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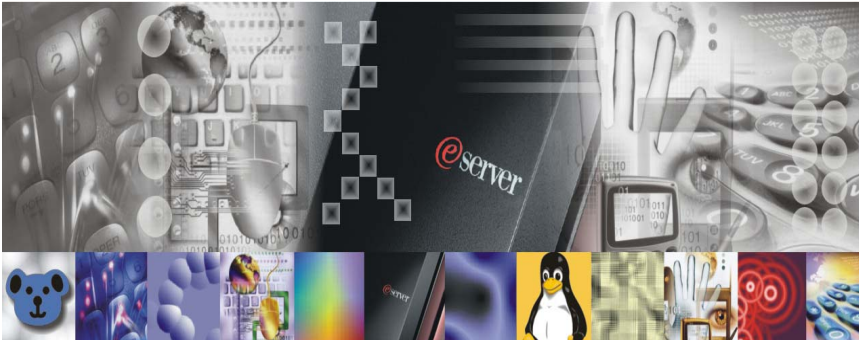
z/VM Version 5 Release 1

Flexible solutions for the competitive advantage.

■ *New pricing model and a reduced entry price*

■ *Virtualization and systems management enhancements to help manage Linux and other guests*

■ *Exploitation of new IBM @server® zSeries® 890 and enhanced zSeries 990 facilities, including support for the IBM PCIX Cryptographic Coprocessor*

Building successful virtual enterprises
Using virtualization technology as a foundation, z/VM® offers new function and technology that takes advantage of IBM Virtual Machine (VM) capabilities. z/VM V5 benefits from more than three decades of innovation and refinement, which can provide users with the ability to respond to rapidly changing market requirements more quickly and easily than with discrete single hardware servers. z/VM offers the ability to host a large number of Linux images on a single mainframe and provides an operational environment designed to be well-suited for on demand computing: highly flexible, adaptable, and efficient.

IBM @server brand
IBM @server brand offers a range of servers designed to be integrated into a robust, flexible infrastructure. This revolutionary brand responds to the unprecedented demands by providing high levels of performance and scalability.

The IBM @server zSeries is the enterprise-class platform optimized for the integration of business applications. The zSeries, with self-configuring and self-healing attributes, provides new functions and features to meet the challenges of e-business on demand™. zSeries servers provide reliability, security, scalability and availability.

Put the power of zSeries partitioning and z/VM virtualization technology to work for you and help realize the benefits of workload isolation and resource sharing, including: reliability, availability, and serviceability of IBM zSeries servers

• *Flexibility to physically partition zSeries processors to support up to 30 LPARs*
• *Virtually partition each LPAR using z/VM to support many virtual machines*
• *Virtualize processor, communication, memory, storage, I/O, and networking resources*
• *Help maximize resources to achieve high-system utilization*
• *Advanced dynamic resource allocation*
• *High-speed communications among LPARs and guests with HiperSockets™*
• *Advanced systems management, administration and accounting tools*

z/VM Version 5 (V5)

z/VM V5 offers new levels of price/performance, functional capabilities, and hardware exploitation that increase the attractiveness of deploying Linux solutions on the mainframe. You can add capacity to existing zSeries systems for hosting Linux on z/VM workloads by configuring their server with Integrated Facility for Linux (IFL) engines. z/VM V5 is the follow-on product to Version 4 (V4).

Using Linux as a guest of z/VM allows you to run tens to hundreds of Linux images on a single zSeries server with z/VM. These Linux images can be deployed on standard processor engines or Integrated Facility for Linux (IFL) engines with z/VM V5. z/VM V5 supports the IBM **@server** zSeries 990 (z990), 890 (z890), 900 (z900), and 800 (z800). V5 offers an ideal platform for consolidating select UNIX®, Microsoft® Windows®, and Linux workloads on a single physical zSeries server and for hosting other zSeries operating systems, including Linux, z/OS® z/OS.e, OS/390®, VSE/ESA™, TPF, VM/ESA®, and z/VM as guests.

z/VM V5.1 Virtualization Technology Enables Linux and other Guests

With z/VM and the IBM Integrated Facility for Linux (IFL), a low-cost, flexible environment is created to test and develop on Linux while running Linux production applications on the z990, z890, z900, z800, or equivalent servers. z/VM V5 support for IFL engines is designed to run Linux workloads without necessarily increasing the IBM software charges for z/OS, z/OS.e, OS/390, z/VM, VSE/ESA, or TPF operating systems and applications running on standard engines of the z990, z890, z900, and z800.

Engine-based Value Unit pricing for z/VM V5.1 replaces the per-engine pricing model available with z/VM V4. Engine-based Value Unit pricing is designed to provide a lower entry price and a decreasing price curve as hardware capacities and workload grow, which may help improve price/performance. Engine-based Value Unit pricing helps you to:

- *Add capacity and workload with an incremental, improved price*
- *Manage software costs better*
- *Aggregate licenses acquired across machines that are part of your enterprise*

The new z/VM V5 pricing model makes it more feasible for you to add z/VM virtualization technology to your standard engine environment (compared to the pricing models of z/VM V3 and V4). z/VM V5 requires z/Architecture™ (64-bit) for execution, therefore, z/VM V5 will run only on zSeries 990, 890, 800, and 900 servers (or equivalent). z/VM V5 provides additional support and exploitation opportunities for the thousands of users who have built enterprise-wide automation and infrastructure enhancements on the VM platform in support of their applications, database systems, and e-business solutions. Only Linux workloads in an LPAR or Linux guests of z/VM V4 or V5 can operate on the IFL engines. Traditional operating systems such as z/OS, z/OS.e, OS/390, TPF, VSE/ESA, z/VM V3.1, or VM/ESA are not supported, nor can they operate on IFL engines.

z/VM V5.1 builds upon z/VM V4 with virtualization technology enhancements in support of Linux and other guests.

New enhancements in V5.1 include:

- *Support for Small Computer System Interface (SCSI) Fibre Channel Protocol (FCP) disk logical units (SCSI disks) for both system and guest use. SCSI disks supported are those within an IBM TotalStorage® Enterprise Storage Server® (ESS) when it is connected to a fibre-channel (FC) fabric via zSeries FCP channels. SCSI disks can be used directly by a guest operating system when an FCP sub-channel is dedicated to a guest. Such a guest must provide its own SCSI device support. Linux for zSeries is designed to be one such guest. VM's SCSI support allows a Linux server farm to be deployed on z/VM in a configuration that includes only SCSI disks. ECKD disks are no longer required. Installation of z/VM from DVD to a SCSI disk, IPL from a SCSI disk using Stand-Alone Program Loader (SAPL), and VM system dumps to a SCSI disk are supported.*

- *Capabilities to install z/VM from a DVD to an IBM TotalStorage Enterprise Storage Server (ESS) SCSI disk emulated as a FBA device or to a 3390 DASD. Installing from a DVD can significantly reduce the required installation media and allows you to install to a zSeries server using only SCSI FCP disks. This is expected to be most beneficial in a z/VM environment with Linux guests and without traditional install devices such as IBM TotalStorage tape drives attached to the zSeries server. This capability requires the Hardware Management Console (HMC) Version 1.8 or later.*

- *z/VM is providing a new HyperSwap™ function so that the virtual devices associated with one real disk can be swapped transparently to another. HyperSwap can be used to switch to secondary disk storage subsystems mirrored by Peer-to-Peer Remote Copy (PPRC). It can also be helpful in data migration scenarios to allow applications to use new disk volumes. Geographically Dispersed Parallel Sysplex™ (GDPS®) 3.1 plans to exploit the new z/VM HyperSwap function to provide a coordinated near-continuous availability and disaster recovery solution for distributed applications, such as WebSphere®, that span z/OS images running natively and Linux guests running under z/VM.*

- *Support for the PCIX Cryptographic Coprocessor (PCIXCC) feature will help protect your assets. z/VM V5.1 provides z/OS and Linux guest support for the PCIXCC feature available with the z890 and z990. z/VM support includes:*
  - *Dedicated-queue support for clear-key and secure-key cryptographic functions for z/OS guests*
  - *Shared-queue and dedicated-queue support for clear-key cryptographic functions for Linux guests*

  The PCIXCC is designed to deliver improved performance for secure-key cryptographic functions compared to the PCI Cryptographic Coprocessor (PCICC).

- *Dynamic virtual machine timeout capability provides an emulated DIAGNOSE instruction that helps enable a guest operating system to specify an action to be taken by CP when the guest becomes unresponsive. If the guest fails to reissue the DIAGNOSE instruction within the specified time interval, CP performs the action.*

Additional guest support enhancements provided in V4 and included in V5.1 are:

- *Improvements to the Control Program (CP) scheduler increase the number of Linux and other guest virtual machines that can be managed concurrently.*

- *Enhancements to the Virtual Machine Resource Manager (VMRM) to provide the infrastructure to allow support of more extensive workload and systems resource management features by providing:*
  - *data monitoring, showing actual workload achievement*
  - *capabilities to dynamically change users in workloads, workload characteristics, and goals in the VMRM configuration file without manually stopping the server*
  - *more flexibility using the VMRM configuration file when managing multiple users*
  - *reliability and performance improvements of the VMRM service virtual machine's monitor data handling*
  - *serviceability enhancements including improved messages, log file entries, and new server options*
- *IPLing from SCSI disks attached to FCP channels for Linux and other guest operating systems that contain required support when z/VM is running on a z990, z900, z890, or z800 server equipped with the SCSI IPL Feature Enabler.*
- *Virtual FICON™ CTCA devices for guest operating systems enhance previous virtual-CTCA capabilities by adding the FICON protocol as an option for guest operating systems. Guests use virtual CTCAs to communicate among themselves within a single z/VM system image, without the need for real FICON CTCAs.*
- *Support for real and virtual integrated 3270 console devices. Real support enables this device, provided through the Hardware Management Console (HMC), to be used as the z/VM system operator console. Virtual support enables testing of guest operating systems and utilities such as the Stand-Alone Program Loader (SAPL) and DASD Dump Restore (DDR) that support the integrated 3270 console device.*
- *Virtual Coupling Facility (CF) support, introduced with VM/ESA V2.3, was enhanced 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. This allows the testing of an OS/390 or z/OS Parallel Sysplex® environment at any guest level.*
- *z/VM can account for the use of system resources by virtual machines, including those running Linux. Accounting records are produced that track a virtual machine's use of processor, paging, I/O, and virtual network resources, including virtual channel-to-channel adapters (CTCAs), inter-user communication vehicles (IUCV) or advanced program-to-program (APPC) connections, and virtual (Guest LAN) network interface cards (NICs).*

Exploiting New Technology

z/VM provides a highly-flexible test and production environment for enterprises deploying the latest business solutions. Enterprises that require multi-system server solutions will find that z/VM helps them meet the demands of their businesses and IT infrastructures with a broad range of support for such operating system environments as z/OS, z/OS.e, OS/390, TPF, VSE/ESA, CMS, and Linux on zSeries. The ability to support multiple machine images and architectures enables z/VM to run multiple production and test versions of zSeries operating systems, all on the same system. z/VM can help simplify migration from one release to another, facilitate the transition to newer applications, provide a test system whenever one is needed, and consolidate several systems onto one physical server. z/VM can also be used to enable access to the latest storage and processor architectures

for systems that lack such support. Technological enhancements in z/VM are designed to:

- *Exploit the z990 and z890 servers:*
  - *Extend Dynamic-I/O configuration support to allow channel paths, control units, and devices to be dynamically added, changed, and deleted in Logical Channel SubSystem (LCSS) environments when z/VM V4.4 or later is running on a z990 or z890 server*
  - *Transparent sharing of internal and external channels across LCSSs*
  - *Support for extended I/O-measurement facilities for improved capacity planning and I/O performance measurement*
  - *Handle I/O-configuration definition and dynamic-I/O configuration for up to 30 LPARs*
  - *Support the OSA-Express Integrated Console Controller (OSA-ICC) helps eliminate the requirement for external console controllers (2074, 3174), which can help reduce cost and complexity while improving productivity with fewer mainframe skills needed to operate an on demand system environment.*
  - *Support for the On/Off Capacity on Demand (On/Off CoD) and the Capacity Backup Upgrade (CBU) functions on IBM zSeries servers and includes functional enhancements that allow z/VM to:*
    - *Recognize and report changed processor configuration and capacity settings on a z990 or z890.*

The z990 and z890 servers are also supported in compatibility mode by z/VM V3.1 and V4.3. However, dynamic-I/O configuration is supported within LCSS0 only.

- *Support for the zSeries capability to cascade two FICON directors within a fibre channel fabric. z/VM and its guests can take advantage of this enhanced and simplified connectivity, which is particularly useful in disaster recovery and business continuity procedures.*
- *Support for the new ESS Model 750 which provides an entry point into the ESS product family. The ESS Model 750 meets the needs of clients who don't require full range of capacity and performance scalability offered by the ESS Model 800, but do need enterprise level functionality designed to provide reliable, continuous access to data at a more affordable price.*
- *Support for ESS FlashCopy® V2 that is designed to enable business continuance solutions with the delivery of new FlashCopy functions and enhancements. FlashCopy V2 is designed to help improve business efficiency, along with FlashCopy performance improvements designed to help minimize operational disruption.*
- *Support for the IBM ESS Peer-to-Peer Remote Copy Extended Distance (PPRC-XD) function designed to copy full volumes of data in non-synchronous mode.PPRC-XD is suitable for data migration, backup, and disaster recovery procedures. z/VM V4.4, and later, is also designed to support PPRC Version 2 (V2) for guest operating systems, designed to offer an Asynchronous Cascading solution providing a complete, consistent, and coherent copy of data at a remote site.*
- *Support for the IBM TotalStorage Enterprise Tape Controller 3592 Model J0 and the TotalStorage Enterprise Tape Drive 3592 Model J1A, designed to provide new levels of performance and attachment capabilities for S/390® and zSeries customers. The 3592 Model J70 can also be used to attach IBM 3590 tape drives.*

Systems Management

Improvements in systems management, some of which help provide

self-configuring, **self-managing**, and **self-optimization** features in z/VM V4.4 and later include:

- *Hardware Configuration Manager (HCM) and Hardware Configuration Definition (HCD) components to create and manage your I/O configuration. This new support provides a comprehensive, easy-to-use I/O configuration-management environment similar to that available with z/OS.*

- *Functions that may be called by applications to allocate and manage resources for guests running in z/VM virtual machines (virtual images). All enhancements to the systems management APIs in z/VM V5.1 have been implemented using Version 2 (V2) of the RPC server. Previous APIs implemented using V1 of the RPC server will also function with the new V2 server. A new server security identification procedure is provided for special authorized clients, which can remove the need to logon with a password, and simplify the logon process.*

Performance Management Tools

- *Performance Toolkit for VM™ provides enhanced capabilities for a z/VM systems programmer, operator, or performance analyst to monitor and report performance data. The toolkit is an optional, priced feature derived from the FCON/ESA program (5788-LGA). The Performance Toolkit is functionally equivalent to the RealTime Monitor (RTM) and Performance Reporting Facility (PRF) priced, optional features, thereby eliminating the need for separate products (PRF and RTM) to help manage your performance more efficiently. The Performance Toolkit for VM provides:*

  - *full-screen mode system console operation and management of multiple z/VM systems*
  - *post-processing of Performance Toolkit for VM history files and of VM monitor data captured by the MON-WRITE utility*
  - *viewing of performance monitor data using either Web browsers or PC-based 3270 emulator graphics*
  - *processing Linux performance data obtained from the Resource Management Facility (RMF™) Linux performance gather, **rmfpms**. Linux performance data obtained from RMF can be viewed and printed similar to the way VM data is viewed and presented.*

  The toolkit can monitor TCP/IP for z/VM and process Linux performance data. z/VM V5.1 enhancements include new high-level Linux reports based on Application Monitor records from Linux and new reports for SCSI disks. With the inclusion of functional equivalence to PRF in V5.1, the RTM and PRF features are not available in z/VM V5.1 satisfying the Statement of Direction announced on May 13, 2003. These features remain available with z/VM V4.4 but cannot be licensed on z/VM V5.

Performance Analysis Facility/VM (VMPAF)

VMPAF is a separately orderable licensed program product for z/VM that is used to statistically correlate and chart system performance problems, tuning information, and trend analysis. VMPAF does this by analyzing the relationships between variables from PRF, monitor and other data sources to determine which subsystems are most affecting current system performance. Using interactive graphics, VMPAF gives you a quick, clear picture of these relationships. VMPAF cannot be licensed for IFL processor features.

Directory Management

The Directory Maintenance Facility (DirMaint™) is an optional, priced feature of z/VM V4 and V5. DirMaint

is designed to provide efficient and highly secure interactive facilities for maintaining your VM system directory. Directory management is simplified by the DirMaint command interface and automated facilities. DirMaint provides a command corresponding to every VM directory statement, including Cross System Extensions (CSE) cluster directory statements. DirMaint's error checking helps to determine that only valid changes are made to the directory and that only authorized personnel are able to make changes.

Security Management

RACF® for z/VM is available as an optional, priced feature of z/VM V4 and V5 and may be licensed for IFL engines. RACF for z/VM works with the existing system features of z/VM to help provide improved data security for an installation. RACF for z/VM is designed to help 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*

Networking with z/VM

TCP/IP for z/VM is the link that brings the power and resources of your zSeries server to the Internet while helping to increase the return on your e-business investment. TCP/IP for z/VM with your zSeries server can communicate and share data with multi-vendor systems via your intranet and via the Internet. Applications can be shared transparently across VM, z/OS, OS/390, UNIX, VAX, and other environments. TCP/IP can be characterized as providing functions and services that can be categorized as follows:

- *Connectivity and gateway functions that handle the physical interfaces and routing of data*
- *Server functions that provide a service to a client (that is, send or transfer a file)*
- *Client functions that request a certain service from a server anywhere in the network*
- *Network status/management functions that detect and solve network problems.*
- *Application Programming Interfaces (APIs) that allow you to write your own client/server applications.*

TCP/IP is used to build an interconnection between networks (or Internet) through universal communication services. To allow communication between these networks, addresses are assigned to each host that is connected to the network.

Performance of the TCP/IP stack is intended to be continually improved and virtual multiprocessing capabilities were added. TCP/IP for z/VM can support tens of thousands of users and communicate with multi-vendor systems within your enterprise via the intranet or with external systems via the Internet. TCP/IP for z/VM allows users to send messages, transfer files, share printers, and access remote resources across a broad range of systems from multiple vendors.

TCP/IP is designed to support the z/Architecture HiperSockets function for high-speed communication among virtual machines and logical partitions within the same zSeries server. The HiperSockets function allows virtual machines and logical partitions to communicate internally over the memory bus using the internal-queued-direct (IQD) channel type in the z990, z900, z890, and z800.

TCP/IP broadcast support is provided for the HiperSockets environment when utilizing Internet Protocol version 4 (IPv4) with z/VM V4.4 and V5.1. Applications that use the broadcast function can now propagate frames to all TCP/IP applications. z/VM V4.4 introduced IPv6 support for guest LANs. The z/VM guest LAN support for the OSA-Express simulation in QDIO mode was updated for IPv6. Virtual machines (z/VM and other guest operating systems) in the z/VM guest LAN environment are able to define and use simulated OSA-Express devices that support both the IPv4 and IPv6 protocols. z/VM V5.1 enhances its IPv6 support by allowing the z/VM TCP/IP stack to be configured for IPv6 networks connected through OSA-Express operating in QDIO mode. The stack can be configured to provide static routing of IPv6 packets and to send IPv6 Router Advertisements. In addition, support is provided to help application developers to create socket applications for IPv6 communications.

The z990 and z890 servers are designed to include an important performance enhancement that virtualizes adapter interruptions and can be used with V=V guests (pageable guests) on z/VM V4.4 and V5.1. With the enhancement of the TCP/IP stack in z/VM V4.4 to use adapter interruptions for OSA-Express channels, TCP/IP for VM can benefit from this performance assist for both HiperSockets and OSA-Express adapters.

z/VM V4.4, and later, exploit the IEEE Virtual Local Area Network (VLAN) technology to help ease the administration of logical groups of users so that they can communicate as if they were on the same physical LAN. VLANs help increase traffic flow and may help reduce overhead to allow the organization of networks by traffic patterns rather than by physical location. To support VLAN, z/VM provides:

- *Enhancements to TCP/IP for z/VM to enable membership in a VLAN for OSA-Express (QDIO) and HiperSockets adapters that support IEEE 802.1q*
- *Enhancements to z/VM virtual QDIO and HiperSockets network interface to support VLAN frame tagging as described in IEEE 802.1q*
- *Management and control of VLAN identifiers (VIDs) that can be used by guest virtual machines*

The guest LAN support introduced in z/VM V4.2 simulates the HiperSockets function for communication among virtual machines without the need for real IQD channels, much as VM simulates channel-to-channel adapters for communication among virtual machines without the need for ESCON®, FICON or other real channel-to-channel connections. With the guest LAN capability, customers with S/390 servers can gain the benefits of HiperSockets communication among the virtual machines within a VM image, since no real IQD channels are required. Guest LANs can now be defined to function as OSA-Express Queued Direct I/O (QDIO) transport media, in addition to HiperSockets media. The addition of QDIO simulation allows the virtualization of a QDIO LAN environment and provides support for the broadcast capability that is part of QDIO architecture. As with z/VM HiperSockets simulation, no real hardware is required to support OSA-Express QDIO simulation.

z/VM V4.4 further enhanced its virtualization technology by providing the capability to deploy virtual IP switches in the guest LAN environment. The z/VM virtual switch eliminates the need

for virtual machines acting as routers to provide IPv4 connectivity to a physical LAN through an OSA-Express adapter. Virtual routers consume valuable processor cycles and require additional copying of the data being transported. The virtual switch helps alleviate this problem and also provides centralized network configuration and control. These controls allow the z/VM guest LAN administrator to more easily grant and revoke access to the network and to manage the configuration of VLAN segments. Improvements to the virtual switch in z/VM V5.1 provides enhanced failover support for less disruptive recovery for some common network failures, helping to ensure business continuity and infrastructure reliability and availability.

z/VM-based TCP/IP servers and clients can exploit Gigabit Ethernet, 1000BASE-T Ethernet, Fast Ethernet, Token-Ring, and ATM networks through the OSA-Express Adapter using QDIO. QDIO can help improve performance through a highly efficient data transfer architecture that can reduce TCP/IP path lengths. Data can be directly exchanged with an I/O device without using traditional I/O instructions. Using QDIO can help

an application achieve the full performance potential of a high-speed network.

TCP/IP for z/VM includes support for File Transfer Protocol (FTP) and Trivial File Transfer Protocol (TFTP). FTP and TFTP clients running on z/VM or other systems can access files residing anywhere on the Internet. z/VM provides FTP support for access to the VM Shared File System (SFS), Byte File System (BFS) and minidisk file system, as well as TFTP support for the BFS.

The multi-protocol dynamic routing server (MPROUTE) implements Open Shortest Path First (OSPF) and Routing Information Protocol (RIP), providing a powerful alternative to TCP/IP static routing. When properly configured, a VM host running the MPROUTE server can become an active OSPF or RIP network router, providing network access to z/VM virtual networks. By using MPROUTE, greater efficiency may be achieved within an IP network and manual network routing table updates are reduced or eliminated.

Virtual IP Addressing (VIPA) can increase the reliability and availability of TCP/IP in the event of a network or

interface failure. With VIPA, hardware link fault tolerance is supplied for both inbound and outbound TCP/IP communications on z/VM, which can provide automatic recovery of hard link failures and network traffic splitting.

IP Multicasting provides a more efficient means of transmitting the same data or messages to multiple users. A set of recipients can be selected and only one copy of the data is sent to the group. TCP/IP for z/VM supports transmitting in this manner, helping you save valuable network resources and users' time.

TCP/IP for z/VM provides numerous **self-protection** functions. A Secure Sockets Layer (SSL) server is available to facilitate highly secure and private conversations between z/VM servers and external clients. With z/VM support for SSL, a VM server can communicate with a secure client without a change to the server itself. The SSL server supplied with z/VM supports 40-bit, 56-bit and 128-bit encryption/decryption services, and requires a copy of Linux on zSeries to run. The upgraded SSL server introduced in z/VM V4.4 provides appropriate Red Hat Package Manager

(RPM) packages for the SUSE LINUX Enterprise Server (SLES) 7 (kernel version 2.4.7), SLES 8 powered by UnitedLinux (kernel version 2.4.19), or Turbolinux Enterprise Server (TLES) 8 powered by UnitedLinux distributions.

Security of the TCP/IP stack was improved to help prevent additional types of Denial of Service (DoS) attacks including: Smurf, Fraggle, Ping-o-Death, Kiss of Death (KOD), KOX, Blat, SynFlood, Stream, and R4P3D. The overall security and audit-ability of the TCP/IP for z/VM stack and the integrity of the z/VM system have been improved by providing better controls, monitoring, and defaults.

z/VM 5.1 enhances the authorization capabilities for z/VM guest LANs and virtual switches by using Resource Access Control Facility (RACF) or any equivalent External Security Man-ager (ESM) that supports this new authorization function. It is designed to provide ESM-centralized control of authorizations and Virtual LAN (VLAN) assignment.

A configuration wizard, **IPWIZARD**, automates the connection of a newly installed z/VM system to a TCP/IP-based network. This easy-to-use tool helps the z/VM installer provide IP configuration information such as host and domain names, IP addresses, and subnet masks. This tool also gener-ates an initial z/VM TCP/IP configura-tion and verifies that connectivity to the network has been established.

Once the initial IP network configura-tion has been created, a dynamic TCP/IP configuration tool, IFCONFIG, is available that can eliminate the need to learn the statement syntax of the z/VM TCP/IP server configuration file. This additional tool can optionally generate configuration statements for incorpora-tion into the configuration file so that the changes may be made permanent.

The Network File Server (NFS) V3 Server allows applications and users from heterogeneous systems to access files stored in the VM Byte File System (BFS), Shared File System (SFS) and CMS minidisk file system. NFS support on z/VM is a natural extension of VM file systems and enables Internet-based heteroge-neous systems to use the enormous DASD resources available on z/VM. Additionally, NFS permits z/VM to be a centralized, transparent file server for PC servers and workstations.

The z/VM NFS client gives CMS users and applications transparent access to data on remote systems that run NFS servers, including z/OS, z/OS.e, OS/390, Microsoft Windows, AIX®, UNIX, Linux, and VM. Mounting remote data on the BFS structure in a single virtual machine allows access by an NFS client.

The Simple Mail Transfer Protocol (SMTP) server, which includes TCP/IP mail services, is integrated with CMS mail functions. This can deliver a con-sistent method of mail and file transfer for TCP/IP and CMS users. The SMTP server provides service extension sup-port, including accepting and forward-ing of MIME-formatted messages.

The Internet Message Access Protocol (IMAP) Server, added in z/VM V4.3, provides support for an IMAP Version 4 Revision 1 (IMAP4rev1) mail server that runs on z/VM. This support allows you to utilize the strengths of z/VM (reliability, availability, and security) for storing and serving electronic mail while allowing any IMAP4rev1 client to access and manipulate mail mes-sages using the IMAP protocol as defined by RFC 2060. In z/VM V4.4, an IMAP user authentication exit removes

restrictions for prior userid and password-length and helps eliminate the need for every IMAP client to have a VM userid and password. Authentication is handled by a user-written exit routine, providing greater flexibility for choosing authentication methods.

Access to 3270-based applications from UNIX and other systems is available with the Telnet TN3270 support provided by TCP/IP for z/VM. The VM SSL server along with an SSL-enabled Telnet client, such as IBM Personal Communications, can be used to determine the security and privacy of telnet session data as it travels over the Internet/intranet.

Users or applications can execute a command on a remote host and receive results based upon TCP/IP remote execution protocol (REXEC) and support from z/VM.

TCP/IP for z/VM allows you to print data from your z/VM system on remote printers in your TCP/IP network. It also delivers enterprise-wide network printer support with line printer router (LPR), line printer daemon (LPD), and TN3270E printer attachment. VM LPR, LPD, and TN3270E print support

has been incorporated into the RSCS print server. Users can specify if they want their remote print data to be processed for delivery by either TCP/IP or RSCS.

z/VM provides network management support with Simple Network Management Protocol (SNMP).

Interoperability of applications

Message Queuing (MQ) is a popular method for applications to interface with one another across heterogeneous systems. MQ communication requires the client API support on the communicating platforms and a message queue manager (MQ server) somewhere on the network. The MQ server facilitates communication between applications without requiring them to actually connect to one another. The MQSeries® Client code is supplied with z/VM, therefore VM-based applications can interact over the Internet with other WebSphere MQ and MQSeries enabled applications and servers.

Statement of Direction

IBM plans to take the following actions in the future:

- *IBM has applied for Common Criteria (ISO/IEC 15408) certification of z/VM V5.1 with the RACF for z/VM optional feature against the Labeled Security Protection Profile (LSPP) and the Controlled Access Protection Profile (CAPP), both at the EAL3+ assurance level.*

- *IBM intends to extend its network virtualization capabilities, with updates to OSA-Express, Virtual Switch, and guest LANs. When delivered, these facilities will be designed to operate in Layer 2 mode (referring to Layer 2 of the Open Systems Interface (OSI) reference model). This is planned to allow destination and target nodes to be referenced by their Media Access Control (MAC) addresses rather than by the Internet Protocol (IP) addresses which is intended to enable protocol-independent network connectivity. Layer 2 support applies to an OSA-Express feature when configured in QDIO mode (CHPID type OSD). Layer 2 support is intended to apply, initially, to the z/VM and Linux on zSeries environments.*

- *z/VM V5.1 is the last release of z/VM to support the use of the IBM 2741 and TWX Terminal Model 33/35 (TTY), or their equivalents, as virtual consoles. This includes any ASCII device, such as the IBM 3101 or IBM 3163, that simulates one of these terminal types using the communication controller Emulator Program (EP). These devices continue to be supported for attachment to a virtual machine. Support for remote terminals under the control of VTAM® is not affected by this change.*

- *IBM intends to withdraw the System Administration Facility from a future release of z/VM. Customers using the System Administration Facility to create and manage Linux images as guests of z/VM should start using other systems management facilities of z/VM, write a client application using the Systems Management APIs introduced in z/VM V4.4, or acquire a system management application from an IBM solution provider. Documentation is available in the System Administration Facility publication, SC24-6034. This publication is not included with the z/VM V5.1 library.*

- *IBM intends to withdraw the Server-Requester Programming Interface (SRPI) from a future release of z/VM. SRPI was introduced in VM in 1986 to provide a programming interface that enhanced the environment of IBM workstations communicating with IBM mainframes operated with VM systems. Customers with applications using SRPI should start using z/VM TCP/IP to provide similar function. Documentation for SRPI is available in the VM/ESA: Programmer's Guide to the Server-Requester Programming Interface for VM, SC24-5455. This publication is not included with the z/VM V5.1 library.*

For more information

To learn more about z/VM V5.1, visit:
ibm.com/eserver/zseries/zvm/

To learn more about the IBM @**server** zSeries, contact your IBM marketing representative, IBM Business Partner, or visit: **ibm.com**/eserver/zseries