

z/VM and IBM @server zSeries
... your path to success



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What is z/VM?

z/VM® offers a base for customers who want to exploit IBM virtualization technology on one of the industry's best-of-breed server platforms, the IBM @server® zSeries®. With virtualization technology, customers can easily create many virtual machines consisting of virtualized processor, communications, storage, networking, and I/O resources. Virtualization technology may help lower your total cost of ownership when deploying new e-business and enterprise application workloads. z/VM includes over 35 years of innovation and invention.

z/VM Version 5 Release 1 - Further Enhancing Virtualization

Capabilities for Linux on zSeries

- Improved security with Linux on zSeries and z/OS guest support for Crypto Express2
 - Engine-based Value Unit pricing and a reduced entry price
 - Virtualization technology and Linux® enablement:
 - Deployment of a Linux server farm on z/VM using only Small Computer System Interface (SCSI) Fibre Channel Protocol (FCP) disks
 - Reduced dependence on tape with installation from DVD
 - Capability to swap from faulty disks using the new HyperSwap™ command
 - Improved cryptographic performance with PCIX Cryptographic Coprocessor (PCIXCC) support for Linux for zSeries and z/OS® guests
 - New Systems Management APIs implemented using Version 2 (V2) of the RPC server
 - Network virtualization and security:
 - Enhanced network recovery with virtual switch failover support
 - More flexible data transfer with virtual switch exploitation of Layer 2 support for OSA-Express and OSA-Express2 with the PTFs for APARs VM63538 and PQ97436
 - Improved authorization for z/VM guest LANs and virtual switches
- Technology exploitation:
 - Support for the IBM @server zSeries 990 (z990) and zSeries 890 (z890)
 - Greater scalability with up to four Logical Channel SubSystems (LCSSs) on the z990 and up to two on the z890
 - Transparent sharing of spanned internal and external channels across LCSSs
 - Support for the Open Systems Adapter (OSA)-Express Integrated Console Controller
 - Support for OSA-Express2 GbE and 10 GbE
 - Support the increase in the number of TCP/IP stacks to provide additional connections to help enable more virtual machines to be connected to an external network with the PTFs for APARs VM63524 and PQ914215
 - Additional security for SCSI devices in a z/VM environment with Linux guests through support of FCP LUN access control with the PTF for APAR VM63328
 - Support for up to 24 processors per z/VM image on a z990 server
 - Improvements to Capacity Upgrade on Demand
 - Support for FICON Express2 that can double the channel capacity and help increase performance
 - Support for the IBM TotalStorage DS8000 Series with the PTF for APAR VM63534

- Planned support for the DS6000 Series with the PTF for APAR VM63535 in March 2005
- Use of SCSI disks by guests that support FBA disks, up to 381 GB in size, without requiring their own SCSI support
- Capability to route IPv6 packets and develop IPv6 applications
- Systems management:
 - Enhanced Performance Toolkit for VM™
 - Functional equivalence to the Performance Reporting Facility (PRF)
 - New reports for Linux and for SCSI FCP disks
 - Supports application monitor records for SUSE LINUX Enterprise Server 9 (SLES 9) with PTF for APAR VM63580

(See z/VM Version 5 General Information – GC24-6095)

z/VM Version 4 Release 4 - Improves Virtualization Capabilities for Linux on zSeries

- Virtualization technology and Linux enablement:
 - Helps reduce overhead and may improve performance of virtual machines on zSeries servers
 - Higher efficiency when managing large numbers of virtual machines
 - High-performance virtual FICON™ CTCAs
 - Guest IPL from FCP-attached SCSI disks for Linux when hardware function is available
 - Upgraded SSL server provides appropriate Red Hat Package Manager (RPM) packages for the SUSE LINUX Enterprise Server (SLES 8) distributions.
 - Virtual Coupling Facility (CF) support to allow VM/ESA or z/VM systems to run as second-level (or higher) guests while simulating complete OS/390® and/or z/OS coupled sysplexes
- Network virtualization enhancements:
 - Additional network-traffic configuration options using Virtual LANs (VLANs)
 - External IP connectivity for guest LANs through virtual switching
 - Guest LAN support for IPv6
 - Extended HiperSockets™ support
- Technology exploitation:
 - Support for IBM z990 with:
 - Improved logical partitioning scalability with Logical Channel SubSystems (LCSSs)
 - Transparent sharing of HiperSockets channels across LCSSs
 - Improved capacity planning and I/O performance measurement
 - Up to 30 logical partitions (LPARs)
 - Cascaded FICON directors for enhanced and simplified connectivity
 - Support for IBM TotalStorage® Enterprise Storage Server® (ESS) Peer-to-Peer Remote Copy Extended Distance (PPRC -XD) and PPRC Version 2 (V2)
 - Support for IBM ESS FlashCopy® Version 2 (V2)
 - Support for IBM TotalStorage Enterprise Tape Controller 3592 Model J70 and Tape Drive 3592 Model J1A
- Systems management improvements:
 - Better control, definition, and dynamic reconfiguration of hardware I/O
 - Comprehensive performance monitoring and reporting with the optional Performance Toolkit for VM feature

- Automated shutdown of the Shared File System
- Networking security enhancements:
 - Dynamic control of network access and configurability
 - Easier IMAP server administration with an authentication exit
- Application enablement:
 - Support for the new C/C++ for z/VM compiler (5654-A22)

z/VM Version 4 Release 3 - Expanding virtualization technology

- Virtualization technology exploitation
 - Accounting of virtual network resources
 - Automated shutdown of virtual machines
 - Guest support for FCP channels
 - I/O priority queuing
 - Shared tape for z/OS, z/OS.e and OS/390
- Connectivity enhancements
 - Multicast support for HiperSockets
 - Simulation of a QDIO network adapter
 - Broadcast capability for QDIO
 - Improved TCP/IP stack security, performance, and configurability
- Systems management improvements
 - z/VM self-management to achieve guest performance goals
 - Enhanced timer management
 - Better utilization of large real storage
 - Additional performance monitor data
 - Improved accounting support for guests
- IBM ESS large volume support
 - RACF® for z/VM as an optional, per-engine priced feature

z/VM Version 4 Release 2 - Exploiting new technology

- Technology exploitation
 - HiperSockets, the high speed internal TCP/IP network, and OSA-Express Token-Ring
 - Guest Coupling Facility duplex support
 - Guest support for FICON channel-to-channel adapter (CTCA) communications
 - Clear-key RSA support of the IBM Cryptographic Accelerator with corresponding Linux for zSeries function
 - Improved disk and minidisk cache access performance for 64-bit guests
- Connectivity enhancements
 - Guest LAN support
 - New TCP/IP server for mail accessibility using the 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 Language Environment®

z/VM Version 4 Release 1 - Can reduce VM costs

- One-time charge (OTC) priced per-engine
- Support for the IBM Integrated Facility for Linux (IFL) processor engines
- Consolidation of select UNIX®, Microsoft® Windows® and Linux workloads on a single physical server
- Improved I/O performance for Linux guests

- *Enhanced page fault support for Linux guests*
- *VM functions available in Version 3 except DCE, LANRES/VM, and Vector Facility*
- *RTM, PRF, and DirMaint™ as preinstalled optional, per engine priced features*

(See z/VM Version 4 General Information – GC24-5991)

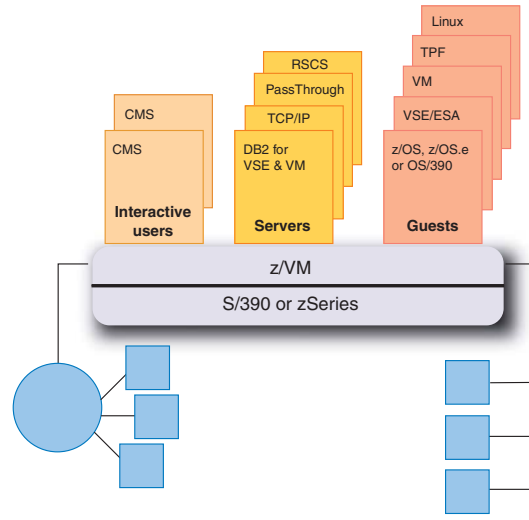
z/VM Version 3 - Exploitation of z/Architecture

- *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 IBM @server zSeries 800 (z800), and 900 (z900), and z890, or z990 server*
- *Provides the capability to run 64-bit and ESA/390 (31-bit) guest operating systems concurrently*
- *QDIO with OSA-Express Gigabit and 1000Base-T Ethernet*

(See z/VM V3.1 General Information – GC24-5944)

z/VM concurrently supports many different virtual machines, each running its own operating environment (as a “guest” operating system), in complete security and isolation.

Note: z/OS.e is available only in LPAR mode on the IBM @server zSeries 800 and 890 and must run in a logical partition, either alone or as a guest of z/VM. You may not run z/OS or OS/390 as a guest of a z/VM system in which z/OS.e is also as a guest.



A solution that builds on VM strengths

- *Virtualization technology*
- *Guest operating system support*
- *Extensive connectivity options*
- *Linux server consolidation platform*
- *CMS interactive support*
- *Server support*
- *Client/server workstation synergy*
- *Open distributed computing*
- *Ideal Web serving platform*
- *Wide range of environments and applications*

(For a complete list of publications available, refer to the z/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 support*

z/VM provides host-based services for the workstation environment

- *TCP/IP for z/VM provides for host/LAN connectivity*
- *TCP/IP Network File System and Message Queuing client interface for access to VM host data and applications*
- *VisualAge® Generator for application development*

z/VM manages the enterprise

- *Dynamic system configuration capabilities*
 - *Help reduce planned and unplanned outages*

- *DFSMS/VM® provides automated data management for Shared File System (SFS), POSIX Byte File System (BFS) files, and minidisk restructuring*
 - *Provides interfaces for TSM tape library usage*
 - *Allows VSE guest access to automated tape libraries containing 3480, 3490, 3590, and 3592 devices*

VM embraces the latest technology

z/VM Version 5 Release 1 provides:

- *Deployment of a Linux server farm on z/VM using only SCSI FCP disks*
- *Reduced dependence on tape with installation from DVD*
- *Improved availability by swapping from faulty disks using the new HyperSwap command*
- *Improved cryptographic performance with PCIXCC support for Linux and z/OS guests*
- *Improved security with Linux on zSeries and z/OS guest support for Crypto Express2*
- *Enhanced network recovery with virtual switch failover support*
- *New Systems Management APIs implemented using Version 2 (V2) of the RPC server*
- *Support for the z990 and z890:*
 - *Up to four LCSSs on the z990 and up to two on the z890*
 - *Transparent sharing of spanned internal and external channels across LCSSs*
 - *Support for the OSA-Express Integrated Console Controller*
 - *More flexible data transfer with virtual switch exploitation of layer 2 support for OSA-Express and OSA-Express2 with the PTFs for APARs VM63538 and PQ97436*

- Support for OSA-Express2 GbE and 10 GbE
- Support the increase in the number of TCP/IP stacks with the PTFs for APARs VM63524 and PQ91421
- Provides additional connections to help enable more virtual machines to be connected to an external network with the PTFs for APARs VM63524 and PQ91421
- Support for FICON Express2 that can double the channel capacity and help increase performance
- Additional security for SCSI devices in a z/VM environment with Linux guests through support of FCP LUN access control with the PTF for APAR VM63328
- Support for up to 24 processors per z/VM image on a z990 server
- Improvements to Capacity Upgrade on Demand
- Use of SCSI disks by guests that support FBA disks up to 361 GB in size, without requiring their own SCSI support
- Support for the IBM TotalStorage DS8000 Series with the PTF for APAR VM63534
- Planned support for DS6000 Series with the PTF for APAR VM63535 in March 2005
- Capability to route IPv6 packets and develop IPv6 applications

z/VM Version 4 Release 4 added:

- Support for z990 functions are designed to provide:
 - Greater scalability with four LCSSs
 - Transparent sharing of HiperSockets channels across LCSSs
 - Facilities to extend I/O measurements
 - Twice the number of LPARs (30)
 - Performance assist to help boost guest performance
- z990 and z890 are supported in ESA/390, z/Architecture, and compatibility modes by z/VM V3.1 and V4.3

- Definition and dynamic reconfiguration of hardware I/O via graphical interface
- Increased flexibility and connectivity with support for cascaded FICON directors
- Guest IPL from SCSI FCP disks for Linux
- IEEE Virtual LAN (VLAN) support
- TCP/IP broadcast support for HiperSockets and OSA-Express adapter
- Virtual FICON CTCA support
- Support for IBM for Enterprise Storage Server (ESS) PPRC-XD and PPRC V2
- Support for IBM ESS FlashCopy V2
- Support for IBM Enterprise Tape Controller 3592 Model J70 and Tape Drive 3592 Model J1A

z/VM Version 4 Release 3 added:

- Guest use of an FCP channel on zSeries processors connected to a fibre-channel fabric to access selected devices on SCSI controllers connected to the fabric
- I/O management facilities exploiting the hardware I/O Priority Queuing facility to prioritize guest and host I/O operations
- Virtualized automated shutdown enabling z/VM 4.3 guests to shut themselves down when signaled to do so
- Sharing of the same tape device among multiple z/VM guests
- Support for up to 32,760-cylinders on 3390 volumes on the IBM ESS
- Extended guest LAN implementation to support multicast transmission with HiperSockets
- Broadcast capability within the QDIO architecture

z/VM Version 4 Release 2 added:

- *HiperSockets, the high-speed internal TCP/IP network, and OSA-Express Token-Ring support*
- *Guest coupling duplex support for the duplexing capabilities of the zSeries Coupling Facility*
- *Guest support for FICON CTCA communications*
- *Clear-key RSA support of the IBM PCI Cryptographic Accelerator for Linux guests*
- *Improved DASD and minidisk cache access performance for 64-bit guests*

z/VM Version 4 Release 1 provides:

- *VM function available in Version 3 except DCE, LANRES/VM, and Vector Facility*
- *Support for the IBM z900 and z800 (in z/Architecture and ESA/390 modes), the S/390® G5 and G6, and the S/390 Multiprise® 3000 servers*
- *Support for IFL engines on z990, z900, z890, and z800, the S/390 G5 and G6, and the S/390 Multiprise 3000 servers*
- *One-time charge (OTC) priced per-engine*
- *Consolidation of Linux workload on a single physical server*
- *Improved I/O performance for Linux guests*
- *Enhanced page fault support for Linux guests*

z/VM Version 3 Release 1 provides:

- *Supports all models of the IBM zSeries including the z800 (except OLF model) and z900 in ESA/390 and z/Architecture modes, S/390 Parallel Enterprise Server™ Generation 5 (G5) and 6 (G6), and the S/390 Multiprise 3000. Also supported are the S/390 Parallel Enterprise Server R2, R3, Generation 3, and Generation 4 models,*

S/390 Multiprise 2000, S/390 Integrated Server, PC Server System/390®, and the RS/6000® with System/390 Server-on-Board.

- *Extended distance and improved data rate with Enterprise Systems Connection Architecture® (ESCON®)*
- *Additional extended distance and improved data rate with Fibre Connection (FICON) architecture*
- *Enabled for Internet and intranet access*
- *Hardware data compression*
- *Support of the IBM ESS*
- *OSA-Express support*
- *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, sharable virtual disk in storage*
 - *VM Data Spaces utilization for high-performance data access*
 - *Minidisk caching of CMS and guest data*
- *z/Architecture to support 64-bit guest operating systems*
- *Pageable guests up to 256 GB*
- *Native FlashCopy for the IBM ESS*
- *QDIO with OSA-Express Gigabit and Fast Ethernet, ATM and Token-Ring adapters*
- *Guest enhancements for the IBM TotalStorage Virtual Tape Server (VTS)*
- *Guest and native support for FICON-attached IBM TotalStorage Enterprise Tape Controller 3590 Model A60*

z/VM for running Parallel Sysplex system environments

- OS/390, z/OS, and z/OS.e Parallel Sysplex® system environments as z/VM guests
- Virtual Coupling Facility (CF) support:
 - Faster deployment of new Parallel Sysplex systems
 - Real hardware coupling facilities and coupling links neither required nor supported
 - Duplexing on the IBM zSeries
 - Support to allow VM/ESA or z/VM systems to run as second-level (or higher) guests
 - Help reduce risk in running new applications for OS/390, z/OS, or z/OS.e releases
 - Can help reduce problems in scheduling test and production time
 - Can help reduce training expense and reduce risk to production operations through training with virtual configurations
 - Additional options for disaster recovery
- z/VM V5 supports the Parallel Sysplex guest environment on all models of the IBM z990, z900, z890, z800 servers. In addition, z/VM V4 added support for this environment on all models of the IBM S/390 Parallel Enterprise Server Generation 5 and 6, and S/390 Multiprise 3000 servers and z/VM V3.1 added support for the S/390 Parallel Enterprise Server Generation 3 and 4 and the S/390 Multiprise 2000 servers.

z/VM encompasses many uses

- Flexible, cost-effective guest environments
- Ideally-suited for e-business on demand
- Consolidation of select UNIX, Windows and Linux workloads onto a single physical server
- Serves data and applications to Internet/intranet users
- Customized personal computing with CMS
- Rich application development environment

z/VM for an on demand business

- Access to enterprise data and applications through TCP/IP NFS
- Enterprise Web serving through IBM Business Partner products working cooperatively with z/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 z/VM
- Virtual Machine Serviceability Enhancements Staged/Extended (VMSES/E) available for:
 - Installation of z/VM, IBM Licensed Products, and vendor products in VMSES/E format
 - Allows the service disks of the z/VM components to reside in SFS
 - Application of z/VM service
 - CORrective service (COR)
 - Recommended Service Upgrades (RSU)
- z/VM installation and service available on CD-ROM
- Installation using 3590-formatted tapes and DVD
- Order z/VM products and service using ShopzSeries
- Internet delivery of z/VM SDO licensed products through ShopzSeries

To learn more about SUF:

ibm.com/eserver/zseries/zos/suf/

To learn more about ShopzSeries:

ibm.com/software/ShopzSeries/

CMS Interactive Support

CMS application multitasking

- Applications can be divided to handle work in parallel
- Application throughput can be improved
- POSIX exploits CMS multitasking
- CMS Pipelines support 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 boosts performance with caching in central and/or expanded storage
- VM Data Spaces allow applications in virtual machines to create additional VM Data Spaces of 2 gigabytes, up to 2 terabytes total

Callable Services Library (CSL)

- Improved application development productivity
- REXX and other high-level languages can use z/VM services, such as requesting Shared File System functions
- Interfaces to use VM data spaces
- Interfaces to POSIX functions for CMS users and applications

CMS Binder/Loader for z/VM

- Enhanced application affinity between CMS and OS/390, z/OS, or z/OS.e
- The CMS binder
 - Creates and utilizes data spaces if the user is authorized
 - Converts object or load modules, or program objects, into a program object and stores the program object in a partitioned data set extended (PDSE) program library
 - Converts object or load modules, or program objects, into a load module and stores the load module in a partitioned data set (PDS) program library
 - Converts object or load modules, or program objects, into an executable program in virtual storage and executes the program
- The CMS loader
 - Increases 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 Server Support

VM Data Spaces

- Offers capabilities unique to 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 data-sharing between a server and multiple users
- Provides an application programming interface and Callable Services Library routines, exploited by DB2® for VSE and VM, SFS and FORTRAN
 - Enables customers and vendors to develop applications using VM Data Spaces
 - Makes development process easier

z/VM Shared File System (SFS)

- Allows read/write sharing at the file level
 - Sharable 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
 - 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
 - Provides dynamic expansion of file space for users
 - Provides dynamic expansion of DASD to file pool
 - Allocates file pool DASD space vs. individual minidisks
 - Allows the 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 users and applications to access the POSIX hierarchical byte file system
- SFS shuts down automatically when the z/VM Control Program (CP) is shutdown

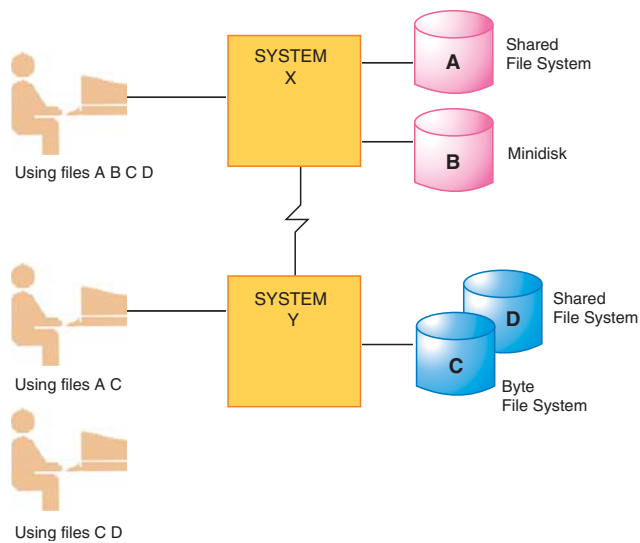
DFSMS/VM

- Provides automated space management
 - Space management for Shared File and Byte File System files
 - Migration, recall and expiration of active and inactive data
 - Archive/restore of SFS files to tape with Tivoli® Storage Manager

Guest Operating System Support

- 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
- Manages IBM TotalStorage Virtual Tape Server (VTS) 3494 tape libraries containing 3480, 3490, 3590, and 3592 drives
 - Includes support for Write Once Read Many (Worm) data cartridges
- Provides the capability for a tape-librarian product to communicate with an automated tape library
- Provides automated tape library access for VSE guests
- Supplied with the z/VM V3 and V4 base
 - Orderable no-charge feature available with the z/VM V5 SDO

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



Linux on zSeries guest benefits

- Consolidation of Linux workloads on a single physical server
 - Multiple Linux images on a z/VM system running IFLs without affecting IBM software charges for existing non-IFL zSeries engines on the same physical hardware server
- Shared DASD resources creating a server farm within a single machine
- More Linux images operating concurrently with reduced contention on the VM scheduler lock for better performance
- High-performance networking among virtual machines
- Upgraded SSL server for improved operation with the Linux 2.4 kernel
- Dedicated support for QDIO devices (HiperSockets, OSA-Express, and FCP channels)
- Attachment of SCSI devices using the zSeries FCP adapter
 - Support of FCP full fabric connectivity for shared links and improved fiber cable infrastructure utilization
 - Guest IPL from SCSI FCP disks on zSeries servers equipped with the SCSI IPL Feature Enabler
 - Deploy a Linux server farm on z/VM using only SCSI FCP disks
 - Additional security for SCSI devices in a VM environment with Linux guests through support of FCP LUN access control with the PTF for APAR VM63328
- z/VM HyperSwap function to help provide a coordinated near-continuous availability and disaster recovery solution for distributed applications, such as WebSphere®, that can span z/OS images running natively and Linux guests running under z/VM

- *New publication for deploying Linux on zSeries with z/VM*
 - *Performance Toolkit enhancements to add new high-level Linux reports and monitor records for SUSE LINUX Enterprise Server 9 (SLES 9) with the PTF for APAR VM63580 Simplified systems management using facilities provided by z/VM*
 - *Simplified systems management using facilities provided by z/VM*
 - *Systems management APIs for client applications to allocate and manage resources for virtual machines*
 - *Handling of unexpected workload growth by the quick addition of Linux virtual machines as needed*
 - *Enhanced device support, such as virtual disks and peer-to-peer remote copy for Linux systems*
 - *More flexible data transfer with virtual switch exploitation of Layer 2 support for OSA-Express and OSA-Express2 with the PTFs for APARs VM63538 and PQ97436*
 - *Support the increase in the number of TCP/IP stacks with the PTFs for APARs VM63524 and PQ91421*
 - *With corresponding function from Linux on zSeries, Linux guest virtual machines may benefit from:*
 - *Enhanced page-fault handling*
 - *Guest support for the IBM PCI Cryptographic Coprocessor (PCICC on the z800/z900) or the IBM PCI Cryptographic Accelerator (PCICA)*
 - *Shared-queue support for clear-key cryptographic functions*
 - *Guest support for the PCIX Cryptographic Coprocessor (PCIXCC) feature*
 - *Dedicated-queue and shared-queue support for clear-key cryptographic functions*
 - *Guest support for the Crypto Express2 feature*
 - *Dedicated-queue and shared-queue support for clear-key cryptographic functions*
 - *Improved DASD-access performance with minidisk cache*
 - *Facilities to back up all Linux data providing a single backup solution for all Linux servers*
 - *Strong tracing, diagnostic and debugging facilities*
 - *Access to a large number of Linux applications*
- VSE/ESA™ guest benefits**
- *A state-of-the-art platform for combining the best of VSE core applications with new workloads that exploit Linux on zSeries*
 - *Outstanding operational flexibility, simplicity, and productivity:*
 - *Multiple specialized VSE guests for test, development, release-to-release transition*
 - *Multiple production VSE guests for system simplicity*
 - *Integration of VSE and Linux guests for server consolidation and new workloads, including WebSphere Application Server*
 - *Improved performance with:*
 - *Virtual disk-in-storage exploitation, for example, shared lock file*
 - *Minidisk caching in expanded and main storage*
 - *DB2 for VSE & VM data sharing for improved performance*
 - *IBM TotalStorage Virtual Tape Server 3494 automated tape library access*

OS/390, z/OS, and z/OS.e guest benefits

- Support of latest zSeries technology
- Parallel Sysplex support for guests within a single VM image
 - Virtual Coupling Facility (CF) support to allow VM/ESA or z/VM systems to run as second-level (or higher) guests while simulating complete OS/390 and/or z/OS coupled sysplexes
- z/VM HyperSwap function to help provide a coordinated near-continuous availability and disaster recovery solution for distributed applications, such as WebSphere, that can span z/OS images running natively and Linux guests running under z/VM
- Guest support for the PCICA feature
 - Dedicated-queue support for clear-key functions
- Guest support for the PCICC (z800/z900) feature
 - Dedicated-queue support for clear-key and secure-key cryptographic functions
- Guest support for the PCIXCC (z890/z990) feature
 - Dedicated-queue support for clear-key and secure-key cryptographic functions
- Guest support for the Crypto Express2 feature
 - Dedicated-queue support for clear-key and secure-key cryptographic functions

Support for z/Architecture and ESA/390-mode operating systems

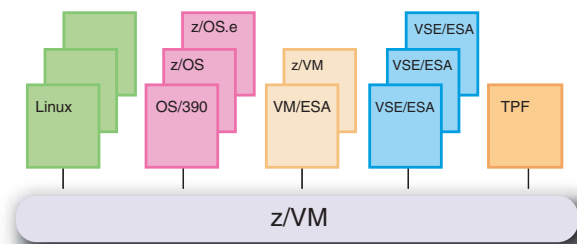
- Performance assist support
 - I/O-assist¹
 - Performance assist²
- Tens to hundreds of guests for migration, testing, production and development
- Virtual device support
- Shared and dedicated resources
- Debugging and trace facilities for guest systems
- 64-bit guest operating systems including z/OS, z/OS.e and Linux on zSeries

Notes:

1) I/O assist is not available when z/VM is running in a logical partition. z/VM must run in a logical partition on the z990 and z890 servers

2) Performance assist is available only on the z990 and z890 servers

Note: z/OS.e is available only in LPAR mode on the z890 or z800 and must run in a logical partition, either alone or as a guest of z/VM. You may not run z/OS or OS/390 as a guest of a z/VM system in which z/OS.e is also as a guest.



Performance

z/VM offers many features that can be used to help 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/O can result 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 z/VM.

The degree of benefit varies with the frequency of system workload I/O that applies to these techniques, data-reference patterns, DASD configuration, storage availability, and other factors.

To learn more about z/VM performance:

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

Connectivity Options

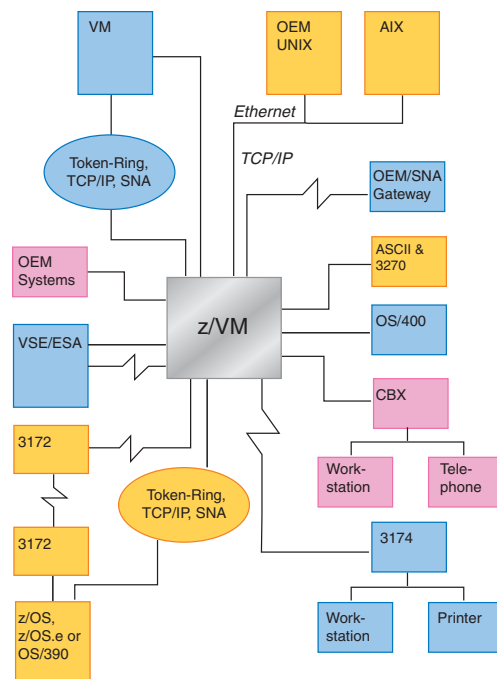
Networking options

z/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
- Ethernet (Gbe, 10 Gbe, and 1000BASE-T)
- X-Windows
- Network File Systems
- Simple Mail Transfer Protocol
- IP Multicast
- X.400 mail exchange protocol
- NJE

Network management

- SNA and TCP/IP networks



Communication Products

TCP/IP for z/VM V5.1

- All functions available in TCP/IP for z/VM Level 440 plus:
 - Enhanced virtual switch support to provide failover support which can provide less-disruptive recovery from some common network failures
 - More flexible data transfer with virtual switch exploitation of Layer 2 support for OSA-Express and OSA-Express2 with the PTFs for APARs VM63538 and PQ97436
 - Support the increase in the number of TCP/IP stacks with the PTFs for APARs VM63524 and PQ91421 to provide additional connections to help enable more virtual machines to be connected to an external network
 - Enhanced authorization capabilities for z/VM guest LANs and virtual switches by RACF or any External Security Manager that supports this new authorization function.
 - IPv6 support to allow the z/VM TCP/IP stack to be configured for IPv6 networks connected through OSA-Express and OSA-Express2 operating in QDIO mode

Note: Operates with z/VM V5.1

(See z/VM TCP/IP User's Guide – SC24-6127)

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

TCP/IP for z/VM V4.4

- All functions available in TCP/IP for z/VM Level 430 plus:
 - Better performance through the use of the performance assist function of the z990 server
 - Helps enable membership in a IEEE VLAN for OSA-Express (QDIO) and HiperSockets adapters
 - Virtual IP switches acting as routers providing IPv4 connectivity to a physical LAN

- Support to propagate broadcast frames to all TCP/IP applications using HiperSockets or OSA-Express adapters
- Improved performance and security of the TCP/IP stack
- IMAP user authentication exit that removes prior user ID and password length restrictions,
- Upgraded SSL server provides appropriate Red Hat Package Manager (RPM) packages for the SUSE LINUX SLES 8

Note: Operates with z/VM V4.4

(See z/VM TCP/IP User's Guide – SC24-6020-02)

TCP/IP for z/VM Level 430

- All functions available in TCP/IP for z/VM Level 420 plus:
 - Guest-LAN implementation extended to support multi-cast transmission across HiperSockets Guest LANs
 - Improved performance of the TCP/IP stack by:
 - redesigning algorithms to reduce path-lengths
 - recoding procedures to optimize high-use paths
 - identifying and implementing performance improvement items
 - Additional prevention of types of DoS attacks have been implemented including Kiss of Death (KOD), KOX, Blat, SynFlood, Stream, and R4P3D
 - Ease-of-use enhancements include:
 - TCP/IP configuration wizard to automate the connection of a newly installed z/VM system to a TCP/IP-based network
 - dynamic configuration of TCP/IP and optional generation of syntactically-correct configuration statements

Note: Operates with z/VM V4.3

(See z/VM TCP/IP Level 430 User's Guide – SC24-6020-01)

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 helps prevent some types of Denial of Service (DoS) attacks (Smurf, Fraggle, Ping-o-Death)

Note: Operates with z/VM V4.2

(See z/VM TCP/IP Level 420 User's Guide – SC24-6020-00)

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 Sockets Layer (SSL) server
 - Transparent data access to remote systems data with an NFS Client
 - Capability and usability 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)

Note: Operates with z/VM V3.1 and V4.1

(See z/VM TCP/IP User's Guide – SC24-5982-00)

To learn more about TCP/IP for z/VM:

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 V4.2 for VM/ESA Release Guide – GC31-8089)

ibm.com/software/network/vtam

RSCS Version 3 Release 2

- Unsolicited File Transfer (UFT) client and daemon support
- Processes NJE data traffic over TCP/IP, SNA, Bisynchronous, or directly-attached systems (CTCA, ESCON and FICON)
- Provides print support to TCP/IP printer daemon in text and PostScript format
- Supports ASCII printers attached to protocol converters or by TCP/IP connection
- Enables RSCS server to be the z/VM daemon to the TCP/IP world
- Enables the z/VM printer daemon to access any printer attached directly or indirectly to the NJE or TCP/IP network

z/VM Decision Support

- *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, FICON, TCP/IP, APPC, IUCV, CTCA, 3088, Bisynchronous connectivity options*
- *Gateway access to SNA network*
- *Connectivity to other VM, z/OS, z/OS.e, VSE and AIX® systems*
- *Provides automated session operations*
- *Transparent, seamless solutions for end-users*
- *Sharing a single session between multiple workstations*
- *Can help provide low-cost workstation support for VSE guest virtual machines*
- *Screen-capture capabilities*
- *Direct support for SDLC terminal control units*
- *Cross-system IUCV support provides communications path for applications on separate VM systems to use IUCV protocols*

(See VM/Pass-Through Facility Users Guide – SC24-5555)

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

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

DB2 Server for VSE & VM

- *Can help improve productivity with Stored Procedures*
- *Exploits DRDA 2 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*
- *Can now connect to DB2 for Linux on zSeries as an application server*

(See Using QMF – SC27-0716, and QMF Reference Guide – SC27-0715)

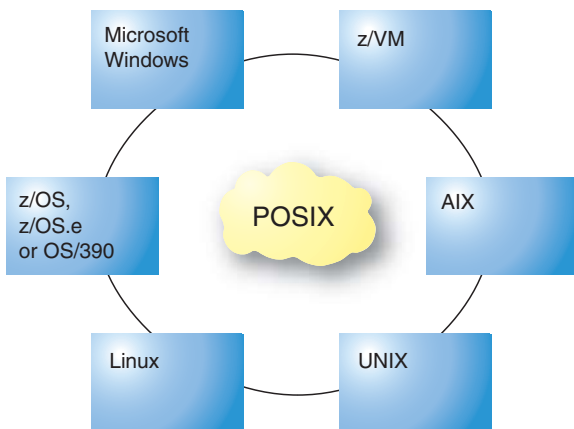
ibm.com/software/data/qmf/

Open Computing

POSIX standards

- Extends portability and provides standards-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 z/VM OpenExtensions Users Guide — SC24-6108)



Notes:

- 1) The OpenExtensions Shell and Utilities, previously a priced optional feature of VM/ESA, is packaged with z/VM at no additional charge
- 3) DCE is not available in z/VM V4 and later

z/VM System Management Products

Performance Toolkit for VM optional feature of z/VM

Provides enhanced capabilities for a z/VM systems programmer, operator, or analyst to monitor and report performance data:

- Full-screen-mode system-console operation
- Management of multiple z/VM systems (local or remote)
- Post-processing of Performance Toolkit for VM history files and of VM monitor data captured by the MONWRITE utility
- Performance monitoring
- Viewing of performance monitor data using either Web browsers or PC-based 3270 emulator graphics
- TCP/IP performance reporting
- Processes Linux performance data obtained from RMF which can be viewed and printed similar to the way VM data is viewed and presented
- New reports for Linux and SCSI FCP disks,
- Support for application monitor records for SUSE LINUX Enterprise Server 9 (SLES 9) with the PTF for APAR VM63580 Functional equivalence to PRF and RTM

(See z/VM: Performance Toolkit for VM - SC24-6062 for V4 or SC24-6136 for V5)

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

Directory Maintenance (DirMaint) for VM Version 1 Release 5 and the DirMaint optional feature of z/VM V4 or V5

- Provides a security-rich interactive facility for maintaining the system directory
- Provides distributed administration
- Provides commands and exits to support new functions
- Supports Systems Management APIs

- Supports the Shared File System
- Enables VMSES/E installation and service

(See DirMaint 1.5 General Information Manual – GC20-1836 or the DirMaint Facility Tailoring and Administration Guide – SC24-6024 for V4 or SC24-6135 for V5)

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

Resource Access Control Facility (RACF) optional feature of z/VM V4 or V5

RACF helps meet the need for security by providing:

- Flexible control of access to protected resources
- Protection of installation-defined resources
- Ability to store information for other products
- Choice of centralized or decentralized control of profiles
- Transparency to end users

(See RACF General Information — GC28-0722)

ibm.com/eserver/zseries/zos/racf/vm.html

CMS Utilities Feature (CUF)

- Integrated into z/VM Version 4 at no additional charge
- Complements the CMS interactive support
- Can increase 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

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

Host Management Facilities/VM

- Monitors subsystems and applications to help 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 5.3 and the RTM optional feature for z/VM V4 FL410 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 RTM 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 recompilations
 - Provide an initial interface for specific commands, helping to eliminate 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 operates on on V3.1 but not on V4 or V5
- RTM is not available with z/VM V5.1

(See RTM VM/ESA Program Description/Operations – SH26-7000 for z/VM 3.1 or the RTM FL410 – SC24-6028 for z/VM V4)

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

VM Performance Reporting Facility (VMPRF) Version 1 Release 2 and the PRF optional feature of z/VM V4 FL410

- Produces performance reports and historical files through processing of monitor data
- Provides analysis and tuning aids for z/VM systems
- VMPRF operates on V3.1 but not on V4 or V5
- PRF is not available with z/VM V5.1

(See VM Performance Reporting Facility User's Guide – SC23-0460 for z/VM 3.1 or the z/VM PRF FL410 – SC24-6027 for z/VM V4)

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 performing capacity management

(See PAF/VM General Information Manual – GC23-0566)

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

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 z/VM technology-related products from IBM and independent software vendors, visit the z/VM Web site at:

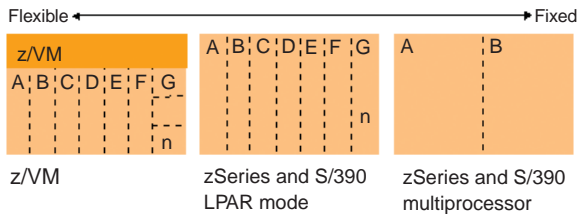
ibm.com/zseries/zvm/products/

Configurability

Partitioning Options

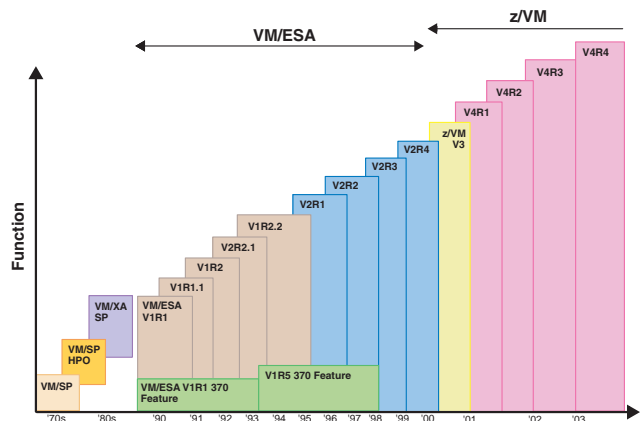
Virtual	Logical
Number of Images	
Many	15 - 30 ¹
Performance	
- I/O-assist ³ - high performance for up to 6 preferred guests	Near Native
- Performance assist ⁴ - high performance for V=V guests (pageable guests) using QDIO	
Resources	
- Dedicated or shared processors, storage and devices	- Dedicated or shared processor
- Virtual devices	- Dynamic storage reconfiguration
	- Dedicated channels, CUs and devices ²
Support Requirements	
Hardware and Software	Hardware
Reliability	
Hardware and Software	Hardware

1. Server-dependent (up to 30 on the z990 or z890 server).
2. Channels (except parallel) may be shared on zSeries and S/390 servers using the Multiple Image Facility (MIF).
3. I/O-assist is not available when z/VM is running in a logical partition. z/VM must run in a logical partition on the z990 or z890 server.
4. Performance assist is available only on the z990 or z890 server.



VM Evolution

- z/VM Version 3 supports all models of the IBM zSeries including the IBM z800 (except 0LF model) and z900 in ESA/390 and z/Architecture modes, S/390 G5, G6, and the S/390 Multiprise 3000. Also supported are the S/390 G3, G4 and the 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, or equivalent servers. z/VM V3.1 has been withdrawn from marketing effective August 27, 2004.
- z/VM Version 4 supports the IBM zSeries family of servers including the z990, z900, z890, and z800 in ESA/390 and z/Architecture mode, S/390 G5, G6, and the S/390 Multiprise 3000, or equivalent servers.
- z/VM Version 4 supports the Integrated Facility for Linux (IFL) engines of the z990, z900, z890, z800, S/390 G5, G6, and the S/390 Multiprise 3000, or equivalent servers.
- z/VM Version 3.1 and 4.3 support the z990 and z890 server, or equivalent servers, in ESA/390, z/Architecture, and compatibility mode.
- z/VM Version 5 supports only the z990, z900, z890, and z800 (standard or IFL engines), or equivalent servers in z/Architecture mode.



VM Operating System Comparison

VM Function	z/VM V3.1	z/VM V4	z/VM V5
Function			
APPC/VM	•	•	•
Shared File System	•	•	•
Callable Services Lib.	•	•	•
Cross Systems Extensions	•	•	•
Virtual disk in storage	•	•	•
Enhanced minidisk caching	•	•	•
370 accommodation	•	•	•
CP Exit Facility	•	•	•
VMSES/E	•	•	•
Java™ and NetRexx™	•	•	-
Parallel Sysplex simulation	•	•	•
Coupling Facility duplexing ³	•	•	•
HiperSockets ³	•	•	•
Guest LAN ³	•	•	•
Shared tape for guests ⁴	•	•	•
Accounting improvements ⁴	-	•	•
VSM APIs ⁵	-	•	•
VMRM enhancements ⁵	-	•	•
Virtual LAN ⁵	-	•	•
Virtual switching ⁵	-	•	•
HCM and HCD ⁵	-	•	•
MQ Interface Client	•	•	•
PCIX Cytographic Coprocessor ⁶	-	-	•
Crypto Express ²	-	-	•
Dynamic Virtual Machine Timeout ⁶	-	-	•
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	•	•	•
256 GB ¹	•	•	•
I/O			
FICON/ESCON I/O	•	•	•
FICON CTCA ³	•	•	•
FICON Express2	•	•	•
Virtual FICON CTCA ⁵	•	•	•
Cascaded FICON Directors ⁵	•	•	•
Fibre Channel Protocol ⁴	•	•	•
Guest IPL from SCSI FCP disks ⁵	-	•	•
SCSI FCP disks ^{6,24}	-	•	•
FCP LUN Access Control ⁵	-	•	•
Logical Channel SubSystems ⁵	•	•	•
HyperSwap ⁶	-	-	•

VM Function	z/VM V3.1	z/VM V4	z/VM V5
Channels			
16	•	•	•
32	•	•	•
48	•	•	•
256	•	•	•
512 ^{5,22}	-	•	•
1024 ^{5,23}	-	•	•
Guest Operating System			
S/370™ architecture	•	•	•
370-XA architecture	•	•	•
ESA/390 architecture	•	•	•
z/Architecture	•	•	•
Performance Assists			
I/O Assist ^{2,20}	•	•	•
Assist for V=V guests ^{5,21}	-	•	•
Processor			
Uni	•	•	•
N-way	•	•	•
Systems Supported			
S/390 R2x, R3x	•	-	-
G3 Servers	•	-	-
G4 Servers [#]	•	-	-
G5 Servers [#]	•	•	-
G6 Servers [#]	•	•	-
zSeries 800/890/900/990 Servers [#]	•	•	•
IPL processor feature	-	•	•
S/390 Multiprise 2000	•	-	-
S/390 Multiprise 3000 [#]	•	•	-
S/390 Integrated Server	•	-	-
RS/6000 and S/390 Server-on-Board	•	-	-
PC Server S/390	•	-	-

Note: For information on versions of VM prior to z/VM, refer to the z/VM Reference Guide, GM13-0137-00.

Legend

- 1 Pageable guests only
 - 2 The sum of storage for each of the preferred guests plus the storage required for the VM Control Program cannot exceed 2 GB
 - 3 Supported on z/VM V4.2 and later
 - 4 Supported on z/VM V4.3 and later
 - 5 Supported on z/VM V4.4 and later
 - 6 Supported on z/VM V5.1 and later
 - 20 I/O - assist is not available when z/VM is running in a logical partition. z/VM must be run in a logical partition on the z890 and z990 servers.
 - 21 Performance assist is available only on the z890 and z990 server
 - 22 Maximum channels on z890
 - 23 Maximum channels on z990
 - 24 Install, IPL, and operation of z/VM V5
- Supported
 - Not applicable
 # No 370 mode execution

VM Feature Comparison

VM Function	z/VM V3.1	z/VM V4	z/VM V5
REXX Sockets	•	•	•
31-bit CMS	•	•	•
CMS Pipelines	•	•	•
CMS multitasking	•	•	•
Reusable Server Kernel	•	•	•
POSIX	•	•	•
DCE	•	-	-
Binder/Loader	•	•	•
NFS Client	•	•	•
APPC	•	•	•
Shared File System	•	•	•
VM Data spaces support	•	•	•
Common SFS and minidisk interface	•	•	•
POSIX Byte File System	•	•	•
Automated SFS shutdown ⁵	-	•	•
DFSMS/VM			
Fast data mover	•	•	•
Space management by policy	•	•	•
Automated tape library support	•	•	•
DB2 for VSE and VM	•	•	•
VM Data spaces	•	•	•
Enhanced Move Page	•	•	•
Operational Enhancements			
Simplified system configuration	•	•	•
Alternate nucleus	•	•	•
Fast warm start	•	•	•
Fast spool backup (SPXTAPE)	•	•	•
Softcopy documentation	•	•	•
Dynamic system configuration	•	•	•
Enhanced timer management ⁴	-	•	•
Virtual Machine accounting improvements ⁴	-	•	•
Systems management APIs ⁵	-	•	•
HCD and HCM ⁵	-	•	•
VM Resource Manager ⁴	-	•	•
Automated shutdown ⁴	-	•	•
Installation from DVD	•	-	•
Serviceability enhancements	•	•	•
VMSES/E	•	•	•
S/390 Service Update Facility	•	•	•
ShopzSeries	•	•	•
System Delivery Offering	•	•	•
ESCON Architecture	•	•	•
FICON Architecture	•	•	•
Fibre Channel Protocol⁴	-	•	•
Device Support			
ESS	•	•	•
ESS Large Volume	•	•	•
ESS Peer-to-Peer	•	•	•
Remote Copy - XD	•	•	•
ESS FlashCopy V2 ³	•	•	•
ESS PPRC V2 ^{3,20}	•	•	•
FBA DASD	•	•	•
DS6000 ²⁵	-	•	•
DS8000 ²⁵	-	•	•
Internal Disk	<•	<•	-
RAMAC DASD Subsystem	•	•	•
RAMAC Array Subsystem	•	•	•
3390 DASD	•	•	•
3990 Model 6 MPLF Support	•	•	•

VM Function	z/VM V3.1	z/VM V4	z/VM V5
9340 DASD Subsystem	•	•	•
3494 Tape Library Subsystem	•	•	•
3495 Tape Library Dataserver	•	•	•
3590 Tape Drive	•	•	•
3592 Tape Controller (J70)/ Drive (J1A) ^{4,5}	•	•	•
9348 Tape	•	•	-
3995 Optical Library Dataserver	•	•	-
Minidisk Cache	•	•	•
OSA-2	•	•	•
OSA-Express			
1000BASE-T Ethernet	•	•	•
Gigabit Ethernet (GbE)	•	•	•
Token-Ring ³	•	•	•
Layer 2	-	-	•
OSA-Express2			
Gigabit Ethernet	•	•	•
10 GbE	•	•	•
Layer 2	-	-	•
Up to 640 TCP/IP Stacks	-	-	•
System Management Products			
HMF	•	•	•
VMPRF	•	-	-
VMPAF	•	•	•
RTM 1.5.3	-	-	-
PRF Feature	-	•	-
RTM Feature	-	•	-
Performance Toolkit for VM ⁵	-	•	•
DirMaint	•	-	-
DirMaint Feature	-	•	•
RACF	•	-	-
RACF Feature ⁴	-	•	•
Communications			
RSCS V3.2.2	•	•	•
ACF/VTAM V4.2	•	•	•
TCP/IP for z/VM ²	-	•	•
TCP/IP Feature for VM	•	-	-
VM Passthru Facility (PVM)	•	•	•
Additional Features			
LANRES	•	-	-
OSA/SF	•	•	•
Shell & Utilities ¹	•	•	•
CMS Utilities ²	•	•	•
DCE Base Services	•	-	-

Note: For information on versions of VM prior to z/VM, refer to the z/VM Reference Guide, GM13-0137-00.

Legend

- 1 Integrated in z/VM
- 2 Integrated in z/VM V4 and later
- 3 Supported on z/VM V4.2 and later
- 4 Supported on z/VM V4.3 and later
- 5 Supported on z/VM V4.4 and later
- 6 Supported on z/VM 5.1 and later
- 20 Guest use only
- 21 Withdrawn from Marketing effective August 27, 2004 (EOS announced for 12/2005)
- 25 Planned to be supported in March 2005
- Supported
- < Supported on S/390 Multiprise 2000/3000
- Not applicable



To learn more

Visit the zSeries World Wide Web site at ibm.com/eserver/zseries or call IBM DIRECT at 1 800 IBM-CALL in the U.S. and Canada.

Australia	132 426
Austria	0660.5109
Belgium	02-225.33.33
Brazil	0800-111426
China	(20) 8755 3828
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