Introducing the IBM z14 Model ZR1, designed for the data-centric cloud ecosystem, with maximum security and enterprise server quality

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Table of contents

(Corrected on October 29, 2018)

The name of feature #0103 was corrected.

(Corrected on October 24, 2018)

The name of feature #0104 was corrected.

(Corrected on June 6, 2018)

Updates were made in the Description, Physical specifications, and Prices sections.

At a glance

 Top rule

Today's announcement extends IBM® Z leadership, delivering:

– A reimagined z14 entry model in an industry-standard frame form factor
– A platform that can deliver trusted digital experiences in a scalable, public, private, or hybrid cloud infrastructure
– New flexible options for all-in-one solutions that can be scaled quickly to deliver production and development features

To help businesses capitalize on new opportunities, IBM has taken the technologies introduced in the IBM z14 (z14) and reimagined them into a nimble new enterprise server, replacing prior systems such as z13s™, zBC12, and z114. The z14 Model ZR1 delivers high reliability capabilities in a smaller, industry-standard frame, with a lower cost of entry, that can easily partner with other platforms in a cloud data center.

The key value propositions of the z14 Models M01 - M05 are just as relevant in the new Model ZR1, including pervasive encryption. In an increasingly intricate world of regulatory requirements and external threats, the security of client data and mission-critical workloads is paramount. The z14 Model ZR1 can be the base for a securable, yet integrated cloud, taking advantage of features such as Central Processor Assist for Cryptographic Functions (CPACF), Crypto Express® 6S for FIPS-4 certified encryption key management, Trusted Key Entry (TKE) systems, or enhanced applications of Secure Service Containers that can soon include client applications. Valuable data assets on the IBM Z® can quickly be integrated for maximum data intelligence, actionable insights, and predictive behavior for both systems of records and systems of client engagement.

Incorporating feedback from close client collaboration, the z14 Model ZR1 is designed into an industry-standard 19-inch rack form factor that is easily planned and installed into your data center. For clients familiar with prior servers, this revised footprint allows the server to be installed in significantly less space than prior offerings, using just two average data center tiles. The Model ZR1 is also based on power distribution units (PDUs), creating an opportunity to utilize common data center power drops while maintaining the redundant power, cooling, and line cords that are intrinsic to high-reliability IBM Z offerings. For clients with 32 or fewer I/O cards, there is also an option to allow a portion of the frame to house other switches, storage, or server components with a 16U Reserved space feature. This reserved space creates an option for client flexibility to create a single-frame ecosystem. With the reduced footprint cost, installability into virtually any existing data center, and flexible offerings, the Model ZR1 is a great fit for more locations than ever before.

Clients can also now take advantange of a number of features to ease application integration. Creating a hybrid cloud has never been easier, with scalability across LPARs and virtual servers, especially via Dynamic Partition Manager and Secure Service Containers. Empower your application developers -- even those with no IBM Z skills -- to quickly exploit the rich value in transactional data with the rapid API development and deployment that is so common in Linux® environments. For clients with significant IBM Z core applications, Application Discovery and Delivery Intelligence (ADDI) assists developers in visualizing and adjusting application endpoints and handling. Those same IBM Z core application users may also significantly reduce development costs with the new Software Container Pricing for z/OS®, which allows new workloads on specific addresses to be eligible for special development pricing and remain separate from production workload pricing.

With the IBM z14 Model ZR1 servers, you can rapidly develop and deliver high-quality services deployed on a trusted cloud infrastructure that is flexible, efficient, and resilient, and includes enhanced security features:

– The use of pervasive encryption for most extended-format data sets can help address compliance requirements around encryption of data on disk and tape devices. Based on experience from IBM Blockchain leadership, extended Secure

Service Container applications create an option for security within a Docker and Kubernetes based container environment requiring no application changes.
- New high-performance processors, large memory, and synchronous I/O to storage are designed to deliver significant performance improvements, driving faster user response times.
- New scale is designed to help you manage more workloads at less cost with increases in capacity per core and increases in single-system capacity.
- Developers and administrators, with no mainframe resources, can rapidly develop new services, as well as monitor and provision resources without the need for new specialized skills.
- Trusted insight is built into everything you do with advanced cognitive and analytics processing.

With IBM z14 servers, in the era of cognitive business, you can build trusted insight into everything you do for smart operations, intelligent transactions, and intuitive business processes. The IBM z14 family of servers provide the ideal hardware platform for running these cognitive and analytical workloads.

- Clients can build new cognitive and analytical applications by taking advantage of data natively created on IBM Z using industry-standard tools like Apache Spark.
- Clients can help enhance the productivity of data scientists and improve time to value of machine learning (ML). Deploying ML on IBM Z gains the benefits of data gravity, high security, and IBM Z resiliency.
- Integrated IBM Z data sources allow clients to capture new business value by leveraging insights from dark transactional data in their systems of insight.

The z14 Model ZR1 delivers high-reliability capabilities in an industry-standard footprint, with a low cost of enterprise-class entry. The Model ZR1 can easily partner with other platforms in a cloud data center, while supporting pervasive encryption technologies and speed and performance improvements over prior generations. The z14 Model ZR1 servers provide the perfect platform to drive business opportunities for the next generation of industry leaders.

Back to topBack to top

Overview

Top rule

IBM z14 Model ZR1 extends the IBM Z leadership in securable and agile cloud capabilities

As businesses grow and evolve, their ability to simultaneously protect and capitalize on data is paramount to future success. Consumer, client, and partner expectations are growing. They demand security, transparency, and greater value in every interaction. The ability to rapidly derive actionable insights enables progressively smarter business decisions and improves user experiences, leading to new opportunities for consumers and clients alike.

These key foundations of business have been the drivers of transformational changes in the IBM z14 models, including the z14 Model ZR1. This announcement highlights not only the advances of the z14 in encryption and security technologies, but also the manner in which businesses of any size can realize the benefits of shared-everything scalability, capacity on demand, and flexibility across internal, external, and microservices platforms.

Back to topBack to top

Key prerequisites

Top rule

Refer to the Hardware requirements and Software requirements sections of this announcement.

Back to topBack to top

Planned availability date

Top rule

– May 31, 2018:
  - IBM z14 Model ZR1
  - Features and functions for the IBM z14 Model ZR1
  - 2965 Models N10 and N20 upgrades to IBM z14 Model ZR1
  - Field-installed features and conversions on IBM z14 Model ZR1 that are delivered solely through a modification to the machine's Licensed Internal Code (LIC)
  - HMC (#0082)
  - HMC Rack Mounted (#0083)
  - TKE (#0086)
  - TKE Rack Mounted (#0085)
  - TKE Smart Card Reader (#0891)
  - TKE Additional Smart Cards (#0892)
  - TKE 9.0 LIC (#0879)
  - HMC Table Top KMM (#0148) for z14 Model ZR1
  - TKE Table Top KMM (#0157) for z14 Model ZR1
– September 17, 2018:
  - MES features for IBM z14 Model ZR1

Schedule dates for orders will be based on sequence, parts availability, and customer requested arrival date.

Back to topBack to top

Description

Top rule

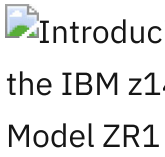
Introducing the new IBM z14 Model ZR1, designed for trusted digital experiences delivered through the cloud

The newest member of the IBM z14 product portfolio, the new z14 Model ZR1 delivers high-reliability, high-speed functions in a smaller, industry-standard frame, that easily partners with other platforms in a cloud data center. As part of the IBM Z portfolio, the z14 Model ZR1 provides a highly available platform that delivers differentiated value, designed to enable business growth, reduce cost, and protect existing investments.

Today's announcement extends IBM Z leadership with z14 ZR1, offering:

High-performance encryption for a pervasive encryption strategy

– IBM Z processor-based cryptography with the Central Processor Assist for Cryptographic Functions (CPACF)
– z/OS data set encryption and z/OS Coupling Facility encryption to help create an envelope of protection
– Support for dm-crypt on Linux on Z transparent file and volume encryption using industry-unique CPACF protected keys
– Trusted Key Entry (TKE) 9.0 Licensed Internal Code (LIC).



- Cryptographic performance with the Crypto Express6S (#0893).
- IBM Secure Service Containers, soon to be enhanced via integration with IBM Cloud Private, designed such that IBM, client, or third-party Docker and Kubernetes based applications can be securely deployed and encrypted in their own partitions without application changes.

Speed and scalability

- Economies of scale with next-generation simultaneous multithreading (SMT) for Linux and zIIP eligible workloads, new support for the I/O System Assist Processor (SAP), 2x AES performance over z13s, a True Random Number Generator with CPACF support, SHA3 support, and RSA/ECC acceleration.
- Java™ 8 SR5 performance support via Guarded Storage Facility with z/OS for reducing program pauses during Java garbage collection.
- New instructions in Single Instruction Multiple Data (SIMD) which are designed to give a performance boost for both traditional and new workloads.
- FICON® Express16S+ (#0427, 0428) which is designed with a boost in I/O rates and a reduction in single stream latency to help absorb large application and transaction spikes driven by large, unpredictable analytic and mobile workloads.
- Improved compression ratio (using Huffman coding) and order-preserving compression for the on-chip compression coprocessor which results in fewer CPU cycles to enable further compression of data, improving memory, transfer, and disk efficiency.
- 30 cores available for client configuration (versus 20 on z13s), with faster uniprocessor performance as compared to z13s.
- Up to 8 terabytes (TB) of available Redundant Array of Independent Memory (RAIM) real memory per server to help improve transaction response times, lower CPU costs, simplify capacity planning, enlarge in-memory buffer pools, and ease deploying memory-intensive workloads.
- 2x more on-chip cache per core, compared to z13s, to minimize memory waits while maximizing the throughput of concurrent workloads -- perfectly optimized for data serving.
- 10 GbE RoCE Express2 with 4x more virtual functions per adapter and a performance improvement.
- Coupling Express LR (#0433), for long reach coupling connectivity, in addition to continued support of Integrated Coupling Adapter Short Reach (ICA-SR) (#0172). These adapters replace older-generation 12x and 1x InfiniBand HCA3-O coupling links.
- IBM Virtual Flash Memory (#0614), the replacement for the Flash Express features (#0402, #0403), offering up to 2.0 TB of virtual flash memory for improved application availability and to handle paging workload spikes.
- IBM zHyperLink Express (#0431), which uses a direct-connect short-distance link (zHyperLink) to deliver low-latency connectivity between z14 and FICON storage systems. Working in conjunction with a corresponding DS8000® Systems Storage zHyperLink feature and an exploiter such as DB2® 12 with a PTF, zHyperLink Express delivers the next generation of I/O for IBM Z storage.

Simplified approaches

- IBM Hardware Management Console (HMC) 2.14 with GUI updates to improve workspace and manage system time. New security features include Multifactor Authentication and a new HMC Mobile application for monitor and recover action controls.
- IBM Dynamic Partition Manager enhancements which provide a consumable IBM Z experience, with visual representations of partitions and options for clear understanding of new and existing Linux on IBM Z, and z/VM® partitions.
- Optimized z/OS platform for IBM Open Data Analytics for z/OS, and portable analytics, such as IBM DB2 Analytics Accelerator (IDAA), for integrating real-time data intelligence and operational decision making as transactional data is being created.
- Container Pricing for z/OS that allows for development and testing of new workloads to be managed separately from production workload, thereby increasing access and predictability for new deployment activities.
- Ongoing collaboration with a wide network of partners across the ecosystem to take advantage of opportunities like Docker on IBM Z.
- Insight to your full portfolio using Application Discovery and Delivery Intelligence (ADDI) to pinpoint opportunities for efficiency in existing code.

Reliable, flexible hardware for cloud data center needs

- Industry-standard 19-inch rail-to-rail frame width, with 240 V range power distribution unit (PDU) support for ease of data center installation planning.
- Features allowing for either top exit or bottom exit cables, independent of raised floor or non-raised floor, offering flexible possibilities for data center layouts.
- ASHRAE class A3 for robustness, data center flexibility, and potential energy savings with a wider environmental envelope.
- A new 16U Reserved (#0617) hardware flexibility offering that allows clients with one or two PCIE+ drawers to reserve 16U of space for other switches, servers, or storage that fit into the 19-inch rack space and meet requirements of the Installation Manual for Physical Planning (IMPP) for z14 Model ZR1. This feature is perfect for small data center footprint requirements, or high-resiliency, high-performance, cloud-in-a-box configurations.

– Upgradability to z14 ZR1 from IBM z13s™, with machine serial number preservation and ability to carry forward most z13® and z13s level I/O adapters.

The performance advantage

IBM's Large Systems Performance Reference (LSPR) method is designed to provide comprehensive z/Architecture® processor capacity ratios for different configurations of Central Processors (CPs) across a wide variety of system control programs and workload environments. For ultimate flexibility in capacity, the z/Architecture processor capacity indicator is defined with up to 6 CPs, with 26 segment slices (A-Z notation), where segments run A01 - Z06.

In addition to the general information provided for z/OS V2.3, the LSPR also contains performance relationships for z/VM and Linux operating environments.

The capacity per processor engine of a z14 ZR1 (3907) processor is expected to provide approximately a 10% increase over that of a z13s (2965), with some variation, based on workload and configuration. The IFL and zIIP processors on the z14 ZR1 provide an optional z14 ZR1 multithreading technology capability; with the multithreading function enabled, the performance capacity of an IFL or zIIP is expected to typically be up to 25% higher than without the multithreading function enabled.

The LSPR contains the Internal Throughput Rate Ratios (ITRRs) for z14 ZR1 and the previous-generation IBM Z processor families based upon measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput that any user may experience will vary depending upon considerations such as the level of multiprogramming in the user's job stream, the I/O configuration, the workload processed, and the LPAR configuration. Therefore, no assurance can be given that an individual user will achieve throughput improvements equivalent to the performance estimates stated.

For more detailed performance information, consult the Large Systems Performance Reference (LSPR) available at the Resource Link® website.

Next-generation availability

The z14 processor builds upon the Reliability, Availability and Serviceability (RAS) of the IBM Z family, with the following RAS improvements:

– z14 Level 3 cache enhancements using powerful symbol ECC that now spreads cache data over multiple physical cache arrays. This enables the detection and correction of multibit errors, making the Level 3 cache more resilient and fault tolerant.
– Preemptive DRAM marking added to main memory to isolate and recover failures more quickly.
– Improved small array error handling in the processor cores.
– Additional error thresholding to the processor core to isolate "sick but not dead" failure scenarios.
– An increase in the number of "Resource Groups" (from 2 to 4) to reduce the impact of firmware updates and failures.

Common Criteria Evaluation Assurance Level 5+ (EAL 5+) certification

The z14 ZR1 is designed for Common Criteria Evaluation Assurance Level 5+ (EAL5+) certification for security of logical partitions. This means that the z14 ZR1 is designed to prevent an application running on one operating system image on one LPAR from accessing application data running on a different operating system image on another LPAR on the server.

Common Cryptographic Architecture (CCA) enhancements

PCI PTS HSM compliance

The Crypto Express6S coprocessor with CCA 6.0 is designed to comply with the Payment Card Industry (PCI) Pin Transaction Security (PTS) Hardware Security Module (HSM) standard. PCI security standards are developed by the Payment Card Industry Security Standards Council to help ensure security in the payment card industry with guidance and direction to HSM vendors to help meet the security needs of the financial payments industry.

The requirements in PCI PTS HSM standards are intended to enhance security for operations that process sensitive data with requirements in key management, HSM API functions, device physical security, controls during manufacturing and delivery, device administration, and a number of other areas.

The Crypto Express6S manufacturing and delivery processes are enhanced with z14 to comply with PCI PTS HSM and with CCA 6.0 introduce several new capabilities both for PCI PTS HSM compliance mode and for general use:

1. A **new derived key hierarchy** so that PCI PTS HSM compliance-tagged key tokens may be used alongside existing keys and services in a nondisruptive fashion -- with existing master keys.
2. **Nondisruptive transition to PCI PTS HSM mode:** Using TKE 9.0, a domain of the Crypto Express6S coprocessor with CCA 6.0 may be placed in PCI PTS HSM compliant mode with no disruption to other domains or to normal/legacy services

using the domain that is moved to PCI PTS HSM compliant mode.

3. **Secure audit log** hosted from the Crypto Express6S coprocessor with CCA 6.0. Required by the PCI PTS HSM standard, this audit log covers all administrative actions and is managed by TKE 9.0. The new audit log is nondisruptive to normal application processing for domains where it is active.
4. **Secure public key infrastructure:** The Crypto Express6S coprocessor with CCA 6.0 adds native X.509 certificate support including PKCS #10 certificate request generation through a new PKI hosted from the coprocessor. Trust chain certificates are managed via TKE 9.0.
5. **Migration planning assistance** through active application reporting. The Crypto Express6S coprocessor with CCA 6.0 can report in real time what operations and keys will need attention if they are planned for use with PCI PTS HSM compliant-tagged keys. Report details and activity depend on host access library/operating system configuration.
6. **CPACF exportable AES cipher key** support added for AES cipher keys created using new options in CCA 6.0.

Trusted Key Entry (TKE) 9.0 Licensed Internal Code (LIC)

The following functions are planned to be supported in the TKE 9.0 level of LIC:

- **Crypto Express6S coprocessor support:** TKE 9.0 is required for managing Crypto Express6S cryptographic coprocessors and manages them through the same Crypto Module notebook functions as previous generations of Cryptographic modules.
- **Key material copy to alternate zone:** TKE 9.0 allows you to copy key material from smart cards in one TKE zone to smart cards in another zone. You might have old 1024 bit strength TKE zones, and may wish to move or copy the key material in those zones into a new, stronger TKE zone. To use this new feature you create new TKE and/or EP11 smart cards on your TKE 9.0 system. You enroll the new TKE and/or EP11 smart cards in an alternate zone. This allows you to copy smart card content from a smart card enrolled in the alternate zone.
- **Save TKE data directory structure with files to USB:** TKE data can be saved to, or restored from, removable media in the same directory structure they were found on the TKE.
- **Create key parts without opening a host:** The TKE application now has the ability for administrators to create key parts without opening a host. This allows the key administrator to create key parts while being offline or before any hosts are defined. This feature can be found in the TKE application under the **Utilities > Create CCA key parts** pull-down menu.
- **New TKE Audit Log application:** There is a new **TKE Audit Log** application available for the Privileged Mode Access ID of AUDITOR. This application provides a new, easy-to-use interface to view the TKE workstation security audit records from the TKE workstation.
- **Heartbeat audit record:** TKE workstations cut an audit record when the TKE boots or when no audit events have occurred during a client-configured duration of time. The record shows the serial number of the TKE local crypto adapter and indicates if the local crypto adapter has been changed since the last check.
- **Performance improvements for domain groups:** With CCA 5.3 and later firmware levels, and TKE 9.0, performance may be improved for operations performed with large domain groups. For example, consider a domain group of 85 domains and a Clear New Master Key Register operation is performed from the TKE. The number of TKE commands issued to the Crypto Express coprocessor from the TKE will be reduced from 85 to 1, thereby reducing the time to complete the operation.
- **Master key part entry on EP11:** Known master key parts can now be entered and saved on smart cards for coprocessors configured in EP11 mode using TKE 9.0. This enables key custodians to manage EP11 master key parts in a fashion that is consistent with coprocessors configured in CCA mode.
- **Smart card readers:** With TKE 9.0, if you have HID/OMNIKEY smart card readers you may continue to use them. See the TKE User's Guide for more detailed smart card reader information.
- **New certificate manager for domains:** Every domain will now have the ability to manage a set of parent X.509 certificates for validating operating X.509 certificates used by applications running in the domain. The Crypto Express6S with CCA 6.0 is designed to meet the PCI-HSM PIN Transaction Security v3.0, 2016 standard.
  The following features are related to support for the Crypto Express6S with CCA 6.0.

- **Domain mode management:** With CCA 6.0, individual domains are in one of the following modes:
  - Normal mode
  - Imprint mode
  - Compliant mode

  Imprint and compliant modes were added to help clients migrate to a PCI-HSM compliant mode and meet PCI-HSM PIN Transaction Security v3.0, 2016 requirements. TKE is required to manage Host Crypto Module domains in imprint and compliant mode.

- **Set clock:** With TKE 9.0, you now have the ability to set the host crypto module's clock. The clock must be set before a domain can be placed in imprint mode.
- **Domain-specific Host Crypto Module audit log management:** Domains in imprint mode or compliant mode on a Crypto Express6S maintain a domain-specific module audit log. The TKE provides a feature for downloading the audit records so they can be viewed.
- **Domain-specific roles and authorities:** Domains in imprint mode or compliant mode on a Crypto Express6S must be managed using domain-specific roles and authorities. The TKE provides new management features for the domain-specific roles and authorities. The roles are subject to forced dual control policies which prevent roles from being able to both issue and cosign a command. Refer to the TKE User's Guide for detailed information on how to manage imprint and compliant mode domains.
- **Setup PCI environment wizard:** To help simplify the management of a PCI-compliant domain, the TKE now provides a setup wizard that will create a minimum set of required dual control roles and authorities needed to manage a PCI-compliant

domain. See the TKE User's Guide for detailed information on how to manage imprint and compliant mode domains.

FICON Express16S+

With the introduction of **FICON Express16S+ on the z14,** you now have additional growth opportunities for your storage area network (SAN).

FICON Express16S+ supports a link data rate of 16 gigabits per second (Gbps) and autonegotiation to 4 or 8 Gbps for synergy with existing switches, directors, and storage devices. With support for native FICON, High Performance FICON for Z (zHPF), and Fibre Channel Protocol (FCP), the z14 server enables you to position your SAN for even higher performance -- helping you to prepare for an end-to-end 16 Gbps infrastructure to meet the lower latency and increased bandwidth demands of your applications.

The new FICON Express16S+ adapter will work with your existing fiber optic cabling environment, both single mode and multimode optical cables. The FICON Express16S+ feature running at end-to-end 16 Gbps link speeds will provide reduced latency for large read/write operations and increased bandwidth compared to the FICON Express8S feature.

Increased throughput for the zHPF protocol: In laboratory measurements using FICON Express16S+ in an IBM z14 Model ZR1 with the zHPF protocol and small data transfer I/O operations, FICON Express16S+ operating at 16 Gbps achieved a maximum of 300,000 IOs/sec. In laboratory measurements, using FICON Express16S+ in an IBM z14 Model ZR1 with the zHPF protocol and a mix of large sequential read and write data transfer I/O operations, FICON Express16S+ operating at 16 Gbps achieved a maximum throughput of 3200 MB/sec (reads + writes) compared to a maximum of 2560 MB/sec (reads + writes) achieved with FICON Express16S operating at 16 Gbps. This performance data was measured in a controlled environment running an I/O driver program under z/OS. The actual throughput or performance that any user will experience will vary depending upon considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload processed.

Increased throughput for the FCP protocol: A FICON Express16S+ feature, when defined as CHPID type FCP, conforms to the Fibre Channel Protocol (FCP) standard to support attachment of SCSI devices, to complement the classical storage attachment supported by FICON and zHPF channels. In laboratory measurements, using FICON Express16S+ in a z14 with the FCP protocol for small data transfer I/O operations, FICON Express16S+ operating at 16 Gbps achieved a maximum of 380,000 IOs/sec, compared to the maximum of 110,000 IOs/sec achieved with FICON Express16S operating at 16 Gbps. In laboratory measurements, using FICON Express16S+ in a z14 with the FCP protocol and FICON Express16S+ operating at 16 Gbps, FICON Express16S+ achieved a maximum throughput of 3200 MB/sec (reads + writes). This represents approximately a 25% increase in throughput. The actual throughput or performance that any user will experience will vary depending upon considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload processed.

The FCP protocol is supported by z/VM, z/VSE®, and Linux on IBM Z. See the Software requirements section.

Channel subsystem (CSS) scalability: The z14 ZR1 server, like the IBM z13s server, has support for 3 logical channel subsystems (LCSSs) which are required to support the 40 LPARs for z14 ZR1.

OSA-Express6S - an Ethernet technology refresh

A new generation of Ethernet features is being introduced for use in the PCIe+ I/O drawer and continues to be supported by the 16 GBps PCIe Gen3 host bus. This is an introduction of the full family of features -- 1000BASE-T Ethernet for copper environments, in addition to 10 Gigabit Ethernet (10 GbE) and Gigabit Ethernet (GbE) for single mode and multimode fiber optic environments. The performance characteristics are comparable to the OSA-Express5S features. They also retain the same form factor and port granularity -- two ports per feature for the 1000BASE-T Ethernet and Gigabit Ethernet features, and one port per feature for the 10 Gigabit Ethernet features.

The OSA-Express6S family of features (#0422, #0423, #0424, #0425, #0426) is exclusive to the z14. They are supported by z/OS, z/VM, z/VSE ®, z/TPF, and Linux on IBM Z. See the Software requirements section.

IBM Virtual Flash Memory

IBM Virtual Flash Memory (VFM) is the replacement for the Flash Express features (#0402, #0403) which were available on the IBM zBC12 and IBM z13s. No application changes are required to change from IBM Flash Express to VFM.

IBM Virtual Flash Memory is designed to help improve availability and handling of paging workload spikes when running z/OS V2.3, V2.2, or V2.1, or on z/OS V1.13*. With this support, z/OS is designed to help improve system availability and responsiveness by using VFM across transitional workload events such as market openings, and diagnostic data collection. z/OS is designed to help improve processor performance by supporting middleware exploitation of pageable large (1 MB) pages.

Using VFM can help availability by reducing latency from paging delays that can occur at the start of the workday or during other transitional periods. It is also designed to help eliminate delays that can occur when collecting diagnostic data during failures. VFM can also be used in Coupling Facility images to provide extended capacity and availability for workloads making use of WebSphere® MQ Shared Queues structures.

VFM can therefore help organizations meet their most demanding service level agreements and compete more effectively. VFM is designed to be easy to configure, and to provide rapid time to value.

* z/OS V1.13 has additional requirements. See the Software requirements section.

IBM Db2® Analytics Accelerator

IBM ® Db2 ® Analytics Accelerator is a high-performance component tightly integrated with Db2 for z/OS ® that transforms the mainframe into a highly efficient, hybrid transaction and analytic processing environment. It delivers high-speed processing for complex Db2 queries to support business-critical reporting and analytic workloads. Db2 Analytics Accelerator Version 7.1 supports deployment on the z14 ZR1. Deployment of the IBM Db2 Analytics Accelerator on IBM Z allows for deeper integration with the IBM Z infrastructure, leveraging IBM Z qualities of service, such as resiliency, high-availability, and security, as well as resource sharing.

IBM zHyperLink Express

IBM zHyperLink Express is a direct connect short distance extremely low latency IBM Z I/O adapter. The zHyperLink adapter works in conjunction with your existing FICON SAN infrastructure, a corresponding DS8K feature, and an exploiter such as Db2 12 with a PTF. For time-sensitive applications, the new zHyperLink infrastructure fosters a new I/O paradigm for IBM mainframes. zHyperLink can improve application response time significantly, cutting read I/O sensitive workload response time by up to 50% without requiring application changes. zHyperLink Express is a 2-port adapter which resides in the PCIe+ I/O drawer and supports direct connectivity to FICON storage systems at distances up to 150 m.

Note: This response time estimate is based on IBM internal measurements and projections that assume 75% 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%. The actual performance that any user will experience may vary.

Dynamic Partition Manager

Dynamic Partition Manager (DPM) provides simplified hardware and virtual infrastructure management, including partition lifecycle and integrated dynamic I/O management for Linux running in an LPAR, and under z/VM. Using DPM, an environment can be created, provisioned, and modified without disrupting running workloads, and monitored for troubleshooting. Previously, DPM only supported FCP storage. Enhancements to DPM provide support for FICON ECKD™ storage as well. Administrators can define, configure, provision, and manage both FCP and FICON ECKD storage in a simplified and consistent manner, without the need to understand underlying protocols during routine use. These enhancements include:

– Support for autoconfiguration of devices to simplify Linux operating system installation, where Linux distribution installers exploit function
– Secure FTP through HMC for booting and installing an operating system via FTP
– Support for OSA-Express6S, FICON Express16S+, Crypto Express6S, and RoCE Express2 adapters

A CPC can be configured in either the Dynamic Partition Manager mode or PR/SM™ mode. The mode is enabled prior to the CPC power-on reset (POR).

Dynamic Partition Manager mode requires two OSA-Express 1000BASE-T Ethernet features for primary and backup connectivity (OSA-Express6S 1000BASE-T Ethernet, #0426 or OSA-Express5S 1000BASE-T Ethernet, #0417), along with associated cabling (HW for DPM, #0016).

The IBM Secure Service Container

The IBM Secure Service Container intends to create a cohesive, integrated platform with IBM Cloud Private for hybrid and private cloud deployments on IBM Z and LinuxONE. Clients will be able to deploy containerized IBM middleware applications as well as utilize common management tooling for deploying homegrown or other third-party Docker and Kubernetes based applications.

IBM Secure Service Container is designed to support the deployment of software container technology without requiring any application changes, making it potentially one of the easiest methods to address access and security concerns. This is especially useful considering the regulatory focus on protecting critical data from internal and external threats. Support features (#0103 and #0104) will ensure that Secure Service Container applications run smoothly, whether you are deploying a single-use application or a variable-purpose application type.

The Secure Service Container will consist of both a firmware framework and a software framework.

The following is an enhancement to the IBM z14 Model ZR1 IBM Secure Service Container firmware framework:

- Simplification -- Dynamic Partition Manager support for dynamic resource management and creation of Secure Service Container LPARs without needing to re-IML.

The following are intended enhancements to the IBM Secure Service Container software framework:

- Security
  - Help enable secure boot of appliance via system unique key smart card access such that the Secure Service Container or system administrator cannot utilize privileged credentials to see or access the key.
  - Runtime and tamper protection via BTRFS Filesystems for root and data volumes.
- Appliance management
  - Support the addition of FCP (and ECKD) storage to different disk pools via the appliance UI.
  - Support network configurations managed by IPv4, IPv6, and VLAN configurations from the appliance UI.
  - Enable appliance updates including import from a prior, saved and exported configuration -- avoid losing configuration data (going back to a "Factory Install"-like state); particularly useful for blockchain, which typically utilizes many concurrently running instances.
  - Support different users and groups via Local LDAP server and UI management.
  - Support starting appliance installer from a running appliance without having to interface with the HMC.
- Usability
  - Avoid appliance spoofs by ensuring that a trusted and uniquely signed instance of an appliance is booted only in one LPAR, not multiple LPARs.

z/Architecture mode

As announced with Hardware Announcement 115-001, dated January 14, 2015, beginning with z14, all IBM Z environments will only support operating systems running in z/Architecture mode. This applies to operating systems running native on PR/SM as well as operating systems running as second-level guests. IBM operating systems that run in ESA/390 mode are either no longer in service or only currently available with extended service contracts, and they are not usable on systems beginning with z14. However, z14 does provide ESA/390-compatibility mode, an environment supporting a subset of DAT-off ESA/390 applications in a hybrid architectural mode.

All 24-bit and 31-bit problem state application programs originally written to run on the ESA/390 architecture will be unaffected by this change.

z/OS support for the z14 ZR1

New functions in z/OS continue to enhance the role of IBM Z, with support for the z14 and its role in helping you provide solutions for a trusted digital economy. Capabilities designed to optimize high availability, performance, security, and operational flexibility can help organizations to grow and to secure their most critical transaction environments.

In addition to base processor support, z/OS provides the support for these z14 functions and features as described in IBM Software Announcement 217-246, dated July 17, 2017, IBM z®/OS Version 2 Release 3 -- Engine for digital transformation:

- Improved cryptographic capabilities that can be leveraged to begin implementation of IBM's pervasive data encryption strategy.
- The IBM zHyperLink Express feature (also, see the "IBM zHyperLink Express " section of this announcement).
- Cryptography enhancements available with the Crypto Express6s feature.
- Asynchronous Memory Clear using System Assist Processors (SAPs).
- Additional new I/O attachment options including the OSA-Express6S, RoCE Express2, and FICON Express16S+ features.
- Coupling Facility Level (CFLEVEL) 22 and new coupling link features (also, see the "Parallel Sysplex® enhancements" section of this announcement).
- The Guarded Storage Facility, exploited by IBM SDK for z/OS, Java Technology Edition, Version 8 (5655-DGG).
- The Instruction Execution Protection Facility.
- IBM Virtual Flash Memory.
- IBM Db2 Analytics Accelerator (IDAA) for z/OS, working with DB2 V11.1 and z/OS V2.1 or later.

See the Software requirements section of this announcement for the minimum z/OS requirements for the z14 and its features.

z/VSE support for the z14 ZR1

z/Architecture support: Starting with z/VSE V5.2, z/VSE and its stand-alone utilities run entirely in z/Architecture mode.

In addition to base processor support, z/VSE 6.2 provides the support for these z14 functions and features as described in Software Announcement 217-203, dated October 10, 2017, IBM z/VSE V6.2:

- High Performance FICON for z Systems® (zHPF)
- Vector Facility for z/Architecture, also referred to as Single Instruction Multiple Data (SIMD)
- Improved cryptographic capabilities using the Crypto Express6S feature

Container Pricing for IBM Z

IBM introduced Container Pricing for IBM Z for qualified solutions running on IBM z13® and IBM z14 servers. Container Pricing provides simplified software pricing for qualified solutions, combining flexible deployment options with competitive economics that are directly relevant to those solutions.

Container Pricing can scale from collocated solutions within existing LPARs, through to separate LPARs, up to multiple-LPAR solutions, without directly impacting the cost of unrelated workloads.

Additionally, Container Pricing simplifies pricing and billing on the IBM Z platform, by superseding a number of existing price offerings and by fully automating the billing process.

IBM announced three solutions that are enabled with Container Pricing:

- The New Application Solution provides a highly competitive stand-alone priced offering for new z/OS applications, such as CICS® TS or WebSphere applications. The New Application Solution is the strategic replacement for the current zCAP and IWP priced offerings. See Software Announcement 217-519, dated November 14, 2017.
- The Application Development and Test Solution provides highly competitive stand-alone pricing for z/OS based development and test workloads. Modern DevOps tooling can be optionally added at uniquely discounted prices. See Software Announcement 217-490, dated November 14, 2017.
- The Payments Solution provides a "per payment" pricing option for IBM Financial Transaction Manager for z/OS deployments. This new offering directly ties operational cost to business value by basing the price on the number of payments processed, rather than capacity used to process them. See Software Announcement 217-518, dated November 14, 2017.

Container Pricing for IBM Z is enabled in z/OS V2.2 and z/OS V2.3. z/OS will enhance both the Workload Manager capability of z/OS (z/OS WLM) and the Sub-Capacity Reporting Tool (SCRT) to support Container Pricing. This includes:

- The introduction of a new Tenant Resource Group capability within z/OS WLM to allow the metering and optional capping of workloads, along with the ability to map those workloads directly to Container Pricing.
- Enhancements to SCRT to capture eligible Container Pricing workloads, allowing for the billing of those solutions independently of traditional Sub-Capacity pricing.

z/VM support for the z14 ZR1

- With the PTF for APAR VM65942, z/VM 6.4 provides support that will enable guests to exploit functions supported by z/VM on z14, which includes:
  - **Support for Crypto Express6S:** z/VM support for the new Crypto Express6S (CEX6S) adapter is included for both shared and dedicated guest use. As with the prior crypto adapter support, the CEX6S adapter can be configured as an accelerator or as an IBM Common Cryptographic Architecture (CCA) coprocessor for shared or dedicated use by z/Architecture guests. When the CEX6S adapter is configured as an IBM Enterprise Public-Key Cryptography Standards (PKCS) #11 (EP11) coprocessor, the domains on the adapter can be dedicated to z/Architecture guests, but not shared. With Crypto Express6S support and support for the new and enhanced CPACF functions, z/VM V6.4 and V7.1 provide the prerequisite z14 encryption support to enable exploitation by guests in support of pervasive encryption.
  - **Installation of z/VM on z14 ZR1:** z/VM V6.4 can be installed directly on an IBM z14 Model ZR1 server with an image obtained from IBM after August 25, 2017. The PTF for APAR VM65942 must be applied immediately after installing z/VM V6.4.

- **New hardware facilities:** z/VM will enable guest use of new instructions and capabilities available on z14.

- **ESA/390-compatibility mode for guests:** z14 does not support the full ESA/390 architectural mode. However, z14 does provide ESA/390-compatibility mode, an environment supporting a subset of DAT-off ESA/390 applications in a hybrid architectural mode. z/VM will provide the support necessary for DAT-off guests to run in this new compatibility mode, which allows guests such as CMS, GCS, and those that start in ESA/390 mode briefly before switching to z/Architecture mode to continue to run on z14.
  The PTF for APAR VM65976 provides infrastructure support for ESA/390 compatibility mode within z/VM V6.2, V6.3, and V6.4, and must be installed on all members of an SSI cluster before any z/VM V6.3 or V6.4 member of the cluster is run on a z14 server.

- **Support for OSA Express6S:** With the PTF for APAR PI73016, the TCP/IP stack and the NETSTAT OSAINFO command are updated to support OSA-Express6S adapters.

- **Dynamic I/O support:** Dynamic I/O support is provided for managing the configuration of OSA-Express 6S OSD CHPIDs, FICON Express 16S+ FC and FCP CHPIDs, Regional Crypto Enablement (RCE), zHyperLink Express, and RoCE Express 2 functions. The PTF for APAR VM65865 provides dynamic I/O support for the Coupling Express LR adapter.

- **RoCE Express2 support:** Guest exploitation support for RoCE Express2 allows the adapters to be brought online and attached to supporting guests for exploitation.

- **Improved memory management support:** The z14 processor design allows greater concurrency in address translation. This improvement may increase z/VM workloads' performance compared to z13, particularly when z/VM is configured to exploit multithreading.

Guest exploitation support for the Instruction Execution Protection Facility:

With the PTF for APAR VM65986, z/VM V6.4 provides support for guest exploitation of the z14 Instruction Execution Protection Facility. This facility provides functionality to help 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.

Guest exploitation support for Guarded Storage during Java garbage collection:

With APAR VM65987, z/VM V6.4 provides support for guest exploitation of the IBM z14 Model ZR1 Guarded Storage Facility. This facility is designed to improve the performance of garbage-collection processing by Java8 SR5. Essentially, this function allows an area of storage to be identified as "do not disturb", and garbage collection will avoid that area until later, intended to reduce percieved hang or pause time during processing.

Encrypted paging support:

With the PTF for APAR VM65993, z/VM V6.4 provides support for encrypted paging, in support of the IBM z14 Model ZR1 pervasive encryption philosophy of encrypting data in flight and at rest. Ciphering will occur as data moves between active memory and a paging volume owned by z/VM. Included in the support is the ability to dynamically control whether a running z/VM system is encrypting this data.

Sub-capacity pricing terms for z/VM and select z/VM-based programs:

Sub-capacity pricing for the z/VM V6 operating environment is available to clients running z/VM Version 6 Release 3 or higher. Software pricing at less than full machine capacity can provide more flexibility and improved cost of computing as a client manages the volatility and growth of new workloads. For more information about sub-capacity pricing terms for z/VM and z/VM-based programs, see Software Announcement 217-267, dated July 17, 2017.

z/VM continuous delivery philosophy:

IBM has adopted a new practice for z/VM, known as the continuous delivery (CD) support model, for delivering new functions via PTFs to assist enterprises in receiving functions more quickly. IBM will deliver new functions via PTFs, while continuing to recognize that base stability is a critical component. Clients will continue to receive the same world-class support and assistance from IBM to which they are accustomed as part of the standard Software Subscription and Support (S&S) offering. The z/VM service page provides details on new z/VM functions that have been or will be provided using this continuous delivery model and allows for subscribing to be alerted when new functions have been made available.

Introducing z/VM V7.1 ushering in a new z/VM release cadence:

IBM plans to usher in a new era for delivering product enhancements to its advanced virtualization technology on IBM Z servers. Continuous delivery of new functions throughout the life of a z/VM release will offer clients timely support for new technology using a delivery mechanism that is trusted and time tested.

z/VM plans to allow two releases to be marketed simultaneously. z/VM Version 7 releases will be delivered on a 24-month cadence: in the month of September every other year, beginning in September 2018. Most new z/VM V7 functions will be delivered as Small Programming Enhancements (SPEs) in the service stream of the current release. When a new release is introduced, SPEs will be delivered on that release going forward and, with few exceptions, the prior release will receive corrective service but no new functions. z/VM 6.4 will remain orderable for 18 months after the availability of z/VM 7.1.

Additional information on z/VM 7.1 can be found in Software Announcement 218-150, dated April 10, 2018, Preview z/VM 7.1.

Access to a Parallel Sysplex environment

Parallel Sysplex is a synergy between hardware and software -- a highly advanced technology for clustering designed to enable the aggregate capacity of multiple z/OS systems to be applied against common workloads. z/OS combined with z14, z13, and

z13s servers, Coupling Facilities, Server Time Protocol (STP), and ICA SR and CE LR coupling links, depending on processor type, allows you to harness the power of multiple systems as though they were a single logical computing system.

Coupling links provide a path to transmit and receive Coupling Facility (CF) data as well as Server Time Protocol (STP) timekeeping messages. The CF data may be exchanged between z/OS and the CF or between CFs.

STP - Time synchronization for Parallel Sysplex Server Time Protocol (STP) is designed to allow events occurring in different servers to be properly sequenced in time. STP is designed for servers that have been configured in a Parallel Sysplex or a basic sysplex (without a Coupling Facility), as well as servers that are not in a sysplex but need time synchronization.

STP is a server-wide facility that is implemented in the Licensed Internal Code (LIC), presenting a single view of time to Processor Resource/Systems Manager™ (PR/SM). STP uses a message-based protocol in which timekeeping information is passed over externally defined coupling links between servers. The STP design introduced a concept called Coordinated Timing Network (CTN), a collection of servers and Coupling Facilities that are time-synchronized to a time value called Coordinated Server Time.

STP enhancements

z14 introduces an additional stratum level 4 for Server Time Protocol (STP) synchronization. With the additional stratum level, STP can synchronize systems up to 3 steps away from the Current Time Server (CTS). Prior systems allowed synchronization only up to level 3, or up to 2 steps from the CTS. This additional stratum level is not intended for long-term use; rather, it is specifically intended for short-term use during configuration changes for large timing networks, to avoid some of the cost and complexity caused by being constrained to a 3-stratum timing configuration.

z14 also introduces a new Graphical User Display for the STP network and configuration. The new user interface has been revamped for a quick, intuitive view of the various pieces of the STP relationship network map, including the status of the components of the timing network. The new IBM z14 Model ZR1 support allows the new level of HMC to manage older systems using the same new interface.

Parallel Sysplex enhancements

The z14 models introduce new features beyond the z13 and z13s for use within Parallel Sysplex environments.

For long reach coupling connectivity, the new **Coupling Express Long Reach (CE LR) link** (#0433) is available with IBM z14 Model ZR1. This CE LR link is concurrently being made available on, and is compatible with all models of z14, z13, and z13s systems, which allows for sysplex connectivity back to these systems. Unlike the 1x IFB InfiniBand coupling links, which were plugged into the processor drawer, the CE LR link is plugged within a PCIe+ I/O drawer slot, taking advantage of more industry-standard I/O technology, such as converged Ethernet. The location inside the PCIe+ I/O drawer allows users to fan links out across multiple 2-port CE LR cards, up to a maximum of 16 features (32 links maximum). Compared to the HCAO-3 IFB InfiniBand LR with 4-port and 4-link increments, the CE LR link allows for more granularity when scaling up or completing maintenance. Link performance is similar to the InfiniBand 1x coupling link and uses identical single mode fiber. The CE LR link provides point-to-point coupling connectivity at distances of 10 km unrepeated and 100 km with a qualified dense wavelength division multiplexing (DWDM) device.

Integrated Coupling Adapter - Short Reach (ICA-SR) continues to be available across the all the models of z14, z13, and z13s. The ICA-SR is replacing connections that may have been 12x IFB InfinBand coupling links in prior generations. The z14 ZR1 does not support 12x IFB InfiniBand coupling links, and clients should take the opportunity to refresh their sysplex coupling links. The ICA-SR is supported via direct processor drawer connection, and can be an integral to a sysplex configuration with up to 8 features (16 ports) available per z14 ZR1.

Per prior Statements of Direction, IBM will remove support for both the HCA3-O LR fanout for 1x IFB InfiniBand coupling links and the HCA3-O fanout for the 12x IFB InfiniBand coupling links for the z14 ZR1 and all future IBM Z systems. The IBM z14 ZR1 server does not support HCA3-O LR 1x IFB InfiniBand coupling links or HCA3-O 12x IFB InfiniBand coupling links. The z13s is the last midrange IBM Z server to support the HCA3-O LR 1x IFB InfiniBand coupling links or HCA3-O 12x IFB InfiniBand coupling links.

IBM Z enterprises should plan to migrate off of InfiniBand coupling links.

- For high-speed short-reach coupling connectivity, enterprises should migrate to the Integrated Coupling Adapter (ICA-SR).
- For long-reach coupling connectivity, enterprises should migrate to the new CE LR coupling adapter. For long-reach coupling connectivity requiring a DWDM, enterprises will need to determine their desired DWDM vendor's plan to qualify the CE LR. See Hardware Announcement 117-031, dated March 14, 2017.

Coupling Facility (CF) processor scalability: The z14 provides a new level of the Coupling Facility Control Code (CFCC), CFLEVEL 22, which provides new capabilities as described below. Coupling Facility work management and dispatching changes for z14 CFLEVEL 22 allow improved efficiency and scalability for Coupling Facility images. Together, these changes will improve the processor scalability and throughput for a CF image.

– Ordered work queues have been eliminated from the CF in favor of first-in / first-out queues, avoiding the overhead of maintaining ordered queues.
– Protocols for system-managed duplexing have been simplified to avoid the potential for latching deadlocks between duplexed structures.

CF list notification enhancements: There are significant enhancements in z14 CFLEVEL 22 to CF notifications that inform users about the status of shared objects within a Coupling Facility. The combination of these notification enhancements provides flexibility to accommodate notification preferences among various CF exploiters, and yields more consistent, timely notifications.

– First, structure notifications can use a round-robin scheme for delivering immediate and deferred notifications that avoids excessive "shotgun" notifications, reducing notification overhead.
– Second, there is now an option for delivering "aggressive" notifications, which can drive a notification when new elements are added to a queue, providing initiative to get new work processed in a timely manner.
– Third, notifications can now be driven when a queue transitions between full and not-full, allowing exploiters to redrive messages that could not previously be written to a full queue.

CF encryption: z/OS V2.3 provides support for end-to-end encryption for both CF data in flight and data at rest in CF structures (as part of a more pervasive encryption solution). Host-based CPACF encryption is used for high performance and low latency. z14 CFLEVEL 22 CF images are not required, but are recommended in order to simplify some sysplex recovery and reconciliation scenarios involving encrypted CF structures. (Note that the CF image itself never decrypts, nor encrypts, any data.) z14 z/OS images are not required, but are recommended for the improved AES CBC encrypt/decrypt performance that z14 provides.

Hardware Management Console (HMC)

HMC/SE user interface: The z14 Hardware Management Console and Support Element will support only the Tree Style user interface. The Classic Style user interface is no longer supported.

The following enhancements have been made to the Tree Style user interface to aid with new users of Tree Style as well as address pain points of existing users.

– A new Masthead with Favorites and Search controls will help users quickly find and launch tasks.
– Tasks will now open in tabs within the user interface (instead of separate browser windows) to make finding and managing running tasks easier.
– There is also the ability to have the task tab "pop out" into a separate window, giving users the ability to have a similar parallel task display window as on previous Tree Style controls and allowing the task displays to be viewed on other physical displays.

Manage System Time: The Manage System Time task replaces the System (Sysplex) Time task on HMC. The new Manage System Time task provides a simplified workflow for system time management including:

– Improved help tools to complement and improve system administrator skills:
  ▪ Inline definition of technical terms.
– Improved user experience with visual representation of configuration panels:
  ▪ Guidance provided within the workflows.
  ▪ Topology displays of system time networks.
  ▪ Errors surfaced in visualization for easier problem resolution of setup errors.
– Single point of system time management for multiple systems.

IBM Hardware Management Console (HMC) 2.14.0 security enhancements: New security features in the Hardware Management Console (HMC) 2.14.0 available with z14 include Multifactor Authentication, Enhanced Computing in support of NIST Standard 800-147B, Crypto Compliance Levels, FTP through HMC, SNMP/BCPii API Security Controls, Secure Console to Console Communication Enhancements, Remote Browser IP Address Limiting, and more.

– **Multifactor Authentication:** The Hardware Management Console will now offer an optional control of Multifactor Authentication in addition to the userid/password controls provided today. If the Multifactor option is selected for a given user, that user will now be required to enter a second authentication factor using a TOTP (Time-based One-Time Password) defined by RFC 6238. RFC 6238 is implemented by freely available smartphone and web apps utilizing a secret key provided per HMC user.
– **HMC Mobile for Z and LinuxONE:** New iOS and Android mobile apps are available for the HMC 2.14.0 supporting z14, z13, and z13s systems. HMC Mobile will help enable HMC users to securely monitor and manage systems from anywhere. The apps provide system and partition views, status monitoring, hardware messages, operating system messages, and the ability to receive push notifications from the HMC using the existing zRSF (z Systems Remote Support Facility) connection. HMC Mobile is disabled by default and, once enabled, provides a robust set of security controls. Administrators can restrict usage

to specific HMC users and IP addresses, require the use of app passwords, enable multifactor authentication, restrict the app to read-only access, and more.

– **Firmware tamper detection:** z14 will also offer an enhancement on the Support Element that provides notification if tampering with booting of firmware on the server (CPC) is detected. This enhancement is designed to meet the BIOS Protection Guidelines recommended and published by the National Institute of Standards and Technology (NIST) in Special Publication 800-147B. If tampering is detected, the Support Element will issue a user alert via a warning or a lock of the Support Element, depending on the configuration. If "call home" support is enabled on a z14 Hardware Management Console managing the Support Element, additional analysis of the Support Element will be performed and displayed by IBM Resource Link.
  In addition to this support, the Hardware Management Console also has been enhanced to provide attempted tamper monitoring and reporting. A newly manufactured Hardware Management Console directly ordered with z14, or at a later time, is required for this protection. Any detected events of attempted tampering will be logged and will issue a user alert via a warning or a lock of the Hardware Management Console, depending on setup configuration. In addition, if "call home" support is enabled on the Hardware Management Console, supplementary analysis of events logged by the Hardware Management Console will be available on IBM Resource Link.

  Although clients can carry forward their Hardware Management Consoles on z14, these tamper protection capabilities will be delivered only on newly manufactured Hardware Management Consoles. The z14 environment can contain both Hardware Management Consoles that have been carried forward and newly manufactured Hardware Management Consoles.

– **IBM Enhanced Remote Support Facility:** The IBM Enhanced Remote Support Facility was first introduced on zEC12/zBC12 systems and for those systems and z13/z13s, both the Enhanced and Legacy Remote Support Facility support could be utilized. The Enhanced support provided improved problem data uploads and fix data downloads. z14 processors will no longer connect to the legacy IBM Support Facility.
  - z14 HMCs supporting older z10EC/z10BC - z13 systems will still require connections to the legacy IBM Support Facility.
  - z14 HMCs supporting only z14 systems only require IBM Enhanced Support Facility connections.
  - A connection to the IBM Enhanced Support Facility is required to support z14 HMCs regardless of the CPC they are supporting.

  If you had not previously configured firewalls and proxy support with the ability to connect to the Enhanced Support Facility, this will be required for z14 HMC and CPC connections per above rules.

– **Global OSA/SF:** The HMC Global OSA/SF will now provide a global view of all OSA PCHIDs and the monitoring and diagnostic information previously available in the Query Host command.
– **New characters supported for Load parms:** Starting with z14 the Load parameter for Load task, Activation Load and Image Profiles will now allow three new characters: @#$. z13/z13s or older systems support a character set of A-Z, 0-9, "." (period), and " " (blanks). z14 systems will support a character set of A-Z, 0-9, "." (period), " " (blanks), "@", "#", and "$".
– **FTP through HMC:** To maximize security features, IBM recommends that clients keep their IBM Z on a dedicated network with one HMC network used for that network and the second HMC network used for outward communication (IBM Support Facility, remote browsing, automation). However, for systems prior to z14, this created a security challenge for FTP operations originating from the SE. Clients have to either put their FTP server on the IBM Z dedicated network or put their IBM Z on their intranet network.
  Starting with z14, all FTP operations originating from the SE will be proxied through a managing HMC. This now allows the FTP SE originated operations to follow IBM security recommendations. In addition, all HMC/SE tasks that support FTP will provide three options of FTP: FTP, FTPS, and SFTP.

  - FTPS is SSL based and uses certificates to authenticate servers.
  - SFTP is SSH based and uses SSH keys to authenticate servers.
  - Username and passwords are required for client authentication in all three protocols.

– **Console to console communications:** HMC consoles have used anonymous cipher suites for some inter-console communication purposes. These cipher suites, while providing encryption and integrity validation, do not provide cryptographic authentication. Network security scanners can detect this, and anonymous cipher suites may not be acceptable to some clients' security policies. Starting with the z14 HMC/SE, the console to console communications solution, when security is enabled, will no longer use anonymous cipher suites and will begin using an industry standard based password driven cryptography system. This system provides cryptographic encryption, integrity validation, and authentication.
– **SNMP/BCPii API enhancements:** Prior to z14, when you enabled SNMP BCPii via controls for the HMC/SE, it was enabled for all LPARs to have equal send and receive command capability. Starting with z14 there are new "BCPii Permission" controls which allow you to have granular LPAR/System BCPii command controls. The HMC/SE can be configured for Enable/disable send capability, Enable/disable receive capability, Enable for all senders, and Enable for list of origin partitions. These controls can be specified for CPC via the System Details task (HMC or SE) or can be specified for Images via the Image profile and Change LPAR Security task (HMC or SE). Some additional changes have been made to improve the performance for z/OS BCPii, for query operations Profiles, LPAR Controls/Security data, and EC/MCL data.
– **Removal of Common Infrastructure Module (CIM) Management Interface:** The HMC 2.14.0 will no longer support the Hardware Console Common Infrastructure Module (CIM) Management Interface. The Hardware Management Console Simple Network Management Protocol (SNMP), and Web Services Application Programming Interfaces (APIs) will continue to be supported.

Enhancements to software pricing Technology Transition Offerings

Coinciding with the announcement of the z14 Model ZR1 server, IBM is making available a new Technology Transition Offering (TTO) called Technology Update Pricing for the z14 Model ZR1. Technology Update Pricing for the z14 Model ZR1 offers price-performance advantages for z14 Model ZR1 servers. IBM is also updating the "Technology Update Pricing for the z14" offering and three revised Transition Charges for Sysplexes or Multiplexes offerings to add the z14 Model ZR1. In addition, zSeries Entry License Charge (zELC) pricing applies to the z14 Model ZR1 capacity setting A01, the entry z14 Model ZR1 server.

Technology Update Pricing for the z14 Model ZR1 extends the software price-performance provided by AEWLC for stand-alone z14 Model ZR1 servers, and applies to eligible z/OS, z/TPF, and z/VSE operating systems and their associated middleware programs. AEWLC, zNALC, and Tiered Workload License Charges (TWLC) are the only pricing metrics available on a stand-alone z14 Model ZR1 server, with the exception of the z14 Model ZR1 capacity setting A01. The Entry Workload License Charges (EWLC) and the Midrange Workload License Charges (MWLC) license options are not available for a z14 Model ZR1 server.

When a z14 Model ZR1 server is in an actively coupled z/OS Parallel Sysplex or z/TPF Loosely Coupled Complex, you may choose either stand-alone AEWLC, aggregated AWLC pricing, or aggregated Parallel Sysplex License Charges (PSLC) pricing, subject to all applicable terms and conditions. When a z14 Model ZR1 server is part of a Multiplex under Country Multiplex Pricing (CMP) terms, CMLC, MzNALC, and Tiered Workload License Charges (TWLC) are the only pricing metrics available, subject to all applicable terms and conditions.

For additional information about software pricing for the z14 Model ZR1 server, see Software Announcement 218-156, dated April 10, 2018.

For more information about AWLC, CMLC, CMP, MzNALC, PSLC, zNALC, or the Transition Charges for Sysplexes or Multiplexes TTO offerings, see the IBM Z software pricing website.

16U Reserved (#0617) hardware configuration flexibility

For clients utilizing one or two PCIe+ drawers, there is a new option to hold 16U Reserved (#0617) space in the z14 ZR1 rack. This 16U of space in the frame can be populated by a client with other server elements such as switches, storage, or servers. These additional elements are beneficial if it helps to plan elements that will work together within a frame, while reducing the physical footprint required in a data center. When the 16U Reserved feature is ordered, the z14 ZR1 order will provide additional power ports in redundant power distribution units (PDUs), along with weight ballast and air flow fillers as appropriate. Clients should take care to evaluate requirements of the Installation Manual for Physical Planning (IMPP), as there are requirements regarding additional element weight, air flow, power draw, and certification status. Note that IBM would first complete installation of the z14 ZR1 and turn it over to client operation, and then the additional elements could be added if the 16U Reserved (#0617) has been ordered. This new hardware configuration flexibility feature is perfect for clients who fit into smaller I/O configurations and need the additional ease of a single-footprint approach.

Accessibility by people with disabilities

A US Section 508 Voluntary Product Accessibility Template (VPAT) containing details on accessibility compliance can be found on the IBM Accessibility website.

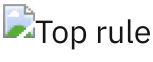
Section 508 of the US Rehabilitation Act

IBM z14 servers are capable on delivery, when used in accordance with IBM's associated documentation, of satisfying the applicable requirements of Section 508 of the Rehabilitation Act of 1973, 29 U.S.C. Section 794d, as implemented by 36 C.F.R. Part 1194, provided that any Assistive Technology used with the Product properly interoperates with it.

IBM makes no representation about the Section 508 status of third-party products included in this offering. Contact the vendor for specific, current information on the Section 508 status of these products.

Back to topBack to top

Product positioning



Information technology is experiencing exponential growth in data and transaction volumes driven by digital transformation and delivery through the cloud. To succeed in this environment, businesses must not only be able to manage, store, and protect information, but also be able to put the data to work predicting new opportunities and customizing user experiences. From a user perspective, IT must create an environment where users have confidence that data is protected and available from anywhere and any device. This ability to be fast and flexible in delivery of new services, with insight and security, will differentiate a business. The z14 Model ZR1 delivers unique capabilities to help with that differentiation.

At the heart of every enterprise lies core business data, assets which if lost or compromised could cause irreparable damage. Core business data is often governed by regulatory requirements designed to protect data and safeguard privacy, often with high penalties in the event of loss or inadvertent disclosure. Internal and external pressures to protect customer data have changed the perspective around how core business data should be handled and protected. Establishing a "perimeter" around core data using encryption is one of the most impactful ways to protect data and prevent loss. The objective is to create a fortified perimeter around core business data, wherever it may physically reside. When as much data and transactional pipeline as possible is encrypted, potential data breach risks and financial losses can be reduced, cloud infrastructures can be secure, and compliance with regulatory mandates can be simplified. On the IBM z14 servers, more secure 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. The IBM z14 platform provides pervasive encryption capabilities designed to enable you to protect data efficiently, and without requiring application changes. This protection is critical in the hybrid cloud environment as businesses try to accommodate placement of workloads.

The IBM z14 platform provides the hardware infrastructure, in a balanced system design, with the encryption capabilities that now make it possible to create a fortified perimeter around critical business data. The Central Processor Assist for Cryptographic Function (CPACF) is standard on every z14 core, and is enabled via feature #3863. The CPACF has both the cryptographic suite and performance characteristics that can enable bulk encryption of sensitive business data that makes it possible to fortify, intrinsically protecting business data using encryption technology. Working with the new Crypto Express6S feature (#0893), the key materials used to create this fortified data perimeter are protected, using the IBM Z® unique protected key CPACF in which the keys used in the encryption process are not visible to the applications or operating system.

IBM Secure Service Container can encapsulate data and applications inside a virtual lockbox -- helping to protect 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. Aimed at the z14 models including ZR1, IBM plans to enhance this technology, and it will be designed to allow for any IBM or non-IBM application deployed via Docker and Kubernetes in a Secure Service Container without requiring application changes, for the simplest form of broad-level securable applications and data.

The z14 Model ZR1 provides a new industry-standard infrastructure to meet the demands of entry-level digital businesses and allow easier delivery through a secure cloud. With up to 30 configurable Linux cores and up to 6 Central Processor (CP) cores for IBM zOS, z/VSE®, z/VM®, or Linux on IBM Z, z14 Model ZR1 has performance and scaling advantages over prior generations, and more capacity than the z13s. The new 16U Reserved feature allows clients to create all-in-one solutions to run their processsors, storage, and switches for a complete private or hybrid cloud server solution.

The new FICON® Express 16S+ features (#0427 and 0428) deliver an increase in I/O rates and in link bandwidth, and a reduction in single-stream latency. This allows the z14 models the ability to absorb large applications and transaction spikes driven by unpredictable mobile and IoT devices. Next-generation SMT on z14 delivers improved virtualization performance to benefit Linux. High-speed connectivity out to the data is critical in achieving exceptional levels of transaction throughput. The new IBM zHyperLink Express adapter (#0431) is a direct connect short distance IBM Z I/O adapter offering extremely low latency connectivity to FICON storage systems.

With up to 8 TB of real memory, z14 Model ZR1 can open opportunities such as in-memory data marts, large buffer pools for data access, and in-memory analytics while giving you the necessary room to tune applications for optimal performance. Through exploitation of the Vector Packed Decimal Facility that allows packed decimal operations to be performed in registers rather than memory, faster mathematical computations and compilers, such as Enterprise COBOL for z/OS, V6.2, Enterprise PL/I for z/OS, V5.2, z/OS V2.3 XL C/C++, the COBOL optimizer, Automatic Binary Optimizer for z/OS, V1.3, and Java™, are optimized on z14. These compilers and optimizer are designed to help improve application performance, reduce CPU usage, and reduce operating costs. Java improvements and the use of crypto acceleration will deliver additional improvements in throughput per core, which gives a natural boost to z/OS Connect EE, WebSphere® Liberty in CICS®, IBM Open Data Analytics for z/OS, and IBM Java for Linux on Z.

To take advantage of new data, businesses on IBM Z can leverage the use of application programming interfaces (APIs) and microservices within the enterprise server environment. The z14 models are especially well-suited, considering the value of a high-availability, high-reliability, high-speed server with the additional value of Linux on Z running side-by-side with z/OS, z/VSE, z/VM, or z/TPF. Linux on Z supports a wealth of new IBM, ISV, and open source products and languages. Application developers can bring on new talent and deploy it quickly, applying skills such as Go, Python, Scala, Node.js, Docker, Spark, MongoDB, PostgreSQL, and MariaDB. New accompanying software like Application Discovery and Delivery Intelligency (ADDI)

can continue to further assist both development and production workload managers in training new talent, identifying areas ripe for changes, and completing self-audits of data structures.

Back to topBack to top

Statement of general direction

Top rule

IBM Storage and IBM Z collaboration on 16U Reserved (#0617) applications

IBM Storage intends to deliver a high-performance, high-availability, ECKD™/Distributed format flash storage that can be mounted in a z14 ZR1 or LinuxONE Rockhopper II server rack with the associated 16U Reserved (#0617) space inside the 19-inch rack. This new storage solution opens the opportunities for clients requiring the high-availability, performance, and Z synergy functions of DS8880, and looking for ways to increase their data center flexibility. For z14 ZR1 customers, this will also create a flexible option for clients to include zHyperLink capability in-rack with the z14 ZR1.

Secure Service Container for IBM Cloud Private on Linux on Z and LinuxONE

IBM intends to deliver IBM Cloud Private on Linux on Z in Secure Service Containers. IBM Cloud Private in Secure Service Containers on Linux on Z and LinuxONE is designed to offer unmatched security of IBM Cloud Private nodes with workload isolation, pervasive encryption of data and executable binaries for container-based applications, and protection from privileged users to mitigate breaches and leaks from internal or external threats, ransomware, and malware.

Application Discovery and Delivery Intelligence

IBM intends to deliver application expansion of Application Discovery and Delivery Intelligence (ADDI) to run on Linux on Z. ADDI significantly enhances a user's ability to view and audit endpoints of applications. This capability can be used to convert older applications into the nimble building blocks desired, as well as view the full application view for both training and self-audit opportunities. IBM ADDI can be referenced as an IBM software product.

Ensemble and zEnterprise® Unified Resource Manager

IBM z14 is the last IBM Z server to support Ensembles and zEnterprise Unified Resource Manager (zManager). The z14 HMC level is the last HMC level to support Ensembles.

IBM's statements regarding its plans, directions, and intent are subject to change or withdrawal without notice at IBM's sole discretion. Information regarding potential future products is intended to outline our general product direction and it should not be relied on in making a purchasing decision. The information mentioned regarding potential future products is not a commitment, promise, or legal obligation to deliver any material, code, or functionality. Information about potential future products may not be incorporated into any contract. The development, release, and timing of any future features or functionality described for our products remain at our sole discretion.

Back to topBack to top

Reference information

Top rule

For more information on IBM Machine Learning on z/OS Version 1 Release 2, see Software Announcement 218-111, dated April 10, 2018.

For more information on the IBM z®/VM 7.1, see Software Announcement 218-150, dated April 10, 2018.

For more information about zSystems Long Distance Coupling, see Hardware Announcement 117-031, dated March 14, 2017.

For more information about IBM z/OS Version 2 Release 3, see Software Announcement 217-246, dated July 17, 2017.

For more information on the IBM z14, see Hardware Announcement 117-044, dated July 17, 2017.

For more information on the IBM LinuxONE Emperor II™, see Hardware Announcement 117-067, dated September 12, 2017.

Back to topBack to top

Product number

Top rule

Description	Machine Type	Model	Feature
z14	3907	ZR1	
Model ZR1 Air Cooled			0200
CPC Drawer Max4			0636
CPC Drawer Max12			0637
CPC Drawer Max24			0638
CPC Drawer Max30			0639
MTU 1 --D			0001
MTU 100 --D			0002
MTU 1 --V			0003
MTU 100 --V			0004
GTU 1 -D			0005

Description	Machine Type	Model	Feature
GTU 100 -D			0006
GTU 1 -V			0007
GTU 100 -V			0008
GTU 1000 -D			0009
GTU 1000 -V			0010
Migration Offering Machine			0014
Blue Letter Internal			0015
HW for DPM			0016
Manage FW Suite			0019
Automate FW Suite			0020
Ensemble Membership			0025
Non RSF On/Off CoD			0032
Serv Docs Optional Print			0033
OSA-ICC 3215 Enablement			0034
RFID Tag			0035
RFID Tag			0036

TKE Rack Mount w/4768	0080
TKE w/4768	0081

HMC	0082

HMC Rack Mount	0083
TKE Rack Mount w/4768	0085
TKE w/4768	0086
WWPN Persistence	0099
Linux Hosting Foundation	0103
Container Hosting Foundation	0104
1 CPE Capacity Unit	0116
100 CPE Capacity Unit	0117
10000 CPE Capacity Unit	0118
1 CPE Capacity Unit-IFL	0119
100 CPE Capacity Unit-IFL	0120
1 CPE Capacity Unit-ICF	0121
100 CPE Capacity Unit-ICF	0122
1 CPE Capacity Unit-zIIP	0125
100 CPE Capacity Unit-zIIP	0126
1 CPE Capacity Unit-SAP	0127
100 CPE Capacity Unit-SAP	0128
HMC Table Top KMM	0148
HMC Rack Keybd/Monitor/Mouse	0154
TKE Rack Keybd/Monitor/Mouse	0156
TKE Table Top KMM	0157

ICA SR Fanout	0172
PCIe Fanout Gen3	0173
Fanout Airflow PCIe	0174
Client Must Provide HMC KMM	0188
Client Must Provide TKE KMM	0190
2828 w/o TEIO & w/o HtR	0192
2828 w/o TEIO & w/ HtR	0193
2828 w/ TEIO & w/o HtR	0194
2828 w/ TEIO & w/ HtR	0195
2965 w/o TEIO & w/o HtR	0196
2965 w/o TEIO & w/ HtR	0197
2965 w/ TEIO & w/o HtR	0198
2965 w/ TEIO & w/ HtR	0199
US English	0235
France	0236
German/Austrian	0237
LA Spanish	0238
Spain	0239
Italian	0240
French Canadian	0241
Portuguese	0242

UK English	0243
Norwegian	0244
Sweden Finland	0245
Netherlands	0246
Belgian French	0247
Denmark	0248
Swiss French/German	0249
PCIe Interconnect Gen3	0401
10 GbE RoCE Express2	0412
zEDC Express	0420
OSA-Express6S GbE LX	0422
OSA-Express6S GbE SX	0423
OSA-Express6S 10 GbE LR	0424
OSA-Express6S 10 GbE SR	0425
OSA-Express6S 1000BASE-T	0426
FICON Express16S+ LX	0427
FICON Express16S+ SX	0428
zHyperLink Express	0431
Coupling Express LR	0433
IBM Virtual Flash Memory	0614
16U Reserved	0617

Switchable PDU	0622
Ethernet Switch	0623
CPC PSU	0641
Read Only Media Option	0845

TKE workstation w/4768	0849
4768 TKE Crypto Adapter	0844
TKE Addl Smart Cards	0892

32GB USB Backup Media	0848
TKE 9.0 LIC	0879
TKE Smart Card Reader	0891
Crypto Express6S	0893

IFL	1064
ICF	1065
SAP (optional)	1066
zIIP	1067
Unassigned IFL	1068
CP-A	1069
CP-B	1070
CP-C	1071
CP-D	1072

CP-E	1073
CP-F	1074
CP-G	1075
CP-H	1076
CP-I	1077
CP-J	1078
CP-K	1079
CP-L	1080
CP-M	1081
CP-N	1082
CP-O	1083
CP-P	1084
CP-Q	1085
CP-R	1086
CP-S	1087
CP-T	1088
CP-U	1089
CP-V	1090
CP-W	1091
CP-X	1092
CP-Y	1093

CP-Z	1094
0-Way Processor A00	1157
1-Way Processor A01	1158
1-Way Processor B01	1159
1-Way Processor C01	1160
1-Way Processor D01	1161
1-Way Processor E01	1162
1-Way Processor F01	1163
1-Way Processor G01	1164
1-Way Processor H01	1165
1-Way Processor I01	1166
1-Way Processor J01	1167
1-Way Processor K01	1168
1-Way Processor L01	1169
1-Way Processor M01	1170
1-Way Processor N01	1171
1-Way Processor O01	1172
1-Way Processor P01	1173
1-Way Processor Q01	1174
1-Way Processor R01	1175
1-Way Processor S01	1176

1-Way Processor T01	1177
1-Way Processor U01	1178
1-Way Processor V01	1179
1-Way Processor W01	1180
1-Way Processor X01	1181
1-Way Processor Y01	1182
1-Way Processor Z01	1183
2-Way Processor A02	1184
2-Way Processor B02	1185
2-Way Processor C02	1186
2-Way Processor D02	1187
2-Way Processor E02	1188
2-Way Processor F02	1189
2-Way Processor G02	1190
2-Way Processor H02	1191
2-Way Processor I02	1192
2-Way Processor J02	1193
2-Way Processor K02	1194
2-Way Processor L02	1195
2-Way Processor M02	1196
2-Way Processor N02	1197

2-Way Processor O02	1198
2-Way Processor P02	1199
2-Way Processor Q02	1200
2-Way Processor R02	1201
2-Way Processor S02	1202
2-Way Processor T02	1203
2-Way Processor U02	1204
2-Way Processor V02	1205
2-Way Processor W02	1206
2-Way Processor X02	1207
2-Way Processor Y02	1208
2-Way Processor Z02	1209
3-Way Processor A03	1210
3-Way Processor B03	1211
3-Way Processor C03	1212
3-Way Processor D03	1213
3-Way Processor E03	1214
3-Way Processor F03	1215
3-Way Processor G03	1216
3-Way Processor H03	1217
3-Way Processor I03	1218

3-Way Processor J03	1219
3-Way Processor K03	1220
3-Way Processor L03	1221
3-Way Processor M03	1222
3-Way Processor N03	1223
3-Way Processor O03	1224
3-Way Processor P03	1225
3-Way Processor Q03	1226
3-Way Processor R03	1227
3-Way Processor S03	1228
3-Way Processor T03	1229
3-Way Processor U03	1230
3-Way Processor V03	1231
3-Way Processor W03	1232
3-Way Processor X03	1233
3-Way Processor Y03	1234
3-Way Processor Z03	1235
4-Way Processor A04	1236
4-Way Processor B04	1237
4-Way Processor C04	1238
4-Way Processor D04	1239

4-Way Processor E04	1240
4-Way Processor F04	1241
4-Way Processor G04	1242
4-Way Processor H04	1243
4-Way Processor I04	1244
4-Way Processor J04	1245
4-Way Processor K04	1246
4-Way Processor L04	1247
4-Way Processor M04	1248
4-Way Processor N04	1249
4-Way Processor O04	1250
4-Way Processor P04	1251
4-Way Processor Q04	1252
4-Way Processor R04	1253
4-Way Processor S04	1254
4-Way Processor T04	1255
4-Way Processor U04	1256
4-Way Processor V04	1257
4-Way Processor W04	1258
4-Way Processor X04	1259
4-Way Processor Y04	1260

4-Way Processor Z04	1261
5-Way Processor A05	1262
5-Way Processor B05	1263
5-Way Processor C05	1264
5-Way Processor D05	1265
5-Way Processor E05	1266
5-Way Processor F05	1267
5-Way Processor G05	1268
5-Way Processor H05	1269
5-Way Processor I05	1270
5-Way Processor J05	1271
5-Way Processor K05	1272
5-Way Processor L05	1273
5-Way Processor M05	1274
5-Way Processor N05	1275
5-Way Processor O05	1276
5-Way Processor P05	1277
5-Way Processor Q05	1278
5-Way Processor R05	1279
5-Way Processor S05	1280
5-Way Processor T05	1281

5-Way Processor U05	1282
5-Way Processor V05	1283
5-Way Processor W05	1284
5-Way Processor X05	1285
5-Way Processor Y05	1286
5-Way Processor Z05	1287
6-Way Processor A06	1288
6-Way Processor B06	1289
6-Way Processor C06	1290
6-Way Processor D06	1291
6-Way Processor E06	1292
6-Way Processor F06	1293
6-Way Processor G06	1294
6-Way Processor H06	1295
6-Way Processor I06	1296
6-Way Processor J06	1297
6-Way Processor K06	1298
6-Way Processor L06	1299
6-Way Processor M06	1300
6-Way Processor N06	1301
6-Way Processor O06	1302

6-Way Processor P06	1303
6-Way Processor Q06	1304
6-Way Processor R06	1305
6-Way Processor S06	1306
6-Way Processor T06	1307
6-Way Processor U06	1308
6-Way Processor V06	1309
6-Way Processor W06	1310
6-Way Processor X06	1311
6-Way Processor Y06	1312
6-Way Processor Z06	1313
A00 Capacity Marker	1340
A01 Capacity Marker	1341
B01 Capacity Marker	1342
C01 Capacity Marker	1343
D01 Capacity Marker	1344
E01 Capacity Marker	1345
F01 Capacity Marker	1346
G01 Capacity Marker	1347
H01 Capacity Marker	1348
I01 Capacity Marker	1349

J01 Capacity Marker	1350
K01 Capacity Marker	1351
L01 Capacity Marker	1352
M01 Capacity Marker	1353
N01 Capacity Marker	1354
O01 Capacity Marker	1355
P01 Capacity Marker	1356
Q01 Capacity Marker	1357
R01 Capacity Marker	1358
S01 Capacity Marker	1359
T01 Capacity Marker	1360
U01 Capacity Marker	1361
V01 Capacity Marker	1362
W01 Capacity Marker	1363
X01 Capacity Marker	1364
Y01 Capacity Marker	1365
Z01 Capacity Marker	1366
A02 Capacity Marker	1367
B02 Capacity Marker	1368
C02 Capacity Marker	1369
D02 Capacity Marker	1370

E02 Capacity Marker	1371
F02 Capacity Marker	1372
G02 Capacity Marker	1373
H02 Capacity Marker	1374
I02 Capacity Marker	1375
J02 Capacity Marker	1376
K02 Capacity Marker	1377
L02 Capacity Marker	1378
M02 Capacity Marker	1379
N02 Capacity Marker	1380
O02 Capacity Marker	1381
P02 Capacity Marker	1382
Q02 Capacity Marker	1383
R02 Capacity Marker	1384
S02 Capacity Marker	1385
T02 Capacity Marker	1386
U02 Capacity Marker	1387
V02 Capacity Marker	1388
W02 Capacity Marker	1389
X02 Capacity Marker	1390
Y02 Capacity Marker	1391

Z02 Capacity Marker	1392
A03 Capacity Marker	1393
B03 Capacity Marker	1394
C03 Capacity Marker	1395
D03 Capacity Marker	1396
E03 Capacity Marker	1397
F03 Capacity Marker	1398
G03 Capacity Marker	1399
H03 Capacity Marker	1400
I03 Capacity Marker	1401
J03 Capacity Marker	1402
K03 Capacity Marker	1403
L03 Capacity Marker	1404
M03 Capacity Marker	1405
N03 Capacity Marker	1406
O03 Capacity Marker	1407
P03 Capacity Marker	1408
Q03 Capacity Marker	1409
R03 Capacity Marker	1410
S03 Capacity Marker	1411
T03 Capacity Marker	1412

U03 Capacity Marker	1413
V03 Capacity Marker	1414
W03 Capacity Marker	1415
X03 Capacity Marker	1416
Y03 Capacity Marker	1417
Z03 Capacity Marker	1418
A04 Capacity Marker	1419
B04 Capacity Marker	1420
C04 Capacity Marker	1421
D04 Capacity Marker	1422
E04 Capacity Marker	1423
F04 Capacity Marker	1424
G04 Capacity Marker	1425
H04 Capacity Marker	1426
I04 Capacity Marker	1427
J04 Capacity Marker	1428
K04 Capacity Marker	1429
L04 Capacity Marker	1430
M04 Capacity Marker	1431
N04 Capacity Marker	1432
O04 Capacity Marker	1433

P04 Capacity Marker	1434
Q04 Capacity Marker	1435
R04 Capacity Marker	1436
S04 Capacity Marker	1437
T04 Capacity Marker	1438
U04 Capacity Marker	1439
V04 Capacity Marker	1440
W04 Capacity Marker	1441
X04 Capacity Marker	1442
Y04 Capacity Marker	1443
Z04 Capacity Marker	1444
A05 Capacity Marker	1445
B05 Capacity Marker	1446
C05 Capacity Marker	1447
D05 Capacity Marker	1448
E05 Capacity Marker	1449
F05 Capacity Marker	1450
G05 Capacity Marker	1451
H05 Capacity Marker	1452
I05 Capacity Marker	1453
J05 Capacity Marker	1454

K05 Capacity Marker	1455
L05 Capacity Marker	1456
M05 Capacity Marker	1457
N05 Capacity Marker	1458
O05 Capacity Marker	1459
P05 Capacity Marker	1460
Q05 Capacity Marker	1461
R05 Capacity Marker	1462
S05 Capacity Marker	1463
T05 Capacity Marker	1464
U05 Capacity Marker	1465
V05 Capacity Marker	1466
W05 Capacity Marker	1467
X05 Capacity Marker	1468
Y05 Capacity Marker	1469
Z05 Capacity Marker	1470
A06 Capacity Marker	1471
B06 Capacity Marker	1472
C06 Capacity Marker	1473
D06 Capacity Marker	1474
E06 Capacity Marker	1475

F06 Capacity Marker	1476
G06 Capacity Marker	1477
H06 Capacity Marker	1478
I06 Capacity Marker	1479
J06 Capacity Marker	1480
K06 Capacity Marker	1481
L06 Capacity Marker	1482
M06 Capacity Marker	1483
N06 Capacity Marker	1484
O06 Capacity Marker	1485
P06 Capacity Marker	1486
Q06 Capacity Marker	1487
R06 Capacity Marker	1488
S06 Capacity Marker	1489
T06 Capacity Marker	1490
U06 Capacity Marker	1491
V06 Capacity Marker	1492
W06 Capacity Marker	1493
X06 Capacity Marker	1494
Y06 Capacity Marker	1495
Z06 Capacity Marker	1496

UID Label for DoD	0998
STP Enablement	1021
EMEA Special Operations	1022
32 GB Mem DIMM(5/feat)	1627
64 GB Mem DIMM(5/feat)	1628
128 GB Mem DIMM(5/feat)	1629
256 GB Mem DIMM(5/feat)	1630
512 GB Mem DIMM(5/feat)	1631
8GB Memory Capacity Incr	1739
8GB Memory Cap Incr>128GB	1740
16GB Memory Cap Incr>128GB	1741
32GB Memory Cap Incr>128GB	1742
8GB Ftr Converted Mem z13s	1743
16GB Ftr Converted Mem z13s	1744
8GB Ftr Converted Mem zBC12	1745
LICCC Ship Via Net Ind	1750
8 GB Preplanned Memory	1993
16 GB Preplanned Memory	1996
Lift Tool Kit	3100
Extension Ladder	3101
64 GB Memory	3539

72 GB Memory	3540
80 GB Memory	3541
88 GB Memory	3542
96 GB Memory	3543
128 GB Memory	3544
160 GB Memory	3545
192 GB Memory	3546
224 GB Memory	3547
256 GB Memory	3548
288 GB Memory	3549
320 GB Memory	3550
352 GB Memory	3551
384 GB Memory	3552
448 GB Memory	3553
512 GB Memory	3554
576 GB Memory	3555
704 GB Memory	3556
832 GB Memory	3557
960 GB Memory	3558
1216 GB Memory	3559
1472 GB Memory	3560

1728 GB Memory	3561
1984 GB Memory	3562
2240 GB Memory	3563
2496 GB Memory	3564
2752 GB Memory	3565
3008 GB Memory	3566
3264 GB Memory	3567
3520 GB Memory	3568
3776 GB Memory	3569
4032 GB Memory	3570
4544 GB Memory	3571
5056 GB Memory	3572
5568 GB Memory	3573
6080 GB Memory	3574
6592 GB Memory	3575
7104 GB Memory	3576
7616 GB Memory	3577
8128 GB Memory	3578
MSS Sales Flag A	3668
MSS Sales Flag B	3669
CPACF Enablement	3863

PCIe+ I/O Drawer	4001
Additional CBU Test	6805
Total CBU Years Ordered	6817
CBU Records Ordered	6818
Single CBU CP Year	6820
25 CBU CP Year	6821
Single CBU IFL Year	6822
25 CBU IFL Year	6823
Single CBU ICF Year	6824
25 CBU ICF Year	6825
Single CBU zIIP Year	6828
25 CBU zIIP Year	6829
Single CBU SAP Year	6830
25 CBU SAP Year	6831
CBU Replenishment	6832
Capacity for Planned Event	6833
OPO Sales Flag	6835
OPO Sales Flag-Alteration	6836
Top Exit Cabling	7917
Bottom Exit Cabling	7919
FQC Bracket & Mounting Hdw	7934

LC Duplex 6.6ft Harness	7935
30A/208V 14ft w/TwistLock	7937
30A/208V 14ft w/Russelstoll	7938
32A/250V Cord EMEA & AP	7939
32A/250V Cord Aus & NZ	7940
32A/250V Cord Korea	7941
32A/250V LSZH Cord	7943
19" Frame Bolt Down Kit	8006
Multi Order Ship Flag	9000
Multi Order Rec Only Flag-NB	9001
Multi Order Rec Only Flag-MES	9002
RPO Action Flag	9003
Downgraded PUs Per Request	9004
On/Off CoD Act 100 IFL Day	9874
On/Off CoD Act 100 ICF Day	9875
On/Off CoD Act 100 CP Day	9876
On/Off CoD Act 100 zIIP Day	9877
On/Off CoD Act 100 SAP Day	9878
19" Rack	9883
On/Off CoD Act IFL Day	9888
On/Off CoD Act ICF Day	9889

On/Off COD authorization	9896
On/Off CoD Act Cap CP Day	9897
Perm upgr auth	9898
CIU Activation (Flag)	9899
On-Line CoD Buying (Flag)	9900
On/Off CoD Act zIIP Day	9908
On/Off CoD Act. SAP Day	9909
CBU authorization	9910
CPE authorizataion	9912
OPO Sales authorization	9913
1 MSU day	9917
100 MSU days	9918
10000 MSU days	9919
1 IFL day	9920
100 IFL days	9921
1 ICF day	9922
100 ICF days	9923
1 zIIP day	9924
100 zIIP days	9925
1 SAP day	9928
100 SAP days	9929

Height Reduce Ship	9975
Height Reduce for Return	9976

z14	3906	M01	
		M02	
		M03	
		M04	
		M05	
Linux Hosting Foundation			0103
Container Hosting Foundation			0104
MSS Sales Flag A			3668
MSS Standard Side cover			3670
MSS Top Exit side cover			3671

Features that may carry forward on an upgrade: The following features may be retained if they are installed at the time of an upgrade to the IBM z14 ZR1.

Description	Machine Type	Model	Feature
z14	3907	ZR1	
HMC			0092
HMC Rack Mount			0094
HMC			0095
HMC Rack Mount			0096

Description	Machine Type	Model	Feature
TKE Rack Mount w/4767			0097
TKE w/4767			0098
Mouse			0152
HMC Tower Keyboard			0153
TKE Tower Keyboard			0155
Client Must Provide Mouse			0186
Client Must Provide HMC KeyBd			0187
Client Must Provide TKE KeyBd			0189
Client Must Provide Display			0191
OSA-Express4S GbE LX			0404
OSA-Express4S GbE SX			0405
OSA-Express4S 10 GbE LR			0406
OSA-Express4S 10 GbE SR			0407
FICON Express8S 10KM LX			0409
FICON Express8S SX			0410
10 GbE RoCE Express			0411
OSA-Express5S GbE LX			0413
OSA-Express5S GbE SX			0414
OSA-Express5S 10 GbE LR			0415
OSA-Express5S 10 GbE SX			0416

Description	Machine Type	Model	Feature
OSA-Express5S 1000BASE-T			0417
FICON Express 16S LX			0418
FICON Express 16S SX			0419
TKE workstation w/4765			0842
TKE workstation w/4767			0847
Addl smart cards			0884
TKE Smart Card Reader			0885
Crypto Express5S			0890
Flat Panel Display			6096

Model conversions

From Machine Type	From Model	To Machine Type	To Model	
2965	N10	3907	ZR1	(*)
	N20	3907	ZR1	(*)

(*) Parts removed or replaced as a result of a model conversion become the property of IBM and must be returned.

Feature conversions

The feature conversion list for z14 Model ZR1 is now available in the Library section of Resource Link. This list can be obtained at Resource Link.

Using the instructions on the Resource Link panels, obtain a user ID and password. Resource Link has been designed for easy access and navigation.

Back to topBack to top

Business Partner information

Top rule

If you are a Direct Reseller - System Reseller acquiring products from IBM, you may link directly to Business Partner information for this announcement. A PartnerWorld ID and password are required (use IBMid).

BP Attachment for Announcement Letter 118-018

Back to topBack to top

Publications

Top rule

The following publications are available now in the Library section of Resource Link®:

Title	Order Number
IBM 3907 Installation manual for Physical Planning (IMPP)	GC28-6974
PR/SM™ Planning Guide	SB10-7169
IOCP User's Guide	SB10-7172
Planning for Fiber Optic Links (FICON/FCP, Coupling Links, and OSA)	GA23-1408

The following publications are shipped with the product and will be available at planned availability in the Library section of Resource Link:

Title	Order Number
IBM 3907 Installation Manual	GC28-6973
IBM 3907 Service Guide	GC28-6975

Title	Order Number
Service Guide for TKE Workstations (Version 7.0)	GC28-6980
Systems Safety Notices	G229-9054
IBM Important Notices	G229-9056
IBM 3907 Safety Inspection	GC28-6972
Systems Environmental Notices and User Guide	Z125-5823
IBM Z Statement of Limited Warranty	GC28-6979
License Agreement for Machine Code	SC28-6872
License Agreement for Machine Code Addendum for Elliptic Curve Cryptography	GC27-2635

The following publications will be available at planned availability in the Library section of Resource Link:

Title	Order Number
IBM 3907 Parts Catalog	GC28-6976
Service Guide for 2461 HMC	GC28-6990
Service Guide for 2461 Support Element	GC28-6991
Service Guide for HMCs and SEs	GC28-6983
SNMP Application Programming Interfaces	SB10-7171
Capacity on Demand User's Guide	SC28-6985
CHPID Mapping Tool User's Guide	GC28-6984
Hardware Management Console Web Services API (V2.14.0)	SC27-2636
IBM Dynamic Partition Manager (DPM) Guide	SB10-7170
Secure Service Container User's Guide	SC28-6978

Title	Order Number
Stand-Alone IOCP User's Guide	SB10-7173
FICON CTC Reference	SB10-7174
Maintenance Information for Fiber Optic Links (FICON/FCP, Coupling Links, and OSA)	SY27-7696
OSA-Express Customer Guide and Reference	SA22-7935
OSA/SF on the Hardware Management Console	SC14-7580
OSA Integrated Console Controller User's Guide	SC27-9003
Integrating the HMC's Broadband RSF into your Enterprise	SC28-6986
Ensemble Workload Resource Group Management Guide	GC27-2633
Ensemble Planning Guide	GC27-2631
SCSI IPL - Machine Loader Messages	SC28-6948
Hardware Management Console Security	SC28-6987

Resource Link: Publications for IBM Z® can be obtained at the Resource Link website.

Using the instructions on the Resource Link panels, obtain a user ID and password. Resource Link has been designed for easy access and navigation.

HMC and SE console documentation

At planned availability, the Hardware Management Console (HMC) and Support Element (SE) console documentation (Version 2.14.0) will be available from IBM Knowledge Center.

IBM Knowledge Center provides you with a single information center where you can access product documentation for IBM systems hardware, operating systems, and server software. Through a consistent framework, you can efficiently find information and personalize your access.

The following Redbooks® publications are available now. To order, contact your IBM representative.

Title	Order Number
IBM z14 Technical Introduction	SG24-8450-00
IBM z14 Technical Guide	SG24-8451-00
IBM z14 Configuration Setup	SG24-8460-00

Title	Order Number
IBM z Systems® Connectivity Handbook	SG24-5444-17
IBM z Systems Functional Matrix	REDP-5157-02

To download these Redbooks publications, go to the IBM zEnterprise System Redbooks website.

For other IBM Redbooks publications, go to the main IBM Redbooks website.

IBM Knowledge Center provides you with a single information center where you can access product documentation for IBM systems hardware, operating systems, and server software. Through a consistent framework, you can efficiently find information and personalize your access. See the IBM Knowledge Center website.

To access the IBM Publications Center Portal, go to the IBM Publications Center website.

The Publications Center is a worldwide central repository for IBM product publications and marketing material with a catalog of 70,000 items. Extensive search facilities are provided. A large number of publications are available online in various file formats, which can currently be downloaded.

National language support

Not applicable.

Back to topBack to top

Services

Top rule

IBM Systems Lab Services

IBM Systems Lab Services offers a wide array of services available for your enterprise. It brings expertise on the latest technologies from the IBM development community and can help with your most difficult technical challenges.

IBM Systems Lab Services exists to help you successfully implement emerging technologies so as to accelerate your return on investment and improve your satisfaction with your IBM systems and solutions. Services examples include initial implementation, integration, migration, and skills transfer on IBM systems solution capabilities and recommended practices. IBM Systems Lab Services is one of the service organizations of IBM's world-renowned IBM Systems Group development labs.

For details on available services, contact your IBM representative or go to the Lab Services website.

Global Technology Services

IBM services include business consulting, outsourcing, hosting services, applications, and other technology management.

These services help you learn about, plan, install, manage, or optimize your IT infrastructure to be an on-demand business. They can help you integrate your high-speed networks, storage systems, application servers, wireless protocols, and an array

of platforms, middleware, and communications software for IBM and many non-IBM offerings. IBM is your one-stop shop for IT support needs.

For details on available services, contact your IBM representative or go to the IBM Global Technology Services® website.

For details on available IBM Business Continuity and Recovery Services, contact your IBM representative or go to the Resiliency Services website.

Details on education offerings related to specific products can be found on the IBM authorized training website.

Back to topBack to top

Technical information

Top rule

Specified operating environment

Physical specifications

Physical specifications - IBM z14 Model ZR1

Dimensions (rounded to the nearest 0.1 in or 1 mm):

Systems with all covers

	Depth	Width	Height
Inches	42.1	23.6	79.3
Millimeters	1070	600	2015
Inches (O/H I/O cable exit)	47.4	24.6	83.8
Millimeters (O/H I/O cable exit)	1204	624	2128

Note: The height with overhead I/O cable exit differs from the standard height only with the optional optical cable organizer feature installed.

Systems with all covers and height reduction

	Depth	Width	Height
Inches	42.1	23.6	74.7
Millimeters	1070	600	1898

	Depth	Width	Height

Approximate weight:

	New Build Maximums - Model ZR1
kg	735
lb	1621
kg (O/H I/O cable exit)	740
lb (O/H I/O cable exit)	1634

Operating environment

Operating environment - IBM z14 Model ZR1 Machine

Environmental class - ASHRAE A3

Temperature: 5° to 40°C (41° to 104°F) for all models up to 900 meters above sea level; maximum ambient reduces 1°C per 300 meters above 900 meters.

Relative humidity: 8% to 85% wet bulb (caloric value): 25°C (77°F)

Operating mode maximum dew point: 24°C (75.2°F) - Operating Mode

Electrical power considerations

- 200 - 240 V ac
- Single phase
- 50/ 60 Hz
- 24 Amp

Note: There are redundant power distribution units (PDUs) in the ZR1, as well as significant reliability testing completed on each individual PDU. For backup power in event of a power outage, the z14 Model ZR1 is designed to be connected into a data center backup power system. Clients who require backup power may utilize an industry-standard solution. There is not an Integrated Battery Feature (IBF) offered with the ZR1.

Capacity of exhaust: 2000 cubic meters / hour (1200 CFM)

Noise level for typical configuration Model ZR1:

- Declared A-weighted sound power level, LWAd(B) = 9.2
- Declared A-weighted sound pressure level, LpAm(dB) = 59

Leakage and starting current: 70 mA / 170 A (approximately 100 microseconds)

Systems

Hardware requirements

The hardware requirements for the IBM Z® servers, features, and functions are identified. **A new driver level is required since z13s.** HMC (V2.14.0) plus MCLs and the Support Element (V2.14.0) are available.

You should review the PSP buckets for minimum Machine Change Levels (MCLs) and software PTF levels before IPLing operating systems.

HMC system support

The new functions available on the Hardware Management Console (HMC) version 2.14.0, as described, apply exclusively to IBM z14 models. However, the HMC version 2.14.0 will also support the systems listed in the table below.

Family	Machine Type	Firmware Driver	SE Version	Ensemble Node Potential
z14	3907	32	2.14.0	Yes
z14	3906	32	2.14.0	Yes
z13®	2964	27	2.13.1	Yes
z13s	2965	27	2.13.1	Yes
zBX Node	2458 Mod 004	22	2.13.0	Required
zBC12	2828	15	2.12.1	Yes
zEC12	2827	15	2.12.1	Yes
z114	2818	93	2.11.1	Yes
z196	2817	93	2.11.1	Yes
z10™ BC	2098	79	2.10.2	No
z10 EC	2097	79	2.10.2	No

Peripheral hardware and device attachments

IBM devices previously attached to IBM z114, z196, zBC12, zEC12, z13s, z13, and z14 servers are supported for attachment to IBM z14 channels, unless otherwise noted. The subject I/O devices must meet the FICON and Fibre Channel Protocol (FCP) architectures to be supported. I/O devices that meet OEMI architecture requirements are supported only using an external converter. Prerequisite Engineering Change Levels may be required. For further detail, contact IBM service personnel.

While the IBM z14 supports devices as described above, IBM does not commit to provide support or service for an IBM device that has reached its End of Service effective date as announced by IBM.

Note: IBM cannot confirm the accuracy of performance, compatibility, or any other claims related to non-IBM products. Questions regarding the capabilities of non-IBM products should be addressed to the suppliers of those products.

Information on switches and directors qualified for IBM Z FICON and FCP channels can be found in the Library section of Resource Link.

Software requirements

IBM z14 Model ZR1 requires at a minimum:

- z/OS V2.3 with PTFs.*
- z/OS V2.2 with PTFs.
- z/OS V2.1 with PTFs.
- z/OS V1.13 (compatibility only, extended support contract for IBM Software Support Services for z/OS required with PTFs).
- z/VM V6.4 with PTFs.
- z/VM 7.1.
- z/VSE V6.2 with PTFs.
- z/VSE V6.1 with PTFs.
- z/VSE V5.2 with PTFs.
- z/TPF V1.1 with PTFs (compatibility, including Crypto Express6S and OSA-Express6S support).
- Linux on Z - IBM plans to support running the following Linux on Z distributions on IBM z14:
  - SUSE SLES 12 SP2 with service and SUSE SLES 11 SP4 with service.
  - Red Hat RHEL 7.3 with service and Red Hat RHEL 6.9 with service.
  - Ubuntu 16.04 LTS (or higher) with service.
  - IBM is working to support the KVM hypervisor which was first offered with the following Linux distributions: SLES 12 SP2 with service, and Ubuntu 16.04 LTS (or higher) with service.
    Note: For minimum required and recommended distribution levels refer to the IBM Z website.

* IBM z/OS V2.3 with IBM z14 will require a minimum of 8 GB of memory. When running as a z/VM guest or on an IBM System z® Personal Development Tool, a minimum of 2 GB will be required for z/OS V2.3. If the minimum is not met, a warning WTOR will be issued at IPL. Continuing with less than the minimum memory could impact availability. A migration health check is planned to be introduced for z/OS V2.2 and z/OS V2.1 with PTFs to warn you when an LPAR on a z14 system has been configured with less than 8 GB.

The following software requirements are listed for features and capabilities supported on IBM z14 ZR1:

FICON Express16S+ (CHPID type FC) when utilizing FICON or Channel-To-Channel (CTC), requires at a minimum:

- z/OS V2.3.
- z/OS V2.2 with PTFs.
- z/OS V2.1 with PTFs.
- z/OS V1.13 (compatibility only, extended support contract for IBM Software Support Services for z/OS required).
- z/VM V6.4.
- z/VSE V6.2 with PTFs.
- z/VSE V6.1 with PTFs.
- z/VSE V5.2 with PTFs.
- z/TPF V1.1 with PTFs.
- Linux on Z:
  - SLES 12 SP2 with service and SLES 11 SP4 with service.
  - RHEL 7.3 with service and RHEL 6.9 with service.
  - Ubuntu 16.04 LTS (or higher) with service.

FICON Express16S+ (CHPID type FC) for support of zHPF single-track operations requires at a minimum:

- z/OS V2.3.
- z/OS V2.2 with PTFs.
- z/OS V2.1 with PTFs.
- z/OS V1.13 (compatibility only, extended support contract for IBM Software Support Services for z/OS required with PTFs).
- z/VM V6.4.
- z/VSE V6.2 with PTFs.
- z/TPF V1.1 with PTFs.
- Linux on Z:
  - SLES 12 SP2 with service and SLES 11 SP4 with service.
  - RHEL 7.3 with service and RHEL 6.9 with service.
  - Ubuntu 16.04 LTS (or higher) with service.

FICON Express16S+ (CHPID type FC) for support of zHPF multitrack operations requires at a minimum:

- z/OS V2.3.
- z/OS V2.2 with PTFs.
- z/OS V2.1 with PTFs.
- z/OS V1.13 (compatibility only, extended support contract for IBM Software Support Services for z/OS required with PTFs).
- z/VM V6.4.
- z/VSE V6.2 with PTFs.
- Linux on Z:

    - SLES 12 SP2 with service and SLES 11 SP4 with service.
    - RHEL 7.3 with service and RHEL 6.9 with service.
    - Ubuntu 16.04 LTS (or higher) with service.

FICON Express16S+ (CHPID type FCP) for support of SCSI devices requires at a minimum:

– z/VM V6.4.
– z/VSE V6.2 with PTFs.
– z/VSE V6.1 with PTFs.
– z/VSE V5.2 with PTFs.
– Linux on Z:
    - SLES 12 SP2 with service and SLES 11 SP4 with service.
    - RHEL 7.3 with service and RHEL 6.9 with service.
    - Ubuntu 16.04 LTS (or higher) with service.

FICON Express16S+ (CHPID type FCP) support of hardware data router requires at a minimum:

– z/VM V6.4 for guest exploitation.
– Linux on Z:
    - SLES 12 SP2 with service and SLES 11 SP4 with service.
    - RHEL 7.3 with service and RHEL 6.9 with service.
    - Ubuntu 16.04 LTS (or higher) with service.

T10-DIF support by the FICON Express16S+ features when defined as CHPID type FCP requires at a minimum:

– z/VM V6.4 for guest exploitation.
– Linux on Z:
    - SLES 12 SP2 with service (DIF and DIX) and SLES 11 SP4 with service (DIF and DIX).
    - RHEL 7.3 with service (DIF and DIX) and RHEL 6.9 with service (DIF only).
    - Ubuntu 16.04 LTS (or higher) with service (DIF and DIX).

OSA-Express6S GbE LX (#0422) and GbE SX (#0423) require at a minimum:

CHPID type OSD:

– z/OS V2.3.
– z/OS V2.2.
– z/OS V2.1.
– z/OS V1.13 (compatibility only, extended support contract for IBM Software Support Services for z/OS required).
– z/VM V6.4 with PTFs.
– z/VSE V6.2 with PTFs.
– z/VSE V6.1 with PTFs.
– z/VSE V5.2 with PTFs.
– z/TPF V1.1 with PTFs.
– Linux on Z:
    - SLES 12 SP2 with service and SLES 11 SP4 with service.
    - RHEL 7.3 with service and RHEL 6.9 with service.
    - Ubuntu 16.04 LTS (or higher) with service.

CHPID type OSD without maximum port exploitation (one port on the PCIe adapter is available for use):

– z/OS V2.3.
– z/OS V2.2.
– z/OS V2.1.
– z/OS V1.13 (compatibility only, extended support contract for IBM Software Support Services for z/OS required).
– z/VM V6.4 with PTFs.
– z/VSE V6.2 with PTFs.
– z/VSE V6.1 with PTFs.
– z/VSE V5.2 with PTFs.
– z/TPF V1.1 with PTFs.
– Linux on Z:
    - SLES 12 SP2 with service and SLES 11 SP4 with service.
    - RHEL 7.3 with service and RHEL 6.9 with service.
    - Ubuntu 16.04 LTS (or higher) with service.

OSA-Express6S 10 GbE LR (#0424) and 10 GbE SR (#0425) require at a minimum:

CHPID type OSD:

- z/OS V2.3.
- z/OS V2.2.
- z/OS V2.1.
- z/OS V1.13 (compatibility only, extended support contract for IBM Software Support Services for z/OS required).
- z/VM V6.4 with PTFs.
- z/VSE V6.2 with PTFs.
- z/VSE V6.1 with PTFs.
- z/VSE V5.2 with PTFs.
- z/TPF V1.1 with PTFs.
- Linux on Z:
  - SLES 12 SP2 with service and SLES 11 SP4 with service.
  - RHEL 7.3 with service and RHEL 6.9 with service.
  - Ubuntu 16.04 LTS (or higher) with service.

CHPID type OSX for access control to the intra-ensemble data network (IEDN) from IBM z14 to Unified Resource Manager functions:

- z/OS V2.3.
- z/OS V2.2.
- z/OS V2.1.
- z/OS V1.13 (compatibility only, extended support contract for IBM Software Support Services for z/OS required).
- z/VM V6.4 to define, modify, and delete OSX CHPID types when z/VM is the controlling LPAR for dynamic I/O.
- z/VSE V6.2 with PTFs.
- z/VSE V6.1 with PTFs.
- z/VSE V5.2 with PTFs.
- z/TPF V1.1 with PTFs.
- Linux on Z:
  - SLES 12 SP2 with service and SLES 11 SP4 with service.
  - RHEL 7.3 with service and RHEL 6.9 with service.
  - Ubuntu 16.04 LTS (or higher) with service.

OSA-Express6S 1000BASE-T Ethernet (#0426) requires at minimum:

CHPID type OSC supporting TN3270E and non-SNA DFT:

- z/OS V2.3.
- z/OS V2.2.
- z/OS V2.1.
- z/OS V1.13 (compatibility only, extended support contract for IBM Software Support Services for z/OS required).
- z/VM V6.4 with PTFs.
- z/VSE V6.2 with PTFs.
- z/VSE V6.1 with PTFs.
- z/VSE V5.2 with PTFs.
- z/TPF V1.1 (support for port 0 only).

CHPID type OSD with exploitation of two ports per CHPID:

- z/OS V2.3.
- z/OS V2.2.
- z/OS V2.1.
- z/OS V1.13 (compatibility only, extended support contract for IBM Software Support Services for z/OS required).
- z/VM V6.4 with PTFs.
- z/VSE V6.2 with PTFs.
- z/VSE V6.1 with PTFs.
- z/VSE V5.2 with PTFs.
- z/TPF V1.1 with PTFs.
- Linux on Z:
  - SLES 12 SP2 with service and SLES 11 SP4 with service.
  - RHEL 7.3 with service and RHEL 6.9 with service.
- Ubuntu 16.04 LTS (or higher) with service.

CHPID type OSD without maximum port exploitation (one port on the PCIe adapter is available for use):

– z/OS V2.3.
– z/OS V2.2.
– z/OS V2.1.
– z/OS V1.13 (compatibility only, extended support contract for IBM Software Support Services for z/OS required).
– z/VM V6.4 with PTFs.
– z/VSE V6.2 with PTFs.
– z/VSE V6.1 with PTFs.
– z/VSE V5.2 with PTFs.
– z/TPF V1.1.
– Linux on Z:
  ▪ SLES 12 SP2 with service and SLES 11 SP4 with service.
  ▪ RHEL 7.3 with service and RHEL 6.9 with service.
  ▪ Ubuntu 16.04 LTS (or higher) with service.

Checksum offload for IPv6 packets (CHPID type OSD):

– z/OS V2.3.
– z/OS V2.2.
– z/OS V2.1.
– z/OS V1.13 (compatibility only, extended support contract for IBM Software Support Services for z/OS required).
– z/VM V6.4 for guest exploitation.

Checksum offload for LPAR-to-LPAR traffic for IPv4 and IPv6 packets (CHPID type OSD):

– z/OS V2.3.
– z/OS V2.2.
– z/OS V2.1.
– z/OS V1.13 (compatibility only, extended support contract for IBM Software Support Services for z/OS required).
– z/VM V6.4 for guest exploitation.

Large Send for IPv6 packets (CHPID type OSD):

– z/OS V2.3.
– z/OS V2.2.
– z/OS V2.1.
– z/OS V1.13 (compatibility only, extended support contract for IBM Software Support Services for z/OS required).
– z/VM V6.4 for guest exploitation.

CHPID type OSE supporting 4 or 2 ports per feature:

– z/OS V2.3.
– z/OS V2.2.
– z/OS V2.1.
– z/OS V1.13 (compatibility only, extended support contract for IBM Software Support Services for z/OS required).
– z/VM V6.4.
– z/VSE V6.2 with PTFs.
– z/VSE V6.1 with PTFs.
– z/VSE V5.2 with PTFs.

CHPID type OSM for intranode management network (INMN):

– z/OS V2.3.
– z/OS V2.2.
– z/OS V2.1.
– z/OS V1.13 (compatibility only, extended support contract for IBM Software Support Services for z/OS required with PTFs).
– z/VM V6.4 to define, modify, and delete CHPID type OSM when z/VM is the controlling LPAR for dynamic I/O.
– Linux on Z:
  ▪ SLES 12 SP2 with service and SLES 11 SP4 with service.
  ▪ RHEL 7.3 with service and RHEL 6.9 with service.
  ▪ Ubuntu 16.04 LTS (or higher) with service.

Crypto Express6S (#0893) Toleration, which treats Crypto Express6S cryptographic coprocessors and accelerators as Crypto Express5 coprocessors and accelerators, requires at a minimum:

– z/OS V2.3 with PTFs.

- z/OS V2.2 with PTFs or:
  - z/OS V2.2 with Cryptographic Support for z/OS V1R13 - z/OS V2R2 (HCR77B1) with PTFs, or
  - z/OS V2.2 with Cryptographic Support for z/OS V2R1 - z/OS V2R2 (HCR77CO) with PTFs.
- z/OS V2.1 with PTFs or:
  - z/OS V2.1 with Cryptographic Support for z/OS V1R13 - z/OS V2R1 (HCR77A1) with PTFs or
  - z/OS V2.1 with Enhanced Cryptographic Support for z/OS V1R13 - z/OS V2R1 (HCR77B0) with PTFs or
  - z/OS V2.1 with Cryptographic Support for z/OS V1R13 - z/OS V2R2 (HCR77B1) with PTFs or
  - z/OS V2.1 with Cryptographic Support for z/OS V2R1 - z/OS V2R2 (HCR77CO) with PTFs.
- z/VM V6.4 with PTFs for guest exploitation and exploitation within the z/VM TLS/SSL server.
- z/VSE V6.2 with PTFs.
- z/VSE V6.1 with PTFs.
- z/VSE V5.2 with PTFs.
- z/TPF V1.1 with PTFs.
- Linux on Z: For the exact kernel levels refer to the Linux on IBM Z website.
  - SLES 12 SP2 with service and SLES 11 SP4 with service.
  - RHEL 7.3 with service and RHEL 6.9 with service.
  - Ubuntu 16.04 LTS (or higher) with service.
  - For secure-key cryptography with Linux on Z, CCA 5.2.23 (or later) is available and can be downloaded from the CryptoCards website.

Crypto Express6S (#0893) support of VISA® Format Preserving Encryption requires at a minimum:

- z/OS V2.3.
- z/OS V2.2.
- z/OS V2.1 with the Enhanced Cryptographic Support for z/OS V1R13-z/OS V2R1 (HCR77B0) web deliverable installed.
- z/VM V6.4 with PTFs for guest exploitation.

Crypto Express6S (#0893) support of greater than 16 Domains requires at a minimum:

- z/OS V2.3.
- z/OS V2.2.
- z/OS V2.1 with the Enhanced Cryptographic Support for z/OS V1R13-z/OS V2R1 (HCR77B0) web deliverable installed.
- z/VM V6.4 with PTFs for guest exploitation and exploitation within the z/VM TLS/SSL server.
- z/VSE V6.2 with PTFs.
- z/VSE V6.1 with PTFs.
- z/VSE V5.2 with PTFs.
- Linux on Z:
  - SLES 12 SP2 with service and SLES 11 SP4 with service.
  - RHEL 7.3 with service and RHEL 6.9 with service.
  - Ubuntu 16.04 LTS (or higher) with service.

Crypto Express6S (#0893) Exploitation requires at a minimum:

- z/OS V2.1 with Cryptographic Support for z/OS V2R1 - z/OS V2R3 (HCR77C1).
- z/OS V2.2 with Cryptographic Support for z/OS V2R1 - z/OS V2R3 (HCR77C1).
- z/OS V2.3 with Cryptographic Support for z/OS V2R1 - z/OS V2R3 (HCR77C1).
- z/VM 6.4 with PTFs for guest exploitation.
- z/TPF V1.1 with support for Crypto Express6S (APAR PJ44689).
- Linux on Z: IBM is working with its Linux distribution partners to provide support in future distribution releases.

Crypto Express6S (#0893) support of PCI-HSM compliance requires at a minimum:

- z/OS V2.1 with Cryptographic Support for z/OS V2R1 - z/OS V2R3 (HCR77C1).
- z/OS V2.2 with Cryptographic Support for z/OS V2R1 - z/OS V2R3 (HCR77C1).
- z/OS V2.3 with Cryptographic Support for z/OS V2R1 - z/OS V2R3 (HCR77C1).
- z/VM 6.4 with PTFs for guest exploitation.

10GbE RoCE Express2 (#0412) for Shared Memory Communications - Remote Direct Memory Access (SMC-R) requires at a minimum:

- z/OS V2.3.
- z/OS V2.2 with PTFs.
- z/OS V2.1 with PTFs.
- z/VM V6.4 with PTFs for guest exploitation.
- Linux on Z: IBM is working with its Linux distribution partners to include support in future distribution releases.

- SLES 12 SP3 includes support for Linux-to-Linux communication as "Tech Preview."

10GbE RoCE Express2 (#0412) for Ethernet communications (which does not require a peer OSA) including Single Root I/O Virtualization (SR-IOV) requires at a minimum:

– z/VM V6.4 with PTFs for guest exploitation.
– Linux on Z:
  - SLES 12 SP2 with service.
  - RHEL 7.3 with service.
  - Ubuntu 16.04 LTS (or higher) with service.

IBM Integrated Coupling Adapter Fanout (ICA SR) (#0172) requires at a minimum:

– z/OS V2.3.
– z/OS V2.2.
– z/OS V2.1 with PTFs.
– z/OS V1.13 (compatibility only, extended support contract for IBM Software Support Services for z/OS required with PTFs).
– z/VM 6.4 to define, modify, and delete CHPID type CS5 when z/VM is the controlling LPAR for dynamic I/O.

Support for 256 Coupling CHPIDs requires at a minimum:

– z/OS V2.3.
– z/OS V2.2.
– z/OS V2.1 with PTFs.
– z/OS V1.13 (compatibility only, extended support contract for IBM Software Support Services for z/OS required with PTFs).
– z/VM V6.4 for guest exploitation.

Coupling Express LR (#0433) requires at a minimum:

– z/OS V2.3 with PTFs.
– z/OS V2.2 with PTFs.
– z/OS V2.1 with PTFs.
– z/OS V1.13 (compatibility only, extended support contract for IBM Software Support Services for z/OS required with PTFs).
– z/VM V6.4 with PTFs to define, modify, and delete CL5 CHPID types when z/VM is the controlling LPAR for dynamic I/O.

CF Scalability Enhancements requires at a minimum:

– z/OS V2.3.
– z/OS V2.2 with PTFs.
– z/OS V2.1 with PTFs.
– z/OS V1.13 (compatibility only, extended support contract for IBM Software Support Services for z/OS required with PTFs).
– z/VM 6.4 for guest coupling exploitation.

CF List Notification Enhancements requires at a minimum:

– z/OS V2.3.
– z/OS V2.2 with PTFs.
– z/OS V2.1 with PTFs.
– z/OS V1.13 (compatibility only, extended support contract for IBM Software Support Services for z/OS required with PTFs).
– z/VM 6.4 for guest coupling exploitation.

zHyperLink Express (#0431) requires at a minimum:

– z/OS V2.3 with PTFs.
– z/OS V2.2 with PTFs.
– z/OS V2.1 with PTFs.

zEDC Express (#0420) requires at a minimum:

– z/OS V2.3 with the zEnterprise data Compression (zEDC) for z/OS feature.
– z/OS V2.2 with the zEnterprise data Compression (zEDC) for z/OS feature.
– z/OS V2.1 with the zEnterprise data Compression (zEDC) for z/OS feature.
– z/VM V6.4 for guest exploitation.

- Linux on Z:
  - SLES 12 SP2 with service.
  - RHEL 7.3 with sevice.
  - Ubuntu 16.04 LTS (or higher) with service.

IBM Virtual Flash Memory (VFM) (#0614) requires at a minimum:

- z/OS V2.3.
- z/OS V2.2.
- z/OS V2.1.
- z/OS V1.13 with PTFs, the z/OS V1.13 RSM Enablement Offering web deliverable installed, and an extended support contract for IBM Software Support Services. The web deliverable is available at the z/OS downloads website.

XL C/C++ support of ARCH(12) and TUNE(12) parameters requires at a minimum:

- z/OS V2.3 with PTFs.

Transactional memory requires at a minimum:

- z/OS V2.3.
- z/OS V2.2.
- z/OS V2.1.
- z/OS V1.13 (compatibility only, extended support contract for IBM Software Support Services for z/OS required with PTFs).
- z/VM V6.4 for guest exploitation.
- Linux on Z:
  - SLES 12 SP2 with service and SLES 11 SP4 with service.
  - RHEL 7.3 with service and RHEL 6.9 with service.
  - Ubuntu 16.04 LTS (or higher) with service.

2 GB Large Pages requires at a minimum:

- z/OS V2.3.
- z/OS V2.2.
- z/OS V2.1.
- z/OS V1.13 with PTFs, the z/OS V1.13 RSM Enablement Offering web deliverable installed, and an extended support contract for IBM Software Support Services. The web deliverable is available at the z/OS downloads website.
- z/TPF V1.1 with PTFs.
- Linux on Z:
  - SLES 12 SP3.
  - RHEL 7.4.
  - Ubuntu 16.10 (or higher)

z/OS global resource serialization (GRS) support for FICON CTCs requires at a minimum:

- z/OS V2.3.
- z/OS V2.2.
- z/OS V2.1.
- z/OS V1.13 with an extended support contract for IBM Software Support Services and PTFs.

Guarded Storage requires at a minimum:

- z/OS V2.3.
- z/OS V2.2 with PTFs.
- z/VM V6.4 with PTFs for guest exploitation.
- Linux on Z: IBM is working with its Linux distribution partners to provide support via future distribution releases.

Instruction Execution Protection Facility requires at a minimum:

- z/OS V2.3.
- z/OS V2.2 with PTFs.
- z/VM V6.4 with PTFs for guest exploitation.
- Linux on Z: IBM is working with its Linux distribution partners to provide support via future distribution releases.

Planning information

Customer responsibilities

Information on customer responsibilities for site preparation can be found in the Library section of Resource Link.

Cable orders
Not applicable.

Installability
The average installation time for an IBM z14 ZR1 is approximately14 installer hours. This does not include planning hours. This assumes a full System Assurance Product Review, and implementation of the cable services have been performed. See your IBM representative for details on these services.

Security, auditability, and control

The IBM z14 uses the security and auditability features and functions of host hardware, host software, and application software.

The customer is responsible for evaluation, selection, and implementation of security features, administrative procedures, and appropriate controls in application systems and communications facilities.

IBM Systems Lab Services

For details on available services, contact your IBM representative or go to the Lab Services website.

Back to topBack to top

Terms and conditions

Top rule

IBM Global Financing

Yes.

Products - terms and conditions

Warranty period
Warranty: One year.

To obtain copies of the IBM Statement of Limited Warranty, contact your reseller or IBM. An IBM part or feature installed during the initial installation of an IBM machine is subject to the full warranty period specified by IBM. An IBM part or feature that replaces a previously installed part or feature assumes the remainder of the warranty period for the replaced part or feature. An IBM part or feature added to a machine without replacing a previously installed part or feature is subject to a full warranty. Unless specified otherwise, the warranty period, type of warranty service, and service level of a part or feature are the same as those for the machine in which it is installed.

Warranty service
The specified level of maintenance service may not be available in all worldwide locations. Additional charges may apply outside IBM's normal service area. Contact your local IBM representative or your reseller for country- and location-specific information. IBM will repair the failing machine at your location and verify its operation. You must provide a suitable working area to allow disassembly and reassembly of the IBM machine. The area must be clean, well lit, and suitable for the purpose. The following service is available as warranty for your machine type.

– 24 hours per day, 7 days a week, same day response

Warranty service upgrades
The specified level of maintenance service may not be available in all worldwide locations. Additional charges may apply outside IBM's normal service area. Contact your local IBM representative or your reseller for country- and location-specific information.

IBM On-site Service: IBM will repair the failing machine at your location and verify its operation. You must provide a suitable working area to allow disassembly and reassembly of the IBM machine. The area must be clean, well lit, and suitable for the purpose.

The following service is provided.

– 24 hours per day, 7 days a week, same day response.

Usage plan machine
No.

IBM hourly service rate classification
Three.

When a type of service involves the exchange of a machine part, the replacement may not be new, but will be in good working order.

General terms and conditions

Field-installable features
Yes.

Model conversions
Yes.

Machine installation
Installation is performed by IBM. IBM will install the machine in accordance with the IBM installation procedures for the Machine.

In the United States, contact IBM at 1-800-IBM-SERV (426-7378). In other countries contact the local IBM office.

Graduated program license charges apply
No.

Licensed Internal Code
IBM Licensed Internal Code (LIC) is licensed for use by a customer on a specific machine, designated by serial number, under the terms and conditions of the IBM License Agreement for Machine Code, to enable a specific machine to function in accordance with its specifications, and only for the capacity authorized by IBM and acquired by the customer. You can obtain the agreement by contacting your IBM representative or visiting the License Agreement for Machine Code and Licensed Internal Code website.

Specific Machine Type Model:

– 3907-ZR1

Licensed Machine Code
Not applicable.

Machine Code License Acceptance Requirement

Acceptance-By-Use Machine: Yes, acceptance of the Machine Code license terms is conveyed through the user's initial use of the Machine.

Other Installed Licensed Code
None.

Educational allowance

Not applicable.

Back to topBack to top

Prices

Top rule

For additional information and current prices, contact your local IBM representative.

Product charges

Desc	Mach type	Model	Feat	**	EWFe	MMMC ind	INIT/MES
z14	3907	ZR1			**	X	
Model ZR1 Air Cooled			0200		**	X	
CPC Drawer Max4			0636		**	X	Both
CPC Drawer Max12			0637		**	X	Both
CPC Drawer Max24			0638		**	X	Both
CPC Drawer Max30			0639		**	X	Both
MTU 1 - D			0001		**		MES
MTU 100 - D			0002	**			MES

Desc	Mach type	Model	Feat	**	EWFe	MMMC ind	INIT/MES
MTU 1 - V			0003	**			Both
MTU 100 - V			0004	**			Both
GTU 1 -D			0005	**			MES
GTU 100- D			0006	**			MES
GTU 1 - V			0007	**			MES
GTU 100 - V			0008	**			MES
GTU 1000 - D			0009	**			MES
GTU 1000 - V			0010	**			MES
Migration Offering Machine			0014	**			Init
Blue Letter Internal			0015	**			Both
HW for DPM			0016	**			Both
Manage FW Suite			0019	**			Both
Automate FW Suite			0020	**			Both
Ensemble Member			0025	**			Both
Non RSF On/Off CoD			0032				Both
Serv Docs Optional Print			0033	**			Both
OSA-ICC 3215 Enable			0034	**			Both
RFID Tag			0035	**			Both
RFID Tag			0036	**			Both

TKE Rack Mount w/4768			0080		**		MES

TKE w/4768	0081	**	MES
HMC	0082	**	Both
HMC Rack Mount	0083	**	Both
TKE Rack Mount w/4768	0085	**	Both
TKE w/4768	0086	**	Both
WWPN Persistence	0099	**	Both
Linux Hosting Foundation	0103	**	Both
Container Hosting Foundation	0104	**	Both
1 CPE Capacity Unit	0116	**	Both
100 CPE Capacity Unit	0117	**	Both
10000 CPE Capacity Unit	0118	**	Both
1 CPE Capacity Unit-IFL	0119	**	Both
100 CPE Capacity Unit-IFL	0120	**	Both
1 CPE Capacity Unit-ICF	0121	**	Both
100 CPE Capacity Unit-ICF	0122	**	Both
1 CPE Capacity Unit-zIIP	0125	**	Both
100 CPE Capacity Unit-zIIP	0126	**	Both
1 CPE Capacity Unit-SAP	0127	**	Both
100 CPE Capacity Unit-SAP	0128	**	Both
HMC Table Top KMM	0148	**	Both

HMC Rack Keybd/Monitor/Mouse	0154	**	Both
TKE Rack Keybd/Monitor/Mouse	0156	**	Both
TKE Table Top KMM	0157	**	Both
ICA SR Fanout	0172	**	Both
PCIe Fanout	0173	**	Both
Fanout Airflow PCIe	0174	**	Both
Client Must Provide HMC KMM	0188	**	Both
Client Must Provide TKE KMM	0190	**	Both
2828 w/o TEIO & w/o HtR	0192	**	Both
2828 w/o TEIO & w/ HtR	0193	**	Both
2828 w/ TEIO & w/o HtR	0194	**	Both
2828 w/ TEIO & w/ HtR	0195	**	Both
2965 w/o TEIO & w/o HtR	0196	**	Both
2965 w/o TEIO & w/ HtR	0197	**	Both
2965 w/ TEIO & w/o HtR	0198	**	Both
2965 w/ TEIO & w/ HtR	0199	**	Both
US English	0235	**	Both
France	0236	**	Both
German/Austrian	0237	**	Both
LA Spanish	0238	**	Both
Spain	0239	**	Both

Italian	0240	**	Both
French Canadian	0241	**	Both
Portuguese	0242	**	Both
UK English	0243	**	Both
Norwegian	0244	**	Both
Sweden Finland	0245	**	Both
Netherlands	0246	**	Both
Belgian French	0247	**	Both
Swiss French/German	0249	**	Both
PCIe Interconnect	0401	**	Both
10 GbE RoCE Express2	0412	**	Both
zEDC Express	0420	**	Both

OSA-Express6S GbE LX	0422	**	Both
OSA-Express6S GbE SX	0423	**	Both
OSA-Express6S 10 GbE LR	0424	**	Both
OSA-Express6S 10 GbE SR	0425	**	Both
OSA-Express6S 1000BASE-T	0426	**	Both
FICON Express16S+ LX	0427	**	Both
FICON Express16S+ SX	0428	**	Both
zHyperLink Express	0431	**	Both
Coupling Express LR	0433	**	Both

IBM Virtual Flash Memory		0614	**	Both
16U Reserved		0617	**	Both
Switchable PDU		0622	**	Both
Ethernet Switch		0623	**	Both
CPC PSU		0641	**	Both
Read Only Media Option		0845	**	Both
TKE workstation w/4768		0849	**	MES
4768 TKE Crypto Adapter		0844	**	MES
TKE Addl Smart Cards		0892	**	Both
32GB USB Backup Media		0848	**	Both
TKE 9.0 LIC		0879	**	Both
TKE Smart Card Reader		0891	**	Both
Crypto Express6S		0893	**	Both
IFL	1064	**	X	Both
ICF	1065	**	X	Both
SAP (optional)	1066	**		Both
zIIP	1067	**	X	Both
Unassigned IFL	1068	**		Both
CP-A	1069	**		Both

CP-B	1070	**	Both
CP-C	1071	**	Both
CP-D	1072	**	Both
CP-E	1073	**	Both
CP-F	1074	**	Both
CP-G	1075	**	Both
CP-H	1076	**	Both
CP-I	1077	**	Both
CP-J	1078	**	Both
CP-K	1079	**	Both
CP-L	1080	**	Both
CP-M	1081	**	Both
CP-N	1082	**	Both
CP-O	1083	**	Both
CP-P	1084	**	Both
CP-Q	1085	**	Both
CP-R	1086	**	Both
CP-S	1087	**	Both
CP-T	1088	**	Both
CP-U	1089	**	Both
CP-V	1090	**	Both

CP-W	1091	**		Both
CP-X	1092	**		Both
CP-Y	1093	**		Both
CP-Z	1094	**		Both
0-Way Processor A00	1157	**	X	Both
1-Way Processor A01	1158	**	X	Both
1-Way Processor B01	1159	**	X	Both
1-Way Processor C01	1160	**	X	Both
1-Way Processor D01	1161	**	X	Both
1-Way Processor E01	1162	**	X	Both
1-Way Processor F01	1163	**	X	Both
1-Way Processor G01	1164	**	X	Both
1-Way Processor H01	1165	**	X	Both
1-Way Processor I01	1166	**	X	Both
1-Way Processor J01	1167	**	X	Both
1-Way Processor K01	1168	**	X	Both
1-Way Processor L01	1169	**	X	Both
1-Way Processor M01	1170	**	X	Both
1-Way Processor N01	1171	**	X	Both
1-Way Processor O01	1172	**	X	Both
1-Way Processor P01	1173	**	X	Both

1-Way Processor Q01	1174	**	X	Both
1-Way Processor R01	1175	**	X	Both
1-Way Processor S01	1176	**	X	Both
1-Way Processor T01	1177	**	X	Both
1-Way Processor U01	1178	**	X	Both
1-Way Processor V01	1179	**	X	Both
1-Way Processor W01	1180	**	X	Both
1-Way Processor X01	1181	**	X	Both
1-Way Processor Y01	1182	**	X	Both
1-Way Processor Z01	1183	**	X	Both
2-Way Processor A02	1184	**	X	Both
2-Way Processor B02	1185	**	X	Both
2-Way Processor C02	1186	**	X	Both
2-Way Processor D02	1187	**	X	Both
2-Way Processor E02	1188	**	X	Both
2-Way Processor F02	1189	**	X	Both
2-Way Processor G02	1190	**	X	Both
2-Way Processor H02	1191	**	X	Both
2-Way Processor I02	1192	**	X	Both
2-Way Processor J02	1193	**	X	Both
2-Way Processor K02	1194	**	X	Both

2-Way Processor L02	1195	**	X	Both
2-Way Processor M02	1196	**	X	Both
2-Way Processor N02	1197	**	X	Both
2-Way Processor O02	1198	**	X	Both
2-Way Processor P02	1199	**	X	Both
2-Way Processor Q02	1200	**	X	Both
2-Way Processor R02	1201	**	X	Both
2-Way Processor S02	1202	**	X	Both
2-Way Processor T02	1203	**	X	Both
2-Way Processor U02	1204	**	X	Both
2-Way Processor V02	1205	**	X	Both
2-Way Processor W02	1206	**	X	Both
2-Way Processor X02	1207	**	X	Both
2-Way Processor Y02	1208	**	X	Both
2-Way Processor Z02	1209	**	X	Both
3-Way Processor A03	1210	**	X	Both
3-Way Processor B03	1211	**	X	Both
3-Way Processor C03	1212	**	X	Both
3-Way Processor D03	1213	**	X	Both
3-Way Processor E03	1214	**	X	Both
3-Way Processor F03	1215	**	X	Both

3-Way Processor G03	1216	**	X	Both
3-Way Processor H03	1217	**	X	Both
3-Way Processor I03	1218	**	X	Both
3-Way Processor J03	1219	**	X	Both
3-Way Processor K03	1220	**	X	Both
3-Way Processor L03	1221	**	X	Both
3-Way Processor M03	1222	**	X	Both
3-Way Processor N03	1223	**	X	Both
3-Way Processor O03	1224	**	X	Both
3-Way Processor P03	1225	**	X	Both
3-Way Processor Q03	1226	**	X	Both
3-Way Processor R03	1227	**	X	Both
3-Way Processor S03	1228	**	X	Both
3-Way Processor T03	1229	**	X	Both
3-Way Processor U03	1230	**	X	Both
3-Way Processor V03	1231	**	X	Both
3-Way Processor W03	1232	**	X	Both
3-Way Processor X03	1233	**	X	Both
3-Way Processor Y03	1234	**	X	Both
3-Way Processor Z03	1235	**	X	Both
4-Way Processor A04	1235	**	X	Both

4-Way Processor B04	1237	**	X	Both
4-Way Processor C04	1238	**	X	Both
4-Way Processor D04	1239	**	X	Both
4-Way Processor E04	1240	**	X	Both
4-Way Processor F04	1241	**	X	Both
4-Way Processor G04	1242	**	X	Both
4-Way Processor H04	1243	**	X	Both
4-Way Processor I04	1244	**	X	Both
4-Way Processor J04	1245	**	X	Both
4-Way Processor K04	1246	**	X	Both
4-Way Processor L04	1247	**	X	Both
4-Way Processor M04	1248	**	X	Both
4-Way Processor N04	1249	**	X	Both
4-Way Processor O04	1250	**	X	Both
4-Way Processor P04	1251	**	X	Both
4-Way Processor Q04	1252	**	X	Both
4-Way Processor R04	1253	**	X	Both
4-Way Processor S04	1254	**	X	Both
4-Way Processor T04	1255	**	X	Both
4-Way Processor U04	1256	**	X	Both
4-Way Processor V04	1257	**	X	Both

4-Way Processor W04	1258	**	X	Both
4-Way Processor X04	1259	**	X	Both
4-Way Processor Y04	1260	**	X	Both
4-Way Processor Z04	1261	**	X	Both
5-Way Processor A05	1262	**	X	Both
5-Way Processor B05	1263	**	X	Both
5-Way Processor C05	1264	**	X	Both
5-Way Processor D05	1265	**	X	Both
5-Way Processor E05	1266	**	X	Both
5-Way Processor F05	1267	**	X	Both
5-Way Processor G05	1268	**	X	Both
5-Way Processor H05	1269	**	X	Both
5-Way Processor I05	1270	**	X	Both
5-Way Processor J05	1271	**	X	Both
5-Way Processor K05	1272	**	X	Both
5-Way Processor L05	1273	**	X	Both
5-Way Processor M05	1274	**	X	Both
5-Way Processor N05	1275	**	X	Both
5-Way Processor O05	1276	**	X	Both
5-Way Processor P05	1277	**	X	Both
5-Way Processor Q05	1278	**	X	Both

5-Way Processor R05	1279	**	X	Both
5-Way Processor S05	1280	**	X	Both
5-Way Processor T05	1281	**	X	Both
5-Way Processor U05	1282	**	X	Both
5-Way Processor V05	1283	**	X	Both
5-Way Processor W05	1284	**	X	Both
5-Way Processor X05	1285	**	X	Both
5-Way Processor Y05	1286	**	X	Both
5-Way Processor Z05	1287	**	X	Both
6-Way Processor A06	1288	**	X	Both
6-Way Processor B06	1289	**	X	Both
6-Way Processor C06	1290	**	X	Both
6-Way Processor D06	1291	**	X	Both
6-Way Processor E06	1292	**	X	Both
6-Way Processor F06	1293	**	X	Both
6-Way Processor G06	1294	**	X	Both
6-Way Processor H06	1295	**	X	Both
6-Way Processor I06	1296	**	X	Both
6-Way Processor J06	1297	**	X	Both
6-Way Processor K06	1298	**	X	Both
6-Way Processor L06	1299	**	X	Both

6-Way Processor M06	1300	**	X	Both
6-Way Processor N06	1301	**	X	Both
6-Way Processor O06	1302	**	X	Both
6-Way Processor P06	1303	**	X	Both
6-Way Processor Q06	1304	**	X	Both
6-Way Processor R06	1305	**	X	Both
6-Way Processor S06	1306	**	X	Both
6-Way Processor T06	1307	**	X	Both
6-Way Processor U06	1308	**	X	Both
6-Way Processor V06	1309	**	X	Both
6-Way Processor W06	1310	**	X	Both
6-Way Processor X06	1311	**	X	Both
6-Way Processor Y06	1312	**	X	Both
6-Way Processor Z06	1313	**	X	Both
A00 Capacity Marker	1340	**		Both
A01 Capacity Marker	1341	**		Both
B01 Capacity Marker	1342	**		Both
C01 Capacity Marker	1343	**		Both
D01 Capacity Marker	1344	**		Both
E01 Capacity Marker	1345	**		Both
F01 Capacity Marker	1346	**		Both

G01 Capacity Marker	1347	**	Both
H01 Capacity Marker	1348	**	Both
I01 Capacity Marker	1349	**	Both
J01 Capacity Marker	1350	**	Both
K01 Capacity Marker	1351	**	Both
L01 Capacity Marker	1352	**	Both
M01 Capacity Marker	1353	**	Both
N01 Capacity Marker	1354	**	Both
O01 Capacity Marker	1355	**	Both
P01 Capacity Marker	1356	**	Both
Q01 Capacity Marker	1357	**	Both
R01 Capacity Marker	1358	**	Both
S01 Capacity Marker	1359	**	Both
T01 Capacity Marker	1360	**	Both
U01 Capacity Marker	1361	**	Both
V01 Capacity Marker	1362	**	Both
W01 Capacity Marker	1363	**	Both
X01 Capacity Marker	1364	**	Both
Y01 Capacity Marker	1365	**	Both
Z01 Capacity Marker	1366	**	Both
A02 Capacity Marker	1367	**	Both

B02 Capacity Marker	1368	**	Both
C02 Capacity Marker	1369	**	Both
D02 Capacity Marker	1370	**	Both
E02 Capacity Marker	1371	**	Both
F02 Capacity Marker	1372	**	Both
G02 Capacity Marker	1373	**	Both
H02 Capacity Marker	1374	**	Both
I02 Capacity Marker	1375	**	Both
J02 Capacity Marker	1376	**	Both
K02 Capacity Marker	1377	**	Both
L02 Capacity Marker	1378	**	Both
M02 Capacity Marker	1379	**	Both
N02 Capacity Marker	1380	**	Both
O02 Capacity Marker	1381	**	Both
P02 Capacity Marker	1382	**	Both
Q02 Capacity Marker	1383	**	Both
R02 Capacity Marker	1384	**	Both
S02 Capacity Marker	1385	**	Both
T02 Capacity Marker	1386	**	Both
U02 Capacity Marker	1387	**	Both
V02 Capacity Marker	1388	**	Both

W02 Capacity Marker	1389	**	Both
X02 Capacity Marker	1390	**	Both
Y02 Capacity Marker	1391	**	Both
Z02 Capacity Marker	1392	**	Both
A03 Capacity Marker	1393	**	Both
B03 Capacity Marker	1394	**	Both
C03 Capacity Marker	1395	**	Both
D03 Capacity Marker	1396	**	Both
E03 Capacity Marker	1397	**	Both
F03 Capacity Marker	1398	**	Both
G03 Capacity Marker	1399	**	Both
H03 Capacity Marker	1400	**	Both
I03 Capacity Marker	1401	**	Both
J03 Capacity Marker	1402	**	Both
K03 Capacity Marker	1403	**	Both
L03 Capacity Marker	1404	**	Both
M03 Capacity Marker	1405	**	Both
N03 Capacity Marker	1406	**	Both
O03 Capacity Marker	1407	**	Both
P03 Capacity Marker	1408	**	Both
Q03 Capacity Marker	1409	**	Both

R03 Capacity Marker	1410	**	Both
S03 Capacity Marker	1411	**	Both
T03 Capacity Marker	1412	**	Both
U03 Capacity Marker	1413	**	Both
V03 Capacity Marker	1414	**	Both
W03 Capacity Marker	1415	**	Both
X03 Capacity Marker	1416	**	Both
Y03 Capacity Marker	1417	**	Both
Z03 Capacity Marker	1418	**	Both
A04 Capacity Marker	1419	**	Both
B04 Capacity Marker	1420	**	Both
C04 Capacity Marker	1421	**	Both
D04 Capacity Marker	1422	**	Both
E04 Capacity Marker	1423	**	Both
F04 Capacity Marker	1424	**	Both
G04 Capacity Marker	1425	**	Both
H04 Capacity Marker	1426	**	Both
I04 Capacity Marker	1427	**	Both
J04 Capacity Marker	1428	**	Both
K04 Capacity Marker	1429	**	Both
L04 Capacity Marker	1430	**	Both

M04 Capacity Marker	1431	**	Both
N04 Capacity Marker	1432	**	Both
O04 Capacity Marker	1433	**	Both
P04 Capacity Marker	1434	**	Both
Q04 Capacity Marker	1435	**	Both
R04 Capacity Marker	1436	**	Both
S04 Capacity Marker	1437	**	Both
T04 Capacity Marker	1438	**	Both
U04 Capacity Marker	1439	**	Both
V04 Capacity Marker	1440	**	Both
W04 Capacity Marker	1441	**	Both
X04 Capacity Marker	1442	**	Both
Y04 Capacity Marker	1443	**	Both
Z04 Capacity Marker	1444	**	Both
A05 Capacity Marker	1445	**	Both
B05 Capacity Marker	1446	**	Both
C05 Capacity Marker	1447	**	Both
D05 Capacity Marker	1448	**	Both
E05 Capacity Marker	1449	**	Both
F05 Capacity Marker	1450	**	Both
G05 Capacity Marker	1451	**	Both

H05 Capacity Marker	1452	**		Both
I05 Capacity Marker	1453	**		Both
J05 Capacity Marker	1454	**		Both
K05 Capacity Marker	1455	**		Both
L05 Capacity Marker	1456	**		Both
M05 Capacity Marker	1457	**		Both
N05 Capacity Marker	1458	**		Both
O05 Capacity Marker	1459	**		Both
P05 Capacity Marker	1460	**		Both
Q05 Capacity Marker	1461	**		Both
R05 Capacity Marker	1462	**		Both
S05 Capacity Marker	1463	**		Both
T05 Capacity Marker	1464	**		Both
U05 Capacity Marker	1465	**		Both
V05 Capacity Marker	1466	**		Both
W05 Capacity Marker	1467	**		Both
X05 Capacity Marker	1468	**		Both
Y05 Capacity Marker	1469	**		Both
Z05 Capacity Marker	1470	**		Both

6-Way Processor A06	1288	**	X	Both
6-Way Processor B06	1289	**	X	Both

6-Way Processor C06	1290	**	X	Both
6-Way Processor D06	1291	**	X	Both
6-Way Processor E06	1292	**	X	Both
6-Way Processor F06	1293	**	X	Both
6-Way Processor G06	1294	**	X	Both
6-Way Processor H06	1295	**	X	Both
6-Way Processor I06	1296	**	X	Both
6-Way Processor J06	1297	**	X	Both
6-Way Processor K06	1298	**	X	Both
6-Way Processor L06	1299	**	X	Both
6-Way Processor M06	1300	**	X	Both
6-Way Processor N06	1301	**	X	Both
6-Way Processor O06	1302	**	X	Both
6-Way Processor P06	1303	**	X	Both
6-Way Processor Q06	1304	**	X	Both
6-Way Processor R06	1305	**	X	Both
6-Way Processor S06	1306	**	X	Both
6-Way Processor T06	1307	**	X	Both
6-Way Processor U06	1308	**	X	Both
6-Way Processor V06	1309	**	X	Both
6-Way Processor W06	1310	**	X	Both

6-Way Processor X06	1311	**	X	Both
6-Way Processor Y06	1312	**	X	Both
6-Way Processor Z06	1313	**	X	Both
A00 Capacity Marker	1340	**		Both
A01 Capacity Marker	1341	**		Both
B01 Capacity Marker	1342	**		Both
C01 Capacity Marker	1343	**		Both
D01 Capacity Marker	1344	**		Both
E01 Capacity Marker	1345	**		Both
F01 Capacity Marker	1346	**		Both
G01 Capacity Marker	1347	**		Both
H01 Capacity Marker	1348	**		Both
I01 Capacity Marker	1349	**		Both
J01 Capacity Marker	1350	**		Both
K01 Capacity Marker	1351	**		Both
L01 Capacity Marker	1352	**		Both
M01 Capacity Marker	1353	**		Both
N01 Capacity Marker	1354	**		Both
O01 Capacity Marker	1355	**		Both
P01 Capacity Marker	1356	**		Both
Q01 Capacity Marker	1357	**		Both

R01 Capacity Marker	1358	**	Both
S01 Capacity Marker	1359	**	Both
T01 Capacity Marker	1360	**	Both
U01 Capacity Marker	1361	**	Both
V01 Capacity Marker	1362	**	Both
W01 Capacity Marker	1363	**	Both
X01 Capacity Marker	1364	**	Both
Y01 Capacity Marker	1365	**	Both
Z01 Capacity Marker	1366	**	Both
A02 Capacity Marker	1367	**	Both
B02 Capacity Marker	1368	**	Both
C02 Capacity Marker	1369	**	Both
D02 Capacity Marker	1370	**	Both
E02 Capacity Marker	1371	**	Both
F02 Capacity Marker	1372	**	Both
G02 Capacity Marker	1373	**	Both
H02 Capacity Marker	1374	**	Both
I02 Capacity Marker	1375	**	Both
J02 Capacity Marker	1376	**	Both
K02 Capacity Marker	1377	**	Both
L02 Capacity Marker	1378	**	Both

M02 Capacity Marker	1379	**	Both
N02 Capacity Marker	1380	**	Both
O02 Capacity Marker	1381	**	Both
P02 Capacity Marker	1382	**	Both
Q02 Capacity Marker	1383	**	Both
R02 Capacity Marker	1384	**	Both
S02 Capacity Marker	1385	**	Both
T02 Capacity Marker	1386	**	Both
U02 Capacity Marker	1387	**	Both
V02 Capacity Marker	1388	**	Both
W02 Capacity Marker	1389	**	Both
X02 Capacity Marker	1390	**	Both
Y02 Capacity Marker	1391	**	Both
Z02 Capacity Marker	1392	**	Both
A03 Capacity Marker	1393	**	Both
B03 Capacity Marker	1394	**	Both
C03 Capacity Marker	1395	**	Both
D03 Capacity Marker	1396	**	Both
E03 Capacity Marker	1397	**	Both
F03 Capacity Marker	1398	**	Both
G03 Capacity Marker	1399	**	Both

H03 Capacity Marker	1400	**	Both
I03 Capacity Marker	1401	**	Both
J03 Capacity Marker	1402	**	Both
K03 Capacity Marker	1403	**	Both
L03 Capacity Marker	1404	**	Both
M03 Capacity Marker	1405	**	Both
N03 Capacity Marker	1406	**	Both
O03 Capacity Marker	1407	**	Both
P03 Capacity Marker	1408	**	Both
Q03 Capacity Marker	1409	**	Both
R03 Capacity Marker	1410	**	Both
S03 Capacity Marker	1411	**	Both
T03 Capacity Marker	1412	**	Both
U03 Capacity Marker	1413	**	Both
V03 Capacity Marker	1414	**	Both
W03 Capacity Marker	1415	**	Both
X03 Capacity Marker	1416	**	Both
Y03 Capacity Marker	1417	**	Both
Z03 Capacity Marker	1418	**	Both
A04 Capacity Marker	1419	**	Both
B04 Capacity Marker	1420	**	Both

C04 Capacity Marker	1421	**	Both
D04 Capacity Marker	1422	**	Both
E04 Capacity Marker	1423	**	Both
F04 Capacity Marker	1424	**	Both
G04 Capacity Marker	1425	**	Both
H04 Capacity Marker	1426	**	Both
I04 Capacity Marker	1427	**	Both
J04 Capacity Marker	1428	**	Both
K04 Capacity Marker	1429	**	Both
L04 Capacity Marker	1430	**	Both
M04 Capacity Marker	1431	**	Both
N04 Capacity Marker	1432	**	Both
O04 Capacity Marker	1433	**	Both
P04 Capacity Marker	1434	**	Both
Q04 Capacity Marker	1435	**	Both
R04 Capacity Marker	1436	**	Both
S04 Capacity Marker	1437	**	Both
T04 Capacity Marker	1438	**	Both
U04 Capacity Marker	1439	**	Both
V04 Capacity Marker	1440	**	Both
W04 Capacity Marker	1441	**	Both

X04 Capacity Marker	1442	**	Both
Y04 Capacity Marker	1443	**	Both
Z04 Capacity Marker	1444	**	Both
A05 Capacity Marker	1445	**	Both
B05 Capacity Marker	1446	**	Both
C05 Capacity Marker	1447	**	Both
D05 Capacity Marker	1448	**	Both
E05 Capacity Marker	1449	**	Both
F05 Capacity Marker	1450	**	Both
G05 Capacity Marker	1451	**	Both
H05 Capacity Marker	1452	**	Both
I05 Capacity Marker	1453	**	Both
J05 Capacity Marker	1454	**	Both
K05 Capacity Marker	1455	**	Both
L05 Capacity Marker	1456	**	Both
M05 Capacity Marker	1457	**	Both
N05 Capacity Marker	1458	**	Both
O05 Capacity Marker	1459	**	Both
P05 Capacity Marker	1460	**	Both
Q05 Capacity Marker	1461	**	Both
R05 Capacity Marker	1462	**	Both

S05 Capacity Marker	1463	**	Both
T05 Capacity Marker	1464	**	Both
U05 Capacity Marker	1465	**	Both
V05 Capacity Marker	1466	**	Both
W05 Capacity Marker	1467	**	Both
X05 Capacity Marker	1468	**	Both
Y05 Capacity Marker	1469	**	Both
Z05 Capacity Marker	1470	**	Both
A06 Capacity Marker	1471	**	Both
B06 Capacity Marker	1472	**	Both
C06 Capacity Marker	1473	**	Both
D06 Capacity Marker	1474	**	Both
E06 Capacity Marker	1475	**	Both
F06 Capacity Marker	1476	**	Both
G06 Capacity Marker	1477	**	Both
H06 Capacity Marker	1478	**	Both
I06 Capacity Marker	1479	**	Both
J06 Capacity Marker	1480	**	Both
K06 Capacity Marker	1481	**	Both
L06 Capacity Marker	1482	**	Both
M06 Capacity Marker	1483	**	Both

N06 Capacity Marker	1484	**	Both
O06 Capacity Marker	1485	**	Both
P06 Capacity Marker	1486	**	Both
Q06 Capacity Marker	1487	**	Both
R06 Capacity Marker	1488	**	Both
S06 Capacity Marker	1489	**	Both
T06 Capacity Marker	1490	**	Both
U06 Capacity Marker	1491	**	Both
V06 Capacity Marker	1492	**	Both
W06 Capacity Marker	1493	**	Both
X06 Capacity Marker	1494	**	Both
Y06 Capacity Marker	1495	**	Both
Z06 Capacity Marker	1496	**	Both
32 GB Mem DIMM (5/feat)	1627	**	Both
64 GB Mem DIMM (5/feat)	1628	**	Both
128 GB Mem DIMM (5/feat)	1629	**	Both
256 GB Mem DIMM (5/feat)	1630	**	Both
512 GB Mem DIMM (5/feat)	1631	**	Both
8GB Memory Capacity Incr	1739	**	Both
8GB Mem Cap Incr> 128GB	1740	**	Both
16GB Mem Cap Incr> 128GB	1741	**	Both

32GB Mem Cap Incr> 128GB	1742	**	Both
8GB FTR Converted Memory z13s	1743	**	Both
16GB FTR Converted Memory z13s	1744	Both	
8GB FTR Converted Mem zBC12	1745	**	Both
LICCC Ship Via Net Ind	1750	**	Both
8 GB Preplanned Memory	1993	**	Both
16GB Preplanned Memory	1996	**	Both
Lift Tool Kit	3100	**	Both
Extension Ladder	3101	**	Both
64 GB Memory	3539	**	Both
72 GB Memory	3540	**	Both
80 GB Memory	3541	**	Both
88 GB Memory	3542	**	Both
96 GB Memory	3543	**	Both
128 GB Memory	3544	**	Both
160 GB Memory	3545	**	Both
192 GB Memory	3546	**	Both
224 GB Memory	3547	**	Both
256 GB Memory	3548	**	Both
288 GB Memory	3549	**	Both
320 GB Memory	3550	**	Both

352 GB Memory	3551	**	Both
384 GB Memory	3552	**	Both
448 GB Memory	3553	**	Both
512 GB Memory	3554	**	Both
576 GB Memory	3555	**	Both
704 GB Memory	3556	**	Both
832 GB Memory	3557	**	Both
960 GB Memory	3558	**	Both
1216 GB Memory	3559	**	Both
1472 GB Memory	3560	**	Both
1728 GB Memory	3561	**	Both
1984 GB Memory	3562	**	Both
2240 GB Memory	3563	**	Both
2496 GB Memory	3564	**	Both
2752 GB Memory	3565	**	Both
3008 GB Memory	3566	**	Both
3264 GB Memory	3567	**	Both
3520 GB Memory	3568	**	Both
3776 GB Memory	3569	**	Both
4032 GB Memory	3570	**	Both
4544 GB Memory	3571	**	Both

5056 GB Memory	3572	**	Both
5568 GB Memory	3573	**	Both
6080 GB Memory	3574	**	Both
6592 GB Memory	3575	**	Both
7104 GB Memory	3576	**	Both
7616 GB Memory	3577	**	Both
8128 GB Memory	3578	**	Both
MSS Sales Flag A	3668	**	Initial
MSS Sales Flag B	3669	**	Initial
CPACF Enable	3863	**	Both
PCIe+ I/O Drawer	4001	**	Both
Flat Panel Display	6096	**	Both
Additional CBU Test	6805	**	Both
Total CBU Years Ordered	6817	**	Both
CBU Records Ordered	6818	**	Both
Single CBU CP Year	6820	**	Both
25 CBU CP Year	6821	**	Both
Single CBU IFL Year	6822	**	Both
25 CBU IFL Year	6823	**	Both
Single CBU ICF Year	6824	**	Both
25 CBU ICF Year	6825	**	Both

Single CBU zIIP Year	6828	**	Both
25 CBU zIIP Year	6829	**	Both
Single CBU SAP Year	6830	**	Both
25 CBU SAP Year	6831	**	Both
CBU Replenish	6832	**	MES
Capacity for Planned Event	6833	**	Both
OPO Sales Flag	6835	**	Both
OPO Sales Flag-Alteration	6836	**	MES
Top Exit Cabling	7917	**	Both
Bottom Exit Cabling	7919	**	Both
FQC Bracket & Mounting Hdw	7934	**	Both
LC Duplex 6.6ft Harness	7935	**	Both
30A/208V 14ft w/TwistLock	7937	**	Both
30A/208V 14ft w/Russelstoll	7938	**	Both
32A/250V Cord EMEA & AP	7939	**	Both
32A/250V Cord Aus & NZ	7940	**	Both
32A/250V Cord Korea	7941	**	Both
32A/250V LSZH Cord	7943	**	Both
19" Frame Bolt Down Kit	8006	**	Both
Multi Order Ship Flag	9000	**	Both
Multi Order Rec Only Flag-NB	9001	**	Both

Multi Order Rec Only Flag-MES	9002	**	MES
RPO Action Flag	9003	**	MES
Downgr PUs Per Request	9004	**	Both
On/Off CoD Act 100 IFL Day	9874	**	MES
On/Off CoD Act 100 ICF Day	9875	**	MES
On/Off CoD Act 100 CP Day	9876	**	MES
On/Off CoD Act 100 zIIP Day	9877	**	MES
On/Off CoD Act 100 SAP Day	9878	**	MES
19" Rack	9883	**	Both
On/Off CoD Act IFL Day	9888	**	MES
On/Off CoD Act ICF Day	9889	**	MES
On/Off COD auth	9896	**	Both
On/Off CoD Act Cap CP Day	9897	**	MES
Perm upgr auth	9898	**	Both
CIU Activation (Flag)	9899	**	MES
On-Line CoD Buying (Flag)	9900	**	Both
On/Off CoD Act zIIP Day	9908	**	MES
On/Off CoD Act. SAP Day	9909	**	MES
CBU author	9910	**	Both
CPE author	9912	**	Both
OPO author	9913	**	Both

1 MSU day			9917	**	MES
100 MSU days			9918	**	MES
10000 MSU days			9919	**	MES
1 IFL day			9920	**	MES
100 IFL days			9921	**	MES
1 ICF day			9922	**	MES
100 ICF days			9923	**	MES
1 zIIP day			9924	**	MES
100 zIIP days			9925	**	MES
1 SAP day			9928	**	MES
100 SAP days			9929	**	MES
Height Reduce Ship			9975	**	Both
Height Reduce for Return			9976	**	MES
These features are newly offered for MT 3906:					
	3906	M01			
		M02			
		M03			
		M04			
		M05			
Linux Hosting Foundation			0103	**	Both

Container Hosting Foundation		0104	**	Both
MSS Sales Flag A		3668	**	Initial
MSS Standard Side Cover		3670	**	Initial
MSS Top Exit Side Cover		3671	**	Initial
These features are Carry Forward only for MT 3907:				
	3907 ZR1			
HMC		0092	**	MES
HMC Rack Mount		0094	**	MES
HMC		0095	**	MES
HMC Rack Mount		0096	**	MES
TKE Rack Mount w/4767		0097	**	MES
TKE w/4767		0098	**	MES
Mouse		0152	**	MES
HMC Tower Keyboard		0153	**	MES
TKE Tower Keyboard		0155	**	MES
Client Must Provide Mouse		0186	**	MES
Client Must Provide HMC KeyBd		0187	**	MES
Client Must Provide TKE KeyBd		0189	**	MES
Client Must Provide Display		0191	**	MES
OSA-Express4S GbE LX		0404	**	MES
OSA-Express4S GbE SX		0405	**	MES

OSA-Express4S 10 GbE LR	0406	**	MES
OSA-Express4S 10 GbE SR	0407	**	MES
FICON Express8S 10KM LX	0409	**	MES
FICON Express8S SX	0410	**	MES
10 GbE RoCE Express	0411	**	MES
OSA-Express5S GbE LX	0413	**	MES
OSA-Express5S GbE SX	0414	**	MES
OSA-Express5S 10 GbE LR	0415	**	MES
OSA-Express5S 10 GbE SX	0416	**	MES
OSA-Express5S 1000BASE-T	0417	**	MES
FICON Express 16S LX	0418	**	MES
FICON Express 16S SX	0419	**	MES
TKE workst w/4765	0842	**	MES
TKE workst w/4767	0847	**	MES
Addl smart cards	0884	**	MES
TKE Smart Card Reader	0885	**	MES
Crypto Express5S	0890	**	MES
Flat Panel Display	6096	**	MES

Annual minimum maintenance charges

Not applicable.

ServiceElect (ESA) charges

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Model conversion purchase price

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From machine type	From Model	To Machine Type	To Model	Returned Parts	Continuous Maintenance
2965	N10	3907	ZR1	Y	Y
	N20	3907	ZR1		
3907	LR1	3907	ZR1	Y	Y

Note: Parts removed or replaced become the property of IBM and must be returned.

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