/ESA library guide, which begins on page 63. The library guide includes an abstract for each VM/ESA book.

How to Send Your Comments

Your feedback is important in helping to provide the most accurate and high-quality information. If you have any comments about this book or any other VM/ESA documentation:

- Visit our home page at:
<http://www.ibm.com/s390/vm>
There you will find the feedback page where you can enter and submit your comments.
- Send your comments by electronic mail to one of the following addresses:

Format	Address
Internet	pubrcf@vnet.ibm.com
IBM Mail	USIB2L8Z@IBMMAIL
IBMLink™	GDLVME(PUBRCF)

Be sure to include the name of the book, the form number (including the suffix), and the page, section title, or topic you are commenting on.

- Fill out the form at the back of this book and return it by mail, by fax, or by giving it to an IBM representative.

> **Summary of Changes**

- > This section describes the technical changes made in this edition of the book. For
- > your convenience, the changes made in this edition are identified in the text by a
- > greater-than symbol (>) in the left margin. This edition may also include minor
- > corrections and editorial changes that are not identified.

> **Summary of Changes for the Fifth Edition**

- > This edition contains updates since the General Availability of VM/ESA 2.4.0. New
- > function, enhancements, and additional support are available through the specified
- > APARs. These APARs will be rolled into any successive release of VM/ESA.

> **Support for S/390 Multiprise® 3000 Enterprise Server**

- > APAR VM62180 provides support for the IBM S/390® Multiprise 3000 Enterprise
- > Server and its Internal Disk. See “Support for IBM S/390 Multiprise 3000 Enterprise
- > Server” on page 9.

> **Support for Enterprise Storage Server™**

- > APAR VM62111 provides support for the IBM Enterprise Storage Server (2105
- > DASD Subsystem). APAR VM62295 provides guest support for the Parallel Access
- > Volumes feature. See “Support for IBM Enterprise Storage Server and Parallel
- > Access Volumes” on page 9.

> **Guest Support for OSA Express**

- > VM/ESA supports additional modes of the OSA Express. This support is included in
- > the VM/ESA 2.4.0 base; no APAR is required. See “Guest Support for QDIO
- > Facility and OSA Express” on page 9.

- > APAR VM62184 adds guest support for OSA Express to VM/ESA 2.2.0 and
- > VM/ESA 2.3.0. QDIO is not supported on those releases. See “Miscellaneous
- > Devices” on page 109.

> **OS Simulation Enhancement**

- > APAR VM62366 provides the new SET TAPENEVR and QUERY TAPENEVR
- > commands. See the additional information on page 12.

Chapter 1. Introducing VM/ESA

VM/ESA is a high-performance, interactive, multiple-access operating system for IBM S/390® servers. It provides a unique mix of services in support of interactive users, client/server environments, and the capability to run full-function operating systems such as OS/390®, VSE/ESA™, or VM/ESA itself as programs.

VM/ESA Supports Open Environments

By supporting a wide range of public and industry standards, protocols, and interfaces, VM/ESA provides a VM foundation for open enterprise network computing.

Network Computing

The network computing paradigm is not new to VM. VM/ESA supports today's computing environments by providing a natural infrastructure for network computing, enabling you to participate in multisystem environments. You can connect your VM/ESA system and its data to a corporate intranet or serve your data to customers on the Internet and the World Wide Web. Through the use of shareware or IBM Business Partner Web servers and Web-related products on VM/ESA, information stored on VM/ESA can be presented to your organization and your customers using the latest Web technology.

VM/ESA networking support includes:

- **IBM® Java™ Port for VM/ESA.** The object-oriented Java programming language permits object code portability across any platform that supports Java. This is an ideal technology for building intranet/Internet applications using standard gateway interfaces.
- **NetRexx™.** NetRexx is a general-purpose programming language that is a blend of the Rexx and Java languages. You can use NetRexx as an alternative to Java, which makes writing and using Java classes quicker and easier than writing in Java.
- **MQSeries® Client for VM/ESA.** IBM Message Queuing Series (MQSeries) enables applications on different systems and architectures to work together. VM/ESA support for MQSeries enables client or server applications in the network to connect to applications on VM/ESA that have implemented the MQSeries communication protocol. (Use of the MQSeries APIs on VM/ESA requires the deployment of an MQSeries server somewhere in the network.)

OpenEdition® for VM/ESA

Through its support of selected IEEE POSIX and X/OPEN portability guide (XPG) standards, VM/ESA provides a set of UNIX®-based programming interfaces that allows you to port applications from UNIX and other POSIX-compliant platforms to VM/ESA. It also allows you to develop POSIX-compliant applications on VM/ESA and port them to other POSIX-compliant platforms.

VM/ESA also supports a collection of Open Software Foundation (OSF) Distributed Computing Environment (DCE) technologies and services. DCE support enables you to develop and deploy distributed applications that access resources such as

Introducing VM/ESA

files, data, applications, and services that reside on other hardware and software platforms.

Heterogeneous Connectivity

VM/ESA provides a wide range of networking and connectivity options and adheres to many of the industry standards, enabling communications across distributed heterogeneous environments. Examples include:

- SNA
- BSC
- TCP/IP
- X.25
- Token-Ring
- Ethernet
- X-Windows
- Network file system (NFS)
- File transfer protocol (FTP)
- Simple mail transfer protocol (SMTP)
- X.400 mail exchange protocol
- FDDI

Network management support is provided through support of the simple network management protocol (SNMP), and through IBM defined interfaces supported in NetView®.

Enterprise Computing

VM/ESA supports a wide range of enterprise computing alternatives, including a relational database, a shared file system, and connections to heterogeneous systems:

- **IBM DATABASE 2® Server for VSE & VM (DB2® Server for VM).** DB2 Server for VM (formerly known as SQL/DS™) provides local relational database support, as well as distributed access and update of distributed VM/ESA, OS/390, MVS™, OS/400®, AIX/6000®, and OS/2® (access only) relational data using IBM's Distributed Relational Database Architecture™ (DRDA®). VM/ESA enables local and distributed relational database sharing for VSE guests.
- **CMS shared file system (SFS).** SFS allows data sharing among users and across multiple VM/ESA system images or processors.
- **TCP/IP Feature for VM/ESA.** TCP/IP provides common protocols that enable access to data from heterogeneous system platforms.

VM/ESA Provides Guest Support

VM/ESA presents a unique approach to computer operating systems. It provides each end user with an individual working environment known as a *virtual machine*. The virtual machine simulates the existence of a dedicated real machine, including processor functions, storage, and input/output (I/O) resources.

But virtual machines support much more than just end users. Application programs and complete operating systems can run in virtual machines. VM/ESA provides the capability to support multiple complete S/390 operating systems as “guests” of VM/ESA. For example, you can run OS/390, MVS, TPF, VSE/ESA, or other

VM/ESA systems on the same VM/ESA system that is supporting VM/ESA applications and end users. As a result, application development, testing, and production environments can share a single physical computer.

The virtual machine capability of VM/ESA allows you to:

- **Test programs that can cause abnormal termination of real machine operations and, at the same time, process production work.** The isolation that is provided for a virtual machine enables system-oriented programs and teleprocessing applications, for example, to be tested on the virtual machine while production work is in progress, because this testing cannot cause abnormal termination of the real machine.
- **Test a new operating system release.** A new release of the primary operating system, or of VM/ESA itself, can be generated and tested at the same time the existing release is performing production work. This enables the new release to be installed more quickly. The ability to operate multiple operating systems concurrently under VM/ESA also enables an installation to continue running programs that operate only under a back-level release (programs that are release-sensitive and uneconomical to convert, for example) concurrently with the most current release.
- **Test a new operating system.** The existing operating system can be used to process production work concurrently with the generation and testing of a new operating system. Experience with the new system can be obtained before it is used on a production basis, without dedicating the real machine to this function.
- **Perform operating system maintenance concurrently with production work.** The installation and testing of program temporary fixes (PTFs) for the primary operating system and VM/ESA can be done at the same time normal production operations are in progress.
- **Provide backup facilities for the primary operating system.** A generated VM/ESA system is not model-dependent and can operate on various processor models as long as the minimum hardware requirements are present. This enables a smaller processor model that has less real storage, fewer channels, fewer direct access devices, and fewer unit record devices than a larger processor model to provide backup for the larger model (normally at a reduced level of performance).
- **Perform operator training concurrently with production work processing.** The real machine does not have to be dedicated to training additional or new operators or to providing initial training when a new operating system is installed. Operator errors cannot cause termination of real machine operations.
- **Simulate new system configurations before the installation of additional channels and I/O devices.** The relative load on channels and disk devices can be determined in this way using the existing smaller I/O configuration. Experience with generating and operating an OS/390 multiple system configuration can be obtained using one real machine.

VM/ESA Provides Host-Based Services for the Workstation Environment

Because VM/ESA is built on a client/server-like model, it can function both as a mainframe server to LAN users and as a client to a LAN server or another mainframe. VM/ESA supports the following products in a client/server environment:

- **Tivoli ADSM™ for VM.** Tivoli ADSM is a client/server tool that enables backup, archiving, and restoration of workstation files, utilizing the host VM/ESA system and DASD. ADSM moves the responsibility of storage management to VM/ESA, while providing client applications for a number of workstation-based environments, such as Microsoft® Windows®, Apple Macintosh, UNIX, and OS/2.
- **LAN Resource Extension and Services/VM (LANRES/VM).** LANRES/VM (available as a no-charge feature of VM/ESA) provides VM/ESA disk, print, administrative, and data distribution services to Novell NetWare LAN users.
- **LAN File Services/ESA (LFS/ESA).** LFS/ESA (available as a no-charge feature of VM/ESA) allows workstation-formatted files to be stored on the host VM/ESA system and shared transparently between users of OS/2, LANs, TCP/IP, and CMS.

VM/ESA Supports Application Development and Deployment

VM/ESA supports a number of programming languages and environments, including:

- REXX
- Assembler
- COBOL
- FORTRAN
- C
- PL/I
- PASCAL
- C + +
- Java
- NetRexx
- Language Environment®
- MQSeries Client
- VisualAge® Generator

VM/ESA also provides a rich set of application development services, including:

- OpenEdition for VM/ESA services
- OpenEdition Shell and Utilities Feature for VM/ESA
- OpenEdition DCE Feature for VM/ESA
- Integrated editors and support for code version management
- Trace and debug facilities

VM/ESA supports program development not only for VM/ESA applications, but also for OS/390, MVS, and VSE.

Special facilities are available to CMS applications, such as:

- Extended Architecture (XC) support

- CMS Pipelines
- CMS multitasking services
- Callable services library (CSL)
- Distributed Graphical User Interface Toolkit (DT)
- Reusable Server Kernel
- CMS macros and functions
- OS/MVS simulation
- DOS/VSE support

VM/ESA Provides a Rich Set of User Services

VM/ESA provides end user services in several important environments:

- Decision support, problem solving, expert systems
- Document creation, editing, and publishing
- Image storage and retrieval
- Graphics development and manipulation
- Office task management
- Communications and document exchange with users on other systems
- Computer Integrated Manufacturing
- Engineering/scientific computing
- Application development
- Application testing
- Communications services
- Backup/archive of programmable workstation or LAN server data
- Services for NetWare and OS/2 LAN servers
- Accessing other systems
- System management
- Network management
- System testing
- Graphical user interface

VM/ESA Is Proven

VM/ESA is built on a foundation of system integrity and security, and incorporates many design features for reliability and availability.

- Integrity and security:
 - IBM will correct any integrity exposures introduced by unauthorized programs into the system.
 - Integrated access control and authentication services may be augmented with the addition of external security managers.
 - Distributed computing poses additional security considerations. The OpenEdition DCE Feature for VM/ESA includes the DCE Security Service Client, which controls access to resources and provides user registration, authorization, and authentication services for distributed applications.
 - Kerberos authentication is provided through the TCP/IP Feature for VM/ESA.

Also see “Integrity and Security of VM/ESA” on page 37.

- Availability and reliability:

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- Application recovery: VM/ESA provides services which permit recovery of incomplete interactions with resource managers.
- Automated operations: VM/ESA offers several levels of automated system management support. One example is the Programmable Operator. For a higher degree of automation, IBM SystemView® Host Management Facilities/VM can be added. Both the Programmable Operator and Host Management Facilities/VM can interact with NetView on VM/ESA, which in turn can interact with NetView on MVS or OS/390.
- VM/ESA provides duplexed data with transparent ongoing synchronization between the primary and backup copy, and automatic transparent cut-over to the backup copy in case of an error in the primary copy.
- On-line configuration changes eliminate many previously-required outages.
- VM/ESA systems can be connected for improved server and user availability.
- Fast restart reduces the end user impact of any outage.

Chapter 2. New Functions, Enhancements, and Other Changes

This chapter provides an overview of the major functions and enhancements provided in VM/ESA Version 2 Release 4.0. These new functions and enhancements, plus other important changes, are briefly described in the following sections:

- “Network Computing”
- “Support for New Products and Hardware Architecture” on page 9
- “Application Development and Deployment” on page 11
- “Operating System Enhancements” on page 13
- “Other Changes” on page 14

Network Computing

This section describes enhancements to the network computing capabilities of VM/ESA.

TCP/IP Feature For VM/ESA, Function Level 320

TCP/IP Function Level 320 contains the functions available in TCP/IP Function Level 310 plus the following:

- Expanded Routed Capability

This enhancement is a major upgrade in function and reliability of the Routed server in TCP/IP. The routing daemon (Routed) is a server that implements the Routing Information Protocols (RIP). The Routed server dynamically creates and maintains network routing tables using RIP. Enhancements being provided over the existing support include:

- RIP Version 2 (RFC 1723). This is an extension of the RIP 1 protocol.
- Variable Subnetting
- Virtual IP Addressing (VIPA)
- Enhanced messages and debugging
- New SMSG commands for changing the server's operational characteristics and debugging

- NFS Version 3 support

The following changes may be of interest to end users:

- NFS Version 3 is supported allowing for improved efficiency of communications between NFS client and server.
- Your administrator can configure a list of EXPORTed file systems, allowing Windows clients, for example, to use point and click to get access to VM file systems.
- New parameters were added to the MOUNT command allowing you to use your LOGON BY privileges as well as specifying both a logon password and a minidisk link password in the same mount string.
- A new SMSG QUERY RESOURCE command allows a CMS user to see what file systems are active for a given VMNFS server. A new SMSG QUERY CONFIG command shows you the configuration parameters used when the VMNFS server was started.

New Functions, Enhancements, and Changes

NFS administrators will find that:

- More of the VMNFS server machine's parameters can be tailored and you can refresh server configuration parameters without stopping the server.
- NFS security has also been enhanced with two new exits VMNFSMON and NFSSMSG. These exits provide additional MOUNT options and the screening of SMSG requests.

- FTP Enhancements

A new SMSG FTPSERVE command which allows for communication with the FTP Server is provided along with three new user exits. In addition, a site specific "Welcome Banner" can now be displayed when connecting to the FTP Server. Also new is FTP to Reader Support which allows the FTP Server to manipulate VM reader files. Basically, this allows the user to:

- CD to a VM user ID reader rather than to a minidisk, SFS directory, or BFS directory
- PUT a file to the reader without having to know the password for that user ID
- List files in the reader, if authorized
- Delete one or more files from the reader, if authorized

- TCP/IP Customization

This support adds dynamic expansion of TCP/IP stack pool sizes, minimizing the need to restart the stack as use increases. It also eliminates the need to restart the stack to make certain kinds of configuration changes.

- Enhanced User Authorization

A new CP Diagnose interface will be used by VM's FTP and NFS servers to allow access to user resources without requiring more than one password to be supplied and without requiring LOGONBY base passwords to be revealed. Three new CMS CSL routines DMSESM, DMSPWCHK, and DMSLINK are also provided for this support.

- Native ATM for TCP/IP

This support enables TCP/IP to exploit an ATM network through the use an Open Systems Adapter configured to support Native ATM.

- SMTP support

Two new service extensions have been added. The 8-bit Multipurpose Internet Mail Extension (MIME) allows for the exchange of messages in which the content body consists of an 8-bit MIME message containing arbitrary octet-aligned material. The SMTP Message Size Declaration service extension allows for some communication regarding message size between the client and server SMTP. The use of this extension allows the server SMTP to identify mail that is too large to be processed (based on the client's estimated size) before any transfer is attempted. Additionally, the SOURCEROUTES configuration statement has been modified providing the ability to remove source routes from the RCPT TO or the MAIL FROM statements.

Support for New Products and Hardware Architecture

This section describes support for new products and hardware architecture.

Support for IBM S/390 G5 and G6 Parallel Enterprise Servers™

VM/ESA supports the IBM S/390 G5 and G6 Parallel Enterprise Servers. See Appendix A, “IBM Processors Supported by VM/ESA” on page 93.

> Support for IBM S/390 Multiprise 3000 Enterprise Server

- >
- > APAR VM62180 provides support for the IBM S/390 Multiprise 3000 Enterprise Server and its Internal Disk. See Appendix A, “IBM Processors Supported by VM/ESA” on page 93 and “Direct Access Storage Devices (DASD)” on page 102.
- >

> Support for IBM Enterprise Storage Server and Parallel Access Volumes

- >
- > APAR VM62111 provides support for the IBM Enterprise Storage Server (2105 DASD Subsystem), which emulates a 3990 Model 3 or 6 Storage Control with 3390 Models 2, 3, and 9 DASD, or a 3390 DASD in 3380 track compatibility mode. Use of the performance-oriented track level commands is supported for guests.
- >

- >
- > APAR VM62295 provides guest support for the Parallel Access Volumes feature. This feature allows the configuration of logical volumes (known as alias Parallel Access Volumes), where each logical volume (alias) has its own unique device address but is actually an exposure of the existing real device (known as the base Parallel Access Volume). This allows the host to issue concurrent I/O requests to one real device, the base volume, through the different alias volumes.
- >

- >
- > Support for Parallel Access Volumes includes:

- >
- >
 - The new CP QUERY PAV command, which displays information about the Parallel Access Volume devices on the system.
 - Enhancements to the CP QUERY DASD DETAILS command to display additional information if the queried device is a Parallel Access Volume.
 - A new CP Monitor Record, which has been added to Domain 6 (I/O) to record state change interrupts that indicate a change in the Parallel Access Volumes information:
 - Record 20 – MRIODSTC – State change
- >

- >
- > Other Parallel Access Volumes information will be recorded in the existing Device Configuration Data Record (Domain 1, Record 6) and the Vary On Device - Event Data Record (Domain 6, Record 1).
- >

- >
- > See “Direct Access Storage Devices (DASD)” on page 102.

> Guest Support for QDIO Facility and OSA Express

VM/ESA provides guest support for the Queued-Direct-I/O (QDIO) Facility on S/390 CMOS processors that support this new I/O architecture. The QDIO Facility allows a program to directly exchange data with an I/O device without performing traditional S/390 I/O instructions. To exchange data, both the I/O device and the program reference main storage directly through a set of data queues.

New Functions, Enhancements, and Changes

- > VM/ESA provides real device support for Open Systems Adapter (OSA) Express devices and guest (dedicated device) support for the following OSA Express modes:
- >
- >
 - OSA Express Gigabit Ethernet (which uses the QDIO Facility)
 - OSA Express Fast Ethernet
 - OSA Express 155 ATM
- > VM/ESA provides dynamic I/O support for the new OSA Direct-Express (OSD) and OSA Express (OSE) channel path IDs.
- >
- > See “Miscellaneous Devices” on page 109.

The following CP commands have been updated:

- DEFINE CHPID / PATH
- QUERY VIRTUAL OSA
- SET CPTRACE
- TRACE mnemonic2

For more information, see the following book:

- *VM/ESA: CP Command and Utility Reference*

Support for Integrated Cluster Bus Channels

VM/ESA provides support for integrated cluster bus channels for S/390 CMOS processors that support this channel type. The existing dynamic I/O configuration support has been updated to allow VM/ESA, when running in an LPAR controlling the dynamic I/O configuration changes, to define integrated cluster bus channels for an OS/390 LPAR on the same Central Electronics Complex (CEC).

Support for Fibre Connection (FICON) Channels

VM/ESA provides support for FICON channels for S/390 CMOS processors that support this channel type. FICON channel technology can improve system performance and total aggregate system bandwidth. Each FICON channel provides the equivalent of eight ESCON channels. VM/ESA support includes:

- Dynamic I/O configuration support for the new FICON and FICON-converter channel types
- Support for the fibre-channel-to-ESCON® converter function on the 9032-5 switch
- Support for the FICON 9042-1 switch
- Support for the S/390 architecture changes in the SCHIB, ORB, and IRB
- A new CP monitor record, Extended Channel Path Measurement Data

Guest Cryptographic Support

This support provides VM/ESA guest virtual machine access to the S/390 CMOS Cryptographic Coprocessor by extending the existing VM/ESA guest cryptographic support for Bipolar processors. The new cryptographic support is upwardly compatible with the existing Bipolar support.

This support is intended primarily for use by OS/390 Integrated Cryptographic Service Facility (ICSF) applications running in an OS/390 guest of VM/ESA. ICSF is

currently the only IBM application program interface to the S/390 CMOS cryptographic hardware. The following commands and statements were updated:

- CP DEFINE CRYPTO command
- CP QUERY CRYPTO command
- CP QUERY VIRTUAL CRYPTO command
- CP SET CRYPTO command
- CPU directory control statement
- CRYPTO directory control statement

Support for IEEE Floating Point

New function has been added to support IEEE Floating Point hardware on S/390 G5 and G6 Servers. The VM/ESA Control Program was updated to allow multiple levels of guest operating systems to use basic floating point extensions, floating point support extensions, hexadecimal floating point extensions, and binary floating point.

This support includes preservation and restoration of 16 floating point registers (Additional Floating Point registers 1,3,5,7,8-15 plus existing floating point registers 0,2,4,6) and the Floating Point Control (FPC) register which is provided by the IEEE Floating Point hardware. The following were updated:

- CP DISPLAY Registers command
- CP STORE (Registers) command
- CP STORE STATUS command
- CP TRACE command
- Messages HCP6153E and HCP6154E (new)

Note: Applications that exploit the IEEE Floating Point hardware require the IBM High Level Assembler Version 1 Release 3.0.

Support for Extended-TOD-Clock

The Extended-TOD-clock facility is a hardware facility available on certain processors which provides a 128-bit Time of Day (TOD) clock. VM/ESA supports the use of the Extended-TOD-clock facility from XA, ESA, and XC virtual machines.

Application Development and Deployment

This section describes enhancements to aid application development and deployment on VM/ESA.

CMS OS Simulation Enhancements

CMS OS Simulation support has been enhanced as follows:

- The CMS FILEDEF command has been changed to allow record length (LRECL) definitions up to 65535 bytes for variable spanned OS records and non-OS CMS files, and block size (BLOCK or BLKSIZE) definitions up to 65535 bytes for non-OS CMS files.
- The CMS LKED command has been changed to allow larger default work area sizes (SIZE option): 400K for *value1* and 100K for *value2*.
- The CMS MOVEFILE command has been changed to allow the processing of QSAM variable spanned records up to 65535 bytes in length under the

New Functions, Enhancements, and Changes

Extended Logical Record Interface (XLRI). MOVEFILE can also process non-OS CMS files up to 65535 bytes.

- The CMS QUERY FILEDEF command has a new optional operand, ATTRIBUT, which allows you to display the RECFM, LRECL, and block size attributes associated with the current FILEDEF.
- OS Simulation DCB macro processing has been changed to allow it to describe and pass both LRI and XLRI conventions for QSAM variable spanned long records, up to 65535 bytes in length, for subsequent OPEN, CLOSE, GET, or PUT processing. DCB can now also describe non-OS CMS files up to 65535 bytes in length.
- The OS Simulation OPEN, CLOSE, GET, and PUT macros, and the SVC 19 and SVC 20 supervisor calls, have been changed to allow the processing of OS formatted variable spanned QSAM records and non-OS CMS files up to 65535 bytes in length.
- The OS Simulation tape processing routines, such as DMSTVS, will issue a new message, DMS2139I, if SENSE data from a tape mount indicates that the mounted tape cartridge may be incorrect for the tape device in use. These tape processing routines may be invoked by MOVEFILE processing and by the following OS Simulation macros: OPEN, CLOSE, GET, PUT, READ, WRITE, and FEOV.
- > • APAR VM62366 provides the new SET TAPENEVR and QUERY TAPENEVR
> commands. The SET TAPENEVR command allows you to control CMS OS
> Simulation tape label date checking for 'Unexpired Files'. The QUERY
> TAPENEVR command allows you to display the current setting.

For more information, see the following books:

- *VM/ESA: CMS Application Development Guide for Assembler*
- *VM/ESA: CMS Command Reference*

OpenEdition for VM/ESA Enhancements

Enhancements to OpenEdition for VM/ESA include:

- New realpath (BPX1RPH) Callable Service
The realpath (BPX1RPH) service finds the absolute path name for a specified relative path name. Any dot (.) or dot dot (..) components, symbolic links, or mount external links included in the relative path name input are resolved in the absolute path name output.
- New setopen (BPX1VM6) Callable Service
The setopen (BPX1VM6) service sets certain flags specific to the OpenEdition for VM/ESA platform without creating a new POSIX process in the virtual machine. The function codes used in the setopen service are mapped by the BPXYVM6 macro.
- Enhancements to openvmf (BPX1VM5) Callable Service
The openvmf (BPX1VM5) service has been enhanced with the new VM5_RESOLVE_PATH function code. This function resolves a BFS path name to its fully-qualified BFS system root. An equate for this function has been added to the BPXYVM5 mapping macro.

For more information, see the following book:

- *IBM OpenEdition for VM/ESA: Callable Services Reference*

Pipelines Enhancements

The DATECONVERT and READER stages have been enhanced.

For more information, see the following book:

- *VM/ESA: CMS Pipelines Reference*

REXX DATE Function Enhancement

Two parameters have been added to the DATE function to allow you to independently define the separator character used for input and output dates.

For more information, see the following book:

- *VM/ESA: REXX/VM Reference*

Operating System Enhancements

This section describes new or enhanced VM/ESA operating system functions.

Dynamic CP Exits

You can define CP exit points dynamically using the DEFINE EXIT command or system configuration file statement. A dynamic CP exit point behaves just like a formally-defined exit point, except that its ability to influence subsequent processing in the module containing the exit point is limited. Dynamic exits provide a convenient way to collect diagnostic or other information or to handle many situations in which the flow of control of a CP module does not need to be changed extensively.

The MODIFY EXIT command or system configuration file statement allows you to change the definition of an existing dynamic CP exit point or remove it from the system. The QUERY EXITS command has been enhanced to display additional information about a dynamic exit: exit location, characteristics, and parameter definitions.

For more information, see the following books:

- *VM/ESA: CP Exit Customization*
- *VM/ESA: CP Command and Utility Reference*
- *VM/ESA: Planning and Administration*

VMFREM Command

The new VMFREM command removes PTFs applied by the VMFAPPLY command. It can also remove PTFs received by the VMFREC command.

For more information, see the following book:

- *VM/ESA: VMSES/E Introduction and Reference*

Other Changes

This section describes other important changes to VM/ESA.

VM/ESA Is Euro Ready

Support has been added to the following:

- Almost 200 new translation tables have been added to VM TCP/IP.
- A new CSL routine, DTCXLATE, provides an application programming interface (API) for programs to use the translation information contained in the TCP/IP translation tables.
- OPENVM GETBFS and PUTBFS commands were updated, increasing the number of code pages that could be specified.
- The FTP server and VM/ESA Version 2 Release 3 TCP/IP FL310 NFS feature have been updated to allow specification of particular translation tables.
- Language Environment V1R6 and V1R8
- LANRES
- LFS
- The TCP/IP LPR client and LPD server applications have been enhanced to provide users with the ability to specify alternate translation tables.
- RSCS LPR/LPD
- SMTP

For more information, see the euro link on the VM/ESA home page.

VM/ESA Library Changes

This section describes major changes to the entire VM/ESA library.

PDF Files

Adobe Portable Document Format (PDF) versions of VM/ESA books that have been updated with new editions for this release are provided on the *IBM Online Library Omnibus Edition: VM Collection* CD-ROM and on the VM/ESA home page. (Some related licensed program books with new editions have also been included.)

Most Printed Books Now Provided in Priced Features

VM/ESA books that are needed to install or configure VM/ESA or some part of the product are considered *basic*. Printed versions of basic books are supplied automatically when you order VM/ESA or an associated product feature. All other printed books are considered *optional* and are available for a fee. See “Basic (Automatically Shipped) VM/ESA Library” on page 64 and “Optional Printed VM/ESA Books” on page 65.

Chapter 3. Technical Information

This chapter discusses the hardware and software (program) requirements of VM/ESA, packaging and ordering information, and restrictions on the operation of this product. It contains the following sections:

- “Hardware Requirements”
- “Supported Processor Modes” on page 22
- “Device Support” on page 22
- “Program Requirements” on page 23
- “Operating Systems Supported as Guests” on page 33
- “Other Programs Supported on VM/ESA” on page 33
- “National Language Support (NLS)” on page 33
- “Packaging and Ordering Information” on page 34
- “Object Code Only and Limited Source Availability” on page 36
- “Restrictions” on page 36
- “Integrity and Security of VM/ESA” on page 37

Note: Some technical information may have changed since this book was published. For the latest requirements for any IBM licensed program, you should review the product installation information (Install Bucket) on HONE.

Hardware Requirements

This section describes the minimum hardware and storage required for VM/ESA and for its additional facilities and optional features. It covers the following topics:

- “Minimum Hardware Configuration for the VM/ESA Base”
- “Storage Requirements” on page 16
- “Cross-System Extensions Hardware Requirements” on page 17
- “VM/ESA GUI Facility Hardware Requirements” on page 17
- “OSA and OSA/SF Hardware Requirements” on page 17
- “TCP/IP Feature for VM/ESA Hardware Requirements” on page 18
- “LAN File Services/ESA Feature Hardware Requirements” on page 18
- “LANRES/VM Feature Hardware Requirements” on page 20

Minimum Hardware Configuration for the VM/ESA Base

The minimum hardware configuration supported is:

- A processor capable of running the ESA/390™ architecture or ESA/370 architecture (see “Supported Processor Modes” on page 22).

Note: VM Data Spaces support requires an ESA/390 processor.

The processor must have:

- At least 8MB of real storage
- One processor unit
- One processor controller or support processor
- One channel subsystem
- One system console (to control the hardware processor)
- One operator console (to control the operating system; depending on the processor type, this may be the same physical device as the system console)
- Direct access storage devices:

Technical Information

- Seven 3380 single-density or
- Four 3380 double-density or
- Three 3380 triple-density or
- Five 3390 single-density or
- Three 3390 double-density or
- Two 3390 triple-density or
- Four 9345 Model 1s or
- Three 9345 Model 2s or
- Nine 9335 single-density or
- Eight 9336 Model-10s or
- Four 9336 Model-20s

Notes:

1. Although the 3370 and 9332 FBA DASD are supported natively, they are not supported as installation devices. Also, the 3390 Model 9 is not supported for installation.
 2. If you choose not to install some optional components and other items, your DASD requirements may be less than indicated above. For more information, see the *VM/ESA: Installation Guide*.
- One of the following input devices:
 - 6250-bpi 9-track magnetic tape unit
 - 3480 tape subsystem
 - 3490 tape subsystem
 - 3490E tape subsystem
 - 4mm variable-block tape cartridge unit
 - CD-ROM

It is highly recommended that a printer be included in the hardware configuration so that if a problem is encountered during IPL, important diagnostic information can be obtained.

Storage Requirements

The minimum real storage needed to generate VM/ESA is 8MB, and VM/ESA requires at least 8MB of real storage to function.

The block paging function requires more DASD space to transfer pages at maximum efficiency and speed.

You may need to increase the DASD space allocated for spooling because of the use of the spool file limit relief function in VM/ESA.

If you use a nonshared copy of CMS, your virtual machine size must be at least 20MB. If you use CMS as a named saved system (NSS), your virtual machine size must be at least 2MB (provided that CSL libraries have also been saved as a saved segment).

Cross-System Extensions Hardware Requirements

The Cross-System Extensions (CSE) function requires certain hardware, as follows:

- The CSE complex consists of two, three, or four VM/ESA systems.
- The systems in the CSE complex must be connected by channel-to-channel adapters or an IBM 3088 Multisystem Channel Communications Unit (MCCU).
- DASD shared by systems in the complex must be count-key-data (CKD) devices. Fixed-block architecture (FBA) devices are supported by the CSE function for spooling only. The cross system link function of CSE is not supported for FBA devices.

VM/ESA GUI Facility Hardware Requirements

The VM/ESA GUI Facility has the following hardware requirements.

Host System

Any System/390® processor supported by this VM/ESA release with the appropriate host network attachment devices for either TCP/IP or APPC.

Workstation

You can use programmable workstations or RS/6000® workstations. You do not need both types, but both are supported.

Programmable Workstation: This type of workstation should have the following minimum specifications:

- 486 processor
- 2 MB available disk storage
- 8 MB of memory

RS/6000 Workstation: This type of workstation should have the following minimum specifications:

- RS/6000 machine (model 340 or higher)
- 8 MB available disk storage

OSA and OSA/SF Hardware Requirements

A full list of OSA and OSA/SF hardware requirements is too detailed for the scope of this book. For that information, especially for the S/390 processors that the OSA supports, refer to the IBM sales manual or *Planning for the System/390 Open Systems Adapter Feature*.

Only the following basic hardware requirements are listed here:

- An OSA-2 can be used for data transfer to a directly-attached FDDI, Ethernet, or token-ring LAN. The type of OSA port connection determines its attachments.
- An ATM OSA-2 is required for data transfer across an emulated Ethernet or token-ring LAN in an ATM-based network.

OSA/SF requires general disk space and a minidisk for each user ID. OSA/SF requires its own user ID and also requires a maintenance user ID for its installation. Refer to the OSA/SF for VM/ESA program directory for more information.

To use the OSA/SF OS/2 (GUI) interface, you also need:

- A workstation with at least an 80386SX, 16MHz microprocessor. (An 80486 microprocessor is recommended.)
- Sufficient memory to support IBM OS/2 3.0 or OS/2-J 3.0 (WARP). (8MB or more is recommended.)
- 5MB of memory on the programmable workstation for installation

The hardware requirements for OSA/SF for MVS/ESA™ or OSA/SF as a base, nonexclusive element of OS/390 fall outside the scope of this book. For these, refer to *Planning for the System/390 Open Systems Adapter Feature*.

TCP/IP Feature for VM/ESA Hardware Requirements

The TCP/IP Feature for VM/ESA requires one of the following network processors:

- IBM 3172 Interconnect Controller with the Interconnect Controller Program (ICP) Version 3 (5621-425) or the TCP/IP Offload Feature for VM/ESA
- IBM Open Systems Adapter (OSA)

TCP/IP Feature for VM/ESA support of the OSA is equivalent to the IBM 3172 Interconnect Controller Model 1 and 2.

- IBM 37xx Communications Controller using X.25 or SNA connections

Native attachment of the IBM 3745 to TCP/IP and associated dynamic IP routing within the 3745 are not supported.

- IBM 8232 LAN Channel Station Model 1 or 2
- HYPERchannel A220 Processor Adapter 42990007

TCP/IP Feature for VM/ESA supports the HYPERchannel Series A devices (and HYPERchannel Series DX devices that are functioning as Series A devices). For additional information, see the appropriate Network Systems Corporation documentation.

- IBM ES/9000® or IBM 9221 with the Integrated Communication Processor

The IBM ES/9000 and 9221 configurations are supported by TCP/IP Feature for VM/ESA when configured for Token-Ring LANs, Ethernet LANs, or X.25 subsystems, depending on the adapters installed.

- IBM RISC System/6000® Channel Attachment using the Block Multiplexer Channel or ESCON Adapter
- IBM 3088 Multi-system Channel Communication Unit

TCP/IP Feature for VM/ESA supports direct connection to another TCP/IP for VM or MVS using the IBM 3088.

LAN File Services/ESA Feature Hardware Requirements

The LAN File Services/ESA feature has the following hardware requirements:

- An IBM System/370™ or System/390 processor or equivalent
- To use the IBM 3172 Interconnect Controller Model 3 as a workstation platform:
 - IBM 3172 Interconnect Controller Model 3 with one of the following features:
 - Hardware Package1 (Feature code 2710)

- Hardware Package2 (Feature code 2720)

See the IBM 3172-003 Interconnect Controller Model 003 Sales Manual for descriptions of these features.

- For ESCON support, order the IBM ESCON Adapter (Feature code 2800)
- For parallel channel, order the Parallel Channel Adapter (Feature code 2501)
- 66 MHz Pentium Processor (Feature code 2850)
- For additional memory in 16MB increments up to 64MB, order Feature code 2810.

Note: Additional memory (from 16MB to 64MB) provides more room for caching, which means better performance for clients. With more memory, more files and volumes may be supported and the 3172 can also more easily perform non-LFS/ESA functions.

- A LAN adapter supported by OS/2

Please refer to the HONE Sales Manual for additional details on 3172 Model 3 requirements.

- For channel connectivity using a PS/2:
 - An IBM Personal System/2 (PS/2) Micro Channel to Mainframe Connection Card (MMC):
 - The MMC requires a PS/2 Model 70 or higher microchannel machine. Please refer to the Micro Channel to Mainframe Connection Hardware Announcement 192-156, dated June 6, 1992, for specific PS/2 models supported.
 - The MMC card will support the following models of the PS/55:
 - 5580-Y0B/Y0C/YEC/Y1C
 - 5571-T0A/V1A/V1B/V1C
 - A minimum of 80MB hard disk space
 - A minimum of 16MB RAM
 - A LAN adapter supported by OS/2
- For OS/2 or DOS coax-connected workstations to LAN File Services/ESA through the OS/2 LAN Server:
 - IBM 3174 Peer Communications RPQ 8Q0718 or the IBM 3174 Peer Communications Feature (8010 or 8060)

The following Japanese clients are supported by IBM 3174 Peer Communications:

 - OS/2 V J2.1
 - OS/2 V J2.0
 - OS/2 EE J1.3
- A workstation capable of running either:
 - OS/2 LAN Server Version 4.0 -- Advanced
 - OS/2 LAN Server Version 4.0 -- Advanced at corrective service diskette level IP07040 or higher with LAN Server Ultimedia 1.0

- A Personal System/55 capable of running one of these versions of OS/2 LAN Server:
 - OS/2 LAN Server Version H4.0 -- Advanced
 - OS/2 LAN Server Version J4.0 -- Advanced
 - OS/2 LAN Server Version J4.0 -- Advanced at corrective service diskette level IPJ7045A or higher with LAN Server Ultimedia 1.0
 - OS/2 LAN Server Version T4.0 -- Advanced
- A minimum of 80MB fixed disk
- A minimum of 10MB RAM (16MB is recommended)
- A LAN adapter supported by OS/2

LANRES/VM Feature Hardware Requirements

The LANRES/VM feature has the following hardware requirements:

- AN IBM S/390 or ESA/370 host processor (or equivalent) with:
 - One of the following tape drives:
 - 9 track/1600 bpi magnetic tape drive
 - 9 track/6250 bpi magnetic tape drive
 - 18 track/38K 3480 cartridge tape system

Note: IBM Micro Channel® 370 Models 110, 112, and 114 are not supported.
 - One of following DASD is recommended for product programs and associated files:
 - FBA -- 103200 blocks
 - 3390 -- 86 cylinders
 - 3380 -- 86 cylinders
 - 3375 -- 138 cylinders
 - 3350 -- 118 cylinders
- One of the following on which to run the NetWare operating system:
 - An IBM Micro Channel PS/2 (or equivalent) capable of running NetWare Version 3.11, Version 3.12, Version 4.01, or Version 4.02 with:
 - A minimum of 70MB hard disk
 - A minimum of 12MB RAM (16MB is recommended)

Note: More memory provides more room for caching, which means better performance for clients. With more memory, more files and volumes may be supported and the PS/2 can more easily perform non-LANRES/VM functions (the PS/2 does not have to be dedicated to LANRES/VM).
 - A 3.5-inch 1.44MB-capable diskette drive
 - A LAN adapter
 - One or more of the following connectivities:
 - An IBM PS/2 Micro Channel to Mainframe Connection

Refer to Hardware Announcement 192-156, dated June 30, 1992, for description, supported models, and ordering information.

- Hardware as required to support SNA LU6.2 communications

Refer to the appropriate NetWare for SAA Administration Guide for details.

- Hardware as required to support TCP/IP

Refer to the appropriate NetWare TCP/IP Transport Supervisor's Guide for details.

- An IBM 3172 Interconnect Controller Model 3 with the following:

- Hardware Package1 (Feature code 2710) or Hardware Package2 (Feature code 2720)
- 66 MHz Pentium® processor (Feature code 2850)
- A LAN adapter supported by the NetWare operating system

Notes:

1. Additional memory provides more room for caching, which means better performance for clients. With more memory, more files and volumes may be supported and the controller can more easily perform non-LANRES/VM functions. For additional memory in 16MB increments up to 64MB, order feature code 2810.
2. Refer to the HONE Sales manual for additional details on 3172 Model 3 requirements.
3. NetWare v3.11J from IBM and NetWare 3.12J/V from IBM cannot be used on the 3172-3.

- One or more of the following connectivities:

- For ESCON support, order the IBM ESCON Adapter (Feature code 2800); for parallel channel, order the Parallel Channel Adapter (Feature code 2501)

- Hardware as required to support SNA LU6.2 communications

Refer to the appropriate NetWare for SAA Administration Guide for details.

- Hardware as required to support TCP/IP

Refer to the appropriate NetWare TCP/IP Transport Supervisor's Guide for details.

- An IBM PS/55 (or equivalent) capable of running NetWare v3.11J from IBM or NetWare 3.12J/V from IBM with the following:

- A minimum of 70MB hard disk
- A minimum of 12MB RAM (16MB is recommended)
- A 3.5-inch 1.44MB-capable diskette drive
- A LAN adapter
- One or more of the following connectivities:

- An IBM PS/2 Micro Channel to Mainframe Connection

Refer to Hardware Announcement 192-156, dated June 30, 1992, for description, supported models, and ordering information.

- Hardware as required to support TCP/IP

Refer to the appropriate NetWare TCP/IP Transport Supervisor's Guide for details.

This requires NetWare for SAA 1.3B from IBM (Japanese Version) and NetWare 3.12J/V from IBM. Refer to the appropriate NetWare for SAA Administration Guide for details.

Supported Processor Modes

VM/ESA runs in ESA/390 mode on supported S/390 Parallel Enterprise Servers, S/390 Multiprise® servers, and ES/9000 processors. VM/ESA runs in ESA/370 mode on supported ES/3090™ processors and the 4381 Models 90, 91, and 92. The performance characteristics of VM/ESA may vary by processor or configuration.

In order to use VM Data Spaces, your processor must be capable of running the ESA/390 architecture.

For information on how VM/ESA operates with the PR/SM™ feature, see “Processor Resource/Systems Manager™ (PR/SM)” on page 45.

For a list of the IBM processors supported by current VM/ESA operating systems, see Appendix A, “IBM Processors Supported by VM/ESA” on page 93.

Device Support

VM/ESA handles real devices as supported or unsupported.

Supported Devices

A supported device is one of those listed in Appendix C, “IBM Devices Supported by VM/ESA” on page 101. The use of such a device is fully supported by IBM through the service support available with VM/ESA. A supported device can be supported either for CP and guest use or for dedicated use by only a single guest.

A device supported for CP and guest use is one that CP and virtual machines can use. CP provides system services for the device, including error recovery for guest DIAGNOSE I/O requests, and a full command set (that is, you can use all of the device-oriented CP commands for the device). Such a device can also be shared among multiple guests if appropriate (as, for example, in the case of a DASD), or it can be dedicated to the exclusive use of a single guest.

A device supported for dedicated use by a single guest can be logically attached to only a single guest virtual machine at any one time. The guest must be capable of running with the device. CP cannot use the device itself, and DIAGNOSE I/O services are not available to the guest for such a device.

Unsupported Devices

In addition to the devices listed in Appendix C, “IBM Devices Supported by VM/ESA” on page 101, you can also connect other devices to VM/ESA if they are equivalent or similar to any of the supported devices. Such other devices are referred to as unsupported devices, and proper operation of such devices with VM/ESA and guest operating systems is your responsibility. IBM does not guarantee that unsupported devices run properly with VM/ESA, and service support for such device attachments is not supplied.

If a device is absolutely equivalent to a supported device, you can define it as such and use it in any way you would use the corresponding supported device. You are responsible for the determination of equivalence.

If a device is not equivalent to any supported device but is more or less similar to one, you can define it as an unsupported device. An unsupported device must be dedicated to a single guest; that is, an unsupported device cannot be a system or CP-owned device. You define an unsupported device by calling it a device type other than any of those shown in Appendix C, “IBM Devices Supported by VM/ESA” on page 101, and by specifying the CLASS operand of the RDEVICE macro. The CLASS value should be the one that comes closest to accurately describing the unsupported device (for example, DASD or TAPE). See the *VM/ESA: Planning and Administration* book for details of the definition and customization processes for unsupported devices.

Program Requirements

This section lists the licensed programs and other program materials required by VM/ESA and by its additional facilities and optional features. It covers the following topics:

- “Program Requirements for the VM/ESA Base” on page 24
- “Cross-System Extensions Program Requirements” on page 25
- “VM/ESA GUI Facility Program Requirements” on page 25
- “OpenEdition for VM/ESA Services (POSIX) Program Requirements” on page 26
- “DFSMS/VM® Program Requirements” on page 26
- “OSA and OSA/SF Program Requirements” on page 27
- “Language Environment Program Requirements” on page 28
- “CMS Utilities Feature Program Requirements” on page 28
- “TCP/IP Feature for VM/ESA Program Requirements” on page 28
- “OpenEdition Shell and Utilities Feature for VM/ESA Program Requirements” on page 29
- “OpenEdition DCE Feature for VM/ESA Program Requirements” on page 29
- “LAN File Services/ESA Feature Program Requirements” on page 29
- “LANRES/VM Feature Program Requirements” on page 30
- “Online Books Program Requirements” on page 32

Program Requirements for the VM/ESA Base

The following IBM licensed programs are required:

- Environmental Record Editing and Printing (EREP/VM) Version 3 (5654-260) Release 5.0 with APAR VM61870
- Device Support Facilities: ICKDSF for VM (5684-042) Release 16 or later

Note: EREP/VM and ICKDSF are preinstalled on VM/ESA. Therefore, when ordering VM/ESA, you must already be licensed for these programs or you must place a separate order for each program to establish a license. Both the CMS version of ICKDSF and an IPLable standalone version (5747-DS1) are supplied with VM/ESA.

The IBM High Level Assembler Version 1 (5696-234), Release 2.0 or later, although not a prerequisite for VM/ESA, is required for various tasks and functions, including:

- Installation:
 - Adding devices that cannot be sensed (updating HCPRIO ASSEMBLE)
 - Local modifications
- Servicing the CP Loader (HCPLDR)
- Creating a new DMSTRT for system languages (NLS)
- Creating image libraries for system printers (FCBs)
- Creating GCS application segments (CONTENTS macro)
- Accessing major CMS application interfaces (CMSCALL)
- Accessing most CP application interfaces (DIAGNOSE)
- Creating the Stand-Alone Dump Utility (HCPSADMP EXEC)
- Modifying the AVS tuning control module (AGWTUN)
- Using RAS tools such as MDCHECK, FS2SFSER, AFTCHAIN, PRINTBLK, PRINTFST, and so on
- Using the API for data compression
- Using the CMS Pipelines assembler macro interface
- Using the VM/ESA GUI Facility assembler interface
- Customizing Language Environment or compiling assembler routines used in mixed-language user applications
- Using exit routines in products such as DirMaint and RSCS
- Installing and servicing RTM/ESA

The IBM High Level Assembler Version 1 (5696-234) Release 3.0 is required for:

- Assembling the following CP modules: HCPFST, HCPMCH, HCPRUN, and HCPWRU
- Running applications that exploit the IEEE Floating Point hardware facility

Installation of VM/ESA from CD-ROM requires:

- IBM Optical Media Attach/2 Enabler Kit (5622-138), which contains the Optical Media Attach/2 Program (5621-264)

If a security product (external security manager) is needed:

- Resource Access Control Facility (RACF®) Version 1 for VM (5740-XXH) Release 10.0 or its equivalent.

Cross-System Extensions Program Requirements

A Cross-System Extensions (CSE) complex consists of two, three, or four VM/ESA systems (excluding VM/ESA 1.1.5 370 Feature).

The following IBM licensed programs are required to support the CSE function:

- Directory Maintenance VM/ESA (DirMaint) Version 1 (5748-XE4) Release 5.0
- VM/Pass-Through Facility Version 2 (5684-100) Release 1.0 or later

A complex that contains both CSE and VM/ISF has these additional requirements:

- PTFs to VM/ISF Releases 1 and 2 that make communication with CSE possible
- The addition of the ISFNDSYN macro to the VM/ISF DUKSYS ASSEMBLE module
- Two dedicated RSCS virtual machines for the spool file bridge, one for the CSE side of the complex and one for the VM/ISF side of the complex
- The WAKEUP utility program distributed with the CMS Utilities Feature

VM/ESA GUI Facility Program Requirements

The VM/ESA GUI Facility has the following program requirements for the host system and the workstation.

Host System

In order for the VM/ESA GUI Facility to communicate properly with the workstation agent, you need the following software installed and operational on your host system.

Base Operating System:

- VM/ESA Version 2 Release 4.0

TCP/IP Environment: If your host is operating in a TCP/IP environment, you need:

- TCP/IP Feature for VM/ESA Function Level 320

APPC Environment: If your host is operating in an APPC environment, you need:

- AVS and GCS components of VM/ESA
- ACF/VTAM® Version 4.2.0 for VM/ESA (5654-010)

Programming Environment: To write host GUI programs, one or more of the following host and workstation language products are required:

- IBM High Level Assembler Version 1 (5696-234) Release 2 or later
- IBM C for VM/ESA Version 3 (5654-033) Release 1
- SAS C/C ++ 5.50K (available from SAS Corporation)
- REXX/VM component of VM/ESA

Workstation

In order for the VM/ESA GUI Facility Workstation Agent to communicate properly with the host, you need the following software installed and running on your workstation.

For TCP/IP environments, the following workstation products are supported:

Operating System (Minimum Level)	Connectivity Product (Minimum Level)
IBM OS/2 Warp	One of the following: <ul style="list-style-type: none"> • IBM TCP/IP for OS/2 Version 2.0 • IBM TCP/IP for OS/2 Version 3.0 • Novell LAN Workplace for OS/2 Version 3.0
Windows 95	<ul style="list-style-type: none"> • TCP/IP connectivity is included in Windows 95
Windows NT®	<ul style="list-style-type: none"> • TCP/IP connectivity is included in Windows NT
AIX® 3.2.5 with AIX Windows	<ul style="list-style-type: none"> • TCP/IP connectivity is included in AIX

For APPC environments, the following workstation products are supported:

Operating System (Minimum Level)	Connectivity Product (Minimum Level)
IBM OS/2 Warp	<ul style="list-style-type: none"> • IBM Communications Manager/2 Version 1.11 • Communications Server/2 (CS/2) Version 4.0 Access feature for OS/2 Warp

Host to Workstation Download Capability: In order to install the Workstation Agent, you need to download files from the host to your workstation. You can use FTP to complete the file transfer, or any other appropriate download utility.

OpenEdition for VM/ESA Services (POSIX) Program Requirements

To do OpenEdition application development in C, you need the C compiler included in the following licensed program:

- IBM C for VM/ESA Version 3 (5654-033) Release 1.0

DFSMS/VM® Program Requirements

DFSMS/VM requires the following licensed programs:

- Interactive System Production Facility (ISPF) Version 3 (5684-043) Release 2.0 or later to use the Interactive Storage Management Facility (ISMF) functions

Note: ISPF is not required if only 3495 Tape Library Dataserver support is needed.
- CMS Utilities Feature 1.1.1 to use the BROWSE and EDIT functions
- Directory Maintenance VM/ESA (DirMaint) Version 1 (5748-XE4) Release 5.0 to use the minidisk management functions

- RACF/VM Version 1 (4740-XXH) Release 10.0, or an equivalent product, if an external security manager is needed
- ADSTAR® Distributed Storage Manager Version 2.1.0 (5654-A02), or Tivoli ADSM for VM Version 3 (5697-VM3), to use the Migration Level 2 (ML2) function
- TCP/IP Feature for VM/ESA Function Level 320 to access the 3495 Tape Library Dataserver for processors capable of 3490/3490E tape I/O but incapable of 3495 control (foreign host support)
- Language Environment (supplied with VM/ESA) if the space management function or foreign host support for the 3495 Tape Library Dataserver is needed
- Remote Spooling Communications Subsystem Networking (RSCS) Version 3 (5684-096) Release 1.1 or later for remote operations
- IBM Compiler for REXX/370 (5695-013) and IBM Library for REXX/370 (5695-014) if the compiled REXX installation-wide exit or a compiled ACS REXX exit is desired

DFSMS/VM APAR VM61214 is required for Year 2000 support.

OSA and OSA/SF Program Requirements

OSA/SF for VM/ESA can be accessed by CMS user ID, by a REXX call to the OSA/SF API, and at the OSA/SF OS/2 (GUI) interface.

Access at the OSA/SF OS/2 (GUI) interface requires IBM OS/2 3.0 (WARP) and one of the following communications protocols:

- EHLLAPI (3270), which requires Communications Manager/2 1.1 on the workstation being used
- TCP/IP, which requires TCP/IP 2.0 for OS/2 on the workstation
- APPC (CPI-C), which requires Communications Manager/2 1.1

OSA/SF for MVS/ESA or OSA/SF as a base, nonexclusive element of OS/390 can also be used in the VM/ESA environment, starting with VM/ESA 1.2.1. Note that:

- Until VM/ESA 2.1.0, the OSA device type is listed or displayed as a CTCA, and OSA/SF must be running on MVS/ESA or OS/390 in LPAR mode in the same system complex as the VM/ESA partition to which the OSA is defined.
- Starting with VM/ESA 2.1.0, the OSA is recognized as TYPE=OSA, and OSA/SF can be running either in an LPAR in the same system complex or as a guest in the VM/ESA environment. (In the latter case, VM/ESA must be authorized to put OSA/SF in the VM guest's directory.)

To support an OSA in its TCP/IP Passthru mode in a VM/ESA environment, OSA/SF requires TCP/IP Feature for VM/ESA Function Level 320. OSA/SF support is required in this mode only if access to one of the OSA's ports is being shared by more than one host program or if an ATM OSA-2 is being used as a LAN emulation client (LEC).

Language Environment Program Requirements

To do Language Environment customization, or to compile assembler routines included in mixed-language user applications, you need the following licensed program:

- IBM High Level Assembler Version 1 (5696-234) Release 2.0 or later

CMS Utilities Feature Program Requirements

To enable the DIRMAP utility of the CMS Utilities Feature to process directory statements that are continued across multiple records, such as the statements for POSIX support (POSIXOPT, POSIXINFO, POSIXGLIST, and POSIXGROUP), APAR VM58937 must be applied.

Note: This function is now provided in Directory Maintenance VM/ESA (DirMaint) Version 1 (5798-XE4) Release 5.0.

APAR VM60540 is required for Year 2000 support.

TCP/IP Feature for VM/ESA Program Requirements

TCP/IP Feature for VM/ESA Function Level 320 requires:

- VM/ESA 2.4.0 (Function Level 320 cannot be used with previous levels of CP and CMS)
- Language Environment supplied with VM/ESA 2.4.0 (previous versions of Language Environment cannot be used)

TCP/IP Feature for VM/ESA has the following additional program requirements:

- If a primary or secondary domain name server is to be run (not a caching-only name server), or the Network Data Base server is to be run:
 - IBM DB2 Server for VSE & VM Version 5 (5648-158) Release 1.0 or later.
- For SNAlink LU0 interface support:
 - ACF/VTAM Version 4.2.0 for VM/ESA (5654-010)
- For X.25 interface support:
 - X.25 NCP Packet Switching Interface (NPSI) Version 3 (5688-035) Release 4 or later for 3745 or 3720
 - X.25 NPSI Version 2 (5668-719) Release 1 for 3725
 - Corresponding levels of ACF/VTAM and ACF/NCP that support NPSI
- If programs are developed in C:
 - IBM C for VM/ESA Version 3 (5654-033) Release 1
- If programs are developed in Pascal:
 - IBM VS Pascal Version 1 (5668-767) Release 2 Compiler and Library
- To use the SNMP (monitor) client support with NewView:
 - NetView for VM/ESA Version 2 (5756-051) Release 3

For more information about program requirements for the TCP/IP Feature for VM/ESA, see *VM/ESA: TCP/IP Function Level 320 Planning and Customization*.

OpenEdition Shell and Utilities Feature for VM/ESA Program Requirements

To do OpenEdition application development in C, you need the C compiler included in the following licensed program:

- IBM C for VM/ESA Version 3 (5654-033) Release 1.0

OpenEdition DCE Feature for VM/ESA Program Requirements

The OpenEdition DCE Feature for VM/ESA requires the following:

- TCP/IP Feature for VM/ESA Function Level 320
- IBM C for VM/ESA Version 3 (5654-033) Release 1.0

LAN File Services/ESA Feature Program Requirements

The LAN File Services/ESA feature has the following programming requirements:

- Prerequisites:
 - IBM C/370 Library Version 2 (5688-188) Release 2
- Optional corequisites:
 - If file level backup of LAN File Services/ESA data is required, use ADSTAR Distributed Storage Manager (5684-020) or Tivoli ADSM for VM Version 3 (5697-VM3).
 - RACF Version 1 for VM (5740-XXH) Release 10, or an equivalent external security manager, if using NFS File Server support.
 - TCP/IP Feature for VM/ESA Function Level 320, if Network File System (NFS) support is required.
 - ACF/VTAM Version 4.2.0 for VM/ESA (5654-010), if SNA connectivity is required.
 - BookManager® READ/VM (5684-062) Release 3, if using optional softcopy publications.
- Connectivity products required on the OS/2 LAN Server:
 - When using the OS/2 Common Link Access to Workstation (CLAW) device driver (shipped with LFS/ESA) with either the IBM PS/2 Micro Channel to Mainframe Connection card or the 3172 Interconnect Controller Model 003 and ESCON:
 - CLAW connectivity no longer requires an RIO370 area, if running in an ESA mode virtual machine on VM/ESA.
 - When using an SNA network, the following is required:
 - Communications Manager/2 Version 1.1 or later
- OS/2 LAN Server support requires one of the following OS/2 LAN Servers:
 - OS/2 LAN Server Version 4.0 -- Advanced
 - OS/2 LAN Server Version 4.0 -- Advanced at corrective service diskette level IP07040 or higher with LAN Server Ultimedia 1.0
 - OS/2 LAN Server Version H4.0 -- Advanced
 - OS/2 LAN Server Version J4.0 -- Advanced

- OS/2 LAN Server Version J4.0 -- Advanced at corrective service diskette level IPJ7045A or higher with LAN Server Ultimedia J1.0
- OS/2 LAN Server Version T4.0 -- Advanced
- OS/2 NFS Offload programming requirements:
 - OS/2 Version 2.0 or later
 - TCP/IP for OS/2 Version 2.0 or later

LANRES/VM Feature Program Requirements

The LANRES/VM feature has the following programming requirements:

- On the NetWare server:
 - One of the following:
 - NetWare Version 3.11 from IBM
 - NetWare Version 3.12 from IBM
 - NetWare Version 4.01 from IBM
 - NetWare Version 4.02 from IBM
 - NetWare v3.11J from IBM
 - NetWare 3.12J/V from IBM
 - Novell NetWare Version 3.11
 - Novell NetWare Version 3.12
 - Novell NetWare Version 4.01
 - Novell NetWare Version 4.02

Notes:

1. NetWare v3.11J from IBM and NetWare 3.12J/V from IBM run only on the PS/55 platform.
 2. You will also need any software required by NetWare.
- Depending on what type of clients you have on your NetWare LAN, you may need this additional software:
 - To use Macintosh client support, you need one of the following on the server:
 - When using NetWare Version 3.11:
 - NetWare for Macintosh Version 3.01, or later
 - NetWare for Macintosh from IBM Version 3.01, or later
 - When using NetWare Version 3.12:
 - NetWare for Macintosh Version 3.12, or later
 - NetWare for Macintosh from IBM Version 3.12, or later
 - When using NetWare Version 4.01 or 4.02:
 - NetWare for Macintosh Version 4.0, or later
 - NetWare for Macintosh from IBM Version 4.0, or later
 - When using NetWare v3.11J from IBM:
 - NetWare for Macintosh v3.011J from IBM
 - When using NetWare 3.12J/V from IBM:
 - NetWare for Macintosh 5-Users, which is bundled to NetWare 3.12J/V from IBM

Note: Product numbers vary based on the number of sessions. See your IBM representative for more information.

- To use NetWare NFS client support, you need one of the following on the server:

- When using NetWare Version 3.11 or Version 3.12:
 - NetWare NFS Version 1.1, or later
 - NetWare NFS from IBM Version 1.1, or later
- When using NetWare Version 4.01 or Version 4.02:
 - NetWare NFS Version 1.2b with patch NFS153.EXE, or later
 - NetWare NFS from IBM Version 1.2b with patch NFS153.EXE, or later
- When using NetWare v3.11J from IBM:
 - NetWare NFS v1.2J from IBM
- When using NetWare 3.12J/V from IBM:
 - NetWare NFS v1.2J from IBM (Version 1.2C)

Note: Versions previous to Version 1.2C are not supported. These users should get an update kit from IBM.

• Additional connectivity requirements:

– To use the NetWare for SAA channel driver connection between the host processor and the NetWare server, you need:

- On the host, ACF/VTAM Version 4.2.0 for VM/ESA (5654-010)
- On the channel-attached NetWare server, you will need one of the following:
 - NetWare 3.12, NetWare 4.01, or NetWare 4.02 with NetWare for SAA Version 1.3B
 - NetWare 3.12J/V from IBM with NetWare for SAA 1.3B from IBM (Japanese Version)

Notes:

1. NetWare for SAA Version 1.3B must be at service level 1.3.59 or later.
2. With NetWare for SAA Version 1.3B, the NetWare Communication Executive must be at service level 1.3.46, or later.
3. NetWare 4.01 must have fix DSPAT.EXE.

– To use SNA LU 6.2 communications between the VM host and the NetWare server, you need:

- ACF/VTAM Version 4.2.0 for VM/ESA (5654-010)
- One of the following installed on the NetWare server:
 - NetWare for SAA from IBM Version 1.2
 - NetWare for SAA from IBM Version 1.3B
 - NetWare for SAA 1.3B from IBM (Japanese Version) -- this is required if you are using NetWare 3.12J/V from IBM

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- NetWare for SAA Version 1.2
- NetWare for SAA Version 1.3B

Product numbers vary based on the number of sessions. See your IBM representative or the appropriate NetWare for SAA Administration Guide for more information.

- To use TCP/IP protocols between the VM/ESA host and the NetWare server, you will also need:
 - TCP/IP Feature for VM/ESA Function Level 320
 - IBM C/370™ Library Version 2 (5688-188)
 - Additional print serving requirements:
 - To use the ASCII ES/9000 support, you need:
 - RSCS Version 3 (5684-096) Release 1.1 or later
 - To use printers supported by the Print Services Facility™ (PSF), you need:
 - PSF/VM Version 2 (5684-141) Release 1.1 or later
 - To print PostScript files, you need:
 - IBM Publishing Systems PostScript Interpreter for Advanced Function Printing™ (5688-104)
 - PSF/VM Version 2 (5684-141) Release 1.1 or later
- Note:** LANRES/VM does not support importing Encapsulated PostScript files into other PostScript language files.
- To send client data to the reader of a host virtual machine, you need:
 - RSCS Version 3 (5684-096) Release 1.1 or later

Online Books Program Requirements

Online books are available in two formats: Adobe Portable Document Format (PDF) and IBM BookManager.

Portable Document Format (PDF)

The Adobe Acrobat Reader is required to open and view PDF books on your workstation. You can also use the Adobe Acrobat Reader to print PDF books or sections of PDF books. The Adobe Acrobat Reader is available free from the Adobe home page (<http://www.adobe.com>).

IBM BookManager

IBM BookManager READ/VM (5684-062) Release 3 or later is required to view BookManager books loaded on the VM/ESA system. This program has the following prerequisite licensed programs:

- GDDM®/VMXA Version 2 (5684-007) Release 3 or later
- C/370 Library Version 2 (5688-188) Release 2 or later
- IBM Compiler and Library for REXX/370 (5695-013) or IBM Library for REXX/370 (5695-014)

BookManager APAR GC05366 is required for READ/VM Public Library to run in a non-370 mode virtual machine.

Special versions of the BookManager READ programs for Windows, OS/2, and DOS are included on the *IBM Online Library Omnibus Edition: VM Collection* CD-ROM. Also included are programs that allow you to upload books to a VM or MVS host for viewing with BookManager READ/VM or READ/MVS.

Note: The IBM Library Reader™ programs for Windows, OS/2, and DOS have been revised to read all books in BookManager format (IBM and non-IBM). The BookManager files supplied with VM/ESA have also been revised to work with the new readers. Library Reader programs provided prior to VM/ESA 2.4.0 will not read the revised BookManager files. To read these files using a Library Reader program on your workstation, you must use one of the programs provided on the *current* CD-ROM or download the revised program from the IBM BookManager Web site (<http://booksrv1.raleigh.ibm.com/homepage/ilrserve.html>).

Operating Systems Supported as Guests

For a comprehensive listing of operating systems and versions of operating systems that are supported as guests of VM/ESA, see Appendix B, “IBM Operating Systems Supported as Guests of VM/ESA” on page 97.

Other Programs Supported on VM/ESA

The following documents contain information about other programs supported on VM/ESA:

- *Licensed Products Migration Matrix for VM/ESA*, which lists IBM licensed programs
- *Software Vendors' Products That Will Run on VM/ESA Version 2 Release 4.0*, which lists non-IBM programs

You can obtain these documents from the VM/ESA home page:

<http://www.ibm.com/s390/vm>

Another source of information about supported products is the *IBM Global Software Solutions Guide*, available at the following URL:

<http://www8.software.ibm.com/solutions/isv/igssg.nsf/LanguageSelector/?OpenForm>

National Language Support (NLS)

VM/ESA provides National Language Support (NLS) for several of its components, facilities, and features. End users can selectively (through commands) receive messages and HELP in their national language. Any of the languages can be set as the system default language. Each session on the same system can select a language that is different from another session, as long as the language selected has been installed on that system. For example, user A can be using German while user B is using Japanese.

VM/ESA Base

The available languages and the components that are translated are:

Language	Translated Components
Canadian French	CP messages and CMS messages
French	CP messages and CMS messages
German	CP, CMS, and REXX/VM
Japanese	CP, CMS, and REXX/VM

In addition, IBM provides uppercase American English on the VM/ESA System DDR.

CP lets virtual machines write Double-Byte Character Set (DBCS) display data to display devices (in line mode) while CP manages the display screen.

VM/ESA GUI Facility

The VM/ESA GUI Facility is enabled for NLS for online HELP and messages. The VM/ESA GUI Facility message repository and the workstation help files are translated to German, Japanese, French, and Canadian French.

DFSMS/VM

DFSMS/VM is enabled for NLS for panels and messages. DFSMS/VM is translated to Japanese (KANJI) as well as mixed-case American English (AMENG) and uppercase American English (UCENG).

In addition to supporting these languages, DFSMS/VM also supports multiple active languages at the same time. For example, a user could have their virtual machine set to upper-case English, enter a DFSMS™ MIGRATE command, and the reader file returned to the user would be in upper-case English. Also, another user could have their virtual machine set to Japanese, enter the same command at the same time the other user issued the command, and the reader file returned to this user would be in Japanese.

CMS Utilities Feature

CMS Utilities Feature is enabled for NLS for panels and messages. CMS Utilities Feature is provided in uppercase American English, but it is also available in German and Japanese.

LAN File Services/ESA Feature

The LAN File Services/ESA feature is available translated to Japanese.

Packaging and Ordering Information

To order VM/ESA, order program number 5654-030.

VM/ESA is distributed as a multivolume system DASD Dump Restore (DDR) image on 3480 or 3490 tape cartridges, 6250 bpi tape reels, 4mm tape cartridges, or CD-ROM disks. The system DDR image is available for the 3380, 3390 (except 3390-9), 9345, and FBA (9335, 9336) DASD devices supported for installation.

The system DDR contains:

- CP
- CMS
- REXX/VM
- VMSES/E
- GCS (preinstalled on minidisks)
- AVS (preinstalled on minidisks)
- TSAF (preinstalled on minidisks)
- SFS and CRR file pools
- Dump Viewing Facility
- ICKDSF for VM Release 16 (includes ICKDSF Standalone Release 16)
- DASD Dump Restore (DDR) Program
- Environmental Record Editing and Printing (EREP/VM) Version 3 Release 5
- Translated CP and CMS message repositories
- 3800 Printer Image Library object code
- 3800 Printer Image Library source
- Language Environment
- OSA/SF for VM/ESA
- TCP/IP Feature for VM/ESA Function Level 320
- VM/ESA online books in BookManager format
- Translated HELP files

Notes:

1. ICKDSF for VM and EREP/VM are not part of VM/ESA. They are separate licensed programs that are prerequisites of VM/ESA, and they are shipped on the VM/ESA system DDR for convenience. You must already be licensed for these programs or you must place separate orders for them to establish a license.
2. Although shipped on the VM/ESA system DDR, the TCP/IP Feature for VM/ESA is a separately-orderable priced feature.
3. For convenience only, the following licensed programs are also shipped on the VM/ESA system DDR. If you decide to use these programs, you must place separate orders for them.
 - RSCS Version 3 Release 2.0
 - Tivoli ADSM for VM Version 3

If you order VM/ESA on tape (cartridges or reels), the base product ships with the following additional feature tapes (on the product medium):

- DFSMS/VM Function Level 221
- REXX/EXEC Migration Tool for VM/ESA
- Programming Language/Cross Systems for System/370 PL/X-370 Source Feature

The following feature tapes (cartridges or reels) are separately-orderable:

- CMS Utilities Feature (CUF)
- OpenEdition Shell and Utilities Feature for VM/ESA
- LANRES/VM Feature
- LAN File Services/ESA Feature
- OpenEdition DCE Feature for VM/ESA, Base Services Feature
- OpenEdition DCE Feature for VM/ESA, User Data Privacy Feature (available only in USA)

- Restricted Source
- TCP/IP Source Feature
- TCP/IP Kerberos (DES) for VM/ESA (available only in USA)

The following separately-orderable feature is available on diskette only:

- TCP/IP Offload Feature

If you order VM/ESA on CD-ROM, you receive all of the items listed above *except* the following, which must be ordered separately:

- CMS Utilities Feature (CUF)
- OpenEdition Shell and Utilities Feature for VM/ESA
- OpenEdition DCE Feature for VM/ESA, Base Services Feature
- OpenEdition DCE Feature for VM/ESA, User Data Privacy Feature
- TCP/IP Kerberos (DES) for VM/ESA
- TCP/IP Offload Feature

Object Code Only and Limited Source Availability

Some VM/ESA components, facilities, and features are distributed in object code only (OCO) form. No source program materials are available for the following:

- AVS
- Dump Viewing Facility
- DFSMS/VM
- OpenEdition DCE Feature for VM/ESA

CP and CMS are distributed partially in OCO form, which means that some modules will not have source program materials available but others will.

Restrictions

VM/ESA does *not* support reconfiguration of partitionable processors, either by VM/ESA itself or by MVS guests running on VM/ESA.

General Restrictions for VM/ESA Virtual Machines

VM/ESA virtual machines have the following general restrictions:

- Dynamically modified channel programs cannot run in a virtual machine unless one of the following is true:
 - The virtual machine uses the V=R performance option
 - The channel program modification facility that the DIAGNOSE interface provides can be used to ensure correct operation of such channel programs.
- Channel command support is limited to basic device support; therefore, VM/ESA does not support the Speed Matching Buffer. Performance degradation occurs when a DASD attached to a 3880 Control Unit with a Speed Matching Buffer is used as a CP-owned device in low speed mode.
- The Resource Management Facility (RMF™) I/O Queuing Activity Report is not supported when MVS/XA™ runs in a virtual machine.
- VSE requires the following:
 - Operation in a virtual machine with a minimum size of 1MB

- System generation with options appropriate to virtual machine operation.
- If operating systems running in virtual machines under VM/ESA control use separate master and logon consoles, the consoles should be placed on different control units; otherwise, console lockout may occur.
- VM/ESA does not support alternate tracking on 3340 and 3344 devices for virtual machines.
- When CP is running in a logical partition, you cannot run V=F guests. (They are converted into V=V guests during logon.)
- The CPUID that appears in most EREP records is not the same as the CPUID of the physical processor on which the error occurred (because there is more than one partition per physical processor in LPAR mode).

Integrity and Security of VM/ESA

This section discusses facilities of VM/ESA that deal with the security and integrity of the system.

Data Integrity for Guests

Operating system failures that occur in virtual machines do not normally affect the VM/ESA operating system running on the real processor. If the error is isolated to a virtual machine, only that virtual machine fails, and the user can re-IPL without affecting the testing and production work running in other virtual machines.

System Integrity Statement for VM/ESA

System integrity is an important characteristic of VM/ESA. This statement extends IBM's previous statements on system integrity to the VM/ESA environment.

IBM has implemented specific design and coding guidelines for maintaining system integrity in the development of VM/ESA. Procedures have also been established to make the application of these design and coding guidelines a formal part of the design and development process.

However, because it is not possible to certify that any system has perfect integrity, IBM will accept APARs that describe exposures to the system integrity of VM/ESA or that describe problems encountered when a program running in a virtual machine not authorized by a mechanism under the customer's control introduces an exposure to the system integrity of VM/ESA, as defined in the following "VM/ESA System Integrity Definition" section.

IBM will continue its efforts to enhance the integrity of VM/ESA and to respond promptly when exposures are identified in VM/ESA and any subsequent releases.

VM/ESA System Integrity Definition

The VM/ESA control program system integrity is the inability of any program running in a virtual machine not authorized by a VM/ESA control program mechanism under the customer's control or a guest operating system mechanism under the customer's control to:

- Circumvent or disable the control program real or auxiliary storage protection.
- Access a resource protected by RACF. Resources protected by RACF include virtual machines, minidisks, and terminals.

Technical Information

- Access a control program password-protected resource.
- Obtain control in real supervisor state or with privilege class authority or directory capabilities greater than those it was assigned.
- Circumvent the system integrity of any guest system that itself has system integrity as the result of an operation by any VM/ESA control program facility. This includes MVS, VSE, and VM/ESA operating systems.

Real storage protection refers to the isolation of one virtual machine from another. CP accomplishes this by hardware dynamic address translation, start interpretive-execution guest storage extent limitation, and the Set Address Limit facility.

Auxiliary storage protection refers to the disk extent isolation implemented for minidisks/virtual disks through channel program translation.

Password-protected resource refers to a resource protected by CP logon passwords and minidisk passwords.

Guest operating system refers to a control program that operates under the VM/ESA control program.

Directory capabilities refer to those directory options that control functions intended to be restricted by specific assignment, such as those that permit system integrity controls to be bypassed or those not intended to be generally granted to users.

Customer Responsibilities: While protection of the customer's data remains the customer's responsibility, data security continues to be an area of vital importance to IBM. IBM's commitment to the system integrity of the VM/ESA environment, as described in this statement, represents a further significant step to help customers protect their data.

Product documentation, subject to change, describes the actions that must be taken and the facilities that must be restricted to complement the system integrity support provided by VM/ESA. Such actions and restrictions may vary depending on the system, configuration, or environment. The customer is responsible for the selection, application, adequacy, and implementation of these actions and restrictions, and for appropriate application controls.

Security, Auditability, and Control

VM/ESA includes several facilities to enhance or improve the security and integrity of the system:

- Each guest and CMS user runs in a unique virtual machine definition which, in combination with hardware features, prohibits one user from accessing another's data in storage (unless specifically allowed through shared segments, communication vehicles such as IUCV and APPC/VM, or ESA/XC data sharing services).
- VM/ESA, in combination with hardware features, provides protection against channel programs accessing another user's virtual addresses.
- A password facility provides minidisk security to control both read-only and read-write access.

- Both user ID and password checking are provided to minimize unauthorized system access.
- User class restructure provides customers with the ability to control access to commands and DIAGNOSE codes more precisely through customer-defined classes.
- Journaling is supported on VM/ESA. In addition, RACF provides customers with many of these facilities, as well as other security capabilities.
- The NOVF parameter on the OPTION directory control statement lets VM/ESA restrict the use of the Vector Facility by the virtual machine.
- Directory control statements and system configuration file statements provide controls for certain POSIX-related functions, such as the ability to change another virtual machine's POSIX security values.

CMS File Pool Security

CMS file pools include the following features to aid data security for SFS data and BFS data stored in them:

- To access a file pool, you must be authorized (enrolled) by someone with administrator authority for that file pool, or PUBLIC must be enrolled.
- If an administrator gives you an SFS file space in a file pool, you are the only one (other than an administrator) who can create files in that file space, unless you specifically grant this authority to another user.
- You can control access to your SFS files and directories by granting and revoking authority to other users.
- Only the owner of an SFS directory or an administrator can delete the directory.
- Implicit and explicit locks prevent simultaneous updates.
- An auditing facility is available that documents:
 - Attempts to access file pool resources
 - Use of CRR recovery server operator commands and file pool server operator commands, which erase CRR and SFS log data in the intervention of CRR activity.

In addition, an external security manager can replace file pool authorizations for those objects protected by the external security manager.

File pools can exploit external security manager services through documented interfaces including the use of the RACROUTE programming interface.

User management is responsible for evaluation, selection and implementation of these features, for administrative procedures, and for appropriate controls in application systems and communications facilities.

RACF Support

The Resource Access Control Facility (RACF) licensed program is a strategic security facility that provides comprehensive security capabilities. RACF controls user access to the system, checks authorization for use of system resources, and audits the use of system resources.

Technical Information

In the VM/ESA environment, RACF verifies logon passwords and checks access to minidisks, data in spool files, and RSCS nodes. You can use RACF commands to audit security-relevant events and prevent users from entering the CP DIAL and MSG commands before they log on. The events you can audit include:

- Any CP command or DIAGNOSE code (including privileged commands and DIAGNOSE codes)
- The creation, opening, and deletion of spool files
- The dumping and loading of spool files through the SPXTAPE and SPTAPE commands
- IUCV CONNECT and SEVER operations and certain VMCF functions
- APPC/VM CONNECT and SEVER operations
- The creation and deletion of logical devices.

Chapter 4. VM/ESA Base Components

This chapter describes the base components of VM/ESA:

- “Control Program (CP)”
- “Conversational Monitor System (CMS)” on page 46
- “REXX/VM” on page 49
- “Group Control System (GCS)” on page 49
- “Transparent Services Access Facility (TSAF)” on page 50
- “APPC/VM VTAM Support (AVS)” on page 50
- “Virtual Machine Serviceability Enhancements Staged/Extended (VMSES/E)” on page 50
- “Dump Viewing Facility” on page 51

Control Program (CP)

CP is primarily a real-machine resource manager. CP provides each user with an individual working environment known as a *virtual machine*. Each virtual machine is a functional equivalent of a real system, sharing the real processor function, storage, console, and input/output (I/O) device resources.

When you first log on to VM/ESA, CP controls the working environment. Many of the facilities of VM/ESA are immediately available to you. For example, you can use CP commands to do various system management tasks. However, most of the work done on VM/ESA requires the CMS component or another operating system, such as OS/390 or VSE/ESA, to help with data processing tasks and to manage work flow.

CP also provides connectivity support that allows application programs to exchange information with each other and to access resources residing on the same VM/ESA system or on different VM/ESA systems.

For National Language Support information, see “VM/ESA Base” on page 34.

VM/ESA Virtual Machines

VM/ESA supports 370, XA, ESA, and XC virtual machines.

- 370 virtual machines process according to the System/370 architecture.
- XA virtual machines are supported for compatibility with older versions of VM. XA virtual machines process according to the same architecture as ESA virtual machines.
- ESA virtual machines process according to the ESA/370 architecture when VM/ESA is running on an ESA/370 processor and process according to the ESA/390 architecture when VM/ESA is operating on an ESA/390 processor.
- XC virtual machines process according to the ESA/XC architecture.

Note: CMS is supported only in an XA or XC virtual machine. Only CMS levels prior to CMS Level 12 can run in a 370 virtual machine. Applications developed for the 370 virtual machine should use the 370 Accommodation Facility and, if necessary, the CMS SET GEN370 OFF command to run in an XA or XC virtual machine.

Table 3 on page 42 shows the different virtual machine designations and their resulting architecture modes.

<i>Table 3. Virtual Machine Architecture Modes</i>		
Virtual Machine Designation	Resulting Virtual Machine Architecture on an ESA/370 Processor	Resulting Virtual Machine Architecture on an ESA/390 Processor
370	System/370	System/370 ¹
XA	ESA/370 ²	ESA/390 ²
ESA	ESA/370	ESA/390 ³
XC	n/a	ESA/XC
Notes:		
<ol style="list-style-type: none"> 1. System/370 mode is supported only on older ESA/390 processors. The S/390 Enterprise Server G4 and later do not support System/370 mode even for guests. 2. Only the 370-XA architecture subset of ESA/370 and ESA/390 is used. 3. ESA/390 is upwardly compatible with ESA/370. 		

VM/ESA also provides three types of virtual machines, which are defined by their storage configurations:

- V=R machine** Virtual=Real machine. This virtual machine has a fixed, contiguous area of host real storage starting at location 0. CP does not page this storage, so guest real storage maps to host real storage. CP provides performance benefits for this virtual machine (compared to V=V machines) and an automatic recovery mechanism.
- V=F machine** Virtual=Fixed machine. This virtual machine also has a fixed, contiguous area of host real storage, but the area does not start at real location 0. CP does not page this storage, so guest real storage maps to host real storage. CP also provides performance benefits for this virtual machine (compared to V=V machines).
- V=V machine** Virtual=Virtual machine. This virtual machine's guest real storage does not permanently map to host real storage. Rather, CP pages the guest real storage of a V=V machine into and out of host real storage.

Because V=R and V=F machines receive preference in terms of storage and performance, these virtual machines are called preferred virtual machines.

For more information about the types of virtual machines, see the following book:

- *VM/ESA: Running Guest Operating Systems.*

Guest ESA/370 and ESA/390 Support

Guests that exploit features of the ESA/370 and ESA/390 architecture can operate in virtual machines on VM/ESA. ESA/370 guests can use the ESA/370 architecture facilities. When VM/ESA is running on an ESA/390 processor, ESA/390 guests can use the ESA/390 architecture facilities.

Note that because ESA/370 is upwardly compatible from 370-XA, 370-XA operating systems can be run in ESA/370 mode. Similarly, because ESA/390 is upwardly compatible from ESA/370, all 370-XA or ESA/370 operating systems can be run in ESA/390 mode. CMS, however, is supported only in XA and XC mode virtual machines. Even though you can still define an XA virtual machine, CP does not distinguish between 370-XA and ESA/370 architectures when running on an ESA/370 processor, or between 370-XA, ESA/370, and ESA/390 architectures when running on an ESA/390 processor.

ESA/XC Architecture

When VM/ESA is running on an ESA/390 processor, it uses ESA/390 extensions to the interpretive-execution facility to provide the Extended Configuration (ESA/XC) virtual machine architecture. ESA/XC is an architecture unique to virtual machines. Because it exists mainly to provide services to application programs in virtual machines, ESA/XC architecture does not have a basic-mode or native-mode equivalent.

ESA/XC architecture lets virtual machines share multiple data spaces. An XC machine can access one or more data spaces of another virtual machine if so authorized. This is extremely useful for applications that require one or more virtual machines to serve many users.

Cross-System Extensions (CSE)

CSE is a function of VM/ESA that allows multiple systems running VM/ESA to be coupled together in a complex that provides cross-system functions:

- Cross-system link, which extends the existing CP minidisk access protocols (for minidisk linking) across the CSE complex
- Cross-system spool, which extends CP spooling
- Cross-system message, query, and other commands
- Support for printer spooling

See “Cross-System Extensions Hardware Requirements” on page 17 and “Cross-System Extensions Program Requirements” on page 25.

Inter-System Facility for Communications (ISFC)

ISFC is a function of CP that enables communication between programs written to the APPC/VM, CPI Communications, or IUCV programming interfaces. A group of interconnected VM/ESA systems that use ISFC to communicate with each other are known as a Communication Services (CS) collection. Programs on systems in the CS collection can use ISFC to access, manage, and share resources defined in the collection. ISFC also enables programs in a CS collection to communicate with APPC programs on systems in the SNA network.

Support for Hardware Architectures and Facilities

CP provides the VM/ESA support for various hardware architectures and facilities, some of which are described here. Note that in many cases this support is available only to guests.

Asynchronous Data Mover Facility (ADMF)

VM/ESA provides guest support for ADMF. ADMF provides an extension to the existing channel subsystem which is capable of off-loading page move activity onto the I/O processor, freeing the instruction processor for other work while the page movement is performed. No external control or intervention is necessary. ADMF is available for guest use automatically at LOGON if:

- VM/ESA is running in basic mode (not in an LPAR)
- The PR/SM feature is available
- The guest is a preferred guest (V=R, V=F)

Concurrent-Sense Facility

VM/ESA provides guest support for the concurrent-sense facility, which is designed for use on channel paths that support the ESCON I/O interface. This facility allows the channel subsystem to present I/O status information and sense information together, in one I/O operation. This eliminates the wait for sense information whenever status information is received.

Cryptographic Facility

VM/ESA supports guest use of a cryptographic facility. The cryptographic facility provides cryptographic capability to transaction processing environments. Cryptography is an effective means of protecting data in computer and communication systems from unauthorized disclosure. It involves the process of transforming plaintext into cyphertext (encipherment) and the reverse process of transforming cyphertext into plaintext (decipherment).

Enterprise Systems Connection Architecture® (ESCON)

ESCON is built around fiber optic transmission technology. Fiber optic cables reduce cable bulk, allow for increased distance between the processor and attached devices, and improve data transfer rates. ESCON I/O devices can be attached to the processor at distances up to 9 kilometers (5.5 miles) using LED technology and 60 kilometers (37.2 miles) using laser technology.

Expanded Storage

Expanded Storage is an optional integrated high-speed storage facility, available on certain processors, that allows for the rapid transfer of 4KB blocks between itself and real storage.

Extended-TOD-Clock Facility

The Extended-TOD-clock facility is a hardware facility available on certain processors which provides a 128-bit Time of Day (TOD) clock. VM/ESA supports the use of the Extended-TOD-clock facility from XA, ESA, and XC virtual machines.

Fibre Connection (FICON) Channels

FICON is the next-generation fibre-optic I/O architecture beyond ESCON. FICON coexists with and exploits existing ESCON equipment and infrastructure. But FICON offers improved link performance and enhanced distance connectivity. Each FICON channel provides the equivalent of eight ESCON channels.

IEEE Floating Point

VM/ESA supports guest use of the IEEE Floating Point hardware on the IBM S/390 Enterprise Server G5 and later. This support allows multiple levels of guests to use basic floating point extensions, floating point support extensions, hexadecimal floating point extensions, and binary floating point.

Move-Page Facility

VM/ESA provides support for V=V guest use of the Move-Page Facility. A page of data can be moved from main storage to main storage, from main storage to expanded storage, or from expanded storage to main storage.

Guest Move-Page support is *not* available to:

- Guest virtual machines when VM/ESA is running in a logical partition
- A VM/ESA guest of VM/ESA

Parallel Access Volumes

VM/ESA provides guest support for the Parallel Access Volumes feature of certain DASD. This feature allows the configuration of logical volumes (known as alias Parallel Access Volumes), where each logical volume (alias) has its own unique device address but is actually an exposure of the existing real device (known as the base Parallel Access Volume). This allows the host to issue concurrent I/O requests to one real device, the base volume, through the different alias volumes.

Processor Resource/Systems Manager™ (PR/SM)

A processor with PR/SM installed operates in one of two modes: basic mode and logically partitioned (LPAR) mode.

PR/SM Support of Multiple Preferred Guests: When the processor operates in basic mode, VM/ESA supports up to six preferred guests. Two configurations are supported: one V=R guest and up to five V=F guests, or no V=R guest and up to six V=F guests. Note that on a physically partitioned multiprocessor, running two copies of VM/ESA supports up to 12 preferred guests.

With multiple preferred guest support, you can simultaneously support many CMS users, test multiple guest systems, and support multiple production guests.

PR/SM Support of Logical Partitioning: When the processor operates in LPAR mode, it provides flexible partitioning of processor resources across multiple logical partitions. Each logical partition contains some portion of the processor, storage, and channel path resources and, if available, some portion of the Expanded Storage and Vector Facility resources of the processor.

VM/ESA supports logical path measurement in an ESCON Multiple Image Facility (EMIF) environment.

Queued-Direct I/O (QDIO) Facility

VM/ESA supports guest use of the QDIO Facility. The QDIO Facility allows a program running on a System/390 processor to directly exchange data with an I/O device without performing traditional System/390 I/O instructions. To exchange data, both the I/O device and the program reference main storage directly through a set of data queues.

Vector Facility

The Vector Facility processor feature improves the performance of vector processing for numerically intensive applications. CMS and guest operating systems can use the Vector Facility.

Conversational Monitor System (CMS)

CMS provides a high-capacity environment that supports large numbers of interactive users. CMS can help you perform a wide variety of tasks:

- Write, test, and debug application programs for use on CMS or guest systems
- Run application programs developed on CMS or guest systems
- Create and edit data files
- Process jobs in batch mode
- Share data between CMS and guest systems
- Communicate with other system users

For National Language Support information, see “VM/ESA Base” on page 34.

For general information about CMS, see the following book:

- *VM/ESA: CMS User's Guide*

CMS Application Programming

CMS supports a wide range of high-level languages and application environments. CMS also provides many application programming facilities, including:

- Extended architecture (XC) support
- CMS Pipelines
- Multitasking services
- Callable services library (CSL)
- Distributed GUI Toolkit (DT)
- Reusable Server Kernel
- Assembler macros and functions
- OS/MVS simulation
- DOS/VSE support

For more information, see the following books:

- *VM/ESA: CMS Application Development Guide*
- *VM/ESA: CMS Application Development Guide for Assembler*
- *IBM OpenEdition for VM/ESA: Callable Services Reference*
- *VM/ESA: CMS Application Multitasking*
- *VM/ESA: Distributed Graphical User Interface Toolkit*

CMS Application Multitasking

CMS application multitasking services provide an execution environment for high-performance applications and servers. With CMS multitasking, an application can divide itself into multiple units of execution and provide the ability for these units, called threads, to run on multiple CPUs simultaneously. The multitasking facilities are available only at the application programming level. The CMS user still runs one application at a time, but these applications can split themselves into multiple execution units, or threads. These multitasking facilities allow applications to harness the power of the underlying multiprocessor complex and to overlap operations to achieve high performance.

For more information, see the following book:

- *VM/ESA: CMS Application Multitasking*

Shared File System (SFS)

- Files are stored in file pools.
- A user can be given an amount of file space in a file pool.
- The files in a file space are organized in directories.
- A file can be placed in more than one directory.
- Users can grant each other authorities on files or directories.
- Multiple users can have concurrent access to the same file or directory.
- Locks on files and directories ensure data integrity among multiple users.
- You can share files and directories with users in other systems.

A file pool is a collection of minidisks assigned to a single virtual machine called a *file pool server machine*. Because the minidisks in the file pool are shared by many users, using SFS can save DASD space. Certain SFS directories can be placed into VM data spaces, providing an additional DASD savings.

DFSMS/VM provides storage management functions for file pools. It erases expired files and migrates low activity files to auxiliary storage, which enables better utilization of high performance DASD.

For more information, see the following book:

- *VM/ESA: CMS File Pool Planning, Administration, and Operation*

Byte File System (BFS)

BFS is a POSIX-compliant file system included as part of OpenEdition for VM/ESA. BFS is a companion to SFS. Like SFS files, BFS files are organized in directories and stored in CMS file pools. A byte file system is enrolled as a file space in a file pool. Multiple byte file systems can be enrolled in the same file pool, and byte file systems can reside in the same file pool as SFS file spaces. BFS files are identified by path names. The path name includes the name of the file and shows the file's position in the hierarchical directory structure. BFS files do not have file types and file modes.

DFSMS/VM can provide storage management functions for BFS files.

For more information about BFS, see the following books:

- *VM/ESA: CMS Application Development Guide*
- *IBM OpenEdition for VM/ESA: User's Guide*

VM/ESA Graphical User Interface (GUI) Facility

The VM/ESA GUI Facility, which is included in CMS, lets you run programs on your VM/ESA host system that display on a workstation using a graphical user interface. A graphical user interface, or GUI, is a type of user interface that takes advantage of high-resolution graphics. GUIs typically include a combination of graphics, objects, the use of pointing devices, menu bars and other menus, and overlapping windows.

The VM/ESA GUI Facility consists of the following parts:

- Distributed GUI Toolkit (DT) is an object-based programming interface that application programmers can use to create GUI applications that run on VM/ESA.
- CMS Desktop is a sample GUI application that lets users perform some common VM/ESA tasks.

See “VM/ESA GUI Facility Hardware Requirements” on page 17 and “VM/ESA GUI Facility Program Requirements” on page 25. For National Language Support information, see “VM/ESA GUI Facility” on page 34.

For more information, see the following book:

- *VM/ESA: Graphical User Interface Facility*

CMS Pipelines

CMS Pipelines provides a rich and efficient set of functions that you can use to solve large problems by breaking them up into smaller, less complex programs. These smaller programs are called *stages*. Many stages are included with CMS Pipelines. Some stages read data from system sources, such as disk files, tape files, or the results of VM/ESA commands. Other stages filter and refine that data in some way. You can combine many stages within a single *pipeline* to create the results you need. You can also write your own stages.

For more information, see the following book:

- *VM/ESA: CMS Pipelines User's Guide*

Reusable Server Kernel

The reusable server kernel enables vendors and ambitious application programmers to write multithreaded server programs that are heavily exploitive of VM/ESA technologies. These servers can be constructed without knowledge of data transport mechanisms, multithreaded APIs, or I/O performance boosters and without reinventing API suites necessary in one server after another.

The reusable server kernel is an “empty” server program that server writers can use as a starting point for developing and executing server programs on CMS. The reusable server kernel consists of a text library of routines and a macro library of function prototypes and constant definitions. To construct an actual server program, the server author attaches application-specific code to a set of interfaces in the reusable server kernel.

For more information, see the following book:

- *VM/ESA: Reusable Server Kernel Programmer's Guide and Reference*

XEDIT

XEDIT is a full-screen editing facility that runs under CMS. You can use XEDIT from a 3270 console session or within a GUI workstation window. XEDIT creates and modifies CMS files and BFS files. System macros and user-written procedures are performed from the XEDIT environment.

For more information, see the following book:

- *VM/ESA: XEDIT User's Guide*

VM/ESA HELP Facility

The VM/ESA HELP Facility provides online assistance in the form of menus and panels. HELP information is available for:

- Tasks
- Commands and options
- Subcommands
- REXX statements
- Callable routines
- Pipelines stages
- Assembler language macros
- Messages

VM/ESA facilities and features, as well as other programs that run on CMS, may provide HELP information for display through the VM/ESA HELP Facility. You can also write your own HELP information.

For more information, see the following book:

- *VM/ESA: CMS User's Guide*

REXX/VM

The REXX/VM component contains the REXX/VM Interpreter, which processes the English-like programming language, REstructured eXtended eXecutor (REXX). It also contains the VM implementation of the SAA REXX programming language. REXX/VM provides a single source base for the REXX/VM Interpreter in the CMS and GCS components. The REXX/VM Interpreter exploits 31-bit addressing.

The REXX/VM Interpreter helps improve the productivity of your organization. Using REXX, you can write customized application programs and command procedures, tailor CMS commands, and create new XEDIT macros.

For more information, see the following book:

- *VM/ESA: REXX/VM User's Guide*

Group Control System (GCS)

GCS runs in a virtual machine (XA or XC mode) in place of CMS. It is a virtual machine supervisor, providing multitasking services that allow numerous tasks to remain active in the virtual machine at one time. The specific function of GCS for VM/ESA is to support a native Systems Network Architecture (SNA) network. The SNA network relies on ACF/VTAM, VTAM® SNA Console Support (VSCS), and

other network applications to manage its collection of links between terminals, controllers, and processors. GCS provides services for ACF/VTAM, VSCS, and the others, which eliminates your need for VTAM Communications Network Application (VM/VCNA) and a second operating system like VS1 or VSE.

Installation of GCS is optional.

For more information, see the following books:

- *VM/ESA: Connectivity Planning, Administration, and Operation*
- *VM/ESA: Group Control System*

Transparent Services Access Facility (TSAF)

TSAF provides communication services within a collection of VM systems without using VTAM. TSAF runs in a CMS virtual machine. A group of up to eight VM systems that each have TSAF installed and running can form a TSAF collection. APPC/VM programs on one VM system in the TSAF collection can communicate with other APPC/VM programs on the other VM systems in the collection. The routing is transparent to the application programs. Communications between the applications proceed as if the applications were running on the same system.

Installation of TSAF is optional.

For more information, see the following book:

- *VM/ESA: Connectivity Planning, Administration, and Operation*

APPC/VM VTAM Support (AVS)

AVS is a VTAM application that provides communication services between VM/ESA and non-VM systems in an SNA network. AVS and VTAM run in the same GCS group on a VM/ESA system. Together, AVS and VTAM enable APPC/VM application programs in a TSAF or CS collection to communicate with:

- Other APPC/VM applications residing in other VM systems within the SNA network
- APPC applications residing in non-VM systems in the SNA network

Installation of AVS is optional.

For more information, see the following book:

- *VM/ESA: Connectivity Planning, Administration, and Operation*

Virtual Machine Serviceability Enhancements Staged/Extended (VMSES/E)

VMSES/E helps you install VM/ESA and other VMSES/E-enabled products and apply code changes that correct or circumvent reported problems. VMSES/E handles both source code and object code.

VMSES/E also helps you define, build, and manage saved segments. The VMFSGMAP EXEC provides a saved segment mapping interface that lets you

modify saved segment definitions and view saved segment layouts prior to actually building them on your system.

For more information, see the following book:

- *VM/ESA: VMSES/E Introduction and Reference*

Dump Viewing Facility

The Dump Viewing Facility helps you interactively diagnose system problems. Using this facility, you can display, format, and print data interactively from CP ABEND dumps, CP stand-alone dumps, and virtual machine dumps, as well as display and format recorded trace data. The BLOCKDEF utility lets you display, format, and print control block information. The VIEWSYM command lets you display symptom records, making it easier to identify duplicate problems when they occur.

VM/ESA provides an INSPECT subcommand within the DUMPSCAN environment that extracts diagnostic information from CPabend dumps. The information is written to the DUMPSCAN session file and to a report file on the user's A-disk or directory.

For more information, see the following book:

- *VM/ESA: Dump Viewing Facility*

Base Components

Chapter 5. Additional Facilities Supplied with VM/ESA

This chapter describes the additional facilities supplied with VM/ESA:

- “OpenEdition for VM/ESA”
- “DFSMS/VM” on page 54
- “Language Environment” on page 55
- “Open Systems Adapter Support Facility for VM/ESA” on page 55

OpenEdition for VM/ESA

OpenEdition for VM/ESA consists of four parts:

- OpenEdition for VM/ESA Services
- OpenEdition for VM/ESA Sockets
- OpenEdition Shell and Utilities Feature for VM/ESA
- OpenEdition DCE Feature for VM/ESA

OpenEdition for VM/ESA Services and OpenEdition for VM/ESA Sockets are provided with the VM/ESA base. OpenEdition Shell and Utilities Feature for VM/ESA and OpenEdition DCE Feature for VM/ESA are optional.

OpenEdition for VM/ESA Services is the VM/ESA implementation of three POSIX standards:

- POSIX 1003.1 (known as POSIX.1) - System Interfaces
- POSIX 1003.1a (known as POSIX.1a) - Extensions to POSIX.1
- POSIX 1003.1c (known as POSIX.1c) - Threads

The POSIX.1, POSIX.1a, and POSIX.1c interfaces are provided as C library routines in the IBM C for VM/ESA (C/VM) run-time library. For programs written in other languages, a language-neutral version of the POSIX functions is provided as a set of callable services library (CSL) routines in VM/ESA known as the OpenEdition for VM/ESA callable services. These CSL routines are called by the C POSIX library routines to provide the functions, but are also available to other applications. The CSL routines can be invoked as REXX functions through a REXX subcommand environment, ADDRESS OPENVM.

Included in the OpenEdition for VM/ESA Services is a POSIX.1 compliant file system known as the OpenEdition for VM/ESA Byte File System (BFS). BFS is a companion to the CMS Shared File System (SFS) that provides a byte-stream view of files. BFS allows data to be organized and used in a UNIX style and format.

Like SFS files, BFS files are organized in a hierarchical directory structure and stored in CMS file pools. While supporting the POSIX file system functions and rules, BFS also takes advantage of administration and system management facilities that it shares with SFS. These include space allocation, backup, and DFSMS/VM file migration, as well as other administrative functions.

CMS provides a set of commands, known as the OPENVM commands, that allow users to manage their BFS directories and files and control their related permission and ownership attributes. CMS Pipelines additionally provides the ability to use BFS from pipeline programs.

See “OpenEdition for VM/ESA Services (POSIX) Program Requirements” on page 26.

For more information about OpenEdition for VM/ESA Services, see the following books:

- *VM/ESA: CMS Application Development Guide*
- *IBM OpenEdition for VM/ESA: POSIX Conformance Document*
- *IBM OpenEdition for VM/ESA: Callable Services Reference*

OpenEdition for VM/ESA sockets are a set of C language functions that provide an industry-accepted protocol for client/server communication. OpenEdition for VM/ESA sockets correspond closely to the sockets used by UNIX applications. For more information, see the following book:

- *IBM OpenEdition for VM/ESA: Sockets Reference*

For information about the OpenEdition Shell and Utilities Feature for VM/ESA, see “OpenEdition Shell and Utilities Feature for VM/ESA” on page 60.

For information about the OpenEdition DCE Feature for VM/ESA, see “OpenEdition DCE Feature for VM/ESA” on page 60.

DFSMS/VM

DFSMS/VM is a storage management system that allows you to control your data and storage resources more efficiently. DFSMS/VM provides:

- **Space Management**

DFSMS/VM improves DASD utilization by automatically managing space in SFS file pools. As the SFS administrator, DFSMS/VM allows you to:

- Convert SFS storage to DFSMS-managed storage by assigning *management classes* to files and directories. Each management class tells DFSMS/VM how to treat its members in the course of its management of the file pool.
- Automatically manage files based on the criteria in each management class. This management may consist of deletion of files, automatic migration of files, or both.
- *Migrate* (or move) files from DFSMS-managed storage to DFSMS-owned storage by using the assigned *management class*. This function also compresses the data. The files can be automatically recalled when referenced (opened and browsed), or they can be explicitly recalled.

- **Minidisk Management**

Using DFSMS/VM for minidisk management allows you to check the integrity of CMS minidisks and move them from one location to another. DFSMS/VM helps you migrate CMS minidisks to new DASD quickly, efficiently, and with minimal impact to users.

- **Interactive Storage Management Facility (ISMF)**

DFSMS/VM uses the ISMF to provide a consistent user interface for storage management tasks.

- **IBM 3495 Tape Library Dataserver Support**

DFSMS/VM provides native VM support for the IBM 3495 Tape Library Dataserver.

See “DFSMS/VM® Program Requirements” on page 26. For National Language Support information, see “DFSMS/VM” on page 34.

For more information, see the following book:

- *VM/ESA: DFSMS/VM Function Level 221 Planning Guide*

Language Environment

Language Environment provides the run-time environment for programs generated with participating high-level languages. Language Environment helps you create mixed-language applications and gives you a consistent method of accessing common, frequently-used services.

Language Environment consists of:

- Basic routines that support starting and stopping programs, allocating storage, communicating with programs written in different languages, and indicating and handling conditions.
- Common library services, such as math services and date and time services, that are commonly needed by programs running on the system. These functions are supported through a library of callable services.
- Language-specific portions of the run-time library. Because many language-specific routines call Language Environment services, behavior is consistent across languages.

See “Language Environment Program Requirements” on page 28.

For more information, see the following book:

- *Language Environment for OS/390 & VM: Concepts Guide*

Open Systems Adapter Support Facility for VM/ESA

The IBM System/390 Open Systems Adapter 2 (OSA-2) is an integrated hardware feature that uniquely combines the functions of an I/O channel with attachments to one or more local area networks (LANs), either directly or over an Asynchronous Transmission Mode (ATM) based network. The S/390 Open Systems Adapter Support Facility (OSA/SF) for VM/ESA allows you to customize an OSA's modes of operation:

- For clients using the SNA/APPN® network protocol, OSA/SF lets you customize an OSA for data transfer between VTAM and these clients on either a directly-attached LAN or an emulated Ethernet or token-ring LAN in an Asynchronous Transmission Mode (ATM) based network.
- For clients using the TCP/IP network protocol, OSA/SF lets you customize an OSA for data transfer between TCP/IP and these clients on an emulated LAN in an ATM-based network as well as clients on a directly-attached LAN. (Without OSA/SF, an OSA can transfer data between TCP/IP and its clients only on a directly-attached LAN.)

Additional Facilities

- For TCP/IP and VTAM programs running in different logical partitions, OSA/SF lets these programs share access through an OSA's physical port either to a directly-attached LAN or as an OSA LAN emulation client (LEC), or logical, port to an emulated LAN.

See “OSA and OSA/SF Hardware Requirements” on page 17 and “OSA and OSA/SF Program Requirements” on page 27.

For more information, see the following books:

- *Planning for the System/390 Open Systems Adapter Feature*
- *IBM VM/ESA: Open Systems Adapter Support Facility User's Guide*

Chapter 6. VM/ESA Optional Features

This chapter describes the optional features of VM/ESA:

- “CMS Utilities Feature”
- “TCP/IP Feature for VM/ESA” on page 58
- “OpenEdition Shell and Utilities Feature for VM/ESA” on page 60
- “OpenEdition DCE Feature for VM/ESA” on page 60
- “LAN File Services/ESA (LFS/ESA)” on page 61
- “LAN Resource Extension and Services/VM (LANRES/VM)” on page 62

CMS Utilities Feature

The CMS Utilities Feature complements CMS by providing tools and services that add enriched function to the CP and CMS environments for end users and application developers. The following programs are included in the CMS Utilities Feature:

Program	Description
ACCOUNT	Processes VM/ESA accounting records
AUDITOR	Monitors service virtual machines
BROWSE	Lets you view a file or library member
CLRSCRN	Clears the terminal screen
DCSSBKUP	Saves CMS saved segments
DCSSRSAV	Restores CMS saved segments
DEPRINT	Writes printer files to a disk
DEVTYPE	Displays device characteristics
DIRMAP	Maps minidisk space in the CP directory
FILESTCK	Transfers data from the program stack to a file
FINDSTAK	Transfers data from a file to the program stack
FLIST	Displays a full-screen list of files
GETFMADR	Finds a free file mode and address
OPTIMISE	Optimizes the performance of EXEC 2 execs
QSYSOWN	Queries system disk space
REPRINT	Transfers files from a virtual reader to a printer
SADT	Stacks minidisk and file directory information
SETKEYX	Sets storage keys for saved segments
SFPURGER	Performs pool file maintenance
SHRLDR	Loads saved segments
STAG	Stacks reader tag information
SYSWATCH	Monitors system data on multiple systems
USERID	Stacks user ID information
VMSIZE	Displays the virtual storage size as a CMS return code
WAKEUP	Controls event-driven virtual machines

Program	Description
XRDR	Displays reader file information
YDISK	Provides a modified CMS DISK LOAD command

See “CMS Utilities Feature Program Requirements” on page 28. For National Language Support information, see “CMS Utilities Feature” on page 34.

For more information, see the following book:

- *VM/ESA: CMS Utilities Feature*

TCP/IP Feature for VM/ESA

The TCP/IP Feature for VM/ESA brings the power and resources of your System/390 computer to the internet. Using the TCP/IP protocol suite of the TCP/IP Feature for VM/ESA, you can reach open multivendor networking environments from your VM/ESA system. With the TCP/IP Feature, VM/ESA systems can act as peers of other central computers in TCP/IP open networks. Applications can be shared transparently across VM/ESA, UNIX, VAX, and other environments. As shown in Figure 1, users can send messages, transfer files, share printers, and access remote resources across a broad range of systems from multiple vendors.

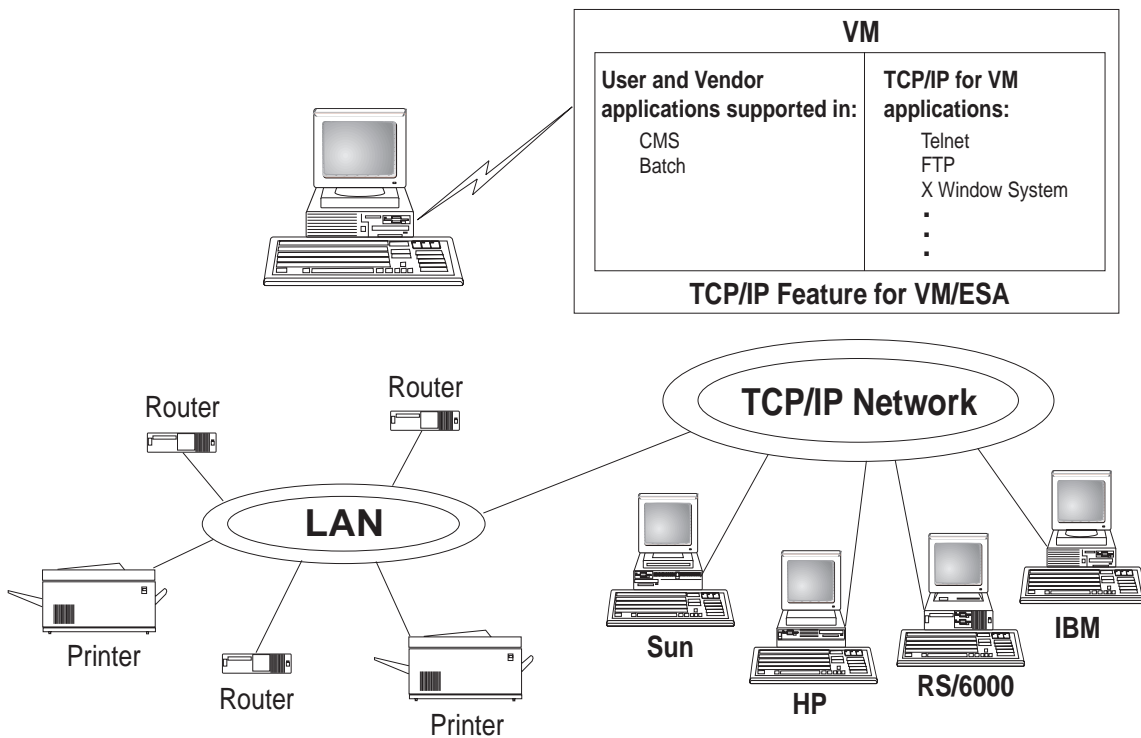


Figure 1. TCP/IP Feature for VM/ESA as Part of a Multivendor Network

TCP/IP can be characterized as belonging to one of the following categories:

- Connectivity and gateway functions, which handle the physical interfaces and routing of data.
- Server functions, which provide a service to a client (that is, send or transfer a file).

- Client functions, which request a certain service from a server anywhere in the network.
- Network status/management functions, which detect and solve network problems.
- Application Programming interfaces, which allow you to write your own client/server applications.

Transport Protocols

The transport layer of TCP/IP consists of transport protocols, which allow communication between application programs. This section describes the transport protocols in TCP/IP.

Transmission Control Protocol (TCP)

The Transmission Control Protocol (TCP) provides a reliable vehicle for delivering packets between hosts on an internet. TCP takes a stream of data, breaks it into datagrams, sends each one individually using IP, and reassembles the datagrams at the destination node. If any datagrams are lost or damaged during transmission, TCP detects this and resends the missing datagrams. The received data stream is a reliable copy of the transmitted data stream.

User Datagram Protocol (UDP)

The User Datagram Protocol (UDP) provides an unreliable mode of communication between source and destination hosts. UDP is a datagram-level protocol built directly on the IP layer. UDP is used for application-to-application programs between TCP/IP hosts.

Like IP, UDP does not offer a guarantee of datagram delivery or duplication protection. UDP does provide checksums for both the header and data portions of a datagram. However, applications that require reliable delivery of streams of data should use TCP.

Applications and Protocols

Applications are provided with the TCP/IP feature that allow users to use network services. These applications are included in the application layer of TCP/IP. The application layer is built on the services of the transport layer. The following applications and protocols are included in TCP/IP:

- Telnet Protocol
- File Transfer Protocol (FTP)
- Trivial File Transfer Protocol (TFTP)
- Simple Mail Transfer Protocol (SMTP)
- Domain Name System (DNS)
- Simple Network Management Protocol (SNMP)
- Kerberos Authentication System
- Remote Printing (LPR and LPD)
- Dynamic Routing (RouteD)
- X Window System
- GDDMXD
- Remote Procedure Call (RPC)
- Network File System (NFS)
- Remote Execution Protocol (REXEC)
- Bootstrap Protocol (BOOTP)

Optional Features

- Dynamic Host Configuration Protocol (DHCP)
- Network Computing System (NCS)
- Network Database System (NDB)
- Socket Interfaces

For More Information

See “TCP/IP Feature for VM/ESA Hardware Requirements” on page 18 and “TCP/IP Feature for VM/ESA Program Requirements” on page 28.

For more information, see the following books:

- *VM/ESA: TCP/IP Function Level 320 Planning and Customization*
- *VM/ESA: TCP/IP Function Level 320 User's Guide*

OpenEdition Shell and Utilities Feature for VM/ESA

The OpenEdition Shell and Utilities Feature for VM/ESA provides application development tools and an interactive environment in support of the POSIX application environment. This feature is a VM/ESA implementation of the POSIX 1003.2 Shell and Utilities standard (known as POSIX.2). Each of the POSIX.2 utilities additionally conforms to the X/Open Portability Guide, issue 4 (XPG4) for Commands and Utilities.

This feature provides a large set of utilities that aid in program development and in porting applications from other open systems. It also provides a UNIX-like interactive user environment. Users of the shell environment have access to both the shell commands set (built-in commands and utilities) and the full CP and CMS command set, as well as both OpenEdition and non-OpenEdition applications.

For more information, see the following book:

- *IBM OpenEdition for VM/ESA: User's Guide*

OpenEdition DCE Feature for VM/ESA

The OpenEdition Distributed Computing Environment (DCE) Feature for VM/ESA facilitates the development of DCE applications and significantly enhances the interoperability characteristics of the VM/ESA system in heterogeneous multivendor computing environments.

VM/ESA support for DCE consists of the following DCE components:

- ***DCE Remote Procedure Call (RPC)***

VM/ESA provides the complete structure for connection-less RPC. RPC provides a facility for calling a procedure on a remote system as if it were a procedure on the local system. RPC also provides a high level programming model which masks the application from the underlying details of the communication network.

- ***DCE Threads***

VM/ESA provides support for the DCE Threads application program interface (API). The DCE Threads service allows a user to create and control multiple threads of execution within a single process. The user threads library implementation is based on IEEE POSIX 1003.4a draft 4.

- ***DCE Cell Directory Service (CDS) Client***

The DCE CDS Client provides access to the DCE CDS Server on another system in the DCE Cell. The DCE Directory Services provide consistent naming throughout the distributed environment. This allows users to identify resources such as RPC based servers, files, or print queues by name and gain access to them without needing to know their location in the network.

- ***DCE Security Service Client***

The DCE Security Service Client provides the API to access the DCE Security Server on another system in the DCE Cell. The DCE Security Service enables clients and servers to prove their identities to each other. It offers integrity and privacy of communications and supports controlled access to resources. In addition, it provides user registration, authorization and authentication services for distributed applications.

See “OpenEdition DCE Feature for VM/ESA Program Requirements” on page 29.

For more information, see the following books:

- *IBM OpenEdition DCE for VM/ESA: Introducing the OpenEdition Distributed Computing Environment*
- *IBM OpenEdition DCE for VM/ESA: Planning*

LAN File Services/ESA (LFS/ESA)

LFS/ESA allows workstation users on TCP/IP networks and OS/2 LAN servers to:

- Use VM/ESA DASD space for storing, sharing, and executing their files
- Have READ or READ/WRITE access to CMS files stored on CMS minidisks
- Share data across the different network environments (OS/2 LAN Server and NFS)

LAN File Services consists of code running in the LAN File Services server and the administration virtual machine on the VM/ESA system and, in the OS/2 environment, in an OS/2 LAN Server that unites the VM/ESA system with the LAN. No LAN File Services code is required on any end user's workstation. In the OS/2 environment, LAN File Services is an extension of the storage capacity of the OS/2 LAN Server.

In the TCP/IP environment, LAN File Services is a standard NFS Version 2 server. LAN File Services also allows a workstation user to directly access CMS files on the VM/ESA system. Workstation users can also concurrently access CMS format files with CMS users, subject to existing CMS minidisk restrictions.

Access to files stored on VM/ESA DASD is transparent to the workstation users and programs. For example, most workstation programs that work with data stored on an OS/2 LAN Server hard drive today can also work unchanged when that data or application is stored on VM/ESA DASD.

See “LAN File Services/ESA Feature Hardware Requirements” on page 18 and “LAN File Services/ESA Feature Program Requirements” on page 29. For National Language Support information, see “LAN File Services/ESA Feature” on page 34.

For more information, see the following book:

- *Introducing LAN File Services/ESA*

LAN Resource Extension and Services/VM (LANRES/VM)

LANRES/VM establishes a server environment on VM/ESA to allow NetWare clients transparent access to mainframe resources. With LANRES/VM, a single Netware server can communicate with VM, MVS, and OS/400 hosts at the same time.

LANRES/VM services include:

- ***Disk Serving***

Using LANRES/VM disk services, NetWare workstation users can transparently store files on VM/ESA DASD. VM/ESA DASD can be configured for use by NetWare servers and subsequently by NetWare clients. Multiple NetWare servers connected to a single VM/ESA host can share disks stored on VM/ESA in read-only mode. To a NetWare user, there is no difference between files stored on DASD on the host and files stored on hard drives on the NetWare server. Each NetWare volume can be mapped to a disk drive letter in the client. The client can access a combination of local disk drives, drives on the NetWare server, and disk drives on the host.

- ***Print Serving***

LANRES/VM provides a print serving capability for NetWare that lets NetWare workstation users route print jobs through NetWare to VM/ESA for printing. In addition, VM/ESA users can route print jobs to NetWare for printing on LAN-attached printers.

- ***Data Distribution***

The data distribution function of LANRES/VM allows authorized VM/ESA users to manipulate files and directories controlled by NetWare. The volumes containing these files may be on the NetWare server or on a LANRES/VM host disk. This function implements a central data distribution capability.

- ***LAN Administration***

The LAN administration function of LANRES/VM allows an authorized VM/ESA administrator to add, delete, and rename users on the LAN. The administrator can also set passwords and password restrictions, limit space utilization, control file and directory access, and perform other administration functions. A VM/ESA administrator can function as the LAN administrator for an almost unlimited number of LANs connected by LANRES/VM.

See “LANRES/VM Feature Hardware Requirements” on page 20 and “LANRES/VM Feature Program Requirements” on page 30.

For more information, see the following book:

- *LAN Resource Extension and Services/VM: General Information*

Chapter 7. VM/ESA Library Guide

This chapter provides information about the VM/ESA product documentation. It contains the following sections:

- “Library Structure”
- “Basic (Automatically Shipped) VM/ESA Library” on page 64
- “Optional Printed VM/ESA Books” on page 65
- “Abstracts of Books in the VM/ESA Base Library” on page 67
- “Abstracts of Books for VM/ESA Additional Facilities” on page 79
- “Abstracts of Books for VM/ESA Optional Features” on page 82
- “Editions and Formats of VM/ESA Books” on page 86

Library Structure

This section explains how the VM/ESA library is organized.

Base Library Task Groups

The VM/ESA base library is organized according to the main tasks that computer users perform. These main tasks are:

Task	Definition
Evaluation	Deciding if VM/ESA meets your installation's needs.
Installation and Service	Generating and maintaining VM/ESA.
Planning and Administration	Making fundamental decisions about the options VM/ESA offers. Planning is an iterative task in that many of the decisions are made before installation, continually evaluated after installation, and revised as appropriate. The administration task involves defining the characteristics of data processing resources to VM/ESA. The resources can be data files, databases, programs, users, and so forth.
Customization	Extending or enhancing VM/ESA.
Operation	Starting VM/ESA, monitoring it to keep it running, and shutting it down if required.
Application Programming	Designing, coding, compiling, running, debugging, and maintaining application programs to do specific functions.
End Use	Performing user tasks.
Diagnosis	Identifying the source of a programming problem, describing the problem, comparing it to similar known problems, reporting a new problem, and correcting the problem.

Other Groups of Books

Also included in the VM/ESA library are groups of books for the following additional facilities and optional VM/ESA features:

- OpenEdition for VM/ESA
- DFSMS/VM
- Language Environment
- OSA/SF for VM/ESA
- CMS Utilities Feature
- TCP/IP Feature for VM/ESA
- OpenEdition DCE Feature for VM/ESA
- LANRES/VM
- LAN File Services/ESA

For a list of all the books in the VM/ESA library, see “Editions and Formats of VM/ESA Books” on page 86.

Basic (Automatically Shipped) VM/ESA Library

The basic VM/ESA library is shipped automatically with each VM/ESA product order at no additional cost. The basic library consists of:

- *IBM Online Library Omnibus Edition: VM Collection*

This CD-ROM contains all the VM/ESA base, additional facility, and optional feature books that are currently available in Adobe® Portable Document Format (PDF). It also contains all the IBM libraries that are available in IBM BookManager format for current VM system products and IBM licensed programs that run on VM/ESA.

Note: Only unlicensed books are included.

IBM Library Reader programs for Windows, OS/2, and DOS are included on the CD-ROM so you can make immediate use of the BookManager libraries on a workstation. Programs are also included that allow you to upload BookManager books to a VM or MVS host for viewing with IBM BookManager READ/VM or READ/MVS.

- A set of VM/ESA base, additional facility, and optional feature books in BookManager format on the VM/ESA system DDR.
- One printed copy of each of the following books:

Note: The latest printed version of each book is shipped. However, a later PDF-only edition may be available on the VM/ESA home page.

- *VM/ESA: Licensed Program Specifications*
- *VM/ESA: General Information*
- *VM/ESA: Planning and Administration*
- *VM/ESA: Conversion Guide and Notebook*
- *VM/ESA: CMS File Pool Planning, Administration, and Operation*
- *VM/ESA: Installation Guide*
- *VM/ESA: Service Guide*
- *VM/ESA: System Operation*
- *VM/ESA: Quick Reference*
- *VM/ESA: System Messages and Codes*
- *VM/ESA: REXX/EXEC Migration Tool for VM/ESA*
- *VM/ESA: DFSMS/VM Function Level 221 Planning Guide*

- *VM/ESA: DFSMS/VM Function Level 221 Installation and Customization*
- *VM/ESA: TCP/IP Function Level 320 Planning and Customization*
- If the CMS Utilities Feature is ordered, one printed copy of the following book:
 - *VM/ESA: CMS Utilities Feature*
- If the TCP/IP Feature for VM/ESA is ordered, one printed copy of the following books:
 - *VM/ESA: TCP/IP Function Level 320 User's Guide*
 - *VM/ESA: TCP/IP Function Level 320 Messages and Codes*
- If the OpenEdition DCE Feature for VM/ESA is ordered, one printed copy of the following books:
 - *IBM OpenEdition DCE for VM/ESA: Configuring and Getting Started*
 - *IBM OpenEdition DCE for VM/ESA: Planning*
- If the LAN File Services/ESA feature is ordered, one printed copy of the following book:
 - *LAN File Services/ESA: VM Guide and Reference*
- If the LANRES/VM feature is ordered, one printed copy of the following book:
 - *LAN Resource Extension and Services/VM: Guide and Reference*

Optional Printed VM/ESA Books

> All printed books other than those listed in the previous section are optional. You can obtain printed copies of many of these optional books by printing the PDF files. For information about what books are available in PDF format, see “Editions and Formats of VM/ESA Books” on page 86.

> You can obtain optional printed books for a fee by specifying feature codes when you order VM/ESA. These feature codes are provided as a convenience for ordering groups of books with the VM/ESA product. (Of course, you can also obtain each of these books for a fee separately from the product the same way you order any IBM books.) Books are grouped into features codes according to the part of the product they describe (the VM/ESA base, or a particular additional facility or optional feature) and whether or not they are new editions (“new edition” means new since the last release of VM/ESA). The available feature codes for printed VM/ESA books are:

> **Note:** In some cases, the new printed version of a book may no longer be the latest edition. A later PDF-only edition may be available on the VM/ESA home page.

Code Contents

8360 Optional VM/ESA base books – NEW editions:

- *VM/ESA: CMS Application Development Guide for Assembler*
- *VM/ESA: CMS Application Development Reference*
- *VM/ESA: CMS Command Reference*
- *VM/ESA: CP Command and Utility Reference*
- *VM/ESA: CP Exit Customization*
- *VM/ESA: CP Programming Services*
- *VM/ESA: Performance*
- *VM/ESA: REXX/VM Reference*

- *VM/ESA: VMSES/E Introduction and Reference*

8361 Other optional VM/ESA base books – NOT new editions:

- *VM/ESA: CMS Application Development Guide*
- *VM/ESA: CMS Application Development Reference for Assembler*
- *VM/ESA: CMS Application Multitasking*
- *VM/ESA: CMS Diagnosis Reference*
- *VM/ESA: CMS Pipelines User's Guide*
- *CMS/TSO Pipelines: Author's Edition*
- *VM/ESA: CMS Primer*
- *VM/ESA: CMS User's Guide*
- *VM/ESA: Connectivity Planning, Administration, and Operation*
- *VM/ESA: CP Diagnosis Reference*
- *VM/ESA: CP Diagnosis Reference Summary*
- *VM/ESA: CPI Communications User's Guide*
- *VM/ESA: Diagnosis Guide*
- *VM/ESA: Distributed Graphical User Interface Toolkit*
- *VM/ESA: Enterprise Systems Architecture/Extended Configuration Principles of Operation*
- *VM/ESA: Group Control System*
- *VM/ESA: Programmer's Guide to the Server-Requester Programming Interface for VM*
- *VM/ESA: REXX/VM Primer*
- *VM/ESA: REXX/VM User's Guide*
- *VM/ESA: Running Guest Operating Systems*
- *VM/ESA: Virtual Machine Operation*
- *VM/ESA: XEDIT Command and Macro Reference*
- *VM/ESA: XEDIT User's Guide*
- *Common Programming Interface Communications Reference*
- *Common Programming Interface Resource Recovery Reference*
- *External Security Interface (RACROUTE) Macro Reference for MVS and VM*

8362 Optional OpenEdition for VM/ESA books – NEW editions:

- > • *IBM OpenEdition for VM/ESA: Callable Services Reference*
- > • *IBM OpenEdition for VM/ESA: Command Reference*
- > • *IBM OpenEdition for VM/ESA: Sockets Reference*

8363 Other optional OpenEdition for VM/ESA books – NOT new editions:

- *IBM OpenEdition for VM/ESA: Advanced Application Programming Tools*
- *IBM OpenEdition for VM/ESA: POSIX Conformance Document*
- *IBM OpenEdition for VM/ESA: User's Guide*
- *Debug Tool User's Guide and Reference*

8364 Optional DFSMS/VM books – NOT new editions:

- *VM/ESA: DFSMS/VM Function Level 221 Messages and Codes*
- *VM/ESA: DFSMS/VM Function Level 221 Removable Media Services User's Guide and Reference*
- *VM/ESA: DFSMS/VM Function Level 221 Storage Administration Guide and Reference*

Note: The *VM/ESA: DFSMS/VM Function Level 221 Diagnosis Guide*, a licensed publication, is *not* included with feature 8364 and must be ordered separately from the product.

- > **8365** Optional Language Environment books – NEW editions :
- *Language Environment for OS/390 & VM: Concepts Guide*
 - *Language Environment for OS/390 & VM: Debugging Guide and Run-Time Messages*
 - *Language Environment for OS/390 & VM: Migration Guide*
 - *Language Environment for OS/390 & VM: Programming Guide*
 - *Language Environment for OS/390 & VM: Programming Reference*
 - *Language Environment for OS/390 & VM: Programming Reference*
- > **8366** Optional Open Systems Adapter books – NEW editions :
- *Planning for the System/390 Open Systems Adapter Feature*
 - *IBM VM/ESA: Open Systems Adapter Support Facility User's Guide*
- 8367** Optional TCP/IP Feature books – NEW editions:
- *VM/ESA: TCP/IP Function Level 320 Diagnosis Guide*
 - *VM/ESA: TCP/IP Function Level 320 Programmer's Reference*
- 8368** Optional DCE Feature books – NOT new editions:
- *IBM OpenEdition DCE for VM/ESA: Administration Guide*
 - *IBM OpenEdition DCE for VM/ESA: Administration Reference*
 - *IBM OpenEdition DCE for VM/ESA: Application Development Guide*
 - *IBM OpenEdition DCE for VM/ESA: Application Development Reference*
 - *IBM OpenEdition DCE for VM/ESA: Introducing the OpenEdition Distributed Computing Environment*
 - *IBM OpenEdition DCE for VM/ESA: Messages and Codes*
 - *IBM OpenEdition DCE for VM/ESA: User's Guide*
- 8369** Optional LAN File Services/ESA Feature books – NOT new editions:
- *Discovering LAN File Services/ESA (CD-ROM)*
 - *LAN File Services/ESA: Licensed Program Specifications*
 - *Introducing LAN File Services/ESA*
- 8370** Optional LANRES/VM Feature books – NOT new editions:
- *LAN Resource Extension and Services/VM: Licensed Program Specifications*
 - *LAN Resource Extension and Services/VM: General Information*

Abstracts of Books in the VM/ESA Base Library

The following abstracts describe the contents of the books in the VM/ESA base library. Each book is listed under its task group. The title of the book is followed by its form number.

For abstracts of the other books in the VM/ESA library, see:

- “Abstracts of Books for VM/ESA Additional Facilities” on page 79
- “Abstracts of Books for VM/ESA Optional Features” on page 82

Evaluation: Deciding If VM/ESA Meets Your Needs

VM/ESA: Licensed Program Specifications, GC24-5744

This document provides information on the warranted functions of VM/ESA, the specified operating environment, and the supplemental terms.

VM/ESA: General Information, GC24-5745

This book provides general information about VM/ESA. It contains:

- An introduction to VM/ESA
- An overview of the functions that are new or changed for the current release
- Hardware and software requirements and packaging information
- Descriptions of the VM/ESA components, additional facilities supplied with VM/ESA, and optional VM/ESA features
- A library guide that explains the structure and content of the VM/ESA publications library
- A list of the IBM processors that support VM/ESA
- A list of the IBM operating systems supported as guests of VM/ESA
- A list of the IBM devices that VM/ESA supports

Installation and Service: Generating and Maintaining VM/ESA

VM/ESA: Installation Guide, GC24-5836

This book guides a system programmer step-by-step through the VM/ESA installation procedures. The procedures feature an automated installation process using an INSTALL exec with a panel interface to load a prebuilt VM/ESA system packaged in DASD Dump Restore (DDR) image format.

This book also offers reference material to be used while you install VM/ESA. For example, some aspects of VM/ESA installation must be preplanned using the installation work sheets provided for you in the introductory chapter.

Note: *VM/ESA Installation and Service Sample Files* is an informal document packaged directly with VM/ESA. These hardcopy files are identical to the sample system definition files found on the VM/ESA system DDR tapes or CD-ROM.

VM/ESA: Service Guide, GC24-5838

This book provides step-by-step procedures for receiving and applying service and rebuilding serviced parts of your VM/ESA system.

This book is intended for system programmers and anyone responsible for servicing (maintaining and updating) VM/ESA. This book should be used in conjunction with the *VM/ESA: VMSES/E Introduction and Reference*.

VM/ESA: VMSES/E Introduction and Reference, GC24-5837

This book provides an overview of the Virtual Machine Serviceability Enhancements Staged/Extended (VMSES/E) component of VM/ESA. It describes how to use the VMSES/E Installation/Service Tool (VMSES/E) to install, migrate, build, service, and delete program products from a more general, less VM/ESA-specific, point of view than the *VM/ESA: Installation Guide* and the *VM/ESA: Service Guide*. This book discusses the Software Inventory and how you can use it to manage the products

on your system. Reference information on the product parameter file, Software Inventory tables, VMSES/E execs, and other related execs is also provided.

Planning and Administration: Making Decisions and Defining Resources for VM/ESA

VM/ESA: Planning and Administration, SC24-5750

This book describes how to plan and administer a VM/ESA system. It describes the following tasks:

- System planning and administration
- User planning and administration
- Storage planning and administration
- Saved segment planning and administration
- CMS planning and administration
- I/O configuration planning and administration

This book is the primary source of information about the system configuration file and the VM/ESA user directory.

Note: This book includes the information formerly provided in the *VM/ESA: Planning Dynamic I/O Configuration* book.

VM/ESA: CMS File Pool Planning, Administration, and Operation, SC24-5751

This book provides guidance and reference information on planning for, administering, and operating CMS file pools. It provides information about using file pools as repositories for Shared File System (SFS) and OpenEdition for VM/ESA Byte File System (BFS) data. It also provides information about using file pool server machines for Coordinated Resource Recovery (CRR) and FIFO functions. The book includes a reference section that contains descriptions of file pool start-up parameters and file pool administration and server commands.

VM/ESA: Conversion Guide and Notebook, GC24-5839

This book provides information to help you plan and do a conversion to VM/ESA Version 2 Release 4.0 from any of the following VM/ESA releases:

- VM/ESA Version 1 Release 1.5 370 Feature
- VM/ESA Version 1 Release 2.0
- VM/ESA Version 1 Release 2.1
- VM/ESA Version 1 Release 2.2
- VM/ESA Version 2 Release 1.0
- VM/ESA Version 2 Release 2.0
- VM/ESA Version 2 Release 3.0

Note: If you are planning to convert from a VM release prior to those listed above, you should first obtain one of the following books (not supplied with VM/ESA Version 2 Release 4.0), which provide information about converting from those older VM releases to VM/ESA Version 2 Release 1.0:

- *VM/ESA: Conversion Guide and Notebook for VM/SP, VM/SP HPO, and VM/ESA (370 Feature)*, SC24-5754
- *VM/ESA: Conversion Guide and Notebook for VM/XA SP and VM/ESA*, SC24-5753

This book:

- Helps you plan a strategy for your conversion
- Shows you how to do some conversion tasks
- Lists differences in components
- Describes new functions added to VM/ESA
- Explains differences in installation, service, administration, system operation, virtual machine operation, application programming, and diagnosis
- Shows changes in externals (commands, macros, routines, directory control statements, messages, and so forth)

This book provides an overview of the changes to VM/ESA for Year 2000 readiness.

This book is intended for system programmers, system analysts, and system support personnel who are responsible for planning and implementing system conversions. It is also intended for applications programmers who use commands, macros, routines, and other externals in their programs.

VM/ESA: REXX/EXEC Migration Tool for VM/ESA, GC24-5752

This book describes how use the REXX/EXEC Migration Tool for VM/ESA (VM/ESA MIGR) to help you migrate REXX, EXEC 2, DMKRIO/HCPRIO, and DMKSYS/HCPSPYS source files to VM/ESA Version 2 Release 4.0 from any of the following VM releases:

- VM/SP Release 5
- VM/SP HPO Release 5
- VM/XA SP Release 2.0 or 2.1
- VM/ESA Version 1 Release 1.0 (ESA Feature)
- VM/ESA Version 1 Release 1.0 (370 Feature)
- VM/ESA Version 2 Release 1.1
- VM/ESA Version 2 Release 2.0
- VM/ESA Version 1 Release 1.5 370 Feature
- VM/ESA Version 1 Release 2.0
- VM/ESA Version 1 Release 2.1
- VM/ESA Version 1 Release 2.2
- VM/ESA Version 2 Release 1.0
- VM/ESA Version 2 Release 2.0
- VM/ESA Version 2 Release 3.0

The areas where VM/ESA MIGR can give you assistance are:

- Estimating the migration effort necessary
- Identifying changes that have to be made in your programs
- Applying the necessary changes in the program. (VM/ESA MIGR only creates an interactive XEDIT environment in which you can make the changes it identifies; VM/ESA MIGR does not change any files.)

VM/ESA: Performance, SC24-5782

This book contains information about the planning, managing, measuring, and tuning considerations needed to obtain optimum VM/ESA system performance.

This book is intended for system programmers and others involved in the performance, monitoring, and tuning activities of VM/ESA.

Note: The CP monitor records are packaged directly with the VM/ESA product. After VM/ESA is installed, the file containing the monitor records is located on your base CP object disk (194). The file ID is MONITOR LIST1403, plus whatever mode designation is given to the CP object disk (194).

VM/ESA: Running Guest Operating Systems, SC24-5755

This book helps the reader to run *guest* operating systems under the supervision of VM/ESA. It contains specific information on running such guest operating systems as VSE, MVS, OS/390, and VM/ESA in a virtual machine.

VM/ESA: Connectivity Planning, Administration, and Operation, SC24-5756

This book describes the VM/ESA components and facilities that enable communications between programs that run on VM/ESA and non-VM/ESA systems. This book presents basic connectivity concepts and planning considerations. It also provides information to help you use the Transparent Services Access Facility (TSAF), APPC/VM VTAM Support (AVS), and Inter-System Facility for Communications (ISFC) on your VM/ESA system.

VM/ESA: Group Control System, SC24-5757

This book provides detailed information on planning for the GCS component of VM/ESA. It also describes the purpose and use of GCS commands and macroinstructions.

This book is intended for anyone writing programs that run in GCS, including system and application programmers in both customer and IBM development environments.

Customization: Extending or Enhancing VM/ESA

VM/ESA: CP Exit Customization, SC24-5672

This book describes how to customize a VM/ESA system using CP exit points, both IBM-defined and customer-written. It describes the following:

- Creating, controlling, and calling CP exit points
- Creating, controlling, and overriding CP commands
- Creating, controlling, and overriding DIAGNOSE codes
- Creating, controlling, and using local message repositories
- Dynamically loading into and unloading from CP storage
- Using dynamic CP exits

Operation: Starting, Running, and Shutting Down VM/ESA

VM/ESA: System Operation, SC24-5758

This book provides information on how to bring up and run the VM/ESA operating system on a processor in ESA/370 or ESA/390 mode.

This book is intended to help you operate VM/ESA by providing system-operation information.

VM/ESA: Virtual Machine Operation, SC24-5759

This book explains how to use VM/ESA to operate virtual machines.

This book is intended for anyone using VM/ESA to run an operating system in a virtual machine.

Application Programming: Creating and Using Application Programs on VM/ESA

VM/ESA: CP Programming Services, SC24-5760

This book describes application programming services and facilities available in the CP component. These services and facilities include:

- DIAGNOSE instruction
- Inter-User-Communications Vehicle (IUCV)
- Advanced Program-to-Program Communications/VM (APPC/VM)
- CP System Services
- ESA/XC address-space management macros
- Symptom record reporting

This book is intended for use by a system programmer.

VM/ESA: CMS Application Development Guide, SC24-5761

This book provides information about developing an application program in CMS. The development process includes planning, designing, writing, compiling, debugging, executing, and updating.

This book also describes what CMS services are available and how you can use these CMS services to develop an application. These CMS services include:

- Shared File System (SFS)
- Byte File System (BFS)
- Common Programming Interface (CPI) Communications
- Coordinated Resource Recovery (CRR) Facility
- VM Data Space Support
- CMS libraries
- CMS Batch Facility
- Parsing Facility
- Message repositories

This book also provides an overview of OpenEdition for VM/ESA.

VM/ESA: CMS Application Development Reference, SC24-5762

This book describes the basic set of callable services library (CSL) routines included in the VMLIB callable services library. It tells application programmers how to call these routines from the following languages:

- ADA
- Assembler
- C
- COBOL (IBM COBOL II and OS/VS COBOL Program Products)
- PL/I
- VS FORTRAN
- VS Pascal

- REXX

VM/ESA: CMS Application Development Guide for Assembler, SC24-5763

This book provides assembler language application programmers and system programmers with information to help them:

- Understand CMS programming interfaces and virtual machine architecture
- Use CMS services to:
 - Handle interrupts
 - Obtain free storage
 - Perform I/O
 - Process abnormal ends
- Manage CMS programs using CMS services to build, load, run, and package assembler programs
- Develop OS/MVS and VSE applications under CMS
- Use Access Methods Services and VSAM under CMS and CMS/DOS

VM/ESA: CMS Application Development Reference for Assembler, SC24-5764

This book provides application and system programmers with reference information on the assembler language programming interface. It explains:

- How to use CMS macroinstructions when writing programs that run in the CMS environment
- How to run CMS functions from programs

This book includes all of the CMS macros and functions in the preferred programming interface and those in the compatibility group.

VM/ESA: Programmer's Guide to the Server-Requester Programming Interface for VM, SC24-5455

This book provides application programmers with information on how to write and install IBM Enhanced Connectivity Facilities services in a VM/ESA system. For workstation users, the book also offers information on how to start IBM Enhanced Connectivity Facilities communications on VM/ESA.

VM/ESA: REXX/VM Primer, SC24-5598

This book introduces you to programming using the REstructured eXtended eXecutor language (REXX). This book is intended to help you get started with writing and running programs, commonly called execs, using the REXX language.

VM/ESA: REXX/VM User's Guide, SC24-5465

This book provides step-by-step instructions for using the REstructured eXtended eXecutor language (REXX), a powerful interpretive command and macrolanguage.

It is intended for users with some knowledge of VM/ESA, editors, and terminals, but previous programming experience is not needed. However, users with no programming experience should read the *VM/ESA: REXX/VM Primer* before reading the book.

VM/ESA: REXX/VM Reference, SC24-5770

This book provides reference information about REXX statements and their use, including:

- Error messages
- Instructions
- Functions
- Debugging aids
- Parsing
- System interfaces
- Syntax descriptions

This book includes the description of the REXX Sockets API.

This book is intended for experienced programmers, particularly those who have used another high-level language such as PL/I, Algol, or Pascal.

VM/ESA: Distributed Graphical User Interface Toolkit, SC24-5724

This book is for application developers who want to create graphical user interface (GUI) applications that run on VM/ESA. It introduces the concepts and structure of the Distributed GUI Toolkit (DT), which is an object-based programming interface for creating GUI applications. It also includes a reference section that contains descriptions of the classes, attributes, and routines provided by DT.

External Security Interface (RACROUTE) Macro Reference for MVS and VM, GC28-1366

This book provides a description of the full function RACROUTE external security interface for MVS and VM, the requests that can be called by it, their respective syntax, and related information. Also included in the book are certain data area fields and parameter lists.

VM/ESA: CPI Communications User's Guide, SC24-5595

This book provides step-by-step instructions for using Systems Application Architecture (SAA) Common Programming Interface (CPI) communications to write communications programs to run in the CMS environment. Sample programs written in REXX/VM show how to use SAA CPI Communications calls and the CMS extensions to CPI Communications.

This book is intended for programmers who want to learn how to write communications programs but are not familiar with communications programming.

Common Programming Interface Communications Reference, SC26-4399

This book describes Systems Application Architecture (SAA) Common Programming Interface (CPI) Communications in detail, including scenarios and individual routines.

This book is intended for anyone writing an application program that communicates with another program using the APPC protocol. The communications occur within a single TSAF collection, across many TSAF collections, or between a TSAF collection and a SNA network.

Common Programming Interface Resource Recovery Reference, SC31-6821

This book describes the System Application Architecture (SAA) Common Programming Interface resource recovery interface in detail, including scenarios and individual routines.

This book is intended for programmers who want to write applications that use the SAA resource recovery interface. The SAA resource recovery interface lets programs coordinate exchanges of data and updates to databases and other resources. This coordination ensures that either all changes become permanent or all are undone.

VM/ESA: Enterprise Systems Architecture/Extended Configuration Principles of Operation, SC24-5594

This book provides a detailed description of the Enterprise System Architecture/Extended Configuration (ESA/XC) virtual machine architecture. It describes how ESA/XC operates as compared to Enterprise Systems Architecture/390® (ESA/390), upon which ESA/XC is based.

This book serves as reference material for system and application programmers that write or debug programs that run in ESA/XC virtual machines.

VM/ESA: CMS Application Multitasking, SC24-5766

This book describes how you can use CMS multitasking to develop and run multitasking application programs written in C or assembler. Information on the topics concerning multitasking include:

- Basic multitasking concepts
- Process management
- Event management
- Interprocess communication
- Synchronization
- Multiprocessor configuration control
- Timer services
- Accounting services
- Abend services
- Trace services
- CMS Monitor data
- Function descriptions
- System exits
- Example multitasking program
- Suggestions for server writers
- Using CMS multitasking with OpenEdition services

VM/ESA: Reusable Server Kernel Programmer's Guide and Reference, SC24-5852

This book describes how you can use the reusable server kernel supplied with VM/ESA to develop and run server programs in the CMS environment.

This book covers advanced material in server construction and is not intended for beginning programmers.

End Use: Performing VM/ESA User Tasks

VM/ESA: CP Command and Utility Reference, SC24-5773

This book lists and describes the Control Program (CP) commands and utilities for users of every privilege class. The descriptions of the commands and utilities contain information about:

- Command or utility name
- User privilege class
- Purpose statement
- Format and syntax
- Parameter descriptions
- Usage notes
- Responses
- Messages

This book is intended to help CP command users operate effectively. It contains only the descriptive material outlined above and should not be used for programming purposes.

VM/ESA: CMS Primer, SC24-5458

This book provides information on basic tasks and commands using the Conversational Monitor System (CMS) component of VM/ESA. The primer presents, through examples, only a portion of the functions and commands available with VM/ESA. The primary emphasis of the primer is to aid you with:

- Logging on to VM/ESA
- Editing and working with notes and files
- Using the Shared File System (SFS)

VM/ESA: CMS User's Guide, SC24-5775

This book shows how to:

- Manage your file system
- Create and maintain an Online Help Facility
- Use windowing commands and full-screen CMS
- Modify and run execs and programs

This book is intended for users with a general understanding of CMS, who want to use CMS at a more advanced level. Users should read the *VM/ESA: CMS Primer* before reading the book.

VM/ESA: CMS Command Reference, SC24-5776

This book provides detailed reference information, including syntax and usage information, for all general-use CMS commands and VM Help Facility format words.

VM/ESA: Graphical User Interface Facility, SC24-5789

This book is for end users who want to install and use the VM/ESA Graphical User Interface (GUI) Facility, or system programmers and LAN administrators who want to make VM GUI applications available to end users. A graphical user interface is a type of user interface that takes advantage of high-resolution graphics, and typically includes a combination of graphics, objects, the use of pointing devices, menu bars and other menus, and overlapping windows.

The information provided in this book is useful whether or not you choose to run the CMS Desktop, which is a subset of VM/ESA function that you can work with through a graphical user interface.

VM/ESA: CMS Pipelines User's Guide, SC24-5777

This book describes the general concepts of CMS Pipelines and how to use CMS Pipelines. This information includes how to:

- Write a pipeline
- Use filters, host command interfaces, and device drivers
- Write a stage command
- Write a multistream pipeline
- Use pipelines in exec procedures and XEDIT macros.
- Store user-written stage commands in a filter package
- Migrate to CMS Pipelines

VM/ESA: CMS Pipelines Reference, SC24-5778

This book provides you with reference information on CMS Pipelines. In addition to a description of CMS Pipelines terms and concepts, included are syntax descriptions, usage information, and examples for each of the following:

- PIPE command
- Stages
- Pipeline subcommands
- Pipeline Assembler macros

CMS/TSO Pipelines: Author's Edition, SL26-0018

This book provides you with reference information on CMS/TSO Pipelines from its author. (CMS/TSO Pipelines evolved from the CMS Pipelines PRPQ.) In addition to a description of CMS/TSO Pipelines terms and concepts, this book includes syntax descriptions, usage information, and examples for each of the following:

- PIPE command
- Built-in Stages
- Pipeline commands
- Pipeline messages

This book contains additional information not found in the *VM/ESA: CMS Pipelines Reference*, and also provides information intended for the advanced Pipelines user.

VM/ESA: XEDIT User's Guide, SC24-5779

This book provides a working knowledge of the VM/ESA system editor, XEDIT. XEDIT provides a wide range of functions for text processing and programming development. Because it is both a full-screen and a line-mode editor, XEDIT can be used on display and on typewriter terminals.

VM/ESA: XEDIT Command and Macro Reference, SC24-5780

This book contains all the command formats, syntax rules, and operand and option descriptions for the XEDIT command, XEDIT subcommands, and macros. It also describes how to enter XEDIT commands, subcommands, and macros.

Users should read the *VM/ESA: XEDIT User's Guide* before reading the book.

VM/ESA: Quick Reference, SX24-5290

This book provides a quick reference and collection of VM/ESA commands, utilities, and REXX and EXEC 2 statements. Each command section contains:

- Commands, utilities, and statements in alphabetic order
- Environment of the command including:
 - APPC/VM VTAM Support (AVS)
 - Conversational Monitor System (CMS)
 - Control Program (CP)
 - Dump Viewing Facility
 - Group Control System (GCS)
 - Transparent Services Access Facilities (TSAF)
 - Virtual Machine Serviceability Enhancements Staged/Extended (VMSES/E)
- Reference book name and order number where you can find more information on the command
- A brief functional description
- Syntax of the command, including operands and options

The book also summarizes VM/ESA reference information such as messages, return codes, reserved file types, and so forth.

The book is intended for all users of VM/ESA, from the general user to the experienced system programmer.

Diagnosis: Identifying, Describing, Reporting, and Correcting Problems in VM/ESA

VM/ESA: System Messages and Codes, GC24-5841

This book provides messages and codes, and restrictions that can be met when using the following:

- Control Program (CP)
- Conversational Monitor System (CMS)
- Dump Viewing Facility
- Group Control System (GCS)
- Transparent Services Access Facility (TSAF)
- Virtual Machine Serviceability Enhancements Staged/Extended (VMSES/E)
- APPC/VM VTAM Support (AVS)
- Spool File Bridge

Conditions that generate these messages and codes are explained, the resulting actions are described, and proper responses are suggested.

VM/ESA: Diagnosis Guide, GC24-5854

This book provides diagnostic guidance information to help you identify, report, solve, and collect information about problems in VM/ESA.

This book is intended for system programmers, system analysts, and others that do diagnosis activities.

VM/ESA: CP Diagnosis Reference, SC24-5855

This book helps the reader to:

- Diagnose system problems
- Report these problems to IBM support representatives, as necessary
- Understand VM/ESA program listings

VM/ESA: CP Diagnosis Reference Summary, SX24-5292

This book contains the CP Trace Table entries from the *VM/ESA: CP Diagnosis Reference*.

VM/ESA: CMS Diagnosis Reference, SC24-5857

This book provides reference material needed to analyze problems that can occur with the CMS component of VM/ESA. In addition to a functional overview, the book contains detailed information about program routines in CMS.

This book is intended for the system programmer and the Level 2—Change Team field support personnel.

VM/ESA: Dump Viewing Facility, GC24-5853

This book provides help to those who use the VM/ESA Dump Viewing Facility for problem determination and problem source identification. It provides a description of the Dump Viewing Facility component and related usage information.

Abstracts of Books for VM/ESA Additional Facilities

This section describes the books for the additional facilities supplied with VM/ESA. The title of the book is followed by its form number.

OpenEdition for VM/ESA

IBM OpenEdition for VM/ESA: POSIX Conformance Document, GC24-5842

This book describes the OpenEdition for VM/ESA implementation of those areas of the IEEE POSIX.1 and POSIX.2 standards that were declared to be optional or implementation-defined.

IBM OpenEdition for VM/ESA: Callable Services Reference, SC24-5726

This book describes the OpenEdition for VM/ESA callable services, which are interfaces between VM/ESA and the functions specified in the IEEE POSIX.1 standard. These functions are used by IBM C for VM/ESA (C/VM™) POSIX support in VM/ESA. This book also describes callable services that are not related to the standards.

IBM OpenEdition for VM/ESA: User's Guide, SC24-5727

This book describes the OpenEdition for VM/ESA Byte File System (BFS) and provides information for using the shell commands in the OpenEdition Shell and Utilities Feature for VM/ESA.

IBM OpenEdition for VM/ESA: Command Reference, SC24-5728

This book describes the commands and utilities in the OpenEdition Shell and Utilities Feature for VM/ESA. It also describes CMS commands for using OpenEdition for VM/ESA services.

IBM OpenEdition for VM/ESA: Advanced Application Programming Tools, SC24-5729

This book provides information for using the *lex*, *yacc*, and *make* utilities in the OpenEdition Shell and Utilities Feature for VM/ESA.

IBM OpenEdition for VM/ESA: Sockets Reference, SC24-5741

This book describes the callable services that VM/ESA provides to support the protocol for client/server communication known as sockets. The OpenEdition for VM/ESA socket application program interface (API) provides support for both UNIX domain sockets and Internet domain sockets.

IBM C for VM/ESA: Library Reference, SC23-3908

This book describes the C/VM language header files, library functions, language extensions, and macros that operate with VM/ESA and Language Environment.

Note: This book is part of the library for the IBM C for VM/ESA product, but is also included in the VM/ESA library.

Debug Tool User's Guide and Reference, SC09-2137

This book is intended for application programmers using Debug Tool to debug High Level Languages with Language Environment.

DFSMS/VM Function Level 221

VM/ESA: DFSMS/VM Function Level 221 Planning Guide, GC35-0121

This book is a guide for system programmers and storage administrators who need to plan for the installation and use of DFSMS/VM.

VM/ESA: DFSMS/VM Function Level 221 Installation and Customization, SC26-4704

This book is for system programmers responsible for installing, customizing, and servicing DFSMS/VM.

VM/ESA: DFSMS/VM Function Level 221 Storage Administration Guide and Reference, SH35-0111

This book provides instructions for performing DFSMS/VM tasks and related reference information.

VM/ESA: DFSMS/VM Function Level 221 Removable Media Services User's Guide and Reference, SC35-0141

This book provides information about planning for, installing, and using the DFSMS/VM Removable Media Services (RMS) subsystem.

VM/ESA: DFSMS/VM Function Level 221 Messages and Codes, SC26-4707

This book contains explanations and suggested actions for messages and codes issued by DFSMS/VM.

VM/ESA: DFSMS/VM Function Level 221 Diagnosis Guide, LY27-9589

This book provides information about diagnosing and reporting DFSMS/VM errors.

S/390 Open Systems Adapter Support Facility (OSA/SF) for VM/ESA**Planning for the System/390 Open Systems Adapter Feature, GC23-3870**

This book provides planning information for all the hardware and programming platforms on which an Open Systems Adapter (OSA) can be run, including VM/ESA. An OSA is a unique S/390 channel type. The book therefore addresses OSA channel and attached device definitions in the hardware I/O configuration, host programming considerations, and considerations for the OSA Support Facility (OSA/SF).

IBM VM/ESA: Open Systems Adapter Support Facility User's Guide, SC28-1992

This book provides step-by-step instructions for setting up and using OSA/SF for VM/ESA, an optionally-installed facility supplied with VM/ESA. It also provides information on OSA/SF user interfaces. The OSA/SF interface is used to customize the modes of operation of an OSA.

Language Environment**Language Environment for OS/390 & VM: Concepts Guide, GC28-1945**

This book provides information on evaluating and planning for Language Environment.

Language Environment for OS/390 & VM: Programming Guide, SC28-1939

This book contains information about linking, running, and using services within the Language Environment. It also contains the Language Environment program management model and provides language- and operating system-specific information, where applicable.

Language Environment for OS/390 & VM: Programming Reference, SC28-1940

This book provides application programmers with a detailed description of each Language Environment run-time option and callable service, as well as information on how to use them. It also provides programming examples that illustrate how each callable service can be used in routines written in Language Environment-conforming high-level languages (HLLs) and assembler language.

Language Environment for OS/390 & VM: Writing Interlanguage Communication Applications, SC28-1943

This book contains information on creating and running interlanguage communication (ILC) applications under the Language Environment.

Language Environment for OS/390 & VM: Debugging Guide and Run-Time Messages, SC28-1942

This book provides assistance in detecting and locating programming errors that occur during run-time under the Language Environment. The book can help you establish a debugging process to analyze data and narrow the scope and location of where an error might have occurred. You can read about how to prepare a routine for debugging, how to classify errors, and how to use the debugging facilities that Language Environment provides. Also included are chapters on debugging HLL-specific routines and routines that run under CICS®.

Language Environment for OS/390 & VM: Migration Guide, SC28-1944

This book provides an overview of the steps that customers must take to migrate applications for use with the Language Environment. These customers may not necessarily be migrating to a new language compiler. This book is written for application developers. Familiarity with the run-time libraries of the different languages, and an understanding of the basics of linking and running applications, are assumed.

The information in this book is designed to help you create a broad migration strategy. This book will help you identify which modules can be migrated first, and which will require relinking or recompiling. It also explains how to use Language Environment run-time options to achieve behavior that is compatible with your old modules. For more detailed information about migration topics such as upgrading source code and load module compatibility, see one of the following manuals:

- *IBM C for VM/ESA: Compiler and Run-Time Migration Guide, SC09-2147*
- *COBOL for OS/390 & VM Compiler and Run-Time Migration Guide, GC26-4764*
- *PL/I for MVS & VM Compiler and Run-Time Migration Guide, SC26-3118*
- *FORTTRAN Run-Time Migration Guide, SC26-8499*

Abstracts of Books for VM/ESA Optional Features

This section describes the books for the optional features of VM/ESA. The title of the book is followed by its form number.

CMS Utilities Feature

VM/ESA: CMS Utilities Feature, SC24-5535

This book describes the tools and services provided in the CMS Utilities Feature. These tools and services make the CP and CMS environments less complex for end users and application developers by reducing the number of commands you must remember and enter to do certain tasks, or by providing useful execs and applications that you might otherwise have to generate yourself.

TCP/IP Feature for VM/ESA

VM/ESA: TCP/IP Function Level 320 Planning and Customization, SC24-5847

This book is intended to help system administrators plan for TCP/IP networks on a VM/ESA host and customize TCP/IP to their systems.

VM/ESA: TCP/IP Function Level 320 Messages and Codes, GC24-5850

This book is intended for use by system programmers in diagnosing TCP/IP problems. The book lists TCP/IP messages and codes by category.

VM/ESA: TCP/IP Function Level 320 User's Guide, SC24-5848

This book is intended for the end user and describes how to use TCP/IP after it has been installed and customized on your network. The book explains how to use the applications available in TCP/IP. These applications include:

- Transferring files
- Sending electronic mail
- Logging on to a foreign host
- Monitoring the network
- Authenticating network users
- Remote printing
- Managing network resources
- Using the Domain Name System

VM/ESA: TCP/IP Function Level 320 Programmer's Reference, SC24-5849

This book is intended for users and programmers who are familiar with VM/ESA and its CP and CMS components. The book contains reference information about the following application program interfaces (APIs):

- C sockets
- Pascal
- Virtual Machine Communication Facility (VMCF)
- Remote Procedure Calls (RPCs)
- X Window System
- Kerberos Authentication System
- Simple Network Management Protocol (SNMP) agent distributed program interface
- Network Computing System (NCS)
- CMS command interface to the name server
- Simple Mail Transfer Protocol (SMTP)

VM/ESA: TCP/IP Function Level 320 Diagnosis Guide, GC24-5851

This book is intended for system programmers who want to diagnose and report problems that can occur in TCP/IP networks.

OpenEdition Shell and Utilities Feature for VM/ESA

There are no separate books for the OpenEdition Shell and Utilities Feature for VM/ESA. The functions included in this feature are described in the following OpenEdition for VM/ESA books:

- *IBM OpenEdition for VM/ESA: POSIX Conformance Document*
- *IBM OpenEdition for VM/ESA: User's Guide*
- *IBM OpenEdition for VM/ESA: Command Reference*
- *IBM OpenEdition for VM/ESA: Advanced Application Programming Tools*

For abstracts of these books, see "OpenEdition for VM/ESA" on page 79.

OpenEdition DCE Feature for VM/ESA

IBM OpenEdition DCE for VM/ESA: Introducing the OpenEdition Distributed Computing Environment, SC24-5735

This book introduces you to OpenEdition DCE for VM/ESA. Whether you are a system manager, technical planner, VM system programmer, or application programmer, it will help you understand the Distributed Computing Environment (DCE).

IBM OpenEdition DCE for VM/ESA: Planning, SC24-5737

This book will help you plan for the organization and installation of OpenEdition DCE for VM/ESA. It discusses the benefits of distributed computing in general, and describes how to develop plans for a distributed system in an OpenEdition VM/ESA environment.

IBM OpenEdition DCE for VM/ESA: Configuring and Getting Started, SC24-5734

This book will help system and network administrators who understand the basic concepts of the Distributed Computing Environment (DCE) configure OpenEdition components. This publication should be used after the successful installation of OpenEdition DCE for VM/ESA which is described in the Program Directory.

IBM OpenEdition DCE for VM/ESA: Administration Guide, SC24-5730

This book provides information to help system and network administrators understand and administer OpenEdition DCE for VM/ESA. It provides guidance information on managing all supported DCE components on the VM/ESA platform. A knowledge of TCP/IP communications and the UNIX operating system can help administrators use this publication more effectively.

IBM OpenEdition DCE for VM/ESA: Administration Reference, SC24-5731

This book provides detailed reference information on commands that system and network administrators use when working with the OpenEdition DCE feature. This reference publication includes:

- DCE Configuration and Process Control Commands

- Remote Procedure Call Administration Commands
- Cell Directory Administration
- Security Services Administration Commands

IBM OpenEdition DCE for VM/ESA: Application Development Guide, SC24-5732

This book provides detailed information to assist the programmer with designing, writing, compiling, linking, and running distributed applications on the VM/ESA operating system. The information includes:

- Steps necessary to develop a distributed application using DCE services and application programming interfaces
- Development considerations and tools that you need to consider when developing your distributed applications using OpenEdition DCE for VM/ESA

IBM OpenEdition DCE for VM/ESA: Application Development Reference, SC24-5733

This reference book explains in detail the Distributed Computing Environment (DCE) Application Program Interfaces (APIs) that a programmer will need to know when writing Distributed applications on the VM/ESA platform.

IBM OpenEdition DCE for VM/ESA: User's Guide, SC24-5738

This book describes how to do the following tasks in OpenEdition DCE for VM/ESA and is intended for anyone who uses a DCE application to:

- Work with your user account
- View namespace entries
- Control access to DCE objects that you own

IBM OpenEdition DCE for VM/ESA: Messages and Codes, SC24-5736

This book provides detailed explanations and recovery actions for the messages, status codes, and exception codes issued by OpenEdition DCE for VM/ESA.

LAN File Services/ESA (LFS/ESA)

LAN File Services/ESA: Licensed Program Specifications, GH24-5260

This document provides information on the warranted functions of LFS/ESA, the specified operating environment, and the supplemental terms.

Introducing LAN File Services/ESA, GH24-5259

This book provides an overview of LFS/ESA and what it can do for you. This book also identifies the hardware and software requirements for installing and using LFS/ESA.

Note: For updated hardware and software requirements, see “LAN File Services/ESA Feature Hardware Requirements” on page 18 and “LAN File Services/ESA Feature Program Requirements” on page 29.

LAN File Services/ESA: VM Guide and Reference, SH24-5264

This book contains information on planning, installing, and administering LFS/ESA. It also contains information for VM system operators and workstation users. It describes all the LFS/ESA commands and configuration files, plus the messages and return codes.

LAN Resource Extension and Services/VM (LANRES/VM)

LAN Resource Extension and Services/VM: Licensed Program Specifications, GC24-5617

This document provides information on the warranted functions of LANRES/VM, the specified operating environment, and the supplemental terms.

LAN Resource Extension and Services/VM: General Information, GC24-5618

This book provides an introduction to LANRES/VM and what it can do for you. This book also identifies the hardware, software, and storage requirements for installing and using LANRES/VM.

Note: For updated hardware and software requirements, see “LANRES/VM Feature Hardware Requirements” on page 20 and “LANRES/VM Feature Program Requirements” on page 30.

LAN Resource Extension and Services/VM: Guide and Reference, SC24-5622

This book tells how to set up, install, start, and use LANRES/VM. Although it is intended for system programmers responsible for installing and maintaining LANRES/VM, it also contains general user information. This book describes the LANRES/VM commands and messages.

Editions and Formats of VM/ESA Books

The following tables identify the current edition and available formats for each book in the VM/ESA library, including the books for VM/ESA additional facilities and VM/ESA optional features. VM/ESA books may be available as printed books, Adobe Portable Document Format (PDF) files, or IBM BookManager files.

> The current edition (form number suffix) of a book is indicated in the **Edition**
> column. A new edition (that is, new since the edition available with the previous
> VM/ESA release) is indicated by **NEW** following the form number suffix.

> Books that are available in printed format are indicated by either “Basic” or
> “Optional” in the **Printed** column. A basic book is supplied free with VM/ESA, or
> when you order the VM/ESA optional feature that the book describes. (Because the
> VM/ESA additional facilities are supplied automatically with the VM/ESA base, basic
> books for VM/ESA additional facilities are also supplied automatically with the
> VM/ESA base.) An optional book is not supplied automatically, but you can order it
> separately for a fee through your IBM representative or through IBM Direct
> (<http://www.elink.ibm.com/pbl/pbl>). You can also obtain groups of optional
> printed books for a fee by specifying feature codes with your VM/ESA product order
> (see “Optional Printed VM/ESA Books” on page 65). If the **Printed** column is blank,
> there is no printed version of the current edition of the book. However, you can
> obtain a printed copy of the current edition by printing the PDF file.

Books that are available in PDF format are indicated by “Yes” in the **PDF** column. PDF files are provided on the *IBM Online Library Omnibus Edition: VM Collection* CD-ROM (supplied free with VM/ESA) and on the IBM VM/ESA operating system home page (<http://www.ibm.com/s390/vm/pubs>). You can view a PDF file using the Adobe Acrobat® Reader, which is available free from the Adobe home page (<http://www.adobe.com>). PDF files look just like printed books on your workstation monitor. They provide topic linking similar to IBM BookManager files. You can also print a PDF file — the whole book or selected sections.

Books that are available in BookManager format are indicated by “Yes” in the **BookMgr** column. BookManager files are provided on the *IBM Online Library Omnibus Edition: VM Collection* CD-ROM (supplied free with VM/ESA), which includes IBM Library Reader programs for Windows, OS/2, and DOS. BookManager files are also provided on the VM/ESA home page and on the VM/ESA product DDR.

Note: See “Online Books Program Requirements” on page 32.

Books for the VM/ESA Base

Table 4 (Page 1 of 3). Current Editions and Available Formats of VM/ESA Base Books

Book Title	Number	Edition	Printed	PDF	BookMgr
VM/ESA: CMS Application Development Guide	SC24-5761	-02	Optional		Yes
VM/ESA: CMS Application Development Guide for Assembler	SC24-5763	-01 NEW	Optional	Yes	Yes
VM/ESA: CMS Application Development Reference	SC24-5762	-03 NEW	Optional	Yes	Yes
VM/ESA: CMS Application Development Reference for Assembler	SC24-5764	-01	Optional		Yes
VM/ESA: CMS Application Multitasking	SC24-5766	-02	Optional		Yes
> VM/ESA: CMS Command Reference	SC24-5776	-04 NEW	Optional ¹	Yes ¹	Yes ¹
VM/ESA: CMS Data Areas and Control Blocks ²					
VM/ESA: CMS Diagnosis Reference	SC24-5857	-00	Optional		Yes
VM/ESA: CMS File Pool Planning, Administration, and Operation	SC24-5751	-02	Basic		Yes
VM/ESA: CMS Pipelines Reference	SC24-5778	-03 NEW		Yes	Yes
VM/ESA: CMS Pipelines User's Guide	SC24-5777	-01	Optional		Yes
CMS/TSO Pipelines: Author's Edition	SL26-0018	-00	Optional		Yes
VM/ESA: CMS Primer	SC24-5458	-02	Optional		Yes
VM/ESA: CMS User's Guide	SC24-5775	-00	Optional		Yes
VM/ESA: Connectivity Planning, Administration, and Operation	SC24-5756	-00	Optional		Yes
VM/ESA: Conversion Guide and Notebook	GC24-5839	-01 NEW	Basic	Yes	Yes

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Table 4 (Page 2 of 3). Current Editions and Available Formats of VM/ESA Base Books

	Book Title	Number	Edition	Printed	PDF	BookMgr
>	VM/ESA: CP Command and Utility Reference	SC24-5773	-04 NEW	Optional ¹	Yes ¹	Yes ¹
	VM/ESA: CP Data Areas and Control Blocks ²					
	VM/ESA: CP Diagnosis Reference	SC24-5855	-00	Optional		Yes
	VM/ESA: CP Diagnosis Reference Summary	SX24-5292	-00	Optional		
	VM/ESA: CP Exit Customization	SC24-5672	-01 NEW	Optional	Yes	Yes
	VM/ESA: CP Programming Services	SC24-5760	-03 NEW	Optional	Yes	Yes
	VM/ESA: CPI Communications User's Guide	SC24-5595	-01	Optional		Yes
	VM/ESA: Diagnosis Guide	GC24-5854	-00	Optional		Yes
	VM/ESA: Distributed Graphical User Interface Toolkit	SC24-5724	-02	Optional		Yes
	VM/ESA: Dump Viewing Facility	GC24-5853	-01 NEW		Yes	Yes
	VM/ESA: Enterprise Systems Architecture/Extended Configuration Principles of Operation	SC24-5594	-02	Optional		Yes
>	VM/ESA: General Information	GC24-5745	-04 NEW	Basic ¹	Yes ¹	Yes ¹
	VM/ESA: Graphical User Interface Facility	SC24-5789	-03 NEW		Yes	Yes
	VM/ESA: Group Control System	SC24-5757	-01	Optional		Yes
>	VM/ESA: Installation Guide	GC24-5836	-03 NEW	Basic ¹	Yes ^{1,3}	
	VM/ESA: Licensed Program Specifications	GC24-5744	-03 NEW	Basic	Yes	Yes
	VM Monitor Records ⁴					
	VM/ESA: Performance	SC24-5782	-03 NEW	Optional	Yes	Yes
>	VM/ESA: Planning and Administration	SC24-5750	-04 NEW	Basic ¹	Yes ¹	Yes ¹
	VM/ESA: Planning Dynamic I/O Configuration ⁵					
	VM/ESA: Programmer's Guide to the Server-Requester Programming Interface for VM	SC24-5455	-01	Optional		Yes
	VM/ESA: Quick Reference	SX24-5290	-03 NEW	Basic	Yes	Yes
	VM/ESA: REXX/EXEC Migration Tool for VM/ESA	GC24-5752	-03 NEW	Basic	Yes	Yes
	VM/ESA: REXX/VM Primer	SC24-5598	-01	Optional		Yes
	VM/ESA: REXX/VM Reference	SC24-5770	-03 NEW	Optional	Yes	Yes
	VM/ESA: REXX/VM User's Guide	SC24-5465	-03	Optional		Yes
	VM/ESA: Running Guest Operating Systems	SC24-5755	-01	Optional		Yes

Book Title	Number	Edition	Printed	PDF	BookMgr
VM/ESA: Reusable Server Kernel Programmer's Guide and Reference	SC24-5852	-00 NEW		Yes	Yes
VM/ESA: Service Guide	GC24-5838	-01 NEW	Basic	Yes	Yes
VM/ESA: System Messages and Codes	GC24-5841	-01 NEW	Basic	Yes	Yes
VM/ESA: System Operation	SC24-5758	-02 NEW	Basic	Yes	Yes
VM/ESA: Virtual Machine Operation	SC24-5759	-01	Optional		Yes
VM/ESA: VMSES/E Introduction and Reference	GC24-5837	-01 NEW	Optional	Yes	Yes
VM/ESA: XEDIT Command and Macro Reference	SC24-5780	-01	Optional		Yes
VM/ESA: XEDIT User's Guide	SC24-5779	-00	Optional		Yes
Common Programming Interface Communications Reference	SC26-4399	-09	Optional		Yes
Common Programming Interface Resource Recovery Reference	SC31-6821	-01	Optional		Yes
External Security Interface (RACROUTE) Macro Reference for MVS and VM	GC28-1366	-07	Optional		Yes
Notes on the VM/ESA Base:					
<ol style="list-style-type: none"> 1. The latest edition of this book is available only in PDF format on the VM/ESA home page. It contains updates since the General Availability (GA) of VM/ESA 2.4.0. The printed book and the PDF and BookManager files (if any) on the <i>IBM Online Library Omnibus Edition: VM Collection</i> CD-ROM are the VM/ESA 2.4.0 GA-level edition (previous form number suffix). 2. CP and CMS control block information is no longer provided in book form. This information is available on the VM/ESA home page, or you can use the BLOCKDEF utility against control blocks on your system to get the most current data. 3. The PDF version of the <i>VM/ESA: Installation Guide</i> is not supplied on the <i>IBM Online Library Omnibus Edition: VM Collection</i> CD-ROM; it is available only from the VM/ESA home page. 4. VM Monitor Records are provided in a MONITOR LIST1403 file, which is packaged with the VM/ESA product. 5. The contents of this book have been merged into <i>VM/ESA: Planning and Administration</i>. 					

Books for VM/ESA Additional Facilities

Facility / Book Title	Number	Edition	Printed	PDF	BookMgr
OpenEdition for VM/ESA					
IBM OpenEdition for VM/ESA: Advanced Application Programming Tools	SC24-5729	-00	Optional		Yes
IBM OpenEdition for VM/ESA: Callable Services Reference	SC24-5726	-03 NEW	Optional	Yes	Yes

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<i>Table 5 (Page 2 of 3). Current Editions and Available Formats of VM/ESA Additional Facility Books</i>						
Facility / Book Title	Number	Edition	Printed	PDF	BookMgr	
IBM OpenEdition for VM/ESA: Command Reference	SC24-5728	-02 NEW	Optional	Yes	Yes	
IBM OpenEdition for VM/ESA: POSIX Conformance Document	GC24-5842	-00	Optional		Yes	
IBM OpenEdition for VM/ESA: Sockets Reference	SC24-5741	-01 NEW	Optional	Yes	Yes	
IBM OpenEdition for VM/ESA: User's Guide	SC24-5727	-00	Optional		Yes	
IBM C for VM/ESA: Library Reference	SC23-3908	-02 NEW		Yes	Yes	
Debug Tool User's Guide and Reference	SC09-2137	-03 NEW	Optional		Yes	
DFSMS/VM						
VM/ESA: DFSMS/VM Function Level 221 Diagnosis Guide	LY27-9589	-02	Optional			
VM/ESA: DFSMS/VM Function Level 221 Installation and Customization	SC26-4704	-03	Basic		Yes	
VM/ESA: DFSMS/VM Function Level 221 Messages and Codes	SC26-4707	-03	Optional		Yes	
VM/ESA: DFSMS/VM Function Level 221 Planning Guide	GC35-0121	-01	Basic		Yes	
VM/ESA: DFSMS/VM Function Level 221 Removable Media Services User's Guide and Reference	SC35-0141	-01	Optional		Yes	
VM/ESA: DFSMS/VM Function Level 221 Storage Administration Guide and Reference	SH35-0111	-01	Optional		Yes	
Language Environment						
> Language Environment for OS/390 & VM: Concepts Guide	GC28-1945	-06 NEW	Optional	Yes	Yes	
> Language Environment for OS/390 & VM: Debugging Guide and Run-Time Messages	SC28-1942	-06 NEW	Optional	Yes	Yes	
> Language Environment for OS/390 & VM: Migration Guide	SC28-1944	-06 NEW	Optional	Yes	Yes	
> Language Environment for OS/390 & VM: Programming Guide	SC28-1939	-06 NEW	Optional	Yes	Yes	
> Language Environment for OS/390 & VM: Programming Reference	SC28-1940	-06 NEW	Optional	Yes	Yes	
> Language Environment for OS/390 & VM: Writing Interlanguage Communication Applications	SC28-1943	-06 NEW	Optional	Yes	Yes	
OSA/SF						
> IBM VM/ESA: Open Systems Adapter Support Facility User's Guide	SC28-1992	-03 NEW	Optional	Yes	Yes	

Table 5 (Page 3 of 3). Current Editions and Available Formats of VM/ESA Additional Facility Books

Facility / Book Title	Number	Edition	Printed	PDF	BookMgr
Planning for the System/390 Open Systems Adapter Feature	GC23-3870	-08 NEW	Optional	Yes	Yes

Books for VM/ESA Optional Features

Table 6 (Page 1 of 2). Current Editions and Available Formats of VM/ESA Optional Feature Books

Feature / Book Title	Number	Edition	Printed	PDF	BookMgr
CMS Utilities Feature					
VM/ESA: CMS Utilities Feature	SC24-5535	-01	Basic		Yes
TCP/IP Feature					
VM/ESA: TCP/IP Function Level 320 Diagnosis Guide	GC24-5851	-01 NEW	Optional	Yes	Yes
VM/ESA: TCP/IP Function Level 320 Messages and Codes	GC24-5850	-01 NEW	Basic ¹	Yes	Yes
VM/ESA: TCP/IP Function Level 320 Planning and Customization	SC24-5847	-01 NEW	Basic ²	Yes	Yes
VM/ESA: TCP/IP Function Level 320 Programmer's Reference	SC24-5849	-01 NEW	Optional	Yes	Yes
VM/ESA: TCP/IP Function Level 320 User's Guide	SC24-5848	-01 NEW	Basic ¹	Yes	Yes
Notes on the TCP/IP Feature:					
1. This book is basic to the TCP/IP Feature.					
2. This book is basic to the VM/ESA base.					
OpenEdition DCE Feature					
IBM OpenEdition DCE for VM/ESA: Administration Guide	SC24-5730	-00	Optional		Yes
IBM OpenEdition DCE for VM/ESA: Administration Reference	SC24-5731	-00	Optional		Yes
IBM OpenEdition DCE for VM/ESA: Application Development Guide	SC24-5732	-00	Optional		Yes
IBM OpenEdition DCE for VM/ESA: Application Development Reference	SC24-5733	-00	Optional		Yes
IBM OpenEdition DCE for VM/ESA: Configuring and Getting Started	SC24-5734	-00	Basic		Yes
IBM OpenEdition DCE for VM/ESA: Introducing the OpenEdition Distributed Computing Environment	SC24-5735	-00	Optional		Yes
IBM OpenEdition DCE for VM/ESA: Messages and Codes	SC24-5736	-00	Optional		Yes
IBM OpenEdition DCE for VM/ESA: Planning	SC24-5737	-00	Basic		Yes
IBM OpenEdition DCE for VM/ESA: User's Guide	SC24-5738	-00	Optional		Yes

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<i>Table 6 (Page 2 of 2). Current Editions and Available Formats of VM/ESA Optional Feature Books</i>					
Feature / Book Title	Number	Edition	Printed	PDF	BookMgr
LAN File Services/ESA					
Discovering LAN File Services/ESA (CD-ROM)	GK2T-5762	-02	Optional		
Introducing LAN File Services/ESA	GH24-5259	-02	Optional		Yes
LAN File Services/ESA: Licensed Program Specifications	GH24-5260	-03	Optional		Yes
LAN File Services/ESA: VM Guide and Reference	SH24-5264	-01	Basic		Yes
LANRES/VM					
LAN Resource Extension and Services/VM: General Information	GC24-5618	-04	Optional		Yes
LAN Resource Extension and Services/VM: Guide and Reference	SC24-5622	-03	Basic		Yes
LAN Resource Extension and Services/VM: Licensed Program Specifications	GC24-5617	-05	Optional		Yes

Appendix A. IBM Processors Supported by VM/ESA

This appendix provides information about the IBM processors supported by current VM/ESA operating systems. It addresses VM/ESA operating systems running first level on the hardware or in an LPAR. For guest considerations, see Appendix B, "IBM Operating Systems Supported as Guests of VM/ESA" on page 97.

The following terms and abbreviations are used in the processor support matrix:

PR/SM	Processor Resource/Systems Manager. A hardware feature that supports LPAR mode and MPG capability.
LPAR	Logically Partitioned. On a processor with PR/SM operating in LPAR mode, processor resources are divided across up to ten logical partitions, depending on the processor model.
MPG	Multiple Preferred Guests. On a processor with PR/SM operating in basic mode, a VM/ESA host operating system supports up to six preferred (high performance) guests.
VM Data Spaces	A facility of all listed VM/ESA releases that allows an XC virtual machine to access as many as 1022 data spaces of 2GB (gigabytes) each. (An XC virtual machine requires an ESA/390 processor.)
S/370™	System/370 architecture
ESA220	VM/ESA Version 2 Release 2.0
ESA230	VM/ESA Version 2 Release 3.0
ESA240	VM/ESA Version 2 Release 4.0

The following general notes apply to the matrix:

- All listed VM/ESA releases can exploit the ESCON Multiple Image Facility (EMIF) when running in a logical partition.
- The inclusion of a processor in this matrix does not imply the processor is available in all countries.

<i>Table 7 (Page 1 of 4). VM/ESA Processor Support Matrix</i>		
Processor	Mode	Current VM/ESA Support
4381-9x (1)	S/370	
	ESA/370	ESA220, ESA230, ESA240
Notes on 4381-9x:		
(1) Storage Key Facility (SKF) and VM Data Spaces facility are not available on this processor.		
3090™ E/S	S/370	
	ESA/370	ESA220 (1), ESA230 (1), ESA240 (1)
	LPAR	ESA220 (1,2), ESA230 (1,2), ESA240 (1,2)

Processor Support

Table 7 (Page 2 of 4). VM/ESA Processor Support Matrix		
Processor	Mode	Current VM/ESA Support
<p>Notes on 3090 E/S:</p> <p>(1) VM Data Spaces facility is not available on the ES/3090 E and S models.</p> <p>(2) On an ES/3090 E, CMS guest environments on a VM/ESA host running in an LPAR are not supported for production, but are supported for test and development.</p> <p>On an ES/3090 S with RPQ 8P1367, CMS guest environments on a VM/ESA host running in an LPAR are supported for production. Many V=V workloads will experience comparable performance when the VM/ESA host is running natively or in an LPAR.</p>		
3090 J	S/370	
	ESA/370	ESA220 (1), ESA230 (1), ESA240 (1)
	LPAR	ESA220 (1,2), ESA230 (1,2), ESA240 (1,2)
<p>Notes on 3090 J:</p> <p>(1) VM Data Spaces facility is not available on the ES/3090 J.</p> <p>(2) CMS guest environments on a VM/ESA host running in an LPAR are supported for production. Many V=V workloads will experience comparable performance when the VM/ESA host is running natively or in an LPAR.</p>		
3090 9000T	S/370	
	ESA/370	ESA220 (1), ESA230 (1), ESA240 (1)
	LPAR	ESA220 (1,2), ESA230 (1,2), ESA240 (1,2)
<p>Notes on 3090 9000T:</p> <p>(1) VM Data Spaces facility is not available on the ES/3090 9000T.</p> <p>(2) CMS guest environments on a VM/ESA host running in an LPAR are supported for production. Many V=V workloads will experience comparable performance when the VM/ESA host is running natively or in an LPAR.</p>		
9221	S/370	
	ESA/390	ESA220, ESA230, ESA240
	LPAR	ESA220 (1), ESA230 (1), ESA240 (1)
9121	ESA/390	ESA220, ESA230, ESA240
	LPAR	ESA220 (1), ESA230 (1), ESA240 (1)
9021	ESA/390	ESA220, ESA230, ESA240
	LPAR	ESA220 (1), ESA230 (1), ESA240 (1)
<p>Notes on 9221, 9121, and 9021:</p> <p>For specific service levels required, contact your IBM representative.</p> <p>(1) CMS guest environments on a VM/ESA host running in an LPAR are supported for production. Many V=V workloads will experience comparable performance when the VM/ESA host is running natively or in an LPAR.</p>		
9672 R2/R3	ESA/390	ESA220, ESA230, ESA240
	LPAR	ESA220 (1), ESA230 (1), ESA240 (1)
<p>Notes on 9672 R2/R3:</p> <p>For specific service levels required, contact your IBM representative.</p> <p>(1) CMS guest environments on a VM/ESA host running in an LPAR are supported for production. Many V=V workloads will experience comparable performance when the VM/ESA host is running natively or in an LPAR.</p>		

Table 7 (Page 3 of 4). VM/ESA Processor Support Matrix

Processor	Mode	Current VM/ESA Support
S/390 Multiprise 2000	ESA/390	ESA220, ESA230 (1), ESA240 (1)
	LPAR	ESA220 (2), ESA230 (1,2), ESA240 (1,2)
<p>Notes on Multiprise 2000:</p> <p>For specific service levels required, contact your IBM representative.</p> <p>(1) VM/ESA guest coupling simulation is supported.</p> <p>(2) CMS guest environments on a VM/ESA host running in an LPAR are supported for production. Many V=V workloads will experience comparable performance when the VM/ESA host is running natively or in an LPAR.</p>		
S/390 Multiprise 3000 Enterprise Server	ESA/390	ESA220 (1), ESA230 (1,2), ESA240 (1,2)
	LPAR	ESA220 (1,3), ESA230 (1,2,3), ESA240 (1,2,3)
<p>Notes on Multiprise 3000:</p> <p>For specific service levels required, contact your IBM representative.</p> <p>(1) APAR VM62180 is required.</p> <p>(2) VM/ESA guest coupling simulation is supported.</p> <p>(3) CMS guest environments on a VM/ESA host running in an LPAR are supported for production. Many V=V workloads will experience comparable performance when the VM/ESA host is running natively or in an LPAR.</p>		
S/390 G3 Parallel Enterprise Server	ESA/390	ESA220 (1), ESA230 (1,2), ESA240 (1,2)
	LPAR	ESA220 (1,3), ESA230 (1,2,3), ESA240 (1,2,3)
<p>Notes on G3:</p> <p>For specific service levels required, contact your IBM representative.</p> <p>(1) ESA220 and ESA230 do not support the CMOS Cryptographic Coprocessor. Moreover, APAR VM61244 is required to run these releases on a machine with the CMOS Cryptographic Processor installed. ESA240 supports the CMS Cryptographic Processor for use by guests.</p> <p>(2) VM/ESA guest coupling simulation is supported.</p> <p>(3) CMS guest environments on a VM/ESA host running in an LPAR are supported for production. Many V=V workloads will experience comparable performance when the VM/ESA host is running natively or in an LPAR.</p>		
S/390 G4 Parallel Enterprise Server	ESA/390	ESA220 (1,2), ESA230 (1,2,3), ESA240 (1,2,3)
	LPAR	ESA220 (1,2,4), ESA230 (1,2,3,4), ESA240 (1,2,3,4)
<p>Notes on G4:</p> <p>For specific service levels required, contact your IBM representative.</p> <p>(1) 370 mode operating systems (including CMS) will not run as guests of VM/ESA on this processor.</p> <p>(2) ESA220 and ESA230 do not support the CMOS Cryptographic Coprocessor. Moreover, APAR VM61244 is required to run these releases on a machine with the CMOS Cryptographic Processor installed. ESA240 supports the CMS Cryptographic Processor for use by guests.</p> <p>(3) VM/ESA guest coupling simulation is supported.</p> <p>(4) CMS guest environments on a VM/ESA host running in an LPAR are supported for production. Many V=V workloads will experience comparable performance when the VM/ESA host is running natively or in an LPAR.</p>		
S/390 G5 Parallel Enterprise Server	ESA/390	ESA220 (1,2,4), ESA230 (1,2,3,4), ESA240 (1,2,3)
	LPAR	ESA220 (1,2,4,5), ESA230 (1,2,3,4,5), ESA240 (1,2,3,5)

Processor Support

<i>Table 7 (Page 4 of 4). VM/ESA Processor Support Matrix</i>		
Processor	Mode	Current VM/ESA Support
<p>Notes on G5:</p> <p>For specific service levels required, contact your IBM representative.</p> <p>(1) 370 mode operating systems (including CMS) will not run as guests of VM/ESA on this processor.</p> <p>(2) ESA220 and ESA230 do not support the CMOS Cryptographic Coprocessor. Moreover, APAR VM61244 is required to run these releases on a machine with the CMOS Cryptographic Processor installed. ESA240 supports the CMS Cryptographic Processor for use by guests.</p> <p>(3) VM/ESA guest coupling simulation is supported.</p> <p>(4) ESA220 does not support IEEE Floating Point. ESA230 requires APAR VM61762 to support IEEE Floating Point.</p> <p>(5) CMS guest environments on a VM/ESA host running in an LPAR are supported for production. Many V=V workloads will experience comparable performance when the VM/ESA host is running natively or in an LPAR.</p>		
S/390 G6 Parallel Enterprise Server	ESA/390	ESA220 (1,2,4), ESA230 (1,2,3,4), ESA240 (1,2,3)
	LPAR	ESA220 (1,2,4,5), ESA230 (1,2,3,4,5), ESA240 (1,2,3,5)
<p>Notes on G6:</p> <p>For specific service levels required, contact your IBM representative.</p> <p>(1) 370 mode operating systems (including CMS) will not run as guests of VM/ESA on this processor.</p> <p>(2) ESA220 and ESA230 do not support the CMOS Cryptographic Coprocessor. Moreover, APAR VM61244 is required to run these releases on a machine with the CMOS Cryptographic Processor installed. ESA240 supports the CMS Cryptographic Processor for use by guests.</p> <p>(3) VM/ESA guest coupling simulation is supported.</p> <p>(4) ESA220 does not support IEEE Floating Point. ESA230 requires APAR VM61762 to support IEEE Floating Point.</p> <p>(5) CMS guest environments on a VM/ESA host running in an LPAR are supported for production. Many V=V workloads will experience comparable performance when the VM/ESA host is running natively or in an LPAR.</p>		

Appendix B. IBM Operating Systems Supported as Guests of VM/ESA

This appendix provides information about the IBM operating systems supported as guests of current VM/ESA releases.

In general, an operating system is supported as a guest of VM/ESA only on hardware (processors, DASD, and other devices) for which support has been announced for that operating system to run native, in an LPAR, or as a guest of VM/ESA.

This appendix is not intended to completely cover the complex issues involved in hardware support. For processor considerations, see Appendix A, "IBM Processors Supported by VM/ESA" on page 93.

On many processors, VM/ESA (ESA) may be run in a logical partition (LPAR), which offers production level performance for V=V workloads, including a mix of CMS and full function operating systems, such as OS/390, MVS/ESA, VSE/ESA, or VM/ESA (ESA). For example, when MVS/ESA or VSE/ESA runs as a V=V guest of a VM/ESA (ESA) image in turn running in an LPAR, it will experience performance comparable to running as a guest of a VM/ESA (ESA) system running natively. Consult the guest support matrix for details on which processors provide this support. Processors not offering this support provide development and test support for VM/ESA in a LPAR. Development and test implies that the performance is considered adequate for development and test activities, but not full production systems.

Several hardware assists available to VM/ESA running native are not available to VM/ESA in an LPAR.

When VM/ESA is run in an LPAR, V=F guests are not supported and I/O passthrough is not available to the V=R guest.

For more details, consult the *PR/SM Planning Guide*, GA22-7123, and documentation for the applicable processor.

The following symbols and abbreviations are used in the "Support" column of the matrix to indicate the level of support:

—	Guest is not supported
V	Guest is supported in V=V virtual machine
R	Guest is supported in V=R virtual machine
	Guest is also supported in V=F virtual machine if the real hardware has the PR/SM feature installed.
U	Guest may be UP (uniprocessor)
A	Guest may be AP (attached processor)
M	Guest may be MP (multiprocessor)
370	Guest runs in a 370 virtual machine
XA	Guest runs in an XA virtual machine

Guest Support

ESA Guest runs in an ESA virtual machine

If a guest is supported in both XA and ESA virtual machines, ESA is preferred.

Table 8 (Page 1 of 2). VM/ESA Guest Support Matrix

Guest	Host	Support
AIX/ESA® Version 2	VM/ESA 2.2.0 VM/ESA 2.3.0 VM/ESA 2.4.0	VR UM ESA VR UM ESA VR UM ESA
MVS/ESA 5.1 or later (1)	VM/ESA 2.2.0 VM/ESA 2.3.0 VM/ESA 2.4.0	VR UM ESA VR UM ESA VR UM ESA
Notes for MVS/ESA Guests: <p>(1) Exploitation of hardware function by MVS may require specific levels of VM/ESA. For details, see the following books:</p> <ul style="list-style-type: none"> • <i>MVS/ESA SP V5 Planning: Installation and Migration with JES2, GC28-1428</i> • <i>MVS/ESA SP V5 Planning: Installation and Migration with JES3, GC28-1429</i> 		
OS/390 (1)	VM/ESA 2.2.0 VM/ESA 2.3.0 VM/ESA 2.4.0	VR UM ESA (2) VR UM ESA (2,3) VR UM ESA (2,3)
Notes for OS/390 Guests: <p>(1) Exploitation of hardware function by OS/390 may require specific levels of VM/ESA. For details, see <i>OS/390: Planning for Installation, GC28-1726</i>.</p> <p>(2) VM/ESA does not support external coupling facilities or real coupling links.</p> <p>(3) VM/ESA supports guest-coupling simulation on IBM S/390 Enterprise Server G3 and later, and on IBM S/390 Multiprise servers. An entire sysplex environment can be defined on a single VM/ESA image. VM/ESA guest coupling simulation is intended for test and development environments only, not for production.</p>		
VM/ESA 2.2.0	VM/ESA 2.2.0 VM/ESA 2.3.0 VM/ESA 2.4.0	VR UM ESA (1,2) VR UM ESA (1,2) VR UM ESA (1,2)
VM/ESA 2.3.0	VM/ESA 2.2.0 VM/ESA 2.3.0 VM/ESA 2.4.0	VR UM ESA (1,2,3) VR UM ESA (1,2,3) VR UM ESA (1,2,3)
VM/ESA 2.4.0	VM/ESA 2.2.0 VM/ESA 2.3.0 VM/ESA 2.4.0	VR UM ESA (1,2,3,4) VR UM ESA (1,2,3,4) VR UM ESA (1,2,3)

<i>Table 8 (Page 2 of 2). VM/ESA Guest Support Matrix</i>		
Guest	Host	Support
<p>Notes for VM/ESA Guests:</p> <p>(1) V=R and V=F guests supported for CMS production on: 3090S with the PR/SM feature and RPQ 8P1367; ES/3090J; ES/3090JH; ES/3090 9000T; ES/9000 9221, 9121, and 9021 families; S/390 Parallel Enterprise Server 9672-R series; S/390 Multiprise servers; S/390 Enterprise Server G3 and later.</p> <p>V=R and V=F guests supported for mixed CMS and other V=V workloads, with performance comparable to the guest running natively, on: 3090S with the PR/SM feature and RPQ 8P1367; ES/3090J; ES/3090JH; ES/3090 9000T; ES/9000, 9021, and 9121 families; S/390 Parallel Enterprise Server 9672-R series; S/390 Multiprise servers; S/390 Enterprise Server G3 and later.</p> <p>(2) ESA/390 SIE extensions required for VM Data Spaces are available to all guests on ESA/390 processors.</p> <p>(3) VM/ESA Guest Coupling Simulation will not work in the VM/ESA guest.</p> <p>(4) Extended-TOD-clock facility is not available.</p>		
VSE/ESA Version 1.4	VM/ESA 2.2.0 VM/ESA 2.3.0 VM/ESA 2.4.0	VR U 370 XA ESA (1) VR U 370 XA ESA (1) VR U 370 XA ESA (1)
VSE/ESA Version 2	VM/ESA 2.2.0 VM/ESA 2.3.0 VM/ESA 2.4.0	VR UM XA ESA VR UM XA ESA VR UM XA ESA
<p>Notes for VSE/ESA Guests:</p> <p>(1) VSE/ESA ESA and VM/ESA modes supported in both XA and ESA virtual machines.</p>		
TPF Version 4.1 (1)	VM/ESA 2.2.0 VM/ESA 2.3.0 VM/ESA 2.4.0	VR UM XA ESA VR UM XA ESA VR UM XA ESA
<p>Notes for TPF Guests:</p> <p>(1) TPF is supported as a guest of VM/ESA in environments where TPF-specific processor and DASD control unit RPQs are not required. If in a V=V virtual machine, use of Emulation Program for 37xx communication controllers is not supported.</p>		

Appendix C. IBM Devices Supported by VM/ESA

This appendix provides information about the IBM devices supported by current VM/ESA operating systems.

The device support matrix is intended to provide a quick reference for support of various devices on VM/ESA. You should also check the hardware device support list for your processor to be sure the hardware supports a particular device. Other devices not found in the device support matrix may be supported; consult device announcements and publications for this information.

Device support might not be in the base release of any system shown, but may have been delivered through the service stream by an APAR.

Devices are fully supported by VM/ESA unless otherwise indicated. VM/ESA supports devices at any of the following three levels of function:

1. **Full support:** VM/ESA uses the device itself and makes it available to guests. VM/ESA will usually manage the device on behalf of all users.
2. **Dedicated to a guest or virtual machine:** VM/ESA does not use the device itself but enables operating systems or applications in virtual machines to use the device. There are usually no restrictions on the use of the device by a virtual machine operating system or application, except that the device may not be dedicated to more than one virtual machine at a time.
3. **Dedicated to a guest or virtual machine as an unsupported device:** VM/ESA does not use the device itself but will allow a full function guest or application in a virtual machine to use it. The guest or virtual machine application is completely responsible for the management and use of the device. Usage restrictions may apply; the major common usage restriction for this type of support is that the device cannot be used as the guest's IPL device.

The device support matrix may show that support for a device was not provided after a particular VM/ESA release. The following clarifications on the meaning of the programming support withdrawal may be helpful:

- Where programming support for a *real* device has been withdrawn as of some VM/ESA release, the corresponding *virtual* device remains supported in the same or later VM/ESA releases.
- There are some device types which can be defined as, or use many of the device attributes of, the real devices for which programming support is being terminated. VM/ESA's support for these currently supported devices remains unchanged.

Additional device restrictions may apply. There may be exceptions to supported devices and releases depending on your specific configuration. See the CP planning book for your release and hardware announcements for additional information.

It is sometimes possible to define a device differently depending on whether the definition is done using HCPRIO or CP Configurability support. For instance, a 3725 Communications Controller would be defined as a 3705 Communications Controller using HCPRIO or a 3725 Communications Controller using dynamic

Device Support

system configuration. For specific details, see the *VM/ESA: Planning and Administration* book.

VM/ESA does not support 7-track tapes.

The following abbreviations are used in the device support matrix:

ESA220	VM/ESA Version 2 Release 2.0
ESA230	VM/ESA Version 2 Release 3.0
ESA240	VM/ESA Version 2 Release 4.0

Direct Access Storage Devices (DASD)

Table 9 (Page 1 of 3). Device Support List—DASD

Device	VM/ESA Releases Providing Support	Support Notes
3350 Model A2, A2F, B2, B2F, C2, C2F	ESA220, ESA230, ESA240	Also supported in 3330 emulation mode.
3370 Model A01, B01, A02, B02	ESA220, ESA230, ESA240	
3375 Model A1, B1, D1	ESA220, ESA230, ESA240	
3380 Model A04, AA4, B04, AD4, BD4, AE4, BE4, AJ4, BJ4, AK4, BK4	ESA220, ESA230, ESA240	Although it was previously announced that support for models A04, AA4, and B04 was withdrawn after VM/ESA 1.1.1, support has been extended on these models.
3380 Model CJ2	ESA220, ESA230, ESA240	
3390 Model A14, A18, B14, B18, B1C, A24, A28, B24, B28, B2C	ESA220, ESA230, ESA240	Supported in 3390 mode (native mode) with VSE/VSAM 2.1.0 or later.
3390 Model A34, A38, B34, B38, B3C	ESA220, ESA230, ESA240	Supported in 3390 mode (native mode) with VSE/VSAM 2.1.0 or later.
3390 Model A94, A98, B94, B98, B9C	ESA220, ESA230, ESA240	3380 Track Compatibility Mode is not supported. Minidisks used with VSE/VSAM or CMS/VSAM are limited to 65,536 tracks (4369 cylinders). Intended as a mass-storage device. Should not be used for system data or for data for applications that require high performance DASD.
3995 Model 131, 132 Optical Library Dataserver	ESA220, ESA230, ESA240	Dedicated to a guest as a 3088.
3995 Model 151, 111 Optical Library Dataserver	ESA220, ESA230, ESA240	Must be defined as a 3390. Intended as a mass-storage device. Should not be used for system data or for data for applications that require high performance DASD.

<i>Table 9 (Page 2 of 3). Device Support List—DASD</i>		
Device	VM/ESA Releases Providing Support	Support Notes
3995 Model 153, 113 Optical Library Dataserver	ESA220, ESA230, ESA240	Must be defined as a 3390. Intended as a mass-storage device. Should not be used for system data or for data for applications that require high performance DASD.
9332 Model 400, 402, 600, 602	ESA220, ESA230, ESA240	
9335 Model B01	ESA220, ESA230, ESA240	
9336 Model 010, 020, 025	ESA220, ESA230, ESA240	
9340 Direct Access Storage Subsystem: 9345 Model B12, B22	ESA220, ESA230, ESA240	
RAMAC® Array DASD: 9391 Model A10 Rack with 9392 Model B13 Drawers	ESA220, ESA230, ESA240	Must be defined as a 3390. Attaches to 3990 Model 3 or Model 6 Storage Control.
RAMAC Virtual Array Subsystem: 9393 Model 002, T42, or T82	ESA220, ESA230, ESA240	Emulates a 3990 Model 3 Storage Control with 3390 Models 1, 2, and 3 DASD or 3380 Models J and K DASD.
RAMAC Array Subsystem: 9394 Model 001, 002, or 003 Cluster Array Controller with 9395 Model B13 or B23 Drawers	ESA220, ESA230, ESA240	Emulates a 3990 Model 2 Storage Control with 3390 Model 3 DASD or 3380 Model K DASD.
Internal Disk (for Multiprise 2000)	ESA220, ESA230, ESA240	This device is a feature of the S/390 Multiprise 2000 server. Emulates a 3990 Model 2 Storage Control with 3390 Models 1, 2, 3, and 9 DASD or 3380 Models E, J, and K DASD. On ESA220, APAR VM60844 is required to enable CP Monitor to gather cache statistics for Internal Disk. IOCP APAR VM61197 and Mirroring Status APAR VM61266 are required for ESA220.

Device Support

Table 9 (Page 3 of 3). Device Support List—DASD

Device	VM/ESA Releases Providing Support	Support Notes
> Internal Disk (for Multiprise 3000)	ESA220, ESA230, ESA240	<p>APAR VM62180 is required.</p> <p>This device is a feature of the S/390 Multiprise 3000 Enterprise Server.</p> <p>Emulates a 3990 Model 2 Storage Control with 3390 Models 1, 2, 3, and 9 DASD or 3380 Models E, J, and K DASD.</p> <p>On ESA230 and later, the performance-oriented track level commands are supported for guest use only.</p> <p>IOCP APAR VM62312 is required.</p> <p>ICKDSF APAR PQ26800 is required.</p>
> Enterprise Storage Server (2105 DASD Subsystem)	ESA220, ESA230, ESA240	<p>APAR VM62111 is required.</p> <p>Supported only in emulation mode. Must be defined as one of the following:</p> <ul style="list-style-type: none"> • 3990 Model 3 or 6 Storage Control with 3390 Models 2, 3, and 9 DASD • 3390 Models 2 or 3 DASD in 3380 track compatibility mode <p>On ESA230 and later, the performance-oriented track level commands are supported for guest use only.</p> <p>On ESA220 and ESA230, the Parallel Access Volumes feature is not supported. On ESA240, APAR VM62295 is required to use this feature. The device must be dedicated to a guest.</p> <p>ICKDSF APAR PQ26800 is required.</p>

DASD Control Units and Storage Controls

Table 10 (Page 1 of 2). Device Support List—DASD Control Units and Storage Controls

Device	VMESA Releases Providing Support	Support Notes
3830 Model 2	ESA220, ESA230, ESA240	
3880 Model 1, 3, 4	ESA220, ESA230, ESA240	
3880 Model E21, G21, H21, J21, D23, E23, G23, H23, J23	ESA220, ESA230, ESA240	

<i>Table 10 (Page 2 of 2). Device Support List—DASD Control Units and Storage Controls</i>		
Device	VMESA Releases Providing Support	Support Notes
3990 Model 1, 2	ESA220, ESA230, ESA240	
3990 Model 3	ESA220, ESA230, ESA240	Concurrent Copy function supported for guest use only.
3990 Model 6	ESA220, ESA230, ESA240	All functions of former 3990 models supported plus increased cache, System Clock Support, and the Control Unit Initiated Reconfiguration feature (CUIR). Concurrent Copy and Extended Remote Copy functions are supported for guest use only.
9221 DASD/Tape Subsystem Control	ESA220, ESA230, ESA240	
9335 Model A01	ESA220, ESA230, ESA240	
9340 Direct Access Storage Subsystem: 9341 Model A02 9343 Model C02, C04	ESA220, ESA230, ESA240	
9340 Direct Access Storage Subsystem: 9343 Model D04	ESA220, ESA230, ESA240	ESCON-attached only.
9340 Direct Access Storage Subsystem: 9343 Model CC2, CC4	ESA220, ESA230, ESA240	Models CC2 and CC4 are cache models (basic caching only). The cache function is not visible to or controllable by software. No additional VM/ESA support is required.
9340 Direct Access Storage Subsystem: 9343 Model DC4	ESA220, ESA230, ESA240	ESCON-attached only. Model DC4 is a cache model (basic caching only). The cache function is not visible to or controllable by software. No additional VM/ESA support is required.

Tape Units and Tape Libraries

<i>Table 11 (Page 1 of 2). Device Support List—Tape Units and Tape Libraries</i>		
Device	VM/ESA Releases Providing Support	Support Notes
2440	ESA220, ESA230, ESA240	Must be defined as a 3420 Model 4.
3420 Model 3, 4, 5, 6, 7, 8	ESA220, ESA230, ESA240	
3422 Tape Unit and Control	ESA220, ESA230, ESA240	
3424 Tape Subsystem	ESA220, ESA230, ESA240	For Brazil only.
3430	ESA220, ESA230, ESA240	
3480 Tape Subsystem	ESA220, ESA230, ESA240	
3490 Tape Subsystem	ESA220, ESA230, ESA240	

Device Support

<i>Table 11 (Page 2 of 2). Device Support List—Tape Units and Tape Libraries</i>		
Device	VM/ESA Releases Providing Support	Support Notes
3490E (Enhanced Capability Model) Tape Subsystem	ESA220, ESA230, ESA240	
3494 Tape Library Dataserver and Virtual Tape Server	ESA220, ESA230, ESA240	Native support is provided in conjunction with DFSMS/VM.
3495 Tape Library Dataserver	ESA220, ESA230, ESA240	Native support is provided in conjunction with DFSMS/VM.
3590 High Performance Tape Subsystem	ESA220, ESA230, ESA240	ESCON-attached only.
9348 Model 11, 12	ESA220, ESA230, ESA240	

Tape Control Units

<i>Table 12. Device Support List—Tape Control Units</i>		
Device	VM/ESA Releases Providing Support	Support Notes
3803 Model 1, 2	ESA220, ESA230, ESA240	
9221 DASD/Tape Subsystem Control	ESA220, ESA230, ESA240	

Printers

<i>Table 13 (Page 1 of 2). Device Support List—Printers</i>		
Device	VM/ESA Releases Providing Support	Support Notes
3203 Model 5	ESA220, ESA230, ESA240	
3262	ESA220, ESA230, ESA240	
3268 Model 2, 2C	ESA220, ESA230, ESA240	Supported if defined as a 3287.
3287 Model 1, 1C, 2, 2C, 4	ESA220, ESA230, ESA240	
3289 Model 1, 3, 4, 8	ESA220, ESA230, ESA240	
3800 Model 1	ESA220, ESA230, ESA240	
3800 Model 3, 6, 8	ESA220, ESA230, ESA240	Full support in Model 1 compatibility mode or using Advanced Function Printing (AFP™) licensed programs.

<i>Table 13 (Page 2 of 2). Device Support List—Printers</i>		
Device	VM/ESA Releases Providing Support	Support Notes
3812	ESA220, ESA230, ESA240	Full support through RSCS 3.1.1 or later, using Advanced Function Printing licensed programs; downloading of fonts is not supported. Loading of fonts requires Print Services Facility/VM (PSF/VM) licensed program (program number 5684-141).
3816 Model 01D, 01S	ESA220, ESA230, ESA240	Full support through RSCS 3.1.1 or later, using AFP licensed programs; downloading of fonts is not supported. Loading of fonts requires PSF/VM licensed program.
3820	ESA220, ESA230, ESA240	Full support through VM/VTAM, using AFP licensed programs.
3825	ESA220, ESA230, ESA240	Full support using AFP licensed programs.
3827	ESA220, ESA230, ESA240	Full support using AFP licensed programs.
3835	ESA220, ESA230, ESA240	Full support using AFP licensed programs.
3900	ESA220, ESA230, ESA240	Supported if defined as a 3800.
4245 Model 1	ESA220, ESA230, ESA240	Supported as a 4245 or in 3262 compatibility mode.
4245 Model 12, 20	ESA220, ESA230, ESA240	
4248 Model 1, 2	ESA220, ESA230, ESA240	Supported as a 4248 or in 3211 compatibility mode.
6262 Model 14, 22	ESA220, ESA230, ESA240	Must be defined as a 4248 Model 1.

Card Readers and Card Punches

<i>Table 14. Device Support List—Card Readers and Card Punches</i>		
Device	VM/ESA Releases Providing Support	Support Notes
3505 Model B1, B2	ESA220, ESA230, ESA240	
3525 Model P1, P2, P3	ESA220, ESA230, ESA240	

Terminals/Displays/Consoles

Most terminals are supported as a virtual machine console (in 3215 emulation mode or 3270 mode). 3270-family displays can be defined generically (for example, as 3270s) with dynamic computation of screen size based on information returned from the device.

Display Printers

Most display printers are supported using Advanced Function Printing (AFP) licensed programs through RSCS.

Display Control Units

Table 15. Device Support List—Display Control Units

Device	VM/ESA Releases Providing Support	Support Notes
3174	ESA220, ESA230, ESA240	
3272 Model 2	ESA220, ESA230, ESA240	
3274	ESA220, ESA230, ESA240	
3276 Display/Control Unit	ESA220, ESA230, ESA240	Dedicated to a virtual machine as a supported device.

Communications Controllers

Table 16. Device Support List—Communications Controllers

Device	VM/ESA Releases Providing Support	Support Notes
3705	ESA220, ESA230, ESA240	Dedicated to a virtual machine as a supported device.
3720	ESA220, ESA230, ESA240	Dedicated to a virtual machine as a supported device. Must be defined as a 3705, unless you are using dynamic system configuration.
3725	ESA220, ESA230, ESA240	Dedicated to a virtual machine as a supported device. Must be defined as a 3705, unless you are using dynamic system configuration.
3745	ESA220, ESA230, ESA240	Dedicated to a virtual machine as a supported device. Must be defined as a 3705, unless you are using dynamic system configuration.
9221 Integrated Communications Attachment	ESA220, ESA230, ESA240	

Enterprise Systems Connection Architecture (ESCON) Devices

<i>Table 17. Device Support List—Enterprise Systems Connection Architecture (ESCON) Devices</i>		
Device	VM/ESA Releases Providing Support	Support Notes
9032 ESCON Director Model 2	ESA220, ESA230, ESA240	
9032 ESCON Director Model 3	ESA220, ESA230, ESA240	
9032 ESCON Director Model 5	ESA220, ESA230, ESA240	
9033 ESCON Director Model 1	ESA220, ESA230, ESA240	
9033 ESCON Director Model 4	ESA220, ESA230, ESA240	
9034 ESCON Converter Model 1	ESA220, ESA230, ESA240	
9035 ESCON Converter Model 2	ESA220, ESA230, ESA240	
9042 FICON Converter Model 1	ESA220, ESA230, ESA240	
ESCON Channel-to-Channel Adapter (CTCA)	ESA220, ESA230, ESA240	Extended mode operation only.
<p>Note: VM/ESA supports ESCON channels, ESCON-attached control units, and the ESCON Director (ESCD) on all IBM S/390 Parallel Enterprise Servers, IBM S/390 Multiprise servers, and IBM ES/9000 processors, plus those IBM ES/3090 processors on which the ESCON hardware is supported.</p> <p>Control units and I/O devices with parallel channels can be attached to ESCON channels through the ESCON Converter Model 1. (See your IBM representative for a list of parallel devices that the ESCON Converter Model 1 supports.) Conversely, the ESCON Converter Model 2 allows ESCON devices to be attached to processors that have parallel channels.</p> <p>For more information about ESCON architecture, see <i>Introducing Enterprise Systems Connection</i>, GA23-0383.</p>		

Miscellaneous Devices

<i>Table 18 (Page 1 of 3). Device Support List—Miscellaneous Devices</i>		
Device	VM/ESA Releases Providing Support	Support Notes
CTCA	ESA220, ESA230, ESA240	Dedicated to a virtual machine as a supported device.

Table 18 (Page 3 of 3). Device Support List—Miscellaneous Devices

Device	VM/ESA Releases Providing Support	Support Notes
7171 Device Attachment Control Unit	ESA220, ESA230, ESA240	The 7171 ASCII Device Attachment Control Unit (DACU) allows the attachment of ASCII terminals locally or (through Start-Stop communication line) remotely. The ASCII terminals appear to the host as 3277s, 3278s, and 3279s, with the DACU itself appearing as a 3274 control unit.
8232 LAN Channel Station	ESA220, ESA230, ESA240	Dedicated to a virtual machine as a supported device. Supported by TCP/IP for VM and the TCP/IP Feature for VM/ESA.

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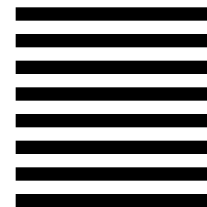
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