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**IBM Z**  
**August 2018**

**IBM z/VM Frequently Asked Questions  
for z/VM V7.1 and z/VM V6.4**

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 in 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.

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

The IBM Z and LinuxONE hardware provides 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.

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

The virtualization layer extends the capabilities of the hardware from the standpoint of sharing hardware, 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.

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

The z/VM Website provides additional material and is the primary location for a detailed description of z/VM capabilities, refer to [ibm.com/it-infrastructure/z/zvm](http://ibm.com/it-infrastructure/z/zvm) or [www.vm.ibm.com/newfunction](http://www.vm.ibm.com/newfunction)

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

## 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 be enlisted 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 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 about the z/VM Sponsor User program, see the [z/VM Sponsor User program](#) web page.
- IBM publishes information about many of its z/VM development projects to help users decide if they want to volunteer as Sponsor Users and also to 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.

## 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. When a new release is introduced, SPEs are delivered on that release that goes forward and, with a few exceptions, the earlier release delivers corrective service only and no new function. When z/VM V7.1 becomes available, licensed users of z/VM V6.4 will receive only corrective service.

- Beginning with Version 7.1, IBM delivers z/VM releases on a fixed, 24-month cycle. These releases are a rollup of:
  - Previously-released 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 SPEs
  - 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 V6.4 client has the option of moving to z/VM V7.1 up to 18 months after the general availability of z/VM V7.2. z/VM V6.4 will be orderable for

18 months after the general availability of z/VM V7.1. For ordering options, see your local IBM representative.

For planning purposes, z/VM V6.4 users receive corrective service six months after the general availability of z/VM V7.2. The planned release cycle for z/VM V7 means z/VM V6.4 service support overlaps the planned availability of z/VM V7.2 by six months. The same applies for future N releases six months after the N+2 release is generally available.

Starting with z/VM V7.1, 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 is changing with the inclusion of the z/VM Single System Image function into the z/VM V7.1 base?

z/VM Single System Image function is included in the base of z/VM V7.1 at no additional cost. Previously, it was a priced feature of z/VM 6, and 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 will be no charge for Subscription and Support (S&S) for SSI with z/VM V7. For clients who are currently paying S&S charges for SSI on an earlier release of z/VM, IBM removes the SSI feature S&S charges for future S&S renewals for clients who have ordered z/VM V7. Client acceptance of the z/VM V7 order is permission for IBM to remove future SSI feature S&S renewals.

It is the clients' 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.

## Which servers are supported by z/VM?

Both version, z/VM V7.1 and z/VM V6.4, support all IBM z14™ (z14) Models (M01, M02, M03, M04, M05, and ZR1), IBM z13® (z13), IBM z13s® (z13s), IBM LinuxONE Emperor™, IBM LinuxONE Emperor II, IBM LinuxONE Rockhopper™, IBM LinuxONE Rockhopper II, IBM zEnterprise® EC12 (zEC12), IBM zEnterprise BC12 (zBC12) servers

z/VM V6.4 is the last z/VM release supporting the IBM Enterprise 196 (z196) or IBM zEnterprise 114 (z114) family of servers.

Refer to the IBM Support Portal for the most current support lifecycle information for z/VM.

## 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, then z/VM might be the better option to use.

## 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](http://ibm.com/marketplace/wave-for-zvm)

## 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. The capabilities of IBM Infrastructure Suite for z/VM and Linux 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](http://ibm.com/marketplace/infrastructure-suite-zvm-and-linux)

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

Both, z/VM V7.1 and z/VM V6.4, can be installed directly on a z14, Emperor II, or Rockhopper II server. For z/VM 6.4 is required an install media after August 25, 2017, and the PTFs for APARs VM65942 and VM66539 (required for ZR1 and Rockhopper II) must be applied immediately after installing z/VM V6.4 and prior to doing any configuration of the new z/VM system.

## How is z/VM licensed?

z/VM is licensed per Value Unit. A Value Unit (VU) is a unit of measure by which the Program can be licensed. Value Unit entitlements are based on the number of units of a specific designated measure used or managed by the Program. Licensee must obtain sufficient entitlements for the number of Value Units required for Licensee's environment for the designated measure specified in the Value Unit Exhibit (VUE) provided below. 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 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 sufficient to cover 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 sufficient to cover all IFL Engines on that Z or LinuxONE server.

## Is Sub-capacity pricing available on z/VM?

Sub-Capacity pricing for z/VM V7 and z/VM V6 is available for clients running z/VM V7.1 or z/VM V6.4. 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](#) or the [US announcement letter](#)

## 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 appliances, and not have IBM software pricing for z/VM programs automatically increase for 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 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 are the pre-requisites for z/VM Sub-capacity requirements?

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 V7.1 or z/VM V6.4.
- 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 that additional required license entitlement.

For information about supported platforms and hardware requirements for use of ILMT administrative server and its agents, visit the [ILMT Knowledge Center](https://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](https://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](https://ibm.com/systems/z/swprice/subcap/zVM.html)

## What is IBM Dynamic Partition Manager?

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

operating system. IBM z/VM is a supported environment using DPM for Linux-only systems with SCSI storage.

The DPM is not a replacement for PR/SM™ – it is 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 z14, IBM z13s, IBM z13, and IBM LinuxONE servers, supports Linux running on z/VM with SCSI storage attached with FCP channels. DPM provides simplified hardware and virtual infrastructure management including integrated dynamic I/O management.

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) for Linux-only servers with SCSI storage. DPM 3.1 will provide support for ECKD DASD in August 2018. This simplifies system administration tasks for a more positive experience by those with limited IBM Z or LinuxONE skills.

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

Yes, IBM Systems Lab Services provides assistance to clients wanting to plan and to 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](http://ibm.com/it-infrastructure/services/lab-services) or send an email to [ibmsls@us.ibm.com](mailto:ibmsls@us.ibm.com)

### **How long did IBM support z/VM V6.3?**

IBM supported z/VM V6.3 until December 31, 2017.



## TECHNICAL QUESTIONS

### IBM z/VM V7.1 and z/VM V6.4

#### What are the feature functions in z/VM V7.1?

- **z/VM Continuous Delivery model:** The introduction of the z/VM Continuous Delivery model provides a new way to deliver z/VM capabilities, allowing for a faster adoption and benefit to the client. New z/VM capabilities will be delivered in the service stream of the current release as Small Programming Enhancements, thus providing the flexibility of selecting and deploying new capabilities immediately, along with moving from one release to release in the new two-year cadence. Clients will continue to receive the same world-class support and assistance that they are accustomed to from IBM. The support is included in the standard Software Subscription and Support (S&S) charges. A web site provides details on new functions delivered via the z/VM continuous delivery model and allows for subscribing to be alerted when they have been made available: [www.vm.ibm.com/newfunction](http://www.vm.ibm.com/newfunction)
- **Integration of z/VM Single System Image (SSI) for continuous operation:** Continuous operation is extended with z/VM V7.1 since it includes the SSI function as part of the z/VM V7.1 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.
- **New Architecture Level Set:** z/VM V7.1 includes an Architecture Level Set and requires IBM zEnterprise EC12 or BC12 or later systems.
- **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.
- **SMAPI ESM authorization support:** With the PTF for APAR VM66167, SMAPI provides the following ESM interaction:
  - When an ESM is present, programs can use the ESM for all SMAPI authorization decisions at the same granularity used with the SMAPI existing authorization mechanism. The ESM logs the decision (or not) that is based on its active policy, without SMAPI knowledge or intervention.

- When an ESM defers its authorization decision to SMAPI, one of the following actions are taken based on a configuration option: SMAPI's authorization decision uses the existing authorization process. SMAPI calls the ESM to log the decision in the ESM-managed security log. SMAPI has no knowledge if the ESM audit logging is enabled or disabled, and SMAPI treats the request as unauthorized.
- **Dynamic Memory Downgrade:** The flexibility to reassign (add and remove) system resources is critical to z/VM clients. Today's workloads are no longer static. Memory configuration requirements for z/VM images are highly variable due to the nature of constant changing demands within guest workloads. z/VM images may regularly require extra memory to handle short term increases in memory demands. Clients require a mechanism to remove this additional memory later once workload memory demands diminish. This action must be accomplished without requiring an IPL.

With the PTF for APAR VM66173, planned to be available in December 2018, z/VM memory management enables dynamic removal of real memory from a running z/VM system. Clients can now reclaim unused real memory from an active z/VM partition. This makes it available to other partitions without an outage.

Dynamic Memory Downgrade requires an IBM z14 system.

- **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, planned to be available in December 2018. ECC provides a faster, more secure mechanism for asymmetric encryption than standard RSA or DSS algorithms.
- **RSCS Query System Service:** The RSCS server is enhanced to provide a means to query the service level of each part that is included within the RSCS LOADLIB with the PTF for APAR VM66174, planned to be available in December 2018. A new RSCS query parameter is provided that will return the highest level PTF that is applied to each part within the running RSCS server. This eliminates ambiguity on whether service was applied.
- **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.
- **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.

Additional details and information, including the PTF availability, can be found on the [z/VM Continuous Delivery News](#) web page.

## What deprecation of installation support comes with z/VM V7.1?

- Installation of z/VM on 3390 Model 3 DASD volumes is no longer supported in z/VM V7.1. 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 was first supplied with z/VM V5.2, are no longer provided or supported in z/VM V7.1. The upgrade installation process that was introduced with z/VM V6.3 can be used to upgrade supported z/VM levels to z/VM V7.1. The migration of customized data for components, features, or products from z/VM levels that are earlier to those supported by the upgrade installation process for z/VM V7.1 now must be performed by using locally developed procedures.

## What are the feature functions in z/VM V7.1 and z/VM V6.4?

z/VM enables extreme scalability, security, and efficiency, creating cost saving opportunities, and provides the foundation for cognitive computing on IBM Z and LinuxONE. z/VM delivers:

- Support for up to 2TB of memory, enabling higher levels of workload deployment, considerable growth in memory-intensive applications, and superior levels of elasticity for workload spikes.
- Increased efficiency with HyperPAV paging that takes advantage of DS8000® features to increase the bandwidth for paging making it easier to manage dozens of page volumes rather than 100s and allows for more efficient memory management of over-committed workloads.
- Easier migration with enhanced upgrade in place infrastructure that provides an improved migration path from previous z/VM releases.
- Improved operations with ease of use enhancements requested by clients, such as querying service applied to the running hypervisor and providing environment variables to allow programming automation based on systems characteristics and client settings.
- Improved Small Computer System Interface (SCSI) support for guest attachment of disk and other peripherals to IBM Z and LinuxONE systems to:
  - Increase efficiency by allowing an IBM FlashSystem™ to attach to z/VM for system use without the need for an IBM System Storage® SAN Volume Controller (SVC).
  - 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 V7000, V840, & V9000
  - A z/VM storage administrator can use FlashSystem storage as a z/VM-system-attached DASD, attached to the host 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.
  - Improved reliability when SCSI disk devices are attached to the z/VM hypervisor for system usage, without the need to be attached behind an SVC
  - Concurrent code loads on the SVC, and devices incorporating SVC technology, is now supported without quiescing EDEVICE I/O.
  - Increased scalability by exploiting Guest Enhanced DAT to allow virtual machines to take advantage of large (1 MB) pages, decreasing the memory and overhead required to perform address translation.
  - Integration of new CMS Pipelines functionality which previously was not formally incorporated in the z/VM product, allowing a much more inclusive set of tools for application developers.

## What are the latest z/VM V6.4 enhancements, included in the base of z/VM V7.1?

Following enhancements are delivered, and the listed PTFs are required for z/VM V6.4. These enhancements are included in the base of z/VM V7.1:

- **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 V6.2, V6.3, and V6.4 and must be installed on all the members of an SSI cluster before any V6.4 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 V6.4 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<sup>®</sup> 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 V6.4 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

### How has z/VM enhanced real memory and guest virtual support?

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.

### What is HyperPAV technology exploitation?

- z/VM exploits the ability for 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 eases to manage dozens of page volumes rather than 100s and allows for 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 ENHANCEMENT

### What is the z/VM Control Program environment variables enhancement?

This enhancement allows 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 of particular value 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 EDEVICES.

SCSI management queries support provides enhancements to the commands for EDEVICES 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 EDEVICES, 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 V6.4.

### 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 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 V6.4 gets the support with the PTF for APAR VM66085.



## HARDWARE CURRENCY

### What new z14, LinuxONE Emperor II, or LinuxONE Rockhopper II functions are available in z/VM in support of Linux?

Guest enablement of new instructions and capabilities of z14, Emperor II, and Rockhopper II. Guest exploitation support is provided for the Crypto Express6S, RoCE Express2, OSA-Express6S, and FICON Express16S+ adapters. z/VM V6.4 gets the support with the PTFs1 for APARs VM65942 and PI73016; the PTF for APAR VM65639 is also required for the z14 model ZR1 and Rockhopper II (see the information at: [www.vm.ibm.com/service/vmreqz14.html](http://www.vm.ibm.com/service/vmreqz14.html))

**Guest exploitation support for the Instruction Execution Protection Facility:** z/VM provides support for guest exploitation of the z14, Emperor II, or Rockhopper II Instruction Execution Protection Facility. This facility provides functionality to improve the security of programs running on IBM Z 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 V6.4 gets the support with the PTF for APAR VM65986.

**Guest exploitation support for Pause-Less Garbage Collection:** z/VM provides support for guest exploitation of the z14, Emperor II, or Rockhopper II guarded storage facility. This facility is designed to improve the performance of garbage-collection processing by various languages, in particular Java™. z/VM V6.4 gets the support with the PTF for APAR VM65987.

### What new z14, LinuxONE Emperor II, and LinuxONE Rockhopper II function 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 V6.4 gets the support with the PTF for APAR VM65993.

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

Support for DS8880 z-Thin Provisioning and Extent Space-Efficient (ESE) volumes is provided. This enables guest support for thin-provisioned volumes and allows CPOWNEED volumes be defined on thin-provisioned volumes. z/VM V6.4 gets the support with the PTFs for APARs VM66098 and VM66108.

### What is the Shared Memory Communications Direct 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 the 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 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 thirty-two cores even when operating in single-threaded mode due to the logical processor addressing limit.

### **Are there services available to help on Simultaneous Multithreading for z/VM?**

Yes, IBM Systems Lab Services provides assistance to 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](http://ibm.com/it-infrastructure/services/lab-services) or send an email to [ibmsls@us.ibm.com](mailto:ibmsls@us.ibm.com)

### **What is the IBM z13 (Driver D27) and z13s I/O support 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 V6.4 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 V6.2 or V6.3 to z/VM V6.4 and positions a system for releases beyond z/VM V6.4. 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 V7.1 is V6.4.
- **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 V6.4 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 V7.1.

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

Yes, IBM Systems Lab Services provides assistance to clients with currency and migration. You can contact IBM Systems Lab Services via the Internet at:

[ibm.com/it-infrastructure/services/lab-services](http://ibm.com/it-infrastructure/services/lab-services) or send an email to [ibmsls@us.ibm.com](mailto:ibmsls@us.ibm.com)

## ADDITIONAL ENHANCEMENTS AND IMPROVEMENTS

### What are the z/VM additional enhancements and improvements?

- **Network Security Enhancement.** The NICDEF Security Controls introduces Directory Network Authorization capability with which each virtual NIC can be configured and authorized entirely within the user directory. This eliminates the need to use SET VSWITCH and COUPLE commands in applicable scenarios.
- **Encryption of TCPNJE connections.** RSCS TCPNJE traffic can be encrypted by directing the 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.
- **Architecture level set (ALS).** z/VM V7.1 includes an Architecture Level Set (ALS) and requires IBM zEnterprise EC12 or BC12 or later systems. z/VM V6.4 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.
- **ESA/390 removal.** z/VM V6.4 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.

For a detailed description of the z/VM capabilities, see the [z/VM](#) website.

## STATEMENT OF DIRECTION FROM AUGUST 7, 2018 ANNOUNCEMENT

### 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 V7.1 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 V7.1 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.

## STATEMENT OF DIRECTION FROM APRIL 10, 2018 ANNOUNCEMENT

### 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 V7.1 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.

**More than 64 logical processors:** IBM intends to provide support in a future z/VM deliverable that will increase the number of supported logical processors beyond the current limit of 64. This will allow clients to run a z/VM LPAR with more than 64 cores or threads to accommodate workload growth demands.

**Discontinuance of support for Environmental Record Editing and Printing Program (EREP):** z/VM V7.1 is planned to be the last z/VM release to support EREP as a separately orderable and serviceable IBM Licensed Program Product.

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## STATEMENT OF DIRECTION FROM JULY 17, 2017 ANNOUNCEMENT

### What z/VM statements of direction were included with the July 17, 2017 announcement?

**Stabilization of z/VM V6.3 support:** The IBM z14, Emperor II, and Rockhopper II are planned to be the last IBM Z server supported by z/VM V6.3 and the last IBM Z server that will be supported where z/VM V6.3 is running as a guest (second level). z/VM V6.3 will continue to be supported until December 31, 2017, as announced in announcement letter # RFA 61207.

**Future z/VM release guest support:** z/VM V6.4 will be the last z/VM release supported as a guest of z/VM V6.2 or older releases.

**Disk-only support for z/VM Dumps:** z/VM V6.4 will be the last z/VM release to support tape as a media option for Stand-alone, Hard Abend, and Snap Dumps. Subsequent releases will support dump to ECKD DASD or FCP SCSI Disks only.

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

## STATEMENT OF DIRECTION FROM OCTOBER 25, 2016 ANNOUNCEMENT

### What z/VM statements of direction were included with the October 25, 2016 announcement?

Stabilization of z/VM support for the IBM zEnterprise 196 (z196) family: z/VM V6.4 is the last z/VM release planned to support the IBM Enterprise 196 (z196) or IBM zEnterprise 114 (z114) family of servers. Either an IBM zEnterprise EC12 (zEC12) or an IBM zEnterprise BC12 (zBC12) is planned as the required minimum level of server for future z/VM releases. Refer to the IBM Support Portal for the most current support lifecycle information for z/VM.

**Removal of support for IEEE 802.3 Ethernet frame types:** z/VM V6.4 is planned to be the last z/VM release to support IEEE 802.3 Ethernet frame types. All future z/VM releases are planned to support DIX Version 2 (DIX V2) exclusively. This includes the z/VM Virtual Switch (VSwitch) and the z/VM TCP/IP server.

**Removal of support for the IMAP server:** z/VM V6.4 is planned to be the last z/VM release to support IMAP.

**Removal of support for certain TCP/IP functions:** z/VM V6.4 is planned to be the last z/VM release to support the Graphics Data Display Manager Interface for X Window System (GDDMXD/VM).

**Install from 3390 Model 3 DASD:** z/VM V6.4 will be the last release to allow installation using Model 3 3390 DASD (Direct Access Storage Device) volumes. Future z/VM releases will support 3390 installation using only model 9 or model 27 DASD. Installation on SCSI volumes will not be affected.

**FIPS Certification of z/VM V6.4:** 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 V6.4.

**Security Evaluation of z/VM V6.4:** IBM intends to evaluate z/VM V6.4 with the RACF Security Server feature, including labeled security, for conformance to the Operating System Protection Profile (OSPP) of the Common Criteria standard for IT security, ISO/IEC 15408, at Evaluation Assurance Level 4 (EAL4+).

**Removal of support for virtual machines with dedicated processors:** z/VM V6.4 is planned to be the last z/VM release to support dedicating of logical to virtual processors via the CP DEDICATE command or with the DEDICATE option on the CPU user directory statement. z/VM running in a dedicated logical partition will continue to be supported.

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## What IBM Wave statements of direction were included with the October 25, 2016 announcement?

**Removal of IBM Wave support for SLES 10:** In a future deliverable, IBM intends to remove IBM Wave support for management of guests that are running the SUSE Linux Enterprise Server (SLES) 10 Linux distribution.

**Removal of IBM Wave support for ext2 file systems:** In a future deliverable, IBM intends to remove IBM Wave management of Linux guest file systems that use ext2, the second extended filesystem.

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