IBM.

IBM z14 Model ZR1

Highlights

- Extending the IBM Z family with the new z14 Model ZR1

- Industry standard 19-inch rack

- Can easily co-exist with other platforms in a cloud data center

- Lower space by 40 percent

- Designed for 10 percent more single processor capacity

- Improved encryption, compression and I/O capabilities

- Peace-of-mind security with pervasive encryption while maintaining SLAs

- Updated secure service containers for deployment simplification

- Improve management, storage and optimization of for a digital economy

- Simplification and standardization of systems administration

We are living in an age of exciting, disruptive technologies driving digital transformation. Businesses of all sizes must adapt to capitalize on the opportunities and challenges of the digital era. That means connecting and using all relevant data, no matter where it is stored. Businesses need to deliver trusted digital experiences, that meet user expectations and deliver value to all parties. The foundation of these digital relationships must be security and transparency - across the value chain, within the business, with partners, and with clients.

To help businesses of all sizes address new opportunities, IBM Z introduced a new entry model to the IBM z14 (z14). The new z14 Model ZR1 delivers secure capabilities in a smaller, industry-standard frame, with a lower cost of entry, that can easily co-exist with other platforms in a cloud data center. Key value propositions of the z14 such as pervasive encryption and secure service containers, help simply and efficiently protect data and applications. Cognitive DevOps and API exploitation helps integrate system of records with systems of engagement. Valuable IBM Z assets can be exposed and accessed as cloud services across the customer's enterprise ecosystem. Machine learning on valuable data is designed to create deeper actionable insights and predictive behavior.

IBM z14 Model ZR1

New flexible design for the entry point of the IBM z14

The z14 Model ZR1 is designed as a new entry point for the IBM Z family. It delivers functional capabilities to meet the demand for new services and better customer experiences; while securing the growing amounts of data and complying with increasingly intricate regulations. The z14 Model ZR1 can be the base for an integrated hybrid cloud with mission critical core business workloads that demand maximum security.

The z14 Model ZR1 is housed in an industry standard 19-inch rack form factor. The design will have Power Distribution Unit (PDU)-based power along with redundant power, cooling and line cords. These factors let you lower power costs, reduce footprint cost and install in virtually any existing data center—with a server rated at ASHRAE A3. By having the same footprint as other data center servers, you gain facility standardization.

The new 19-inch rack design opens a new opportunity for IBM Z. For the first time in the history of IBM Z technology, there is a potential for up to 16U of available frame space, depending on the configuration. Businesses can choose to install storage, servers or switches within the frame when space is available.

Differentiated value at the core

The 10-core z14 processor chip leverages the density and efficiency of 14 nm silicon-on-insulator technology to deliver increased performance and capacity across a wide range of workloads. Much of that increase is a result of innovations in the microprocessor design, driven by tight collaboration across hardware, firmware, and software development.

These innovations include:

- The z14 Model ZR1 delivers 10 percent more performance per core than z13s.[1]
- IBM Z has redesigned the cache architecture with 1.5 times more on-chip cache per core compared to the IBM z13s (z13s). Bigger and faster caches help to avoid untimely swaps and memory waits while maximizing the throughput of concurrent workloads.
- New instructions in the single instruction, multiple data (SIMD) facility offer a boost for traditional workloads using decimal operations (i.e. COBOL 6.2, PL/I 5.2) and new application like analytics (i.e. Open Data Analytics for z/OS) over and above that provided by the faster processor.
- The new Guarded Storage Facility (GSF) will deliver pause-less garbage collection to enable enterprise scale Java applications to run with fewer and shorter pauses for garbage collection on larger heaps.
- The z14 delivers next generation simultaneous multithreading (SMT) with improved virtualization performance for Linux cores and incremental throughput for the z Integrated Information Processor (zIIP). SMT on the z14 Model ZR1 improves throughput by up to 25 percent[1] for an IFL or zIIP to benefit exploiters. With up to 30 configurable cores the z14 Model ZR1 offers up to 60 percent more total Linux capacity in a single footprint compared to a z13s.[1]
- The compression co-processor in each core has been improved to use fewer CPU cycles for compression and expansion. Db2 plans to enable new order-preserving compression for Db2 indices in the future[2] which can also take advantage of the compression co-processor to enable further improvements in Db2 memory usage, data transfer, and storage efficiency.
- Every core has hardware accelerated encryption implementing the CP Assist for Cryptographic Function (CPACF) which provides cryptographic functions and hashing functions in support of clear-key operations. This encryption acceleration means IBM z14 Model ZR1 offers up to six times faster encryption for like modes and data sizes with the CPACF compared to the previous-generation IBM z13s.[3]
- The z14 Model ZR1 can have up to 8 TB memory—2X the memory on a z13s. The additional memory can support new workloads, data-in-memory applications, larger local buffer pools as well as efficiently process huge amounts of information for faster business insight.

The z14 Model ZR1 is extremely scalable and supports an optimized cloud infrastructure which is flexible and meets workload demands.

Achieving pervasive encryption

The IBM z14 introduced a new approach for encryption. Historically, policies were based on selective encryption—manual selection of the most critical data. Development of a comprehensive approach to data protection required a large investment in time and money. Encryption decisions were made on where to execute, the impact on service level agreements, the ownership of encryption, and on the extensiveness of the encryption plan.

The IBM z14 introduced the concept of 'pervasive encryption'. The server has the speed and capabilities to help businesses defend and protect critical assets with unrivaled encryption and intelligent data monitoring—without compromising on transactional throughput or response times. Most importantly, there are no application changes. And using workload isolation and security advances, appliances and applications can have credible protection against both external and internal threats. This protection is critical in a hybrid cloud environment as businesses try to accommodate placement of workloads.

By encrypting as much data and transactional pipeline as possible, potential data breach risks and financial losses can be reduced, cloud infrastructures can be secured—and compliance with regulatory mandates can be simplified. On the IBM z14, pervasive encryption capabilities offer a transparent and consumable approach to encrypt virtually all in-flight and at-rest data. Using simple policy controls, z14 pervasive encryption streamlines data protection for mission-critical datasets.

Changing the game in security

The performance enhancements on the IBM z14 Model ZR1 are what make a difference and changes the security game. The enhanced performance of on-chip cryptographic coprocessors and the new Crypto Express6S feature is key to enabling pervasive encryption and supporting a secure cloud strategy.

The Central Processor Assist for Cryptographic Function (CPACF), standard on every core, provides dramatic improvements in hardware acceleration that makes support of pervasive encryption affordable. CPACF will be used for encryption of data in-flight and data at-rest.

The performance boost of the new Crypto Express6S is due to increased processor frequency and improved parallelism. Crypto Express6S supports Accelerator for SSL (Secure Sockets Layer) transactions that are used to establish an encrypted link between a web server and a browser. Crypto enhancements enable compliance with PCI, ANSI, and other evolving standards, provides enhanced performance, simplified TKE processes and a new smart card to meet expected encryption strengths required for compliance.

The Crypto Express6S feature on a IBM z14 Model ZR1 provides up to 2X the SSL or TLS

performance compared to the previous-generation (Crypto Express5S) on an IBM z13s[3].

Dataset level or file encryption is broad coverage for sensitive data using encryption tied to access control. This broad protection and privacy is managed by the operating system. z/OS dataset encryption capability in z/OS V2.2 is enabled through simple policy-based controls. Dataset encryption will protect z/OS datasets automatically throughout their life cycle. Whereas Linux volume encryption transparently exploits on-chip cryptographic functions to leverage hardware performance gains and expects[4] an extended level of security through protected key for encryption for data at-rest to encrypt complete disks (volumes) for example.

Coupling facility (CF) encryption is a key piece of pervasive encryption helping to protect CF data end to end, using encryption that's transparent to applications. Although no encryption happens on the CF itself, data is encrypted on a host in the sysplex using CPACF on a per-workload, per-structure basis, using established policies before being sent to the CF. The data written to the CF remains encrypted until it is read from the CF and decrypted by a host elsewhere in the sysplex. Thus, the encrypted data is safe in-flight as it flows to the coupling facility, as well as when it is at-rest on the CF.

An IBM exclusive, IBM Secure Service Container encapsulates data inside a virtual lockbox—protecting it from external and internal threats. By completely restricting system administrator access to the container, Secure Service Container defends against the misuse of privileged user credentials. For the z14 Model ZR1, IBM has enhanced this technology to simplify application deployment. Previously, only select IBM appliances could run in the container. Now other vendors can take advantage of the extreme container security to get their applications up and running faster. IBM Secure Service Container for IBM Cloud Private is a software appliance built on the Secure Service Container framework that securely hosts IBM Cloud Private Docker / Kubernetes based solutions on IBM Z Private and Hybrid cloud deployments. It provides an encrypted environment (data at rest, data in flight), with peer to peer and peer to host isolation protecting container applications from access via Hardware and Operating System admin credentials, whether access is accidental or malicious, internal or external to an organization.

Designed for data

Data is the new natural resource. However, being able to manage, store and optimize the vast amounts available is changing how IT is being viewed by the business, and cloud integration means being able to access, synchronize, and replicate the data as needed by users. The z14 Model ZR1 is designed with I/O options to help.

High-speed connectivity to data is critical to achieve exceptional transaction throughput. The new FICON Express16S+ feature is designed to boost I/O rates and reduce single stream latency. These features help absorb large application and transaction spikes driven by unpredictable cloud, analytic and mobile workloads.

A new IBM Z direct-connect, short distance I/O called IBM zHyperLink Express offers extremely low latency connectivity to FICON storage systems. Working in conjunction with existing FICON SAN infrastructure, zHyperLink fosters a new I/O paradigm for IBM mainframes. zHyperLink improves application response time, cutting I/O sensitive workload response time by up to 50 percent without requiring application changes[5]. Support for zHyperLink Writes accelerates Db2 log writes to help meet clients most stringent requirements and deliver superior service levels by processing high volume Db2 transactions.

IBM Virtual Flash Memory is the next generation of Flash Express and provides the same high levels of availability and performance. Virtual Flash Memory has been moved to RAIM storage eliminating the need for PCIe I/O slots. It can improve end to end performance for Flash Express use cases based on improvements in Read/Write latency.

The new OSA-Express7S 25 Gigabit Ethernet (GbE) short reach (SR) feature adds significant speed and a new NIC module unit, and benefits from prior level OSA-Express6S 10GbE performance and reliability. There is one PCIe adapter and one port per feature. This adapter allows for some potential consolidation of prior level adapters.

A new 25GbE RoCE Express2 with z14 GA2 code provides additional bandwidth for your z/OS SMC-R workloads. The 25GbE RoCE Express2 feature also provides for an opportunity for increased sharing, such as adding additional users (Virtual Functions) to share the same physical port (adapter consolidation). This could also provide flexibility for clients to consolidate adapters or increase overall speed, while still seeing high reliability and performance established on prior adapters.

The z14 Model ZR1 offers an Ethernet based coupling link called Coupling Express Long Range (CE LR). This is the companion to the Integrated Coupling Adapter Short Range (ICA SR) that was introduced with IBM z13s. Note that the InfiniBand Coupling Links are not supported on the IBM z14 Model ZR1.

The z14 Model ZR1 supports the DevOps approach to lean and agile software delivery that promotes closer collaboration between lines of business, development and IT operations. Historically, development and operations, and even testing, have been siloed operations. DevOps brings them together to improve agility and reduce the time needed to address customer feedback.

The z14 Model ZR1 is a cloud-ready platform which fully supports connecting and integrating Z applications and data via industry standard APIs and microservices with other applications across the customer's enterprise ecosystem which empowers application developers, even those with no IBM Z skills, to continuously and rapidly build, refine and deploy applications.

Simplified administration

IBM appreciates the skills gap that may exist for new system administrators to IBM Z. The z14 Model ZR1 supports several key enhancements to the Hardware Management Console (HMC) to close this gap and provide a more industry standard look/feel to administrator functions.

The Manage System Time task replaces the System (sysplex) Time task on the HMC. The new task provides a simplified workflow for system time management including improved help tools such as inline definitions of technical terms, visualization representation of configuration plans and a single point of system time management for multiple systems.

Dynamic I/O for Standalone Coupling Facility eliminates the client workload disruption caused by needing to perform CEC IMLs to make dynamic I/O configuration changes involving standalone Coupling Facilities in a parallel sysplex environment. Improves client workload availability and minimizes the risks associated with disruptive changes.

A new mobile application interface will be provided for the HMC on systems including z14, z13 and IBM z13s. The mobile application will allow HMC users to securely monitor and manage systems from anywhere. iOS and Android HMC Apps will be available to provide system and partition views, the ability to monitor status and hardware and operating system messages, and the ability to receive mobile push notifications from the HMC using the existing zRSF (IBM Z Remote Support Facility) connection. IBM continues to provide improvements in the areas of I/O, security, system concurrency, user experience, and HMC Mobile.

Colocation of Linux on IBM Z and z/OS for performance and efficiency

The z14 Model ZR1 provides a secure, massive capacity Linux platform that can be deployed as a standalone server, or side-by-side with z/OS or z/VSE or z/TPF environments for easy integration on a single physical server. The result—the infrastructure benefits from tight data and application co-location connecting "system of record" and "system of engagement", thus benefiting in operational efficiency.

IBM z/VM provides high levels of extreme security, scalability, agility, and efficiency, creating opportunities for cost savings while providing a robust foundation for cloud computing. z/VM virtualization technology is designed to run hundreds to thousands of Linux servers on a single Z server with the highest degrees of efficiency, elasticity, and security. Real memory support in z/VM 6.4 and 7.1, for up to 2 TB per z/VM logical partition allows higher levels of workload consolidation, massive growth in memory-intensive applications and superior levels of elasticity for workload spikes. Features in IBM Wave for z/VM further simplify z/VM and Linux guest management throughout the enterprise. z/VM Continuous Delivery model provides a new way to deliver z/VM capabilities, allowing for a faster adoption and benefit to businesses.

Linux on IBM Z on the IBM z14 Model ZR1 offers greater flexibility, higher asset utilization through SaaS and enhanced deployment capabilities to help deliver more Linux workload capacity with less risk leveraging all the power of open standards and technologies—critical and

valuable for cloud environments.

Designed for cloud workloads

As business technology needs evolve to compete in today's digital economy, IBM stands ready to help with intelligent, robust and comprehensive solutions. The new IBM z14 Model ZR1 offers a new flexible infrastructure that supports existing Z environment and is ready to securely and aggressively participate in a cloud data center. The z14 Model ZR1 delivers the power and speed users demand, the security users and regulators require, the operational efficiency that maximizes the bottom line and a new lower cost of entry for Z businesses.

[1] Based on preliminary internal measurements and projections and compared to the z13s. Official performance data will be available upon announce. Results may vary by customer based on individual workload, configuration and software levels. Visit LSPR website for more details at: **https://www-304.ibm.com/servers/resourcelink/lib03060.nsf/pages/lsprindex**

[2] IBM's statements regarding its plans, directions, and intent are subject to change or withdrawal without notice at IBM's sole discretion.

[3] Based on preliminary internal IBM lab measurements on a stand-alone IBM z14 dedicated system in a controlled environment and compared to the IBM z13. Results may vary.

[4] IBM is working with the Linux distribution partners to get the functionality included in their distribution for Linux on IBM Z.

[5] This response time estimate is based on IBM internal measurements and projections that assume 75 percent or more of the workload response time is associated with read DASD I/O and the storage system random read cache hit ratio is above 80 percent. The actual performance that any user will experience may vary.

IBM z14 Model ZR1 at a glance		
Processor Core Types: CP / IFL / ICF / zIIP* / Standard SAP(s) / Additional/Optional SAP(s) / Spares		
	Minimum	Maximum
Max4	$0^{\dagger}$ / $0^{\dagger}$ / $0^{\dagger}$ / 0 / 2 / 0 / 1	4 / 4 / 4 / 2 / 2 / 2 / 1
Max12	$0^{\dagger}$ / $0^{\dagger}$ / $0^{\dagger}$ / 0 / 2 / 0 / 1	6 / 12 / 12 / 8 / 2 / 2 / 1
Max24	$0^{\dagger}$ / $0^{\dagger}$ / $0^{\dagger}$ / 0 / 2 / 0 / 1	6 / 24 / 24 / 12 / 2 / 2 / 1
Max30	$0^{\dagger}$ / $0^{\dagger}$ / $0^{\dagger}$ / 0 / 2 / 0 / 1	6 / 30 / 30 / 12 / 2 / 2 / 1
Channels		
	FICON Express16S+ / FICON Express16S§ / FICON Express8S§ / OSA-Express7S 25 GbE / OSA-Express6S / OSA-Express5S§ / OSA-Express4S 1000-BaseT§	
Max4	Maximum features**: 16 / 16 / 16 / 16 / 16 / 16	
Max12	Maximum features**: 32 / 32 / 32 / 32 / 32/ 32	
Max24, Max30	Maximum features**: 64 / 64 / 64 / 48 / 48 / 48	
HiperSockets	Up to 32 high-speed "virtual" Local Area Networks	
IBM zHyperLink		
IBM zHyperLink Express	16 features** - can be shared by multiple LPARs	
Coupling Links		
IC maximum	32	
ICA SR		
Max4	Maximum features: 2**	
Max12	Maximum features: 4**	
Max24, Max30	Maximum features: 8**	
Coupling Express LR maximum	16 features**	
Cryptography		
Crypto Express6S / Crypto Express5S§	Minimum 0, then 2, then up to 16 features	
Compression Acceleration		
zEDC Express	8 features – minimum recommended is 2	
RDMA over Converged Ethernet (RoCE)		
10 GbE RoCE Express2, 10 GbE RoCE Express§§, 25 GbE RoCE Express2	4 features** – minimum recommended is 2	
Processor Memory		
	Minimum	Maximum
Max4	64 GB	2 TB††
Max12	64 GB	4 TB
Max24, Max30	64 GB	8 TB
IBM Virtual Flash Memory	Min: 0 Max: 2 TB (ordered 0 – 4, in increments of 512 GB)	

Upgradeability	Upgradeable within the z14 ZR1 family Upgradeable from IBM z13s
Supported Operating Systems	
z/OS	z/OS V2.3 z/OS V2.2 z/OS V2.1 z/OS V1.13 (compatibility only) Available via IBM Software Support Services
Linux on IBM Z	Canonical, Red Hat and SUSE; for the minimum and recommended levels see IBM Tested platforms page: **ibm.com**/systems/z/os/linux/resources/testedplatforms.html
z/VSE	z/VSE V6.2 z/VSE V6.1 z/VSE V5.2
z/TPF	z/TPF 1.1
Supported Hypervisors	
z/VM	z/VM 6.4 z/VM 7.1
KVM	KVM offered with the Linux distributions

* If ordering a zIIP, one or more general purpose processor (CP) per the specialty engine is required. IBM has modified the ratio of zIIP to CPs to be 2:1. Up to two zIIP processors may be purchased for every general-purpose processor purchased on the server.

† There must be at least one CP, IFL or ICF ordered on the server. No IFL is required unless ordering an IFL only server—model capacity identifier A00. No ICF is required unless ordering an ICF only server—model capacity identifier A00. If you order a A00 no CP is orderable.

§ Carry forward only

** Two ports per feature

†† Provides the minimum physical memory required to hold base purchase memory plus 64 GB HSA

§§ When RoCE Express is carried forward and used in combination with a RoCE Express2 the maximum combination cannot exceed 4 features

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 an IBM z14 solution optimized for the needs of your business.

For more information

To learn more about the z14 Model ZR1, please contact your IBM representative or IBM Business Partner, or visit the following website: **ibm.com/marketplace/z14**

Additionally, IBM Global Financing provides numerous payment options to help you acquire the technology you need to grow your business. We provide full lifecycle management of IT products and services, from acquisition to disposition. For more information, visit: **ibm.com/financing**

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