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G320-9997-17

z/VM and VM/ESA Reference Guide

October 2001



What is Virtual Machine/Enterprise Systems Architecture (VM/ESA®) and z/VM™?

VM/ESA – a highly flexible network computing platform

- Provides a VM foundation for open enterprise computing
- Supports the IBM® S/390® family of servers
- Supports the IBM zSeries™ family of servers in 31-bit mode
- Provides vertical and horizontal growth options (See VM/ESA General Information - GC24-5745)

z/VM Version 3 - the successor to VM/ESA

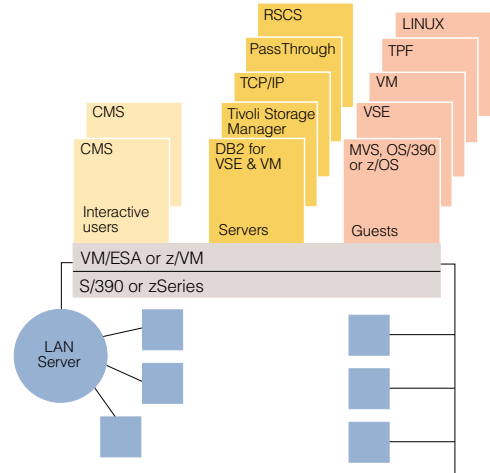
- Provides all the benefits and expands the capabilities of VM/ESA
- Exploits z/Architecture™ to support 64-bit guest operating systems and provides constraint relief when running on an ^ zSeries 900 server
- Provides the capability to run 64-bit and ESA/390 guest operating systems concurrently
- QDIO with OSA-Express Gigabit and Fast Ethernet and ATM adapters (See z/VM General Information– GC24-5944)

z/VM Version 4 Release 1 - VM at reduced costs

- Includes VM function available in Version 3 except DCE, LANRES/VM, and Vector Facility
- Support for the IBM Integrated Facility for Linux (IFL) processor feature
- One-time charge (OTC) priced per-engine or IFL processor feature
- Consolidation of Linux workload on a single server
- Improved I/O performance for Linux guests
- Enhanced page fault support for Linux guests

z/VM Version 4 Release 2 - Exploiting new technology

- Technology exploitation
 - HiperSockets™ high-speed internal TCP/IP network and OSA-Express Token Ring
 - Guest coupling duplex support
 - Guest support for FICON™ CTCA communications
 - Clear-key RSA support of the IBM Cryptographic Accelerator provided Linux for zSeries functionality is available
 - Fast CCW translation extensions for 64-bit IDAWs



- Connectivity enhancements
 - Guest LAN support
 - New TCP/IP server for mail accessibility using IMAP protocol
 - TCP/IP stack security improvements
 - Systems management improvements
 - Ease-of-use functions for managing Linux images
 - Move configurations and data from Virtual Image Facility
 - Converging VM C sockets libraries within the LE environment (See z/VM Version 4 General Information – GC24-5991)
- Note:** Unless specifically stated, the use of the term VM within this guide refers to both VM/ESA and z/VM

A solution that builds on VM strengths

- CMS interactive support
- Server support
- Client/server workstation synergy
- Guest operating system support
- Virtualization technology
- Extensive connectivity options
- Open distributed computing
- Ideal Web serving platform
- Wide range of environments and applications (For a complete list of publications available for VM/ESA and z/VM, refer to the VM Web site at: ibm.com/zseries/zvm/library/)

VM supports a wide range of industry standards

- Networking protocols and connections, languages, programming and graphical user interfaces (GUI)
- POSIX and DCE support
- Java™ Development Kit (JDK), Version 1.1.6

VM provides host-based services for the workstation environment

- Tivoli® Storage Manager (TSM), formerly Tivoli ADSTAR® Distributed Storage Manager (ADSM) for workstation data backup/restore to/from the host
- DB2® Table Edit for development of Windows DB2 e-business applications
- TCP/IP for VM provides for host/LAN connectivity
- TCP/IP Network File System and Message Queueing client interface for access to VM host data and applications
- VisualAge® Generator for application development
- Supports IBM Network Station™ as boot-server and manager

VM manages the enterprise

- Dynamic system configuration capabilities
 - Reduced planned and unplanned outages
- DFSMS/VM® provides automated data management for Shared File System (SFS) and POSIX Byte File System (BFS) files, and minidisk restructuring
- Interfaces with TSM for tape library usage

VM embraces the latest technology

- VM/ESA and z/VM Version 3 support all models of the IBM ^ zSeries including the z900 (ESA/390 mode), S/390 Parallel Enterprise Server™ Generation 5 and 6, and S/390 Multiprise® 3000. In addition, the S/390 Parallel Enterprise Server™ Generation 3, 4, R2, and R3 Models, S/390 Multiprise® 2000, and S/390 Integrated Server are also supported. z/VM Version 3 supports the zSeries 900 in 64-bit mode.
- Extended distance and data rate with Enterprise Systems Connection Architecture® (ESCON®)
- Improved performance with exploitation of Fibre CONnection (FICON) Channel architecture
- Enabler for Internet and intranet access
- Exploits hardware data compression
- Native and guest operating system support of the IBM Enterprise Storage Server™ (ESS)
- Supports Open Systems Adapter 2
- Improved performance, capacity, and availability with support for IBM RAMAC® Array Family
- Capacity Upgrade on Demand (CUoD) architecture
- Multiple Preferred Guests with Processor Resource/Systems Manager™ (PR/SM™) function
- Extensive use of ESA/390 architecture for data in memory

- High-performance, shareable virtual disk in storage
- VM Data Spaces utilization for high-performance data access
- Minidisk caching of CMS and guest data
- 2 GB virtual machines for application growth
- Includes the IBM Java Port for VM and NetRexx™
- In addition, z/VM supports:
 - z/Architecture to support 64-bit guest operating systems
 - Pageable guests up to 64 GB
 - Native Flash copy for the ESS
 - QDIO with OSA-Express Gigabit and Fast Ethernet, ATM and Token Ring adapters
 - Guest enhancements for the Virtual Tape Server (VTS)
 - Guest and native support for FICON-attached 3590 A60 Tape Controller
- z/VM Version 4 supports the zSeries 900 (64- and ESA/390) mode, S/390 Parallel Enterprise Server Generation 5 and 6, and the S/390 Multiprise 3000
- z/VM Version 4 supports the Integrated Facility for Linux feature of the zSeries 900, S/390 Parallel Enterprise Server Generation 5 and 6, and the S/390 Multiprise 3000
- z/VM Version 4 Release 2 adds:
 - HiperSockets high-speed internal TCP/IP network and OSA-Express Token Ring support
 - Guest coupling duplex to support the new duplexing capabilities of the zSeries Coupling Facility
 - Guest support for FICON CTCA communications
 - Clear-key RSA support of the IBM PCI Cryptographic Accelerator provided Linux for zSeries functionality is available
 - Fast CCW translation extensions for 64-bit IDAWs

VM for running Parallel Sysplex® system environments

- MVS, OS/390®, or z/OS (only on z/VM in 64-bit mode) Parallel Sysplex® system environments as VM guests
- Speed time to deploy new Parallel Sysplex systems
- Real hardware coupling facilities and coupling links not required, nor supported
- Take advantage of guest coupling duplexing on the zSeries
- Reduces risk in running new applications for OS/390 or z/OS releases
- Minimize problems of scheduling test and production time
- Reduce training expense and minimize risk to production through training with virtual configurations
- Provide additional options for disaster recovery

- Supported on all models of the IBM zSeries including the z900, S/390 Parallel Enterprise Server Generation 5 and 6, and S/390 Multiprise 3000. In addition, the S/390 Parallel Enterprise Server Generation 3 and 4 and the S/390 Multiprise 2000 are also supported

ibm.com/eserver/zseries/zvm

VM encompasses many uses

- Flexible, cost-effective guest environments
- Ideally suited for e-business
- Consolidation of Linux® workload
- Server of data and applications to Internet/intranet users
- Customized personal computing with CMS
- Rich application development environment
- Graphical User Interface (GUI) for CMS

VM for e-business

- Access to enterprise data and applications through TCP/IP NFS
- Java™ and NetRexx for more rapid development of Internet applications
- Enterprise Web Serving through IBM Business Partner products working cooperatively with VM
- IBM Network Station support for boot-serving and management
- DB2 accessibility from the Internet using DB2 WWW Connection for VM
- Reusable Server Kernel (RSK) for vendors and application programmers to write multithreaded server programs

VM installation and service tools

- S/390 Service Update Facility (SUF) for Internet-based service of VM
- Virtual Machine Serviceability Enhancements Staged/Extended (VMSES/E)
- Used for installation of VM, IBM Licensed Products, and vendor products in VMSES/E format
- Application of service
 - CORrective service (COR)
 - Recommended Service Upgrades (RSU)
- Service available on CD-ROM

To learn more about SUF:

ibm.com/eserver/zseries/suf

CMS interactive support

CMS application multitasking

- Allows applications to be divided to handle work in parallel
- Improves application throughput
- POSIX and DCE threading exploits CMS multitasking
- CMS Pipelines supports the use of CMS multitasking

CMS Pipelines

- Programmer productivity tool for simple creation of powerful, reusable REXX and Assembler programs and Common Gateway Interface (CGI) scripts for Web servers

Data-in-memory exploitation

- Virtual disk in storage—provides fast access to data in memory
- Minidisk caching—performance booster allowing caching in central and/or expanded storage
- VM Data Spaces—allow applications in virtual machines to create additional VM Data Spaces of 2 GB, up to 2 terabytes total

Callable Services Library (CSL)

- Enables improved application development productivity
- REXX and other high-level languages can use VM services, such as requesting Shared File System functions
- Provides interfaces to use VM data spaces
- Provides interfaces to POSIX functions for CMS users and applications

CMS Binder/Loader for z/VM

- Enhances application affinity between CMS and OS/390 or z/OS
- The CMS binder will:
 - Create and utilize data spaces if the user is authorized
 - Convert object or load modules, or program objects, into a program object and store the program object in a partitioned data set extended (PDSE) program library
 - Convert object or load modules, or program objects, into a load module and store the load module in a partitioned data set (PDS) program library

VM server support

- Convert object or load modules, or program objects, into an executable program in virtual storage and execute the program
- The CMS loader will:
 - Increase the services of the program fetch component by adding support for loading program objects
 - Reads both program objects and load modules into virtual storage and prepares them for execution

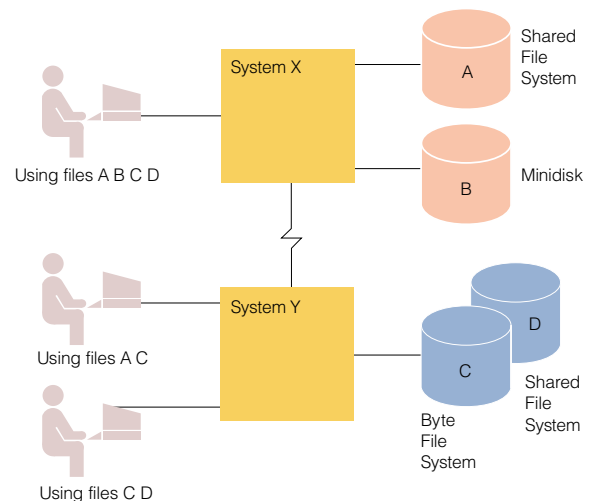
VMLINK

- User productivity enhancer for linking minidisks and SFS directories
- Rewritten for improved serviceability in z/VM

ibm.com/eserver/zseries/zvm

VM Data Spaces

- Offers capabilities unique to S/390 and zSeries family
- Provides high-speed transfer and data access between virtual machines improving throughput and response times
- Allows applications to address multiple 2 GB data spaces
- Supports datasharing between server and multiple users
- Accessed through an application programming interface and Callable Services Library routines, exploited by Database Server 2 (DB2) for VSE and VM, Shared File System and Fortran
 - Enables customers and vendors to develop applications using VM Data Spaces
 - Makes development process easier



VM Shared File System (SFS)

- Allows read/write sharing at the file level
 - Shareable within one system or across multiple systems
 - Provides file security through authorization scheme
- Improves performance
 - Utilizes minidisk caching using main or expanded storage
 - Exploits VM Data Spaces
- Improves usage of direct access storage devices (DASD)
 - Data stored in file pools
 - Logical vs. physical allocation of data blocks

VM Workstation Management

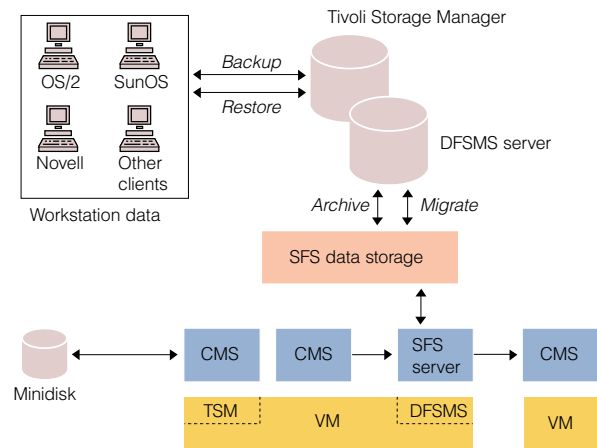
- Unused blocks available to any user of file pool
- Improves productivity
 - Organizes files in hierarchical directories
 - Supports aliases for file names
 - Provides single application interface via CSL routines for SFS and minidisk data
- Simplifies system administration
 - Provides file pool backup and file-level restore
 - Dynamic expansion of file space for users
 - Dynamic expansion of DASD to file pool
 - Allocates file pool DASD space vs. individual minidisks
 - Allows same administration tools to be used for POSIX hierarchical byte file system files
- Uses Coordinated Resource Recovery
 - Coordinates updates to multiple file pools
 - More easily developed distributed applications, with system coordination of data integrity
- Enables access to distributed data
 - Transparent access to remote data
- Allows CMS and DCE users and applications to access the POSIX hierarchical byte file system

VM DFSMS/VM

- Provides automated space management
 - Space management for Shared File System files
 - Migration, recall and expiration of active and inactive data
 - With Tivoli Storage Manager, provides archive/restore of SFS files to tape
- Provides a high-performance data mover
 - Enables fast migration to new storage devices
- Includes Interactive Storage Management Facility (ISMF)
 - Provides consistent interface for VM, OS/390 or z/OS storage administrators
 - Assists in managing minidisk data
- Included with VM
- Manages 3494/3495 tape libraries

Tivoli Storage Manager for VM, Version 4.1

- Same function as Tivoli ADSM for VM/ESA, Version 3.1
 - Integrate unattended network backup and archive capabilities with storage management and powerful disaster recovery functions
 - Uses VM host resources for backing up, archiving and restoring data for personal workstations and LAN file servers
 - Improves productivity of workstation users
 - Network support for IBM AIX®, Apple Macintosh, Digital UNIX®, HP-UX, Novell NetWare, IBM OS/390 UNIX System Services, IBM OS/2®, SCO, Silicon Graphics IRIX, Solaris, Windows® 32-bit Intel, and Windows 32-bit DEC Alpha
 - Administrator control of server activities, implementation of storage management policies, and scheduling of automated backup and archive services
 - Lets user or system administrator schedule backups
 - Web browser interfaces to support remote administration and remote backup-archive operations
- (See *Tivoli Storage Manager Quick Start – GC35-0351* or *Administrator's Guide – GC35-0352*)



To learn more about Tivoli Storage Manager,

tivoli.com/adsm

Guest Operating System Support

Linux for zSeries and S/390 guest benefits

- Consolidation of Linux workloads on a single server
- Share DASD resources creating a Server Farm within a single machine
- High performance networking among virtual machines
- Dedicated device support for both HiperSockets and OSA-Express adapters
- Access a wealth of Linux applications
- Simplify systems management using facilities provided by z/VM
- Handle unexpected workload growth by adding Linux virtual machines as needed
- Provides enhanced device support, such as virtual disks and peer-to-peer remote copy for Linux systems
- Exploitation of the IBM PCI Cryptographic Coprocessor (PCICC) and the IBM PCI Cryptographic Accelerator (PCICA)
- Provides DASD fast CCW translation using 64-bit IDAWs
- Supports enhanced page fault handling
- Backup facilities to back up all Linux data providing a single backup solution for all Linux servers
- Strong tracing, diagnostic and debug facilities

VSE/ESA® guest benefits

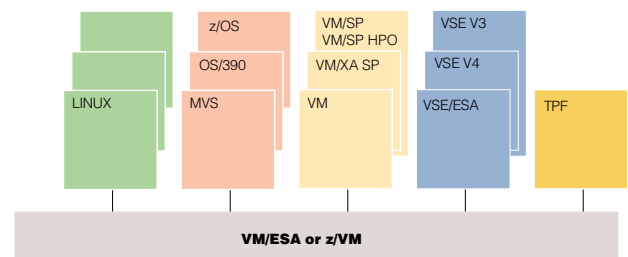
- Improved performance with:
 - CCW Fast Path translation
 - Virtual disk in storage exploitation, for example, shared lock file
 - Minidisk caching in expanded and main storage
- DB2 for VSE and VM datasharing with improved performance

MVS/ESA, OS/390, and z/OS guest benefits

- Support of latest S/390 and zSeries technology
- Parallel Sysplex support for guests within a single VM image
- IEEE Floating Point
- IBM Cryptographic Coprocessor

Supports z/Architecture, ESA/390, ESA/370, 370-XA and 370-mode operating systems

- ESA I/O used for S/370™ guests is only available on processors that support 370-mode
- Supports up to six production-level guests with PR/SM
- Supports many additional guests for migration, testing, production and development
- Provides virtual device support
- Allows both shared and dedicated resources
- Provides debug and trace facilities for guest systems
- z/VM provides guest support for 64-bit operating systems including z/OS, OS/390 Release 10, and Linux for zSeries



Performance

VM offers many features that can be used to improve performance. A number of these features work by keeping frequently used data in memory, thus significantly reducing repeated I/O for the same data. The reduction in I/Os results in faster response times, improved processor efficiency and reduced load on the I/O subsystem. Minidisk caching and virtual disk in storage are two examples of the use of data in memory techniques in VM.

The degree of benefit will vary depending on how frequently the system workload does I/Os that apply to these techniques, data reference patterns, DASD configuration, how much storage is available, and other factors.

To learn more about VM performance

ibm.com/eserver/zseries/zvm/perf/

Connectivity options

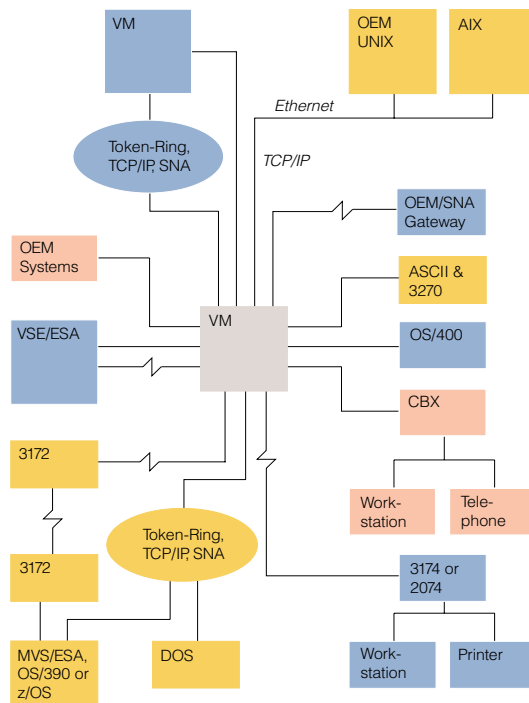
Networking options

VM 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
- Gigabit and fast ethernet
- 155 ATM
- X-Windows
- Network File Systems
- Simple Mail Transfer Protocol
- IP Multicast
- X.400 mail exchange protocol
- FDDI

NetView® network management

- SNA and TCP/IP networks



Communication products

TCP/IP feature for VM/ESA (FL320)

- All functions available in TCP/IP for VM Version 2 Release 4
 - Native Asynchronous Transfer Mode (ATM) Connectivity
 - Upgraded RouteD server with support for Virtual IP Addressing (VIPA), variable subnetting, Routing Information Protocol Version 2, and enhanced configuration and problem determination capabilities
 - Better customization and diagnostic tools for TCP/IP and NFS administration
 - Simple Mail Transfer Protocol (SMTP) enhancements include service extension support for Message Size Declaration and 8-bit MIME message transfers
 - Files can be transferred to the VM Reader using the File Transfer Protocol (FTP) server
 - All function available in TCP/IP FL310 feature including:
 - Improved performance and additional compliance with open mail standards of the Simple Mail Transfer Protocol (SMTP)
 - Improvements in functionality and usability of the File Transfer Protocol (FTP)
 - Network File System (NFS) access to data residing in the Shared and Byte File Systems, as well as on CMS minidisks
 - Support for NFS client use of TCP protocol for improved communications between NFS client and VM NFS server
 - Integration of TCP/IP and CMS mail functions
 - Extension of the multihome support to include virtual hosting allowing one network to be used to serve multiple users
 - Remote printing support provides the option to utilize the RSCS for print serving
 - Exploitation of S/390 checksum facility
 - Faster communication between NFS client and server, improved performance, and administrative enhancements
- (See *VM/ESA TCP/IP User's Guide – SC24-5848*)

ibm.com/eserver/zseries/zvm/related/tcpip

TCP/IP feature for z/VM (Level 3A0) and TCP/IP for z/VM

- All functions available in TCP/IP feature for VM/ESA (FL320) plus:
 - Improved security with the inclusion of a Secure Socket Layer (SSL) server
 - Transparent data access to remote systems data with an NFS Client
 - Capability and useability improvements to FTP server for Web browsers
 - Better TCP/IP efficiency with the MPROUTE server
 - Reduced load on hosts with support for IP Multicasting
 - Improved data transfer performance with QDIO supporting Gigabit Ethernet, Fast Ethernet, and 155 ATM (Ethernet Lan Emulation)
- (See *z/VM TCP/IP User's Guide – SC24-5982*)

TCP/IP for z/VM (Level 420)

- All functions available in TCP/IP for z/VM (Level 3A0) plus:
 - Guest LAN capability designed to allow a VM guest to install a virtual HiperSockets adapter for interconnection of virtual machines
 - IMAP Server supporting the IMAP Version 4 Revision 1 (IMAP4rev1) mail server for storing and serving electronic mail
 - Improved TCP/IP stack security by preventing some Denial of Service (DOS) attacks
- (See *z/VM TCP/IP Level 420 User's Guide – SC24-6024*)

ACF/VTAM® Version 4 Release 2 for VM/ESA

- Enhanced growth and constraint relief
 - Increased number of users connected to a single VTAM® image
 - Larger, more functional, less complex networks
 - APPN® capability
 - Provides Low End Networking (LEN) communications to all nodes
 - Better interconnection with multivendor networks
 - Increased performance for on-line transaction processing
 - Improved client/server access
 - More flexible access to applications and resources across multiple platforms
- (See *VTAM V4R2 for VM/ESA Release Guide – GC31-8089*)

ibm.com/software/network/vtam

VM Office Support

RSCS Version 3 Release 2

- Unsolicited File Transfer (UFT) client and daemon support
- Process NJE data traffic over TCP/IP, SNA, BYSC or directly attached systems
- Provides print support to TCP/IP printer daemons in text and postscript format
- Supports ASCII printers attached to protocol converters or by TCP/IP connection
- Enables RSCS server to be the VM daemon to the TCP/IP world
- Enables the VM daemon printer queue to be any printer attached directly or indirectly to the NJE/TCP/IP network
- Provides API interface to code your own device drivers for RSCS
- Easy to customize, maintain and use
(See *VM RSCS General Information Guide – GH24-5218*)

ibm.com/eserver/zseries/zvm/related/rscs

VM/Pass-Through Facility Version 2

- Multisession support for CMS and dialed users
- Auto sign-on support
- ESCON, TCP/IP, 3088, CTC, BYSC connectivity options
- Gateway access to SNA network
- Connectivity to other VM, OS/390, z/OS, MVS™, VSE and AIX systems
- Provides automated session operations
- Transparent, seamless solutions for end users
- Sharing a single session between multiple workstations
- Low cost workstation support for VSE Guest Machines
- Screen capture capabilities
- Direct support for SDLC terminal control units
- Cross-system IUCV support provides communications path for applications on VM systems to use IUCV protocols
(See *VM/Pass-Through Facility Users Guide – SC24-5555*)

ibm.com/eserver/zseries/zvm/related/pvm

- OfficeVision/VM™ (OV/VM)
 - Cost-effective and scalable e-mail environment
 - Exceptionally high capacity calendar facility
 - Internet access to OV/VM server data by business partner Web products
 - Exploits SFS for calendar data
 - Tolerates user A-disks in SFS
 - Management system for notes and documents
 - Virtual storage constraint relief
(See *Planning for Office Vision/VM – SH21-0410*)

ibm.com/eserver/zseries/zvm/related/ovvm

- OfficeVision® to Notes™ Migration Tool
 - Eases migration from OV to Lotus® Notes
 - Seamless batch transfer of mail, notelogs, folders, distribution lists, nicknames and calendars (Notes 4.5+)
 - Automatic directory migration and user registration
 - Capable of migrating OV users in multiple stages

ibm.com/software/gpl/inmt/vm

VM Decision Support

VM has multiple offerings that enable the end user to transform business data into timely and accurate business decisions.

DB2 Server for VSE & VM

- Improves productivity with Stored Procedures
- Exploits DRDA2 in application server for accessibility to data on local or remote systems
- DB2 access over a TCP/IP network from DRDA® requesters
- Increased database availability with Incremental Archive
- Optional QMF™ and QMF for Windows features
- Enables database switching
- Allows multiple read-only users access to all data
- Provides VM database access from VSE system
- Recovery of databases at the table and storage pool level
- Supports VM Data Spaces
- Optional database administration feature
(See *DB2 Server for VSE & VM Overview – GC09-2995*)

ibm.com/software/data/db2/vse-vm

Query Management Facility (QMF) Feature

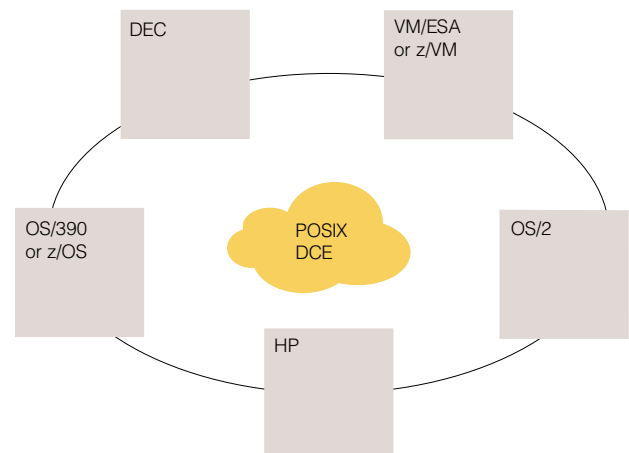
- Provides easy-to-use workstation GUI interfaces
- Powerful query and report writer for DB2 data
- Client/server capabilities for the workstation environment
- Processes both relational and non-relational data
(See *Using QMF – SC27-0716*, and *QMF Reference – SC27-0715*)

ibm.com/software/data/qmf

Open Distributed client/server computing

- OSF/DCE feature
 - Interoperability across heterogeneous platforms
 - Application development and deployment on any DCE supporting platform
(See *Introducing OpenEdition DCE - SC24-5735*)
- POSIX standards
 - Extends portability and provides standard-based application development services
 - Defines basic operating system interfaces and behavior
 - POSIX 1003.1c threads– Provide a general set of services for developing multitasking server applications that support multiple, concurrent execution streams
 - POSIX 1003.1c
 - POSIX 1003.1 and POSIX 1003.1a
 - POSIX 1003.2 – Shell and Utilities
 - POSIX hierarchical byte file system support by CMS and SFS enables access by heterogeneous systems across LANs and WANs
(See *OpenEdition® User's Guide for VM/ESA - SC24-5727* or *z/VM OpenExtensions User's Guide - SC24-5977*)

Notes: 1) The OpenEdition Shell and Utilities, previously a priced optional feature of VM/ESA, is packaged with z/VM at no additional charge has been renamed to OpenExtensions in z/VM. 2) DCE is not available in z/VM Version 4.



VM systems management products

Host Management Facilities/VM

- Monitors subsystems and applications to reduce outages
- Coordinates and simplifies performance analysis
- Enables increased console automation
- Manages local and remote systems
- Enables automation of subsystem and application management
- VMSES/E installation and service enabled
(See *Host Management Facilities/VM General Information Manual – SC24-5612*)

ibm.com/eserver/zseries/zvm/related/hmf

RTM VM/ESA Version 1 Release 5.2

- Realtime monitor of VM systems
- Used for performance analysis and installation management of VM environments
- VMSES/E installation and service enabled
- RTM Version 1 Release 5.2 does not operate on z/VM
(See *RTM VM Program Description/Operations – SH26-7000*)

RTM VM/ESA Version 1 Release 5.3 and the RTM feature for z/VM Version 4

- Realtime monitor of z/VM systems, including 64-bit architecture support
- Used for performance analysis and installation management of z/VM environments
- 31-bit enabled allowing any RTM module to address storage above 16 MB
- Elimination of 370 accommodation requirement
- Improved initialization control with+ the availability of an external configuration file which can be used to:
 - Establish table sizes, reducing the need for local modifications and recompiles
 - Provide an initial interface for specific commands, eliminating the need for RTMINIT processing
- Query command updated to provide:
 - Service level of executable RTM parts using the new LEVEL operand

- Storage addresses of dynamically allocated tables using the new TABLES operand
- System information, such as the CP and CMS levels, hardware level, and installed features using the new ENVIRON operand
- RTM Version 1 Release 5.3 and the RTM feature for z/VM do not operate on VM/ESA
(See *RTM VM/ESA Program Description/Operations – SH26-7000 or the RTM FL410 – SC24-6028*)

ibm.com/eserver/zseries/zvm/related/rtm

VM Performance Reporting Facility (VMPRF) Version 1 Release 2 and the PRF feature of z/VM Version 4

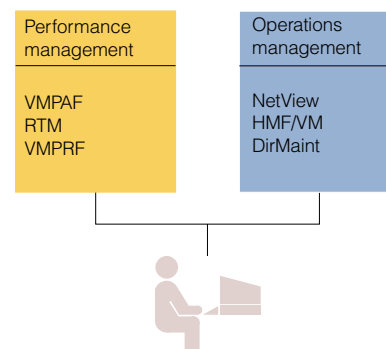
- Produces performance reports and historical files through processing of monitor data
- Analysis and tuning aid for z/VM, VM/ESA and VM/XA SP systems
(See *VM Performance Reporting Facility User's Guide – SC23-0460 or the z/VM PRF FL410 – SC24-6027*)

ibm.com/eserver/zseries/zvm/related/prf

Performance Analysis Facility/VM (VMPAF)

- Offers rapid visualization of system performance via a graphical interface
- Aids in identifying and resolving performance problems and capacity management
(See *PAF/VM General Information Manual – GC23-0566*)

ibm.com/eserver/zseries/zvm/related/paf



Configurability

Directory Maintenance (DirMaint) for VM Version 1 Release 5 and the DirMaint feature of z/VM Version 4

- Secure interactive facility for maintaining system directory
- Easier to maintain
- Improved DASD management
- XA exploitation and constraint relief
- Distributed administration
- New commands and exits
- Shared File System support
- VMSES/E installation and service enabled
(See *DirMaint 1.5 General Information Manual – GC20-1836* or the *Directory Maintenance Facility FL410 – SC24-6024*)

ibm.com/eserver/zseries/zvm/related/dirmaint

CMS Utilities Feature (CUF)

- Complements the CMS interactive support
- Increases the productivity of your local operations
 - Provides tools and services that simplify and enhance the operation of CP and CMS environments for end users and application developers
 - Provides fully supported commands, execs and applications that would otherwise need to be created locally
- Packaged with z/VM Version 4 at no additional charge

ibm.com/eserver/zseries/zvm/related/cuf

Display Management System for CMS (DMS/CMS)

- Provides a convenient mechanism for generating panels and menus for 3270 display terminals
- Provides the ability to utilize the designed screens with any application program

Additional Product Information

For additional information on the many VM-related products from IBM and software vendors, visit the z/VM Web site at:

ibm.com/zseries/zvm/products/

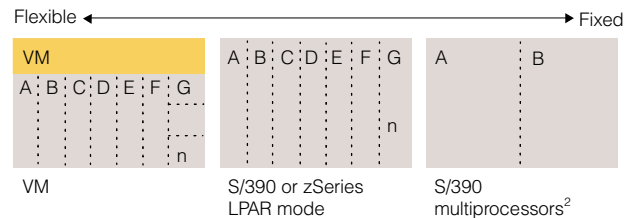
Partitioning options

Software partitioning	Logical partitioning	Physical partitioning ¹
Number of images		
Many	15 ²	2
Performance		
Near native with 6 preferred guests	Near native	Native
Resources		
Dedicated or shared processors, storage and devices Virtual devices	Dedicated or shared processors Dynamic storage reconfiguration Dedicated channels, CUs and devices ³	Dedicated processors Dedicated storage Dedicated channels
Support requirements		
Hardware and software	Hardware	Hardware
Reliability		
Hardware and software	Hardware	Hardware

¹ Only on Bipolar machines

² Machine dependent

³ ESCON channels may be shared on S/390 processors equipped with ESCON Multiple Image Facility (EMIF).



VM operating system comparison

VM functions	VM/SP	VM/ESA 370 Feature	VM/SP HPO	VM/XA SP	VM
Function					
REXX Sockets ²	–	–	–	–	•
APPC/VM	R5	•	R5	–	•
Shared File System	R6	•	R6	–	•
Cross System Extensions	–	–	•	•	•
Coordinated Resource Recovery	–	•	–	–	•
Callable Services Library	R6	•	R6	–	•
CMS application multitasking	–	–	–	–	•
Reusable Server Kernel	–	–	–	–	•
Virtual disk in storage	–	–	–	–	•
Enhanced minidisk caching	–	–	–	–	•
370 accommodation [†]	–	–	–	–	•
REXX L2 support	–	–	–	–	•
CP Exit Facility ¹	–	–	–	–	•
Enhanced Dynamic System Configuration ¹	–	–	–	–	•
VMSES/E	–	•	–	–	•
CMS Pipelines	–	•	–	–	•
VM GUI ¹	–	–	–	–	•
POSIX ¹ and DCE ^{1,7}	–	–	–	–	•
Java and NetRexx ³	–	–	–	–	•
Parallel Sysplex support ²	–	–	–	–	•
Guest coupling duplex ⁹	–	–	–	–	@
HiperSockets ⁹	–	–	–	–	@
Message Queuing Interface Client ³	–	–	–	–	•
NFS Client	–	–	–	–	@
Binder/Loader	–	–	–	–	@
Converged C Sockets library ⁹	–	–	–	–	@
Central storage					
16 MB	•	•	•	•	•
64 MB	–	•	•	•	•
1 GB	–	–	–	•	•
2 GB	–	–	–	–	•
64 GB	–	–	–	–	@
Expanded storage					
Paging	–	–	•	•	•
Guest	–	–	–	•	•
VM Data Spaces	–	–	–	–	•
Virtual Machine size					
16 MB	•	•	•	•	•
999 MB	–	–	–	•	•
2 GB	–	–	–	–	•
64 GB ⁴	–	–	–	–	@
I/O					
S/370 mode	•	•	•	–	–
Dynamic Channel Subsystem	–	–	–	•	•
ESCON I/O	–	–	–	–	•
FICON I/O	–	–	–	–	•
FICON CTCA ⁸	–	–	–	–	@
Fast CCW Translation Extensions ⁸	–	–	–	–	@
OSA-Express and OSA-2 and Fast Ethernet, 155 ATM	–	–	–	–	•

VM functions	VM/SP	VM/ESA 370 Feature	VM/SP HPO	VM/XA SP	VM
Channels					
16	•	•	•	•	•
32	–	•	•	•	•
48	–	–	•	•	•
256	–	–	–	•	•
Guest operating systems					
S/370	•	•	•	•	•
370-XA mode	–	–	–	–	•
ESA/390™ mode	–	–	–	•	•
z/Architecture mode	–	–	–	–	@
Preferred guests					
One	–	–	•	•	•
One to six ⁵	–	–	–	•	•
Processor					
Uni	•	•	•	•	•
Dual and dyadic ⁶	•	•	•	•	%
N-way	–	–	–	•	•
Systems supported					
ES/9370™	•	•	–	–	–
ES/4381™	<	•	–	<	<%
ES/3090™	>	>	>	•	+%
ES/9221	•	•	•	•	%
ES/9121	>	>	>	•	%
ES/9021	>	>	>	•	%
S/390 R1x	–	>	–	–	%
S/390 R2x, R3x ⁷	–	>	–	–	•
G3 Servers ⁷	–	>	–	–	•
G4 Servers ^{*,7}	–	–	–	–	•
G5 Servers [*]	–	–	–	–	•
G6 Servers [*]	–	–	–	–	•
zSeries Servers [*]	–	–	–	–	^
Integrated Facility for Linux (IFL) ⁸	–	–	–	–	@
S/390 Multiprise 2000 ⁷	–	>	–	–	•
S/390 Multiprise 3000 [*]	–	–	–	–	•
S/390 Integrated Server ⁷	–	•	–	–	•
RS/6000 ⁹ and S/390 Server on Board ⁷	–	•	–	–	•
PC Server S/390 ⁷	–	•	–	–	•

Legend

- ¹ Only on VM/ESA V2R1 or later or z/VM
- ² Only on VM/ESA V2R2 or later or z/VM
- ³ Only on VM/ESA V2R3 or later or z/VM
- ⁴ Pageable guests only on z/VM
- ⁵ The sum of storage for each of the preferred guests plus the storage required for the VM Control Program cannot exceed 2 GB
- ⁶ N/A to processors supported by z/VM
- ⁷ Not supported on z/VM V4 and later
- ⁸ Only supported on z/VM V4 and later
- ⁹ Only supported on z/VM V4R2 and later
- † Required to run 370 CMS application on VM V2
- Supported
- > Supported in logical partition only
- x Native on some models, logical partitions on others
- + Supported VM Data Spaces are not available
- < ES/4381 Models 9xE
- R5 Available under VM/SP Release 5 (with or without HPO)
- R6 Available under VM/SP Release 6 (with or without HPO)
- Not applicable
- # No 370 mode execution
- % Supported on VM/ESA but not on z/VM
- @ Supported only on z/VM
- ^ Supported in 64-bit mode only with z/VM

VM feature comparison

VM functions	VM/ESA		z/VM
	370	ESA	
REXX Sockets ²	–	•	•
31-bit CMS	–	•	•
CMS Pipelines	•	•	•
CMS multitasking	–	•	•
Reusable Server Kernel	–	•	•
VM GUI ¹	–	•	•
POSIX and DCE ¹	–	•	•
Binder/Loader	–	–	•
NFS Client	–	–	•
Coordinated Resource Recovery	•	•	•
APPC	•	•	•
Shared File System	•	•	•
SFS minidisk caching	–	•	•
VM Data Spaces support	–	•	•
Common SFS and minidisk interface	–	•	•
POSIX Byte File System ¹	–	•	•
DFSMS/VM			
Fast data mover	•	•	•
Space management by policy	–	•	•
Base for DoD security support	–	•	•
DB2 for VSE & VM	•	•	•
VM Data Spaces	–	•	•
Enhanced Move Page	–	•	•
Operational enhancements			
Simplified system configuration (logo, TOD changes)	•	•	•
Alternate nucleus	•	•	•
Fast warm start	–	•	•
Fast spool backup (SPXTAPE)	–	•	•
Soft-copy documentation	–	•	•
Enhanced dynamic system configuration ¹	–	•	•
Serviceability enhancements	•	•	•
VMSES/E	•	•	•
S/390 Service Update Facility ³	–	•	•
System Delivery Offering	•	•	•
ESCON architecture	–	•	•
FICON architecture	–	•	•
Additional device support			
FBA DASD, 9348 Tape	•	•	•
9340 DASD Subsystem	•	•	•
3390 DASD	–	•	•
3495 Tape Library Dataserver	–	•	•
3995 Optical Library Dataserver	–	•	•
3590 Tape Drive	–	•	•

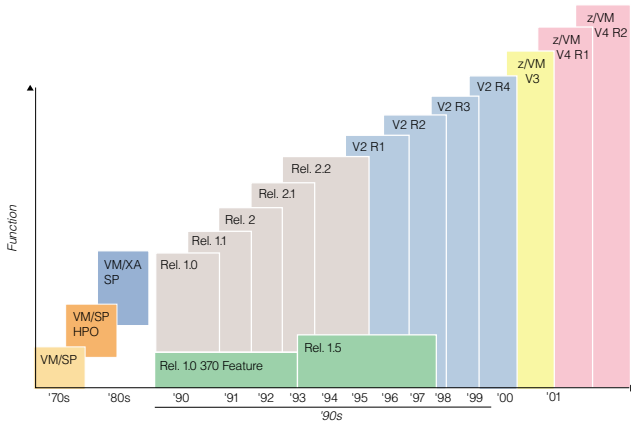
VM functions	VM/ESA		z/VM
	370	ESA	
3494 Tape Library Subsystem	–	•	•
3990 Model 6 MPLF Support	–	•	•
Internal Disk	–	•	•
RAMAC DASD Subsystem	–	•	•
RAMAC Array Subsystem	–	•	•
Enterprise Storage Server ²	–	•	•
Minidisk Caching	–	•	•
OSA-2/OSA Express Gigabit ⁴	–	•	•
OSA Express Token Ring ³	–	–	•
System Management Products			
HMF	–	•	•
PRF	–	•	•
PAF	–	•	•
RTM 1.5.2 ³	–	–	–
RTM 1.5.3 ^{1,5}	–	–	•
DirMaint	•	•	•
Communications			
RSCS V3R2.2	–	•	•
ACF/VTAM V4R2	–	•	•
TCP/IP for z/VM ^{3,6}	–	–	•
Additional Features			
LANRES ⁷	–	•	•
OSA/SF	–	•	•
Shell & Utilities ^{1,5}	–	•	•
CMS Utilities ⁶	–	•	•
DCE Base Services ^{1,7}	–	•	•
TCP/IP Feature for VM ^{3,7}	–	–	•
PRF Feature FL410 ⁸	–	–	•
RTM Feature FL410 ⁸	–	–	•
DirMaint Feature FL410 ⁸	–	–	•

Legend

- ¹ Only on VM/ESA V2R1 or later or z/VM
- ² Only on VM/ESA V2R2 or later or z/VM
- ³ Only on VM/ESA V2R3 or later or z/VM
- ⁴ QDIO supported only on z/VM
- ⁵ Integrated in z/VM
- ⁶ Integrated in z/VM V4
- ⁷ Not supported in z/VM V4
- ⁸ Only supported in z/VM V4
- ⁹ Only supported on z/VM V4R2 and later
- † Required to run 370 CMS application on VM/ESA V2
- Supported
- > Supported in logical partition only
- x Native on some models, logical partitions on others
- ÷ VM Data Spaces are not available
- Not applicable

VM Evolution

- VM/ESA and z/VM Version 3 supports all models of the IBM ^ zSeries including the z900 (ESA/390 mode), S/390 Parallel Enterprise Server Generation 5 and 6, and the S/390 Multiprise 3000. In addition, the S/390 Parallel Enterprise Server Generation 3, 4, R2, and R3 models, S/390 Multiprise 2000, S/390 Integrated Server, PC Server System/390, and the RS/6000 with System/390 Server-on-Board are also supported. z/VM Version 3 supports the zSeries 900 in 64-bit mode.
- z/VM Version 4 Release supports the IBM ^ zSeries family of servers including the z900, the S/390 Parallel Enterprise Server Generation 5 and 6 and the S/390 Multiprise 3000
- z/VM Version 4 Release supports the Integrated Facility for Linux (IFL) processor feature of the IBM ^ zSeries 900, the S/390 Parallel Enterprise Server Generation 5 and 6, and the S/390 Multiprise 3000



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