IBM z/VM

Modernize for efficiency and hybrid cloud with virtualization for extreme scalability, security, and helping on your sustainability goals

IBM® z/VM® delivers extremely high levels of security, scalability, and efficiency, providing a robust foundation for on-premises cloud computing using both containerized and noncontainerized workloads.

z/VM virtualization technology is designed to run up to thousands of Linux® and container workloads, helping to reduce your energy consumption and operational costs without compromising scale, security, and performance. The workloads can be based on Linux, Red Hat® OpenShift® Container Platform, IBM z/OS®, IBM z/TPF, and 21CS VSEn all on a single IBM Z® or IBM® LinuxONE[1].

z/VM's ability to support many machine images and solution architectures provides highly flexible production, development, and test environments for IBM Z and IBM® LinuxONE operating systems and Red Hat OpenShift. This simplifies enterprise solutions and infrastructure upgrades in a timely manner, provides a test environment whenever needed, and deploys and consolidates several systems onto one physical server.

z/VM, together with IBM Cloud Infrastructure Center[2], which helps to manage the lifecycle of virtual infrastructure, provides the foundation for on-premises infrastructure-as-a-service computing on IBM Z and IBM® LinuxONE, which can be integrated into a hybrid cloud.

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

z/VM technology offers leading-edge virtualization capabilities for:

- Noncontainerized workloads, deployed in a traditional and as-a-service environment, or
- Container workloads based on Red Hat OpenShift, IBM Cloud Paks®, or other container technologies.

In addition, the z/VM hypervisor helps ensure continuous infrastructure availability by tightly integrating with IBM GDPS® resiliency-focused offerings and Live Guest Relocation support.

The foundation for on-premises cloud computing

The IT infrastructure continues to be the foundation for IT services – including cloud computing services.

Realizing the benefits of a cloud computing service model require an infrastructure that delivers strong virtualization technology, like z/VM, while also providing availability, reliability, security, scalability, and performance.

Virtualization enables organizations to get maximum use of their data center resources in the form of virtualized infrastructure, such as servers, operating system software, and networking, so that the infrastructure can be pooled and divided independently of the physical hardware. It is foundational to delivering infrastructure as a service (IaaS), a basic building block for cloud computing services.

To manage the lifecycle of the virtual infrastructure based on z/VM, IBM Cloud Infrastructure Center can provide a consistent, industry-standard user experience for defining, instantiating, and managing it, resulting in a highly scalable, secure, and efficient on-premises cloud infrastructure that can be part of a hybrid cloud.

Highlights

- Enable more virtual machines on a single system
- Turn your sustainability strategy into action
- Benefit from scalability, system management, and performance
- Help ensure continuous availability
- Integrate on-premises cloud computing with hybrid cloud
- Get new functions via the continuous delivery model

“With z/VM, we can dynamically re-allocate and cap resources. z/VM is key to the efficiency of our IT operations.”

z/VM[3] provides support for all supported IBM Z and all supported IBM® LinuxONE servers, and the Linux distributions from Canonical, Red Hat, SUSE, and Red Hat OpenShift.

Two examples of the many z/VM’s strengths:

- IBM z17™ systems or I BM® LinuxONE 5, with GDPS, IBM DS8000® series storage with HyperSwap™, and running a Red Hat OpenShift Container Platform environment, are designed to deliver 99.99999% availability.[4]
- Accessing your database while running an OLTP workload on Red Hat OpenShift Container Platform, requires up to 3.6x fewer cores running your workload when co-located on IBM z16® or IBM® LinuxONE Emperor 4 versus running the workload on compared x86 platform connecting remotely to the IBM z16® or IBM® LinuxONE Emperor 4.[5]

These measurements include z/VM hosting Red Hat OpenShift.

“z/VM is a highly mature and robust virtualization platform, which helps us manage large numbers of completely isolated environments in a single physical footprint.”

Sub-Capacity pricing[6] is available with z/VM, allowing for software pricing at less than full machine capacity and providing more flexibility and improved cost of computing when managing the volatility and growth of new workloads.

IBM continues to expand z/VM and to offer the choice to deploy z/VM product enhancements via the ‘z/VM Continuous Delivery’[7] model for faster adoption and benefit. New z/VM capabilities are delivered in the service stream of the latest release as new Function APARs, thus providing the flexibility to select and deploy new capabilities immediately, along with moving from one release to another on a regular two-year cadence.

IBM z17 / IBM® LinuxONE 5 and z/VM

z/VM 7.4 and z/VM 7.3 will support host and guests on IBM z17 / IBM® LinuxONE 5 at the IBM z16 / IBM® LinuxONE 4 functional level with selected exploitation of new functions, while some of the new functions will be transparent. The IBM z17 / IBM® LinuxONE 5 support is provided with PTFs for both z/VM releases at the general availability of IBM z17 / IBM® LinuxONE 5.

Guest exploitation support will be provided for the following new functions:

- RoCE Network Express Adapter Hybrid (NETH) support
- Networking Express Adapter EQDIO OSA Hybrid (OSH) CHPID support
- AI Accelerator Adapter

Guest compatibility support will be provided for the following new functions:

- Vector-Enhancements Facility 3
- Vector-Packed-Decimal-Enhancement 3
- Workload-Instrumentation
- Message-Security-Assist Extensions
- Reduced support for TX
- Perform Lock Operation (PLO)
- Concurrent-Functions

Host support will be provided for the following new functions:

- Network Express Adapter EQDIO Support within the z/VM VSwitch and a new TCP/IP device driver
- Power Consumption metrics provided within z/VM monitor that can be visualized by the z/VM performance datapump power metric dashboard
- CPU-Measurement Facility (CPU-MF) enhancements
- Data Processing Unit Next Generation I/O accelerator Instrumentation provided within z/VM monitor
- Dynamic I/O support and guest exploitation for the following:
- 25G LR for Long Distance Coupling CHPID type CL6 (Dynamic I/O support only; No guest exploitation)
- Network Express Adapter CHPID type OSH and PCI Function Types NETH
- AI Accelerator Adapter PCI Function Type PAIA

For detailed information on the new function support and PTFs, please refer to the z/VM service required for the IBM z17 / IBM® LinuxONE 5 family servers[8].

IBM z/VM 7.4

IBM z/VM 7.4 provides clients with a premier hypervisor for their existing workloads while also

providing support for a modernization journey to hybrid cloud, hosting enterprise-class virtual servers to exploit the advantages in scalability, performance, high availability, and security of IBM Z and IBM® LinuxONE. z/VM 7.4 provides:

Timely, client-driven function, previously delivered in the service stream of z/VM 7.3[9]. New function delivered with z/VM 7.3 positions z/VM 7.4 with improved:

- Consumability. Through the performance data pump.
- Performance. With reduced large guest logoff time.
- Scalability. Supporting 2 TB guest virtual memory, improved CPU handling, and providing 8-member single system image (SSI) support.
- Resilience and usability. Provided by many enhancements for z/VM system programmers.
- Security. With secure guest IPL, a new compliance interface, and digital signature verification of service.

To improve the service experience, a new strategy for applying z/VM service in a linear fashion provides a simpler approach for servicing z/VM systems. In a linear service model, applying a PTF will require all previous service for the same component to be installed.

The product service level, as reported by z/VM 7.4 for all components using the environment variables, uses new format ffxx:

- ff indicates the latest feature pack number.
- xx indicates the fix pack number for the latest feature pack.

A new Architecture Level Set (ALS) that requires one of the following IBM Z and IBM® LinuxONE servers, or later:

- IBM z15® Models T01 and T02
- IBM® LinuxONE III Models LT1 and LT2

IBM z/VM 7.3

z/VM 7.3 includes:

- 8-member Single System Image (SSI) support increases the maximum size of an SSI cluster from four members to eight, enabling clients to grow their SSI clusters to allow for more workload and providing more flexibility to use live guest relocation (LGR) for nondisruptive upgrades and workload balancing.
- NVMe emulated device (EDEVICE) support enables NVMe devices connected through PCI Express (PCIe) adapters to be defined and managed as Fixed-Block Architecture (FBA) EDEVICEs. As such, all host and guest FBA functions are supported except those that require stand-alone support such as Warm Start and Checkpoint. Linux guests exploiting EDEVICEs defined on NVMe adapters are not eligible for LGR.
- Up to 4 TB of memory per LPAR. This new function was delivered in the service stream of z/VM 7.2. With z/VM 7.3, a fully configured 8-member SSI can address up to 32 TB on a single IBM Z or IBM® LinuxONE server, or 32 TB across multiple servers along with up to 80 logical processors supported on each member.
- External Security Manager interfaces have been enhanced to allow control of the CP DEFINE MDISK command. They are exploited by IBM RACF®/VM and enable a z/VM security administrator to restrict and audit all means of creating a minidisk.
- The z/VM Language Environment runtime libraries have been upgraded to z/OS V2.5 equivalency.
- z/VM 7.3 has been enhanced to support 4-character time zone identifiers within the Control Program.
- z/VM now displays mnemonics for instructions in CP TRACE output regardless of whether the instruction is fully supported by the TRACE function.
- New Architecture Level Set (ALS); z/VM 7.3 includes an ALS that requires an IBM z14® server or IBM® LinuxONE II generation and higher.
- Select RACF utilities for database installation, maintenance, and operations along with select RACF reports are now allowed to run if the 490 (RACF System Disk) disk was IPLed. In addition, the RACUT100, RACUT200, and RACFCONV utilities require the IPL of disk 490 to support reserve/release of the RACF database
- z/VM V7.3 prohibits the sharing of RACF databases between z/VM and z/OS systems. While databases remain compatible, sharing between operating systems has long been discouraged due to distinct security and administrative requirements of each platform. z/VM V7.3 formally flags a RACF database as belonging either to z/VM or z/OS, and will reject its use if flagged as the latter.
- Centralized Service Management (CSM) usability enhancements have been made. The QUERY processing for service levels now allows queries specific to individual components in a service level.
- Several system defaults have been changed.
- SMAPI FCP EQID API Support provides a SMAPI API to enable modification of device equivalency IDs (EQID) for real FCP adapter devices.
- 4 TB Real Memory support for up to 4 TB of real memory will allow z/VM systems to address a full 4 TB of first-level real memory.
- Dynamic Memory Downgrade support, extending the real storage dynamic management characteristics of z/VM by allowing up to 50% of the real memory to be removed from a running z/VM system.
- Improved LGR for shared crypto users is enabled when the type of shared crypto resource on the source system does not match the type on the target system.
- IBM z/Architecture® Extended Configuration (z/XC) support, CMS applications that run in z/Architecture can use multiple address spaces.
- Direct to Host Service Download support, providing an optional way to download service to your z/VM system.

Many additional z/VM 7.3 enhancements have been delivered via the ‘z/VM Continuous Delivery’[7] model, check them out.

Why IBM?

As you transform your business and differentiate yourself in a trust economy, IBM remains your partner.

We have the total expertise in systems, software, delivery, and financing to help you create a secure, open, and intelligent foundation for the future.

Our experts can help you configure, design, and implement z/VM on IBM Z and IBM® LinuxONE, not only as your on-premises cloud infrastructure, but also optimized for your needs.

For more information

You can and subscribe to z/VM availability alerts[7], and to learn more about the IBM z/VM offering, please contact your IBM representative or IBM Business Partner.

1. IBM® LinuxONE servers support IBM z/VM, Linux distributions, KVM, and Red Hat OpenShift.
2. See at: ibm.com/products/cloud-infrastructure-center
3. See the z/VM version specific Architecture Level Set (ALS) requirements.
4. IBM internal data based on measurements and projections was used in calculating the expected value. Necessary components include IBM z17 or IBM LinuxONE 5; IBM z/VM V7.3 systems or above collected in a Single System Image, each running Red Hat OpenShift Container Platform 4.14 or above; IBM Operations Manager; GDPS 4.6 or above for management of data recovery and virtual machine recovery across metro distance systems and storage, including Metro Multi-site workload and GDPS Global; and IBM DS8000 series storage with IBM HyperSwap. A MongoDB v4.4 workload was used. Necessary resiliency technology must be enabled, including z/VM Single System Image clustering, GDPS xDR Proxy for z/VM, and Red Hat OpenShift Data Foundation (ODF) 4.14 or above for management of local storage devices. Application-induced outages are not included in the above measurements. Other configurations (hardware or software) may provide different availability characteristics.
5. This is an IBM internal study designed to replicate banking OLTP workload usage in the marketplace deployed on Red Hat OpenShift Container Platform (RHOCP) 4.9 on IBM z16 or IBM® LinuxONE Emperor 4 using z/VM versus on compared x86 platform using KVM accessing the same PostgreSQL 12 database running in an IBM z16 or IBM® LinuxONE Emperor 4 LPAR. IBM z16 or IBM® LinuxONE Emperor 4 configuration: The PostgreSQL database ran in a LPAR with 12 dedicated cores, 128 GB memory, 1TB IBM FlashSystem® 900 storage, Red Hat Enterprise Linux (RHEL) 7.7 (SMT mode). The compute nodes ran on z/VM 7.2 in a LPAR with 8 dedicated cores, 188 GB memory, DASD storage, and OSA connection to the PostgreSQL LPAR. The RHOCP Proxy server ran in an LPAR with 1 core, 4 GB memory and RHEL 8.5. x86 configuration: The compute nodes ran on KVM on RHEL 8.5 on 32 Cascade Lake Intel® Xeon® Gold CPU @ 2.30GHz with Hyperthreading turned on, 192 GB memory, RAID5 local SSD storage, and 10Gbit Ethernet connection to the PostgreSQL LPAR. Both systems are delivering equal throughput. Results may vary.
6. For more information read the information in the IBM z/VM FAQ: https://www.ibm.com/downloads/cas/GDVOX61O
7. https://www.vm.ibm.com/service/vmreqz17.html
8. The details can be found at: www.vm.ibm.com/newfunction/
9. For a detailed description of function delivered in the z/VM 7.3 service stream, see the z/VM Continuous Delivery News web page.

Learn more:
IBM z/VM
IBM z16
IBM LinuxONE

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