

IBM z14 (z14)

Highlights

- Pervasive encryption offers a simplified way to protect data
 - Improved performance in a single footprint
 - More cores, memory, and enhanced accelerators
 - Improved response times with new IBM zHyperLink
 - Mobile push notifications and remote monitor and management of HMC
 - Open, scalable, connected
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No organization on the planet can escape the effects of today's digital transformation. Data and transaction volumes are exploding. Workload complexity is skyrocketing. Customers want 24x7 access from any device, anywhere. The result is a massive demand for access to the data, creation of new services using the data and development of individualized customer experiences. In addition, organizations in every industry and sector must secure the growing data and comply with increasingly intricate regulations. Ensuring quality in every interaction and transaction builds trust that is at the core of every relationship with clients and partners.

The IBM z14 (z14) was designed as the infrastructure to trust in the digital economy. It delivers function and capabilities to meet the demands for new services and better customer experiences, while securing the growing amounts of data and complying with increasingly intricate regulations. The IBM z14 can create the foundation for better business partnerships.

Achieving pervasive encryption

Until today encryption policies were based on selective encryption—manual selection of the most critical data. Development of a comprehensive approach to data protection requires a large investment in time and money. Decisions were made on where to execute, what is the impact to service level agreements, who is responsible, and how extensive is the plan for encryption. The IBM z14 introduces a new approach. IBM z14 allows business to defend and protect critical assets with unrivaled encryption and intelligent data monitoring—without compromising transactional throughput or response times. Most importantly, there are no application changes. We call this pervasive encryption.

By encrypting as much of your data and transactional pipeline as possible, you can reduce potential data breach risks and financial losses—and comply with complex regulatory mandates. IBM z14 pervasive encryption capabilities give you a transparent and consumable approach to encrypt virtually all of your in-flight and at-rest data. Using simple policy controls¹, z14 pervasive computing streamlines data protection for mission critical datasets.



IBM z14

Differentiated value at the core

The new 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 results from innovations in the microprocessor design, driven by tight collaboration across hardware, firmware, and software development. These innovations include:

- IBM Z has redesigned the cache architecture with 1.5x more on-chip cache per core compared to the IBM z13 (z13). 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 offers a boost for traditional workloads using decimal operations (i.e. COBOL 6.2, PL/I 5.2) and new application like analytics (i.e. Apache Spark 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 and 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 improves throughput up to 25 percent for an IFL or zIIP to benefit exploiters¹. SMT has been extended to support the dedicated I/O processors called System Assist Processors (SAPs).
- 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 future² which can also take advantage of the compression co-processor to support index compression (using a new compression algorithm which preserves ordering of data) and enhanced data compression (using Huffman coding). These features 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. The performance of critical encryption functions has been improved by 2X or more compared to z13, and is a key element of the pervasive encryption capabilities of the z14 platform.
- Each z14 can have up to 32 TB memory – 3X the memory on a z13. 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.

Through these and other design innovations the z14 deliver 10 percent more performance per core than z13³. With up to 170 configurable cores the z14 offers up to 35 percent more total capacity in a single footprint compared to a z13. The z14 can scale to securely support the digital engagement that is accelerating as business executes on digital transformation. The amount of work generated by of mobile, cognitive, and Internet of Things (IoT) are all requiring business to have greater scalability.

The z14 offers up to 32 TB of Random Array of Independent Memory (RAIM) memory to support new workloads, data-in-memory applications, and can be efficiently used to process huge amounts of information for real-time business insights. Large memory can aid compression by providing large buffers to stage processing. Sizeable z/VM consolidations can use large memory to provide a higher ceiling for vertical scale needs.

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. The z14 is designed with I/O options to help access, share, analyze and protect data.

High-speed connectivity to your 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 analytic and mobile workloads.

IBM zHyperLink Express, a direct connect short distance, IBM Z I/O adapter offering extremely low latency connectivity to FICON storage systems. Working in conjunction with your 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 changes⁴. 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 OSA-Express6S feature is available for direct connection to the network. The new OSA can optimize work and improve z/OS processing with support for Inbound Workload Queuing for IPSec.

The new OSA-Express 7S 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.

Replacing the 10 GbE RoCE Express feature, the 10 GbE RoCE Express2 continues to augment IBM Z server-to-server Shared Memory Communications (SMC-R). SMC-R is designed to take advantage of high speed protocols and direct memory placement of data for faster communications versus consuming large amounts of TCP/IP resources. The RoCE Express² feature provides increased virtualization (sharing capability) allowing RoCE to be extended to more workloads by allowing additional virtual functions (VFs) per physical port.

The z14 continues to support Shared Memory Communications—Direct Memory Access (SMC-D) to improve memory communication between logical partitions on a single server. SMC-D optimizes z/OS for improved performance in “within-the-box” communications versus standard TCP/IP HiperSockets or Open Systems Adapter.

A new 25GbE Express2 with z14 GA2 code now allows for exploitation of routable RoCE and better adapter sharing. This could provide flexibility for clients to consolidate adapters or increase overall speed, while still seeing high reliability and performance established on prior adapters.

The IBM z14 embraces application programming interfaces (APIs) to exploit the vast amounts of new data available today. APIs enable collaboration by connecting Z applications with mobile and cloud applications and empowering application developers, even those with no IBM Z skills, to continuously and rapidly build, refine and deploy applications.

Changing the game in security

The performance enhancements on the IBM z14 make pervasive encryption achievable that changes the security game. The enhanced performance of on-chip cryptographic coprocessors as well as the new Crypto Express6S feature are the keys to enabling pervasive encryption.

The Central Processor Assist for Cryptographic Function (CPACF), standard on every core, provides the dramatic improvements in hardware acceleration that make 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.

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 controls¹. 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 expects⁵ 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 z/OS 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 CF5. 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 External 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 z14, 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.

Simplification of the HMC

IBM appreciates the skills gap that may exist for new system administrators to IBM Z. The z14 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.

On the HMC, a new masthead with favorites and search controls will help administrators quickly find and launch tasks. The tasks themselves will now open in tabs within the user interface (instead of separate browser windows) to make finding and managing running tasks easier.

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.

There are multiple new security features in the HMC including Multifactor Authentication. If Multifactor Authentication is selected for a given user, that user will now be required to enter a second authentication utilizing a secret key provided per HMC user.

A new mobile application interface will be provided for the HMC and 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 (Z Remote Support Facility) connection. IBM continues to provide improvements in the areas of I/O,

security, system concurrency, user experience, and HMC Mobile.

Java on the mainframe

The z14 has several new hardware features and 50-plus new instructions co-designed to support Java. These new features include improved throughput on zIIP with SMT and up to 32 TB of available memory. It also encompasses enhancements to the Crypto Express6S for improved performance, exploitation of the new Galois Counter Mode (GCM) encryption, and exploitation of SIMD instruction enhancements that can help improve performance for Java-based applications. The new z14 introduces Guarded Storage Facility on the z14 can help support the reduction in program pauses during Java Garbage Collection (pause-less garbage collection).

These enhancements on IBM Z demonstrate IBM's ongoing investment in Java. Application developers can build secure services with Java, Node.js or Swift and co-locate them with their data to leverage the performance, scalability, and reliability of z14.

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

The z14 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—your infrastructure benefits from tight data and application co-location connecting “systems of record” and “systems of engagement”, thus benefiting in performance and operational efficiency.

IBM Dynamic Partition Manager has made a statement of direction to support extended county key data (ECKD) storage devices² is available on z14. Administrators can configure system storage connections that are consistent and valid, and can orchestrate partition storage resources without requiring insights into cabling and protocols.

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 Z on the IBM z14 gives you greater flexibility, higher asset utilization through SaaS and enhanced deployment capabilities to help deliver more Linux workload capacity with less risk—valuable for cloud environments.

IBM z14 optimized for a trust economy

As your business technology needs evolve to compete in today's digital economy, IBM stands ready to help with intelligent, robust and comprehensive technology solutions. The IBM approach integrates server, software and storage solutions to ensure each member of the stack is designed and optimized to work together. The new IBM z14 leads that approach—delivering the power and speed users demand, the security users and regulators require and the operational efficiency that maximizes your bottom line.

¹**IBM z/OS 2.3 Preview Announcement Letter**

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 measurements and projections and compared to the z13. Results may vary by customer based on individual workload, configuration and software levels. Visit LSPR website for more details at:

<https://www.ibm.com/servers/resourcelink/lib03060.nsf/pages/lspindex>.

⁴ 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.

⁵ IBM is working with the Linux distribution partners to get the functionality included in their distribution for Linux on IBM Z.

IBM z14 at a glance		
Processor Core Types: CP / IFL / ICF / zIIP* / Standard SAP(s) / Additional/Optional SAP(s) / Spares		
Model	Minimum	Maximum
M01	0† / 0† / 0† / 0 / 5 / 0 / 2	33 / 33 / 33 / 22 / 5 / 4 / 2
M02	0† / 0† / 0† / 0 / 10 / 0 / 2	69 / 69 / 69 / 46 / 10 / 8 / 2
M03	0† / 0† / 0† / 0 / 15 / 0 / 2	105 / 105 / 105 / 70 / 15 / 12 / 2
M04	0† / 0† / 0† / 0 / 20 / 0 / 2	141 / 141 / 141 / 94 / 20 / 16 / 2
M05	0† / 0† / 0† / 0 / 23 / 0 / 2	170 / 170 / 170 / 112 / 23 / 16 / 2
Coupling Links		
IC maximum	32	
ICA SR maximum	80 ports [‡]	
Coupling Express LR maximum	64 ports	
12x HCA3-O InfiniBand maximum	32 ports [‡]	
1x HCA3-O LR InfiniBand maximum	64 ports [‡]	
Channels		
FICON Express16S+ / FICON Express16S [§] / FICON Express8S [§] / OSA-Express6S / OSA-Express5S [§] / OSA-Express4S 1000-BaseT [§] / OSA-Express7S 25 GbE	Maximum: 320 / 320 / 320 / 96 / 96 / 96	
IBM Virtual Flash Memory	1.5 TB / 6 TB (ordered 1-4)	
HiperSockets	Up to 32 high-speed “virtual” Local Area Networks	
Cryptography		
Crypto Express6S	Minimum order 2 features; Maximum order 16 features	
Crypto Express5S	Carry forward only minimum 2 features; maximum 16 features	
Compression Acceleration		
zEDC Express	16 – minimum recommended is 2	
RDMA over Converged Ethernet (RoCE)		
10 GbE RoCE Express2	8 – minimum recommended is 2 ^{††}	
10 GbE RoCE Express	Carry forward only; 16 – minimum recommended is 2 ^{††}	
25 GbE RoCE Express	16 - minimum recommended is 2	
IBM zHyperLink		
IBM zHyperLink Express	16 (32 ports) can be shared by multiple LPARs	
Processor Memory		
Model	Minimum	Maximum
M01	256 GB	8 TB**
M02	256 GB	16 TB
M03	256 GB	24 TB
M04	256 GB	32 TB

M05	256 GB	32 TB
Upgradeability	Upgradeable within the z14 M01-M04 family No upgrade into M05 Upgradeable from IBM z13 and IBM zEnterprise EC12	
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 Z	Canonical, Red Hat and SUSE with their latest supported releases and versions; for the minimum and recommended levels please 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 6.3	
KVM	KVM hypervisor which is offered with the following Linux distributions: SLES-12 SP2 or higher, and Ubuntu 16.04 or higher	

* 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 400. No ICF is required unless ordering an ICF only server—model capacity identifier 400. If you order a 400 no CP is orderable.

‡ N30 (i.e. 1 Drawer) Coupling Feature and Port Maximums:
ICA SR: 10 Features, 20 Ports
12X HCA3-O: 4 Features, 8 Ports
1X HCA3-O LR: 4 Features, 16 Ports

§ Carry forward only

** Provides the minimum physical memory required to hold base purchase memory plus 192 GB HSA

†† When RoCE Express is carried forward and used in combination with a RoCE Express2 then the maximum combination cannot exceed 8 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 IBM z14 (z14), please contact your IBM representative or IBM Business Partner, or visit the following website: [ibm.com/us-en/marketplace/z14](https://www.ibm.com/us-en/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](https://www.ibm.com/financing)



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