
IBM Z
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**IBM z/VM Frequently Asked Questions
for z/VM 7.2, z/VM 7.1 and z/VM 6.4**

Worldwide



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General Questions

What is IBM Z® and IBM® LinuxONE virtualization technology?

IBM Z and IBM LinuxONE virtualization technology allows customers to create virtual processors, communications, memory, I/O, and networking resources, thus helping to reduce the overhead of planning, purchasing and installing new hardware to deploy, consolidate and support new workloads. The virtualization technology for IBM Z and LinuxONE platforms has multiple layers, which are considered when the IBM Z and LinuxONE servers are designed. IBM Z and LinuxONE virtualization is not an afterthought; it is designed into hardware, firmware, and software from the ground up. Unlike distributed hardware-based solutions, z/VM® virtualization technology allows you to virtualize processor, communications, storage, I/O, and networking resources to help reduce the need to duplicate hardware, programming, and data resources. Additional virtualization technologies for IBM Z and LinuxONE are the open source based KVM and container technologies.

What do the hardware and firmware provide for IBM Z and LinuxONE virtualization technology?

The IBM Z and LinuxONE hardware and firmware provide the virtualization foundation with functions critical to its success, particularly on a large scale, such as the ability to partition the machine, share devices, and communicate between partitions. It also provides built-in capabilities to support running guests on hypervisors at native speeds while allowing hypervisor interception of functions that require additional virtualization.

What does the virtualization layer provide for IBM Z and LinuxONE virtualization technology?

The virtualization layer extends the capabilities of the hardware and firmware from the standpoint of sharing hardware resources, virtualizing resources, and communication. It also introduces the flexibility required to support large numbers of virtual servers in an on-demand enterprise. Operational support, control, accountability, and maintenance are a large part of the operation of any group of servers. The z/VM hypervisor is the IBM Z and IBM LinuxONE product providing the software virtualization layer functionality.

How does IBM Z and LinuxONE virtualization technology help a business become more efficient and responsive?

With virtualization technology as its foundation, z/VM provides new function and technology exploitation on the IBM Z and LinuxONE that helps enable customers to virtualize processors, communications, memory, I/O, and networking resources, with the potential to help reduce the need to plan for, purchase, and install hardware to deploy, consolidate, and support new workloads.

With support for IBM Z and LinuxONE dynamic reconfiguration capabilities, z/VM helps enable resources, such as processors and memory, to be added to an active LPAR running z/VM non-disruptively. Customers can configure their systems to help reduce the need to restart z/VM. They can dynamically add processors, channels, OSA adapters, I/O, and memory to both the z/VM system itself and to individual guests.

Does z/VM help to run a private cloud on IBM Z or IBM LinuxONE?

Yes, the z/VM hypervisor extends the capabilities of the IBM Z and IBM LinuxONE enterprise platforms from the standpoint of sharing hardware assets, virtualization facilities, and communication resources.

IBM z/VM delivers extremely high levels of security, scalability, and efficiency, providing a robust foundation for on-premises private cloud computing. z/VM virtualization technology is designed to run hundreds to thousands of Linux® servers and IBM Cloud Paks® based on Red Hat® OpenShift® Container Platform on a single IBM Z or LinuxONE server with the highest degrees of efficiency, elasticity, and security.

Together with [IBM Wave for z/VM](#), the comprehensive administration solution for z/VM-based virtual Linux server environments, z/VM makes it easier to extract the maximum value from large-scale virtual server hosting on IBM Z and LinuxONE. This includes software and personnel savings, operational efficiency, power savings, and optimal qualities of service.

z/VM, together with Linux and [IBM Cloud Paks](#) based on [Red Hat OpenShift Container Platform](#), IBM Z and LinuxONE provide a highly scalable, secure, and efficient on-premises private cloud infrastructure for your hybrid multicloud.

Realizing the benefits of cloud computing requires an infrastructure that delivers availability, reliability, security, and performance, while also providing strong virtualization technology. Virtualization is foundational to delivering Infrastructure as a Service, a basic building block for cloud.

To accelerate cloud adoption, [IBM Cloud Infrastructure Center](#) can help cloud administrators and cloud development teams to provide a consistent, industry-standard user experience for defining, instantiating, and managing the lifecycle of virtual infrastructure, and deployment of images. It also integrates with higher-level cloud automation tools, such as IBM Cloud Automation Manager or VMware vRealize Automation or vRealize Orchestrator.

Where can I find more information about IBM z/VM?

The z/VM Websites are the primary location for detailed information and material about z/VM's capabilities. See: ibm.com/it-infrastructure/z/zvm or www.vm.ibm.com/newfunction

In addition, the [z/VM Sponsor User program](#) and the [z/VM Council](#) pages might be of interest.

What are the options to interact with the z/VM community?

IBM has a long history of working with clients to deliver capabilities to improve z/VM. IBM takes this interaction to a new level:

- z/VM clients may enlist as “Sponsor Users” and participate in the z/VM Council to advise IBM throughout the design process for many z/VM development projects. These clients may also test early versions of the new support before its delivery to the marketplace to ensure their expectations are met or exceeded. IBM finds the Sponsor User relationship to be beneficial and is soliciting more z/VM clients to become involved in this process. To learn more, see the [z/VM Sponsor User program](#) and [z/VM Council](#) web pages.
- IBM publishes information about many of its z/VM development projects to help users decide if they want to volunteer as Sponsor Users and help the community at large plan for the introduction of new z/VM function. This new level of communication between IBM and the z/VM user community facilitates discussion regarding implications of the planned support, such as operational incompatibilities, changes to system behavior, and software vendor impacts. These plans are posted and updated on the [z/VM Continuous Delivery News](#) web page.

Besides that, there are other ways that most of our customers already leverage:

- z/VM and related Mailing Lists: Very friendly community of users, customers, vendors and IBM employees always willing to help. For more information see the [List Server Discussion](#) website.
- IBM and Customer driven events: IBM Think, IBM Tech U., VM Workshop, SHARE, GSE and other events. For more information see the [Worldwide Events Calendar](#) website.

What are the implications of the z/VM Continuous Delivery model?

New z/VM capabilities will be delivered in the service stream of the current version 7 release as Small Programming Enhancements (SPE). When a new release is introduced, SPEs are delivered on that release going forward and, with a few exceptions, the earlier release delivers corrective service only and no new function. With the availability of z/VM 7.2, licensed users of z/VM 7.1 receive only corrective service.

- Beginning with Version 7, IBM delivers z/VM releases on a fixed, 24-month cycle. These releases are a rollup of:
 - Previously-released new function APARs (previously known as SPEs)
 - New function that is too disruptive or pervasive to ship in the z/VM service stream
 - Fixes that were shipped in the service stream of the earlier release
- IBM services each z/VM release for 54 months.
- A z/VM release remains orderable for 18 months after the general availability of its follow-on release. This enables clients who are running older levels of z/VM the option of:
 - Moving to the most current release, to receive new function APARs
 - Moving to the service-only release, to receive corrective service only

Clients are afforded the flexibility of moving from one service-only release to another, if they prefer not to receive new function in the service stream. For example, a z/VM 6.4 client has the option of moving to z/VM 7.1 up to 18 months after the general availability of z/VM 7.2. z/VM 7.1 will be orderable for 18 months after the general availability of z/VM 7.2. For ordering options, see your local IBM representative.

For planning purposes, z/VM 6.4 users will receive corrective service six months after the general availability of z/VM 7.2. The planned release cycle for z/VM 7 means z/VM 6.4 service support overlaps the planned availability of z/VM 7.2 by six months. The same applies for future releases, such that release N will be supported for six months after release N+2 becomes generally available.

Starting with z/VM 7, IBM enabled the z/VM documentation for Continuous Delivery capability to update topics in [IBM Knowledge Center](#) and publications in PDF format as the need arises. For more information, see the z/VM General Information manual (GC24-6286-10) on the [z/VM Internet Library](#).

What changed with the inclusion of the z/VM Single System Image function in the z/VM 7 base?

z/VM Single System Image (SSI) function is included in the base of z/VM 7 at no additional cost. Previously, it was a priced feature of z/VM 6 but has been withdrawn. Integrating and making SSI available at no charge is intended to help more clients reduce or shorten planned outages of their Linux workloads as they adopt the z/VM Continuous Delivery model for their z/VM systems.

For additional information on SSI and setting up an SSI environment, see the [IBM Knowledge Center](#).

Also, there is no charge for Subscription and Support (S&S) for SSI with z/VM 7. For clients who are currently paying S&S charges for SSI on z/VM 6, IBM removes the SSI feature S&S charges for future S&S renewals for clients who have ordered z/VM 7. Client acceptance of the z/VM 7 order is permission for IBM to remove future SSI feature S&S renewals.

It is the client's responsibility to verify that this charge has been removed with subsequent S&S renewals as there are no refunds or credits on S&S. Clients with any questions should contact their IBM representative or Business Partner.

Which servers are supported by z/VM?

All versions – z/VM 7.2, z/VM 7.1 and z/VM 6.4 – support IBM z15™ (z15), IBM z14® (z14), IBM z13® (z13), IBM z13s® (z13s), IBM LinuxONE III, IBM LinuxONE Emperor, IBM LinuxONE Emperor II, IBM LinuxONE Rockhopper, and IBM LinuxONE Rockhopper II.

z/VM 7.1 is the last z/VM release supporting the IBM zEnterprise® EC12 (zEC12) and IBM zEnterprise BC12 (zBC12) servers.

z/VM 6.4 is the last z/VM release supporting the IBM zEnterprise 196 (z196) and IBM zEnterprise 114 (z114) family of servers.

IBM z/VM 6.4 was withdrawn from marketing (EoM) on March 9, 2020, as announced on Dec. 3, 2019. IBM z/VM 6.4 will be withdrawn and discontinued from service (EoS) on March 31, 2021, as announced on Feb. 4, 2020.

Refer to the [IBM Support Portal](#) for the most current support lifecycle information for z/VM.

Which operating systems are supported by z/VM?

IBM z/VM 7.2, z/VM 7.1 and z/VM 6.4 support the Linux distributions from Canonical, Red Hat and SUSE, and the IBM Z operating systems IBM z/OS®, IBM z/VSE®, and IBM z/TPF. z/VM can also host guest virtual machines running supported copies of z/VM.

What are the pre-requisites for installing z/VM on a z15 or LinuxONE III?

z/VM can be installed directly on a z15 or Emperor III server. Installing z/VM 6.4 on one of these servers requires an image obtained from IBM after August 25, 2017. The PTF for APAR VM66248 must be applied immediately after installing z/VM 6.4.

Installation of z/VM from the IBM z15 and LinuxONE III server's USB flash drive is supported.

Information on receiving z/VM product deliverables electronically can be found at:

www.vm.ibm.com/install/prodinst.html

For details, see the [z/VM Required Service](#) website.

What are the pre-requisites for installing z/VM on a z14, LinuxONE Emperor II, or LinuxONE Rockhopper II?

z/VM can be installed directly on a z14, Emperor II, or Rockhopper II server. Installing z/VM 6.4 requires an install medium produced after August 25, 2017, and the PTFs for APARs VM65942, VM66071, and VM66539 (required for ZR1 and Rockhopper II) must be applied immediately after installing z/VM 6.4 and prior to doing any configuration of the new z/VM system. For more information see the [z/VM Required Service](#) website.

What is IBM Wave for z/VM?

IBM Wave for z/VM is a comprehensive management solution for z/VM-based virtual Linux server environments on IBM Z and IBM LinuxONE. It provides outstanding virtualization management capabilities through unique visualization and simplification technologies. IBM Wave's management facilities are designed for Linux and z/VM system administrators, programmers, and operators. For additional information, see ibm.com/marketplace/wave-for-zvm

What is IBM Cloud Infrastructure Center?

IBM Cloud Infrastructure Center is an advanced infrastructure management solution that supports on-premises, private cloud deployments of z/VM-based Linux virtual machines on IBM Z and LinuxONE. It is an Infrastructure as a Service solution that provides a consistent, industry-standard user experience to define, instantiate, discover and manage the lifecycle of virtual infrastructure and the deployment of images. It fits perfectly in the hybrid cloud strategy, providing infrastructure management for on-premises, private cloud deployments. For additional information, see ibm.com/products/cloud-infrastructure-center

What is Infrastructure Suite for z/VM?

The management of z/VM environments and Linux on IBM Z guests, as well as support for backup and recovery of the entire system, is now available in one solution - IBM Infrastructure Suite for z/VM and Linux. It provides you with comprehensive insight to efficiently control and support your IBM z/VM and Linux on IBM Z environment with:

- Simplified IT administration.
- Performance monitoring of z/VM and Linux guests.
- Ability to facilitate automated operations.
- Rapid cloning and provisioning of Linux guests on z/VM.
- Backup and restore of the z/VM and Linux on IBM Z environment.

For additional information, see ibm.com/marketplace/infrastructure-suite-zvm-and-linux

How is z/VM licensed?

z/VM is licensed per Value Unit. Value Unit entitlements are based on the number of units of a specific designated measure used or managed by the Program. A licensee must obtain sufficient entitlements for the number of Value Units required for their environment for the designated measure specified in the Value Unit Exhibit (VUE). The Value Unit Exhibit for z/VM is [VUE021](#). Value Unit entitlements are specific to the Program and may not be exchanged, interchanged, aggregated with Value Unit entitlements of another Program.

The designated measure for the purpose of Value Unit calculation for z/VM is Engines. An Engine is a central processor (CP) or a specialty processor, such as an Integrated Facility for Linux (IFL) processor, configured for use on an IBM Z or IBM LinuxONE server. If the Program is used on any CP Engine on a Z server, Licensee must acquire entitlements for all CP Engines on that Z server. If the Program is used on any IFL Engine on a Z or LinuxONE server, Licensee must acquire entitlements for all IFL Engines on that Z or LinuxONE server.

For more information see [z/VM Software Licensing Overview](#).

Is Sub-capacity pricing available on z/VM?

Sub-Capacity pricing for z/VM 7 and z/VM 6 is available for clients running z/VM 7 or z/VM 6.4. It allows for software pricing at less than full machine capacity and can provide more flexibility and improved cost of computing as a client manages the volatility and growth of new workloads. For more information read: [Sub-Capacity for z/VM](#)

What can clients do with the implementation of sub-capacity pricing for select z/VM programs?

- Pay for z/VM programs based on defined workload requirements and not necessarily the full engine capacity of the machine.
- Add hardware capacity for new workloads, capabilities, and functions, e.g. KVM or [IBM Secure Service Container](#)-appliances, and not have IBM software pricing for z/VM programs automatically increase for the existing workload
- Buy new hardware capacity for future growth with no immediate increase to their IBM software bill provided that no additional software capacity is required at that time.
- Potentially benefit from improved price performance as workloads grow.

What are the pre-requisites for z/VM Sub-capacity exploitation?

Sub-capacity terms and conditions for z/VM are only available for eligible IBM Z programs and only on IBM Z machines that have implemented z/VM sub-capacity pricing.

Prerequisites:

- Run z/VM 7.2, z/VM 7.1 or z/VM 6.4.
- Install and configure the most recent version of the IBM License Metric Tool (ILMT).
- Install and configure the z/VM Hypervisor Proxy in each logical partition (LPAR) running z/VM.
- Run ILMT to prepare ILMT Reports on a monthly basis and keep these reports on file for presentation to IBM upon request.
- Each month, determine from the ILMT Report if any additional program license entitlements are required, and if so promptly place an order for those additional entitlements.

For information about supported platforms and hardware requirements for use of ILMT administrative server and its agents, visit the [ILMT Knowledge Center](#) (ibm.com/support/knowledgecenter/SS8JFY/lmt_welcome.html)

ILMT and instructions for its ordering and installation and use are available from ibm.com/software/passportadvantage/ibmlicensemetrictool.html

The z/VM Hypervisor Proxy and instructions for its installation and use are available from ibm.com/systems/z/swprice/subcap/zVM.html

What is the IBM License Metric Tool?

The IBM License Metric Tool (ILMT) is used to determine z/VM sub-capacity program licensing requirements, and is the same tool used to support sub-capacity pricing for Linux on IBM Z middleware programs from IBM.

What is IBM Dynamic Partition Manager?

IBM Dynamic Partition Manager (DPM) is a new administrative mode of PR/SM that is designed to perform simplified configuration for Linux environments. It allows LPARs to be configured and manages system resources, including integrated dynamic I/O management, as quickly and easily as other virtualized environments. It was developed for new-to-Z users working on servers with z/VM, KVM on IBM Z, and Linux for Z as a partition-hosted operating system.

DPM is not a replacement for PR/SM™ – it is part of PR/SM. More specifically, it is a new administrative mode of PR/SM that allows for simplified configuration of partitions, associated resources, and I/O.

Dynamic Partition Manager (DPM), provided with all IBM z15, IBM z14, IBM z13s, IBM z13, and IBM LinuxONE servers, supports Linux running on z/VM.

DPM provides simplified, consumable, and enhanced partition lifecycle and dynamic I/O management capabilities via the Hardware Management Console (HMC) to:

- Create and provision an environment includes the creation of new partitions, assignment of processors and memory, and configuration of I/O adapters (network, FCP storage, crypto, and accelerators)
- Manage the environment by modifying system resources without disrupting running workloads
- Monitor and troubleshoot the environment to identify the source identification of system failures, conditions, states, or events that may lead to workload degradation

IBM z/VM is a supported environment using IBM Dynamic Partition Manager (DPM) with SCSI storage and/or ECKD™ DASD.

I am new to Linux on IBM Z or LinuxONE. Should I use KVM or z/VM?

You should use the hypervisor that best meets your operational needs. If you are running Linux today on x86 using KVM, it may be most natural for you to use KVM for deployment on IBM Z or LinuxONE. In large measure, the KVM management interfaces, administrative functions, tools, and techniques are identical between IBM Z, LinuxONE and x86, so the transition should be straightforward. However, if you need server virtualization that requires deep IBM Z or LinuxONE integration, or you plan to run Oracle in a virtualized environment, or you want your Linux workload to be part of an Enterprise ready HA/DR environment like [IBM GDPS®](#) with HyperSwap® support, then z/VM is the better option to use.

Are there planning, implementation, migration services for z/VM, IBM Wave for z/VM, Infrastructure Suite for z/VM, and Linux?

Yes, IBM Systems Lab Services helps clients who want to plan and implement Infrastructure Suite for z/VM (IISz), or implement new levels of z/VM, IBM Wave, or Linux. You can contact IBM Systems Lab Services via: ibm.com/it-infrastructure/services/lab-services or send an email to ibmsls@us.ibm.com

IBM z/VM Support for IBM z15 and IBM LinuxONE III

What are the feature functions of z15 and LinuxONE III supported by z/VM?

z/VM 7.2, z/VM 7.1, and z/VM 6.4 support z15 and LinuxONE III. See the [z/VM Required Service](#) website for details on the PTFs required.

Enable guest exploitation of:

- Synchronous execution support for on-chip data compression
- Enhanced sort acceleration and optimization
- Enhanced Vector and Vector packed decimal processing
- Crypto Express7S adapter and cryptographic enhancements
- FICON® Express16SA, OSA adapters
- Dynamic I/O enhancements, providing support for the configuration management of OSAExpress7S, Crypto Express7S, FICON Express16SA FC and FCP CHPIDs, RoCE Express2, and Coupling Express3 LR adapters
- IBM Fibre Channel Endpoint Security between an z15 Model T01 or LinuxONE III Model LT1 and the IBM DS8900F

In addition, z/VM 7.2 and z/VM 7.1 support IBM System Recovery Boost, by providing a temporary boost of the sub-capacity general purpose processors (CPs) to full capacity during z/VM system initialization and workload bring-up, workload quiesce and system shutdown, and during system abend processing. System Recovery Boost will return the system to doing normal work faster, after any kind of planned or unplanned disruption. Support is primarily targeted to the z/VSE and z/TPF guest environment and only for sub-capacity systems.

Technical Questions - IBM z/VM 7.2, z/VM 7.1, and z/VM 6.4

What is announced for z/VM 7.2 with the August 04, 2020 announcement?

The objective of z/VM 7.2 is to enhance the proof points that support digital transformation, specifically those associated with scalability and efficiency. This is designed to enable the deployment of up to thousands of Linux servers on a single IBM Z or IBM LinuxONE server, including the IBM z15 Models T01 and T02 and LinuxONE III Models LT1 and LT2 servers.

Enhancements with z/VM 7.2 include:

- **Centralized service management for non-SSI environments**
This function provides support to deploy service to multiple systems, regardless of geographic location, from a centralized primary location that manages distinct levels of service for a select group of traditional z/VM systems. One system will be designated as a principal system and will use the z/VM Shared File System (SFS) to manage service levels for a set of defined-managed systems, regardless of their geographic location. The principal system will build service levels using the new service management command, SERVMGR, and existing VMSES/E SERVICE commands. This centralized service process will keep track of available service levels and manage whatever files are needed to supply a customer-defined service level to a managed system.
- **Multiple Subchannel Set (MSS) Multi-Target Peer-To-Peer Remote Copy (MT PPRC) support for the GDPS environment**
This function enables a disk device to be the primary for up to three secondary devices in each of up to three alternate subchannel sets. MSS MT PPRC requires support for multiple subchannel sets that reflect the actual hardware configuration, specifically, subchannel sets 0, 1, 2, and 3. The devices currently in use by z/VM will be referred to as the ACTIVE configuration. Devices not in the ACTIVE configuration will be referred to as being in the STANDBY configuration.
- **Support for the z/VM ADJUNCT environment**
The z/VM ADJUNCT support provides an environment that enables the manipulation of a guest operating system running in a primary configuration. The companion ADJUNCT environment can display and modify the primary's memory, making it useful for observing and manipulating a guest system that is running there.
- **Removal of line edit support during LOGON**
When a z/VM External Security Manager (ESM) is not configured and active, z/VM V7.2 no longer performs line editing of data entered during LOGON, such as user ID, password, or command. However, it continues to honor the use of the system default line-end character to identify guest console input data in a LOGON command entered on the LOGON panel or in responses to prompts issued before LOGON completes. When an ESM is configured, it will control these aspects of system behavior.
- **System default changes:**
 - TDISK clearing default has changed to Enabled. The default can be turned off with the FEATURES DISABLE CLEAR_TDISK configuration statement. This change causes any residual data that might be otherwise left on a temporary disk after use to be purged by default, enabling z/VM to be more in line with modern security guidelines.

- z/VM Directory Maintenance (DirMaint) NEEDPASS default value has changed to No. Based on client feedback and guest service machine requirements, there no longer is a need for an extra layer of authentication. This change enables users and service machines to enter DirMaint commands without supplying passwords and eliminates the need to update specific configuration options.
- z/VM DirMaint default DVHWAIT BATCH and CLUSTER INTERVAL values have been updated to improve DirMaint’s overall processing time in response to directory change requests.
- The default unparking model has changed from HIGH to MEDIUM. This reduces the tendency to use vertical-low (VL) logical cores and has the potential to reduce the overhead induced in the Processor Resource/Systems Manager (PR/SM) hypervisor and improve the use of processor cache.
- System Recovery Boost has been enabled by default, allowing z/VM to automatically take advantage of boosting sub-capacity processors to full capacity for a limited duration during startup and shutdown when running on the IBM z15.
- The PAGING63 IPL parameter and associated external interfaces have been removed. z/VM paging subsystem improvements include support for IBM High Performance Fibre Connection (FICON), IBM HyperParallel Access Volumes (HyperPAV), encryption, and IBM Extended Address Volume (EAV), which are not available when the PAGING63 IPL parameter is specified.
- The Environmental Record Editing and Printing Program (EREP) licensed program will no longer be preinstalled with z/VM. Instead, EREP functional executables will be preinstalled and delivered as part of the z/VM 7.2 product and serviced through the Control Program (CP) component, simplifying the process for applying EREP service.
- **Roll up of timely, client-driven functions previously delivered in the service stream of z/VM 7.1** (see [z/VM New Function](#) for additional information):
 - *Virtual Switch (VSwitch) Priority Queueing*: New support provides exploitation for IBM Open Systems Adapter (OSA) Express Priority Queuing when it is available on a VSwitch's Uplink Port. Without this support, all VSwitch outbound traffic to the external network is transmitted at the same priority. When VSwitch Priority Queueing is enabled, z/VM establishes multiple OSA Queued Direct Input/Output (QDIO) output queues, and transmits data to the external network at different priorities based on client-defined guest NIC importance. This support is available for z/VM 7.1 with the PTF for APARs VM66219, VM66223, and PH04703.
 - *EAV paging*: Support for z/VM paging space located anywhere on EAVs enables clients to define enough paging capacity for z/VM partitions with large memory sizes while reducing the burden of managing a larger number of smaller paging devices. As systems have continued to grow, their need for paging space has increased. This z/VM support enables allocation and use of paging space on Extended Count Key Data (ECKD) devices above cylinder 65520 up to 1 TB (1,182,006 cylinders). This support is available for z/VM 7.1 with the PTF for APAR VM66263.
 - *80 logical processors*: Support for 80 logical processors on z15, LinuxONE III, z14, LinuxONE Emperor II, and LinuxONE Rockhopper II servers relieves the previous limitation of 64 logical processors per logical partition (LPAR). This gives clients the ability to run more workload on z/VM by increasing the number of supported logical processors, which is especially important when multithreading is enabled. From a

client's perspective, this enables defining more logical processors for running workload on an LPAR, possibly requiring fewer LPARs to support the same workload. This support is available for z/VM 7.1 with the PTF for APAR VM66265.

- *Dynamic crypto*: Support for dynamic changes to the IBM Adjunct Processor (AP) cryptographic (crypto) environment on a z/VM system enables the addition, removal, or reassignment of crypto hardware to be less disruptive to the system and its guests. This support is available for z/VM 7.1 with the PTF for APAR VM66266.
 - *Fast minidisk erase*: Enhancements to the CPFMTXA utility enable users to erase data on minidisks more quickly. In addition, DirMaint is enhanced to use this new support in CPFMTXA. This can be especially beneficial when DirMaint is used to delete a user ID and its minidisks. This support is available for z/VM 7.1 with the PTFs for APARs VM66288, VM65784, and PH14249.
 - *RACF Multi-Factor Authentication (MFA)*: Enhancements within RACF provide for the establishment of a user's identity by utilizing more than one type of authentication. This provides greater security by requiring an additional form of proof to help avoid an exposure if one token (for example, a password) becomes compromised. Previously, authentication of identity during the logon process could be met only by using a password or passphrase. MFA enables support for an external service to authenticate tokens that have been generated after a successful multifactor authentication. This support is available for z/VM 7.1 with the PTFs for APARs VM66324 and VM66338.
 - *Transport Layer Security (TLS) certificate verification*: Enhancements within the TCP/IP TLS/Secure Sockets Layer (SSL) server enable authentication of client certificates, host name validation, and extraction of fields from a certificate.
Client certificate authentication support enables a server to verify a client by examining the certificate it presents to ensure that it has been signed by a certificate authority the server trusts and that the certificate has not expired. The client authentication support that was previously added to dynamically secured Telnet connections has been expanded to the z/VM File Transfer Protocol (FTP) and Simple Mail Transfer Protocol (SMTP) servers. Additionally, the PORT statement in the TCPIP configuration file has been updated to enable client certificate authentication for statically secured connections.
Host name validation support enables a client to verify the identity of a server by passing a string containing a host name, domain name, or IP address on the handshake request. The string is compared to fields in the server certificate. If the string is not contained in the server certificate, the client may decide to fail the handshake.
In addition to the above support, new APIs extract fields from a client or server certificate. This support is available for z/VM 7.1 with the PTFs for APARs PH18435, VM66348, and VM66349.
 - *IBM Conversational Monitor System (CMS) Pipelines SSL support*: Enhancements within the CMS Pipelines TCP/IP stages to enable applications to establish secure connections using SSL/TLS and use the TCP/IP API to implement application transparent SSL to support protocols that use implicit (such as HTTPS) and explicit (such as FTP) SSL connections.
- z/VM 7.2 includes a new Architecture Level Set (ALS) that requires an IBM z13, IBM z13s, IBM LinuxONE Emperor, IBM LinuxONE Rockhopper, or later server.

- **Planned Continuous Delivery enhancements for z/VM 7.2 in 2020** (see [z/VM New Function](#) for the PTFs required and additional information):
 - *CP New Feature Interrogation API*: This functionality will provide an interface for interrogating whether a named capability is present in the running CP system. This enhancement will simplify scripting and automation written by customers and vendors that is sensitive to the function level of CP.
 - *FlashCopy® Preserve Mirror Support*: This functionality will provide new operands for z/VM FlashCopy commands to allow managing FlashCopy relationships between PPRC primary devices without affecting the PPRC status of the target devices. This will avoid PPRC suspend conditions on FlashCopy target devices.
 - *SET EDEVICE Optional LUN Specification*: This functionality will allow specification of the LUN operand on the SET EDEVICE command and the EDEVICE system configuration statement to be optional after the first path has been established.
- **National language support**
 Messages and Help files no longer are translated into Japanese Kanji. The Kanji language and Help infrastructure are removed in z/VM 7.2. American English and Uppercase English are the supported languages.
- **Foundational support for future enhancements**
 z/VM exploitation of the CPU Measurement Facility sampler function will provide a means for a client to collect hardware samples, instead of requiring an IBM customer engineer to use the client's Support Element to collect field-mode samples.
- **Support for the IBM z15 (Models T01 and T02) and LinuxONE III (Models LT1 and LT2) servers** (www.vm.ibm.com/service/vmreqz15.html)
 - Guest enablement to exploit the following functions:
 - Miscellaneous-Instruction-Extensions Facility 3
 - Vector Enhancements Facility 2
 - Vector Packed Decimal Enhancement Facility
 - Synchronous execution for on-chip data compression and deflate-conversion
 - Enhanced sort acceleration and optimization
 - Message-Security-Assist Extension 9
 - Crypto Express7S adapter shared and dedicated guest support
 This support is available for z/VM 6.4 and 7.1 with the PTFs for APARs VM66248, VM66321, VM66332, and VM66325.
 - Infrastructure support that must be installed on all members within an SSI cluster before any member of the cluster is IPLed on a z15 or LinuxONE III server:
 - z/VM 7.2
 - z/VM 7.1 with the PTF for APAR VM66206
 - z/VM 6.4 with the PTFs for APARs VM65976 and VM66206
 - Enhancements to the TCP/IP stack and NETSTAT OSAINFO command to provide support for:
 - OSA-Express7S GbE
 - OSA-Express7S 10GbE
 - OSA-Express7S 25GbE
 - OSA-Express7S 1000BASE-T
 This support is available for z/VM 6.4 and 7.1 with the PTF for APAR PI99085.

- Installation of z/VM using a USB flash drive
- Support for the System Recovery Boost feature of the z15 Models T01 and T02 This support enables z/VM to boost general-purpose processors running at subcapacity to full capacity for up to 60 minutes during z/VM system initialization and workload bringup and for up to 30 minutes during workload quiesce, system shutdown, and system abend processing. z/VM System Recovery Boost support primarily benefits z/VSE and z/TPF guest environments, though it increases the processor resources available to the z/VM Control Program. This support is available for z/VM 7.1 with the PTF for APAR VM66283.
- IBM Fibre Channel Endpoint Security between an IBM z15 Model T01 or LinuxONE III Model LT1 and the DS8900F by providing the following functions:
 - Display the encryption status of target worldwide port names (WWPNs) associated with a Fibre Channel Protocol (FCP) device via the QUERY FCP command.
 - Display the encryption and authentication capability of a channel path via the QUERY PATHS command.
 - Track encryption state changes by recognizing Store Event Information channel report data.
 - Create an event monitor record for each state change.

This support is available for z/VM 6.4 and 7.1 with the PTF for APAR VM66242.

- **z/VM Continuous Delivery model**

IBM delivers most new z/VM 7.2 functions as Small Programming Enhancements (SPEs) in the service stream. With the availability of z/VM 7.2, z/VM 7.1 will, with a few exceptions, receive only corrective service. Similarly, when a new release is introduced after z/VM 7.2, SPEs will be delivered on that release going forward and V7.2 will receive mostly corrective service only. For additional information on the z/VM Continuous Delivery model, see the z/VM 7.1 Software Announcement, dated August 07, 2018.

- **New Architecture Level Set (ALS)**

z/VM 7.2 will include an ALS and will require one of the following IBM Z server: IBM z15 (all models), IBM z14 (all models), IBM z13, or IBM z13s, or a LinuxONE server. This will satisfy the statement of direction from Software Announcement , dated August 07, 2018.

- **Interaction with the z/VM community**

IBM has a long history of working with clients to deliver capabilities to improve z/VM. IBM will continue this interaction by continuing to:

- Enlisting z/VM clients as Sponsor Users to advise IBM throughout the design process for many z/VM development projects. These clients may also test early versions of the new support prior to its delivery to the marketplace to help ensure that the user experience matches their expectations.
- Soliciting clients to become involved with the z/VM Continuous Delivery process. IBM finds the Sponsor User relationship beneficial to delivering new functionality for z/VM and continues to encourage z/VM clients to participate in the continuous delivery process. To learn more about the z/VM Sponsor User program, see the [z/VM Sponsor User program](#) webpage. For details on z/VM client communication and collaboration, see the [z/VM Council](#) webpage.

- Publishing information about many of its z/VM development projects as they unfold to help users decide whether they want to volunteer as Sponsor Users for selected development projects and help the community at large plan for the introduction of new z/VM functions. This level of communication between IBM and the z/VM user community facilitates discussion regarding implications of the planned support, such as operational incompatibilities, software vendor impacts, and changes to system behavior. These plans are posted and updated on the [z/VM](#) website.

What are the new features and functions available with z/VM 7.1?

See the [z/VM New Function](#) website for the PTFs required and additional information:

- **VSwitch Priority Queuing:** When VSwitch Priority Queuing is enabled, z/VM establishes multiple OSA QDIO Output queues and transmits data to the external network at different priorities based on guest NIC importance.
- **EAV Paging:** Paging capacity for z/VM partitions with large memory sizes can be achieved on Extended Address Volume (EAV) devices. Using EAV devices reduces the number of paging devices required and the associated burden of managing a larger number of smaller paging devices. As systems continue to grow, this functionality helps when the need for paging space increases.
- **80 Logical processor support:** 80 logical processors are supported on z15, z14, LinuxONE III, LinuxONE Emperor II, and LinuxONE Rockhopper II, increasing the support from 64 logical processors per LPAR. This allows running more workload on a single z/VM instance, which is especially important when multithreading is enabled. Defining more logical processors for workloads on each LPAR may mean that fewer LPARs are required to support the same workloads.
- **Dynamic Crypto:** Dynamic Crypto support enables dynamic changes to the Adjunct Processor (AP) Cryptographic environment on a z/VM system, allowing the addition or removal of crypto hardware to be less disruptive to the system and its guests.
- **Fast minidisk erase:** Enhancements to the CPFMTXA utility enable users to erase data on minidisks more quickly. In addition, the Directory Maintenance Facility (DirMaint) is enhanced to use this new support in CPFMTXA. This can be especially beneficial when DirMaint is used to delete a user ID and its minidisks.
- **Multi-Factor Authentication (MFA):** Enhancements within RACF® provide for the establishment of a user's identity by utilizing more than one type of authentication. This provides greater security by requiring an additional form of proof to help avoid an exposure if one token (for example, a password) becomes compromised. Previously, authentication of identity during the logon process could be met only by using a password or passphrase. MFA enables support for an external service to authenticate tokens that have been generated after a successful Multi-Factor Authentication.

- **Transport Layer Security (TLS) certificate verification:** Enhancements within the TCP/IP TLS/SSL server allow authentication of client certificates, host name validation, and extraction of fields from a certificate. Client certificate authentication support allows a server to verify a client by examining the certificate it presents to ensure that it has been signed by a certificate authority the server trusts and that it has not expired. The client authentication support that was previously added to dynamically secured Telnet connections has been expanded to the z/VM FTP and SMTP servers. Additionally, the PORT statement in the TCPIP configuration file has been updated to allow client certificate authentication for statically secured connections. Host name validation support allows a client to verify the identity of a server by passing a string containing a host name, domain name, or IP address on the handshake request. The string will be compared to fields in the server certificate. If the string is not contained in the server certificate, the client may decide to fail the handshake. In addition to the above support, new APIs extract fields from a client or server certificate.
- **Integration of z/VM Single System Image (SSI) for continuous operation:** Continuous operation is extended with z/VM 7.1 since it includes the SSI function as part of the z/VM 7.1 base at no additional cost. SSI includes Live Guest Relocation and single system maintenance to give clients a mechanism to host Linux virtual server images without suffering interruptions as they apply updates to their z/VM system. This helps continuous deployment of new capabilities as the new z/VM delivery model is adopted.
- **Improvements to the z/VM Dump process:** Dump processing is enhanced to reduce the time required to create, process, and transmit data from SNAPDUMP and hard Abend dumps. By default, these dumps will be considerably smaller, thus requiring less space in both the system SPOOL and CMS file system. The increased efficiency of dump processing can help save time, resources, and removes an inhibitor to the deployment of z/VM configurations with large amounts of memory. The PTF for APAR VM66176 further reduces the time required to create a SNAPDUMP or HARD Abend dump.
- **ESM Authorization and Auditing of SMAPI Requests:** With the PTF for APAR VM66167, SMAPI provides the following two functions in support of an external security manager (ESM). First, some commands can use the current dynamic command protection setting of the LINK command when validating the required LINK authorizations, and second, programs can use the ESM for all Systems Management API (SMAPI) authorization decisions at the same granularity used with the SMAPI existing authorization mechanism.
- **Elliptic Curve Cryptography (ECC):** The z/VM TLS/SSL server is enhanced to improve security through the enablement of ECC cipher suites with the PTF for APAR PI99184. ECC provides a faster, more secure mechanism for asymmetric encryption than standard RSA or DSS algorithms.
- **RSCS Query System Service:** This functionality provides a means to query the service level of each part that is included in RSCS with the PTF for APAR VM66174. A new command parameter returns the highest level PTF that is applied to each part within the running RSCS server, eliminating ambiguity on what service is installed and active.

- **QUERY BYUSER support for class B users:** This support provides privilege class B users the ability to issue the QUERY BYUSER command for other users, similarly to the function granted by privilege class E.
- **Dynamic ESM protection support for CPACCESS, CPTYPE, and CPVLOAD:** Dynamic external security manager (ESM) protection support for the CPACCESS, CPTYPE, and CPVLOAD commands enables these commands to use the current dynamic command protection setting of the LINK command when validating the required LINK authorizations, and ensures the ESM will be called only when it is configured to handle LINK authorization requests.
- **IBM z/VM Cloud Connector:** The z/VM Cloud Connector is a development toolkit that manages z/VM host and virtual machines. It provides a set of RESTful APIs to operate z/VM resources. Upper layer cloud management solutions can consume these RESTful APIs directly to manage z/VM. For additional information, see the [IBM z/VM Cloud Connector](#) webpage.
- **New Architecture Level Set:** z/VM 7.1 includes an Architecture Level Set and requires IBM zEnterprise EC12 or BC12 or later systems.
- **CMS Pipelines SSL support**
The CMS Pipelines TCP/IP stages have been enhanced to allow applications to establish secure connections using z/VM System SSL and provides support for protocols which use both implicit and explicit SSL/TLS connections. In addition, a new built-in stage implements secure FTP client support is also provided that enables reading data from an FTP server into a pipeline stream or writing data from a pipeline stream to an FTP server.

What deprecation of installation support came with z/VM 7.1?

- **Installation of z/VM on 3390 Model 3 DASD volumes is no longer supported** in z/VM 7.1. 3390 Model 3 DASD volumes continue to be supported in general, but not for installation. Storage devices that are supported for installation include:
 - 3390 volumes with a minimum size of 10016 cylinders
 - SCSI volumes with a minimum size of 6 GB
- **The Open Systems Adapter/Support Facility (OSA/SF) is no longer included with z/VM.** To customize the modes of operation of OSA features, clients should use OSA/SF on the Hardware Management Console (HMC).
- **The VMSES/E MIGRATE command and related commands,** which were first supplied with z/VM V5.2, are no longer provided or supported in z/VM 7.1. The upgrade installation process that was introduced with z/VM 6.3 can be used to upgrade supported z/VM levels to z/VM 7.1. The migration of customized data for components, features, or products from z/VM levels that are earlier than those supported by the upgrade installation process for z/VM 7.1 now must be performed using locally developed procedures.

What z/VM 6.4 enhancements are included in the base of z/VM 7.1?

The following enhancements have been delivered, and the associated PTFs are listed for z/VM 6.4. These enhancements are included in the base of z/VM 7.1:

- **Concurrent I/O support for the IBM XIV® Storage System:** With the available PTF for APAR VM65929, the z/VM SCSI container enables multiple I/O requests to be issued concurrently to

EDEVICEs backed by IBM XIV Storage System hardware, which may improve performance. This support particularly benefits EDEVICE paging I/O or volumes containing multiple minidisks.

- **Distributed IUCV Enhancements:** With the available PTF for APAR VM65872, the rules for Distributed IUCV CONNECT in a single system image (SSI) environment are revised. This support allows IUCV CONNECT to work in cases that were originally restricted, primarily because they involved a Multiconfiguration Virtual Machine (IDENTITY) user. This support also makes it easier for an administrator to change the Distributed IUCV policy for an SSI cluster. Previously, the Distributed IUCV policy within an active SSI cluster could be changed only by shutting down all members at the same time. As this new support is applied to each system, it will be possible for that member to join the cluster regardless of its Distributed IUCV configuration
- **NICDEF Security Control Enhancements:** With the PTFs for APARs VM65925, VM65926, and VM65931, the NICDEF directory statement is enhanced to provide a set of new operands referred to as Directory Network Authorization (DNA). With DNA, a system administrator can configure and consolidate a virtual NIC device and its network properties in a secure, centralized location - z/VM's User Directory. Operational differences between PORTBASED and USERBASED VSwitches has been eliminated with this support. A system administrator has the option to manage a VSwitch by user, by port number or using a combination of the two methods. While the management of USERBASED and PORTBASED VSWITCHes is simplified, Live Guest Relocation of a guest connected to a VSwitch still requires the destination system to have a VSwitch with a PORTBASED or USERBASED designation matching that of the source system.
- **RACF® Security Policy Enhancements:** With the available PTFs for APAR VM65930 and VM65982, the z/VM RACF Security Server feature supports the following security policy enhancements:
 - Read-Only Auditor (ROAUDIT): This new user role allows many of the common auditing tasks to be performed without the ability to modify settings or manipulate audit logs.
 - XAUTOLOG..ON control: This enhancement introduces new security policy requirements for the ON operand of the CP XAUTOLOG command. This changes default behavior of this operand when an ESM is installed on your system.
 - List the current VMXEVENT profile: This enhancement updates the SETEVENT LIST command to provide an authorized user with the names of the VMXEVENT profiles activated and in use by RACF.

Note: The PTF for APAR VM65923 provides infrastructure support in z/VM 6.4 and must be installed on all the members of an SSI cluster before any 6.4 member is running with the PTF for APAR VM65930.

- **Crypto Express APVIRT Support for the z/VM TLS/SSL Server and LDAP/VM:** With the available PTF for APAR PI72106, the z/VM System SSL cryptographic library is updated to offload cryptographic operations to Crypto Express hardware associated with your IBM Z or IBM LinuxONE hardware, which may improve performance. This support is intended for clear- key RSA operations. To enable this support, add the CRYPTO APVIRTUAL statement to the pertinent service virtual machine entries in the z/VM User Directory.

- **Extended Address Volume (EAV) Minidisk Support:** Enhanced EAV support for 3390-A DASD devices allows non-full pack minidisks to reside anywhere on the volume, including beyond the current restriction of the 64K cylinder boundary (0-65519), and up to the one terabyte limit currently supported. z/VM 6.4 gets the support with the PTFs for APARs VM65943 and VM65945.
- **Multi-VSwitch Link Aggregation Load Balancing Support:** With the PTF for APAR VM65918, z/VM Multi-VSwitch Link Aggregation support is enhanced to improve load balancing to leverage both horizontal and vertical growth in single and cross virtual switch networking configurations.
- **DUMP Processing Enhancements:** The amount of time it takes for z/VM to write a hard abend or snap dump to 3390 DASD can be reduced. z/VM 6.4 gets the support with the PTF for APAR VM65989. The improvements were achieved via changes to the I/O channel program used to write central memory to z/VM spool space located on 3390 DASD.
- **Processor Scalability Efficiency Improvements:** The z/VM hypervisor is enhanced to more efficiently manage internal spinlocks and thereby reduce system overhead with the PTF for APAR VM65988. This enhancement will contribute to improved performance and throughput for large n-way configurations and thereby help to improve overall system capacity by allowing additional work to be performed. These improvements are greatest for workloads experiencing significant Scheduler Lock contention. The benefits achieved will also be realized on the IBM z13[®] processor.
- **Virtual Switch Enhanced Load Balancing:** z/VM supports exclusive and shared Multi-VSwitch Link Aggregation configurations to improve load balancing to leverage both horizontal and vertical growth in single and cross virtual switch networking configurations. z/VM 6.4 gets the support with the PTF for APAR VM65918. With this improvement, a VSwitch can utilize more fully the capacity of the OSA devices used for link aggregation, whether that is a single VSwitch growing vertically or a Multi-VSwitch growing horizontally.

Efficiency and Scalability

What is Encrypted Paging support?

z/VM provides encrypted paging, in support of the philosophy of encrypting all data in flight and at rest. Ciphering will occur as data moves between active memory and a paging volume owned by CP. Included in the support is the ability to dynamically control whether a running z/VM system is encrypting this data. See the [z/VM New Function](#) website for information on the z/VM 6.4 PTFs required for Encrypted Paging. This capability is in the base of z/VM 7.1.

What is guest exploitation support for the Instruction Execution Protection Facility?

The Instruction Execution Protection Facility (IEPF) provides functionality to improve the security of programs running on IBM Z and LinuxONE by allowing virtual memory elements to be identified as containing only data. If an attempt is made to fetch an instruction from an address in such an element or if an address in such an element is the target of an Execute-type instruction, a protection exception will occur. z/VM provides support for guest exploitation of the IEPF. See the [z/VM New Function](#) website for information on the z/VM 6.4 PTFs required for Encrypted Paging. This capability is in the base of z/VM 7.1.

What is Guest exploitation support for Pause-Less Garbage Collection?

The guarded storage facility (GSF) is designed to improve the performance of garbage-collection processing by various languages, in particular Java™. z/VM provides support for guest exploitation of the GSF. See the [z/VM New Function](#) website for information on the z/VM 6.4 PTFs required for Encrypted Paging. This capability is in the base of z/VM 7.1.

What are z/VM real memory and guest virtual memory support limits?

The maximum amount of real memory that z/VM exploits is 2 TB. The maximum supported virtual memory for a single guest remains at 1 TB. When configured with 2 TB of real storage and keeping the same over-commitment ratio for virtual-to-real memory, this can double the amount of virtual memory that can be efficiently used compared to the previous limit of 1 TB. The 2 TB limit was introduced in the base of z/VM 6.4.

What is HyperPAV technology exploitation?

z/VM exploits the ability of an IBM DS8000® device to execute concurrent I/O requests to an ECKD paging volume. In HyperPAV mode, if the base volume is busy, z/VM selects a free alias device from a pool, binds the alias to the base device, and starts the I/O. When the I/O completes, the alias device is returned to the pool to be used for another I/O to the same logical subsystem (LSS). The primary benefit of exploiting HyperPAV is to improve paging throughput during periods of high-volume disk I/O, which will increase the efficiency of z/VM memory management for memory over-committed workloads. HyperPAV paging also enables the management of fewer and larger CPOWNER volumes.

With HyperPAV paging taking advantage of DS8000 features, the bandwidth for paging increases to allow managing dozens of page volumes rather than 100s and to permit more efficient memory management of over-committed workloads.

HyperPAV is exploited by the z/VM hypervisor not only for paging but also for:

- The SYSRES volume, and volumes containing checkpoint and warm start data
- Volumes used for spooling, and the z/VM user directory
- Minidisk pools, as defined by a guest's use of MAPMDISK IDENTIFY

Does z/VM provide support for the Enhanced-DAT facility?

z/VM provides support for the Enhanced-DAT facility, which allows a guest to exploit large (1 MB) pages. A larger page size decreases the amount of guest memory needed for dynamic address translation (DAT) tables and also decreases the hardware overhead required to perform address translation. In all cases, guest memory is mapped into 4 KB pages at the host level. With Guest Large Page support, Linux on Z, z/VSE® and z/OS® virtual machines can benefit from reduced memory footprints and address translation times, which in turn can decrease overhead and improved throughput.

Does z/VM support Guest Transaction Execution (TX) support?

z/VM supports guest exploitation of the Transactional Execution (TX) facility on supported machines. The TX facility allows a program to issue multiple instructions that appear to operate atomically, offering an alternative to costly mutual-exclusion mechanisms such as software locks. This support can improve the efficiency and scalability of multithreaded software such as Java or guest operating system functions.

System Ease of Use

What are z/VM Control Program environment variables?

z/VM CP environment variables allow automation procedures to adapt more easily to changes in operating environments to help simplify the control and testing of a system setup. For example, an operator can indicate at IPL time that the system is running in a disaster recovery or test environment, which in turn enables automation routines to modify the devices used and alter the choice and sequence in which virtual machines are activated, as well as perform other environment-dependent functions.

What is the z/VM Query Shutdown command?

The QUERY SHUTDOWN command has been enhanced to enable a z/VM system programmer or a guest virtual machine to determine whether a system shutdown is in progress and obtain additional information about the shutdown. This can help automate an orderly shutdown of the z/VM system and its virtual servers. This function can be particularly valuable to virtual machines that coordinate the shutdown of other virtual machines. The coordinating virtual machines would receive the signal that the system is shutting down, issue the new QUERY command to get additional information, and take the appropriate action for an orderly shutdown.

What are the SCSI enhancements for z/VM?

Improved Small Computer System Interface (SCSI) support for guest attachment of disk and other peripherals to IBM Z and LinuxONE servers to:

- Enable ease of use with enhanced management for SCSI devices to provide information needed about device configuration characteristics.
- Enhance interoperability between the SCSI driver and SAN Volume Controller (SVC) and devices incorporating SVC technology such as the IBM Storwize® V7000 and IBM FlashSystem® V840 and V9000.
- A z/VM storage administrator can use FlashSystem storage as a z/VM-system-attached disk without the need for an intermediate SAN Volume Controller (SVC). Previously, while FlashSystem could be used by a Linux virtual machine without an SVC, to use it for z/VM system volumes or EDEVs for virtual machines, an external or internal SVC was required
- Improve reliability when SCSI disk devices are attached to the z/VM hypervisor for system use, without the need to be attached behind an SVC.
- With the available PTF for APAR VM65929, the z/VM SCSI container enables multiple I/O requests to be issued concurrently to EDEVs.

SCSI management QUERY support provides enhancements to the commands for EDEVs within z/VM to improve the usability and problem diagnosis for EDEV-intensive environments and provide a clearer end-to-end view of the storage configuration. This simplifies the process of verifying that the storage configuration is consistent between z/VM and the disk storage subsystem.

The following updates are designed to further enhance the reliability of SCSI devices:

- The CP missing interrupt handler is disabled for EDEVs, allowing the SCSI driver to manage its outstanding requests in a more appropriate manner.
- The SCSI driver is updated to provide additional path recovery.

- Debug facilities within the SCSI driver are enhanced, allowing IBM support teams to more quickly diagnose and debug issues in the field.
- Guidelines for multi-path configuration are provided for SVC and devices incorporating SVC technology to ensure path recovery is optimal.
- Concurrent code loads on the SVC and devices incorporating SVC technology are now supported without quiescing EDEVICE I/O. This was previously, and continues to be, restricted on releases prior to z/VM 6.4.

What is the z/VM CMS Pipelines update?

Integration of new CMS Pipelines functionality, which previously was not formally incorporated in the z/VM product, provides a much more inclusive set of tools for application developers. This upgrade addresses client concerns with using downloaded code, includes fixes not previously integrated into the z/VM product, broadens the ecosystem, enables innovation for clients and ISVs, and includes additional functionality.

How has the DirMaint™ RACF connector been modernized with z/VM?

The DirMaint RACF® connector is modernized with a collection of functional enhancements that improve how z/VM security is handled in a RACF-managed environment. The Connector allows appropriate security policy changes to be passed directly to RACF. This allows a z/VM environment managed by IBM Wave for z/VM or via an OpenStack® environment to function properly with RACF installed on the system.

How does z/VM RACF automate control of access list authority?

The ADDCREATOR and NOADDCREATOR options on the RACF SETROPTS command determine whether the creator of a RACF profile is automatically added to its access control list. This enhancement removes the need for manual intervention in RACF resource configuration and eliminates a point of potential human error from security policy management.

What are the z/VM Performance Toolkit enhancements?

Performance Toolkit for VM™ function exploits z/Architecture® and its expanded set of instructions. Consequently, the PERFSVM virtual machine must run on z/Architecture CMS (z/CMS).

New and updated performance reports are providing within the Performance Toolkit Feature in support of HyperPAV Paging. These new reports include information that will help clients tune the z/VM HyperPAV Paging Subsystem. z/VM 6.4 support is provided with the PTF for APAR VM66085.

What are the Network Security enhancements?

NICDEF Security Controls introduces a Directory Network Authorization capability that allows each virtual NIC to be configured and authorized entirely within the user directory. This eliminates the need to use SET VSWITCH and COUPLE commands to configure virtual network connections.

Can TCPNJE connections be encrypted?

RSCS TCPNJE traffic can be encrypted by directing the data flow through an SSL server. The secure TCP/IP protocols that were previously implemented to support VMCF clients and servers are extended for IUCV clients and servers.

Hardware Currency

What new z15 and LinuxONE III functions are available in z/VM in support of Linux?

z/VM 7.2, z/VM 7.1 and z/VM 6.4 provide support for Linux guest exploitation of:

- Synchronous execution support for on-chip data compression
- Enhanced sort acceleration and optimization
- Enhanced Vector and Vector packed decimal processing
- Crypto Express7S adapter and cryptographic enhancements
- FICON® Express16SA, OSA-Express7S adapters
- Dynamic I/O enhancements, providing support for the configuration management of OSAExpress7S, OSD CHPIDs, Crypto Express7S, FICON Express16SA FC and FCP CHPIDs, RoCE Express2, and Coupling Express3 LR adapters.
- IBM Fibre Channel Endpoint Security between an z15 Model T01 or LinuxONE III Model LT1 and the IBM DS8900F.

What new z14, LinuxONE Emperor II, and LinuxONE Rockhopper II functions are available in z/VM in support of Pervasive Encryption?

z/VM provides support for encrypted paging, in support of the z14, Emperor II, or Rockhopper II pervasive computing philosophy of encrypting all data in flight and at rest. Ciphering will occur as data moves between active memory and a paging volume owned by CP. Included in the support is the ability to dynamically control whether a running z/VM system is encrypting this data. z/VM 6.4 gets the support with the PTF for APAR VM65993.

What is z-Thin Provisioning support for z/VM?

DS8880 z-Thin Provisioning and Extent Space-Efficient (ESE) volumes enables guests to exploit thin-provisioned volumes and allows CPOWNER volumes be defined on thin-provisioned volumes. z/VM 6.4 gets the support with the PTFs for APARs VM66098 and VM66108.

What is Shared Memory Communications Direct support for z/VM?

Shared Memory Communications Direct (SMC-D) protocol support is the latest networking innovation for the z13 family of processors and provides support for fast, low-latency LPAR-to-LPAR TCP/IP traffic using Direct Memory Access over firmware-provided Internal Shared Memory (ISM) devices. Supported for z/VM guest exploitation, SMC-D and ISM are designed to use shared memory areas to provide low-latency, high-bandwidth, cross-LPAR connections for applications. This support is intended to provide application-transparent DMA communications to TCP endpoints for sockets-based connections. SMC-D is expected to provide substantial performance, throughput, response time, and CPU consumption benefits compared with standard TCP/IP communications over HiperSockets™. z/VM supports dynamic I/O and guest use of the Internal Shared Memory (ISM) PCI function type. See the z/OS subset within the 2964DEVICE or 2965DEVICE PSP bucket for z/OS service required in support of SMC-D connectivity.

What is Dynamic Simultaneous Multithreading Level support for z/VM?

Support for Simultaneous Multithreading (SMT) is enhanced with the addition of the SET MULTITHREAD command. Once z/VM has been IPLed with multithreading enabled in the system configuration file, this command can be used to switch non-disruptively between one and two activated threads per IFL core. Performance of a system and workload with multithreading enabled and one active thread per core is comparable to that of the same system and workload with multithreading disabled. Thus, the Dynamic SMT Level capability allows the benefit of multithreading to be evaluated for a workload without requiring an outage to enable or disable SMT. The SET MULTITHREAD command is allowed only when the system has been enabled for multithreading in the system configuration file, which can specify activating either one or two threads per core. It is not possible to revert to a non-SMT configuration without an IPL. SMT-enabled configurations are restricted to forty cores even when operating in single-threaded mode due to the logical processor addressing limit.

Are there services available to help implement Simultaneous Multithreading for z/VM?

Yes, IBM Systems Lab Services help clients wanting to implement new hardware innovations such as Simultaneous Multithreading (SMT). You can contact IBM Systems Lab Services via the Internet at: ibm.com/it-infrastructure/services/lab-services or send an email to ibmsls@us.ibm.com

What IBM z13 (Driver D27) and z13s I/O support is available with z/VM?

A UID (user defined identifier) can be assigned to a real PCI function to more accurately indicate equivalent functions between different LPARs and for exploitation by guest operating systems, and Linux in particular. z/VM supports dynamic I/O and guest use for PCIe UID support. z/VM 6.4 gets the support with the PTF for APAR VM65865.

Installation, Migration, and Serviceability

What are the z/VM enhanced functions and processes to improve the installation, migration, and serviceability of z/VM?

- **Enhanced upgrade in place.** The z/VM upgrade in place process allows upgrading an existing system to a new release of z/VM with minimal impact to the running system. The upgrade in place process has been extended to allow upgrade from z/VM 6.2 or 6.3 to z/VM 6.4 and positions a system for releases beyond z/VM 6.4. Upgrade in place is supported for a member of a z/VM SSI cluster as well as for a non-clustered z/VM system. The only release supported for upgrading to z/VM 7.1 is 6.4.
- **Determine installed service.** Enhancements to CP and VMSES/E enable you to determine if specific CP service is built into the CP nucleus (load module). The new CPSERVICE option on the CP QUERY command allows queries based on APAR, PTF, or local modification identifiers of the nucleus that is currently running.
- **3590 and 3592 tape formats not supported for the installation of z/VM.** z/VM 6.4 is not available in 3590 or 3592 tape format. z/VM is available on DVD and electronic delivery. In addition, z/VM service for all releases will no longer be orderable in 3590 or 3592 tape format.
- **Installing z/VM 6.4** on a z14 requires updated installation media available since August 25, 2017.
- **Dump to tape** is no longer supported with z/VM 7.1.
- **ESA/390 removal.** z/VM 6.4 enhancements enable hypervisor initialization and termination, the Stand-Alone Program Loader (SAPL), DDR, Stand-Alone Dump, and stand-alone utilities to run entirely in z/Architecture mode.
- **Architecture level set (ALS).** z/VM 7.1 includes an Architecture Level Set (ALS) and requires IBM zEnterprise EC12 or BC12 or later systems. z/VM 6.4 includes an ALS and requires IBM zEnterprise 196 (z196) and IBM zEnterprise 114 (z114) and later systems. See the appropriate preventive service planning (PSP) bucket for the minimum microcode level (MCL) and any required updates.

Are there services available to migrate to a newer z/VM level?

Yes, IBM Systems Lab Service helps clients with currency and migration. You can contact IBM Systems Lab Services via the Internet at : ibm.com/it-infrastructure/services/lab-services or send an email to ibmsls@us.ibm.com

Statements of Direction from Announcements

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What z/VM statements of direction were included with the August 04, 2020 announcement?

Security evaluation of z/VM 7.2: IBM intends to pursue an evaluation of z/VM 7.2 with the RACF Security Server and SSI features. This includes labeled security for conformance to the Virtualization Protection Profile (VPP) and Server Virtualization Extended Package of the Common Criteria standard for IT security, ISO/IEC 15408, at Evaluation Assurance Level 4 (EAL4+).

FIPS certification of z/VM 7.2: IBM intends to pursue an evaluation of the Federal Information Processing Standard (FIPS) 140-2 using National Institute of Standards and Technology's (NIST) Cryptographic Module Validation Program (CMVP) for the System SSL implementation utilized by z/VM 7.2.

Stabilization of z/VM support for the z13 and z13s server family: z/VM V 7.2 is the last z/VM release planned to support the z13, z13s, and LinuxONE Emperor, or LinuxONE Rockhopper servers. A z14, IBM z14 ZR1, LinuxONE Emperor II or LinuxONE Rockhopper II server will be the required minimum level for future z/VM releases. See the [IBM Support Portal](#) for the most current z/VM support lifecycle information.

Removal of support for multiple RACF servers in a single z/VM system: z/VM 7.2 is intended to be the last release to support multiple RACF for z/VM servers running concurrently in a single z/VM system. This support was implemented to enable greater throughput in handling security policy requests and updates against a single RACF database. However, modern I/O speeds and processing power have rendered this support superfluous. This statement has no bearing on RACFVM multiconfiguration virtual machines in a z/VM Single System Image cluster or on the RACMAINT virtual machine used in support and service.

What z/VM statements of direction were included with the April 14, 2020 announcement?

Security evaluation of z/VM 7.2: IBM intends to pursue an evaluation of z/VM 7.2 with the RACF Security Server and Single System Image features. This includes labeled security, for conformance to the Virtualization Protection Profile (VPP) and Server Virtualization Extended Package of the Common Criteria standard for IT security, ISO/IEC 15408, at Evaluation Assurance Level 4 (EAL4+).

FIPS certification of z/VM 7.2: IBM intends to pursue an evaluation of the Federal Information Processing Standard (FIPS) 140-2 using National Institute of Standards and Technology's (NIST) Cryptographic Module Validation Program (CMVP) for the System SSL implementation utilized by z/VM 7.2.

Removal of RACF for z/VM support for RACF database sharing between z/VM and z/OS: z/VM 7.2 is intended to be the last z/VM release to support sharing RACF databases between z/VM and z/OS systems. While databases may remain compatible, sharing between operating systems is discouraged due to the distinct security and administration requirements of different platforms. A future z/VM release will be updated to detect whether a database is flagged as a z/OS database and reject its use if so marked. Sharing of databases between z/VM systems, whether in a Single System Image cluster or in stand-alone z/VM systems, is not affected by this statement.

Removal of line edit support during LOGON: z/VM 7.2 intends to remove support for performing line editing of data entered during LOGON, such as user ID, password, or command, when a z/VM External Security Manager (ESM) is not configured and active. This excludes honoring the system default line-end character to identify guest console input data in a LOGON command entered on the LOGON panel or in responses to prompts issued before LOGON completes. When an ESM is configured, it will control these aspects of system behavior.

What z/VM statements of direction were included with the September 12, 2019 announcement?

Removal of the z/VM PAGING63 IPL parameter: z/VM 7.1 will be the last z/VM release to support use of the PAGING63 IPL parameter. This parameter directed the paging subsystem to perform as it had in releases prior to z/VM 6.4. It also prevented use of z/VM 6.4 and 7.1 paging subsystem improvements, which include support for High Performance FICON, HyperPAV, encryption, and EAV.

What z/VM statements of direction were included with the August 7, 2018 announcement?

Stabilization of z/VM support for the IBM EC12 and BC12 server family: z/VM 7.1 is the last z/VM release that is planned to support the EC12 or BC12 family of servers. Consequently, either an IBM z13 or an IBM z13s will be the required minimum level of server for future z/VM releases. See the IBM Support Portal for the most current z/VM support lifecycle information.

Discontinuance of support for separately ordered Environmental Record Editing and Printing Program (EREP) licensed product: z/VM 7.1 is planned to be the last z/VM release to support EREP as a separately orderable and serviceable IBM licensed product. EREP functionality will continue to be delivered as part of the z/VM offering.

z/VM new function portal: The [z/VM Continuous Delivery News](#) web page will be the primary vehicle used by IBM to describe new functions that are planned for z/VM. It is the recommended way to keep track of future development and support plans for the z/VM product. z/VM clients should consider subscribing to this page. Instructions are included on the [VM Site File Change Notification](#) web page.

Statements regarding IBM's future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only.

What z/VM statements of direction were included with the April 10, 2018 announcement?

Stabilization of z/VM support for the IBM EC12 and BC12 server family: z/VM 7.1 is the last z/VM release that is planned to support the EC12 or BC12 family of servers. Consequently, either an IBM z13 or an IBM z13s will be the required minimum level of server for future z/VM releases. See the IBM Support Portal for the most current support lifecycle information for z/VM.

Dynamic memory downgrade: IBM intends to provide support in a future z/VM deliverable to increase flexibility in managing z/VM configurations by enabling real storage to be removed from a z/VM LPAR without requiring an outage. This support will complement existing functionality to add real storage to an active z/VM system.

Discontinuance of support for Environmental Record Editing and Printing Program (EREP): z/VM 7.1 is planned to be the last z/VM release to support EREP as a separately orderable and serviceable IBM Licensed Program Product.

Resources

IBM z/VM virtualization	ibm.com/it-infrastructure/z/zvm and www.ibm.com/products/zvm
z/VM Continuous Delivery News	www.vm.ibm.com/newfunction
z/VM Sponsor User program	www.vm.ibm.com/sponsor_user/index.html
z/VM Council	www.vm.ibm.com/sponsor_user/zvm_council.html
About z/VM	www.vm.ibm.com/overview
IBM Infrastructure Suite for z/VM and Linux	ibm.com/us-en/marketplace/infrastructure-suite-zvm-and-linux
IBM Wave for z/VM	ibm.com/marketplace/wave-for-zvm
IBM Cloud Infrastructure Center	ibm.com/marketplace/cloud-infrastructure-center
IBM Dynamic Partition Manager	ibm.com/support/pages/ibm-z-dynamic-partition-manager-dpm-guide
Storage Interoperation Center (SSIC)	ibm.com/systems/support/storage/ssic/interoperability.wss
Linux on IBM Z	ibm.com/it-infrastructure/z/os/linux
IBM's base KVM on Z information	ibm.com/support/knowledgecenter/linuxonibm/liaaf/lnz_r_kvm_base.html
IBM Systems Lab Services	ibm.com/it-infrastructure/services/lab-services
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