Introducing the IBM z15 - The enterprise platform for mission-critical hybrid multicloud

Table of contents

2 Overview
3 Key requirements
3 Planned availability date
4 Description
22 Product positioning
24 Statement of general direction
26 Product number
56 Publications
58 Technical information
71 Terms and conditions
72 Prices
73 Corrections

At a glance

Announcing the IBM(R) z15

Today's announcement extends the IBM Z(R) position as the industry-leading platform for mission-critical hybrid cloud, with new innovations across security, data privacy, and resilience.

Data privacy and security

Pervasive encryption easily encrypts all data associated with an application, database, or cloud service -- whether on premises or in the cloud, at rest or in flight. The IBM z15 extends this beyond the border of the IBM Z environment.

- The new IBM Z Data Privacy Passports, in conjunction with IBM z15 and available via an IBM z15 only PID, is being designed to enforce security and privacy protections to data not only on Z, but across platforms. It provides a data-centric security solution that enables data to play an active role in its own protection. For more information about IBM Z Data Privacy Passports V1.0 beta program, see Software Announcement JP19-0548, dated September 12, 2019.
- IBM Z Data Privacy for Diagnostics provides clients with the capability to protect sensitive data that may be included in diagnostic dumps. Now sensitive data can be tagged such that it can be identified in dumps with no impact to dump capture times. Tagged sensitive data in dumps can be secured and redacted before sending to third-party vendors.
- There is a new Crypto Express7S adapter introduced on the IBM z15 whose design and format have been driven by the adoption of blockchain and other highly secure applications.

Business continuity and resilience

IBM Z is a market leader for uptime and resilience. The new z15 takes this leadership to a whole new level through letting you unlock the power of IBM Z to help you adapt to planned or unplanned events while keeping services and operations running smoothly and continuously, on premises or in the cloud.

- New IBM System Recovery Boost expedites everything you need to get back ready for workload execution, including planned operating system shutdown processing, operating system IPL (Initial Program Load), middleware/workload restart and recovery, and uniquely the client workload execution that follows helping you catch up for lost time. It will let businesses return their systems to doing normal work faster for scenarios such as planned software maintenance and patching, but also in the event of Disaster Recovery scenarios when you need it the most.

- Enhancements in GDPS(R) combined with System Recovery Boost also expedite and streamline the execution of GDPS recovery scripts which perform reconfiguration actions during various planned and unplanned operational scenarios. The combination of these capabilities allows you to plan and test more easily for key activities such as site switches, perform business continuity activities more quickly, and prove ability to comply with industry regulation.

Hybrid cloud readiness

You can build a hybrid cloud ecosystem while ensuring availability, security, and accessibility with flexibility as you deliver timely and efficient new services for your digital business. The IBM z15 server provides the availability required by your most mission-critical workloads and the security demanded by your most valuable data. Then a comprehensive portfolio of IBM solutions help you deploy and support your cloud environment, as well as expand access to it.

- IBM Z software offerings combine to help you integrate and manage your ideal cloud environment.
  - In September 2019, IBM plans to introduce IBM z/OS(R) Container Extensions (zCX), which is intended to enable access to a large ecosystem of open source and Linux(R) on IBM Z applications that are planned to be deployed and managed within the native z/OS environment without requiring a separately provisioned and managed Linux server, using popular Docker container skills and patterns. This will allow you to be able to use the latest open source tools, popular NoSQL databases, analytics frameworks, application servers, and so on within your z/OS environment. It is intended that z/OS developers will gain DevOps agility through the use of Docker containers and the ability to deploy open source application development utilities, Linux-based shell environments, and so on.
- IBM Integrated Accelerator for zEnterprise Data Compression is provided on each processor chip and uses industry-standard compression formats for file compression that can enable reduction in the size of data which can save storage space and increase data transfer rates. It can also reduce CPU consumption and costs associated with moving, processing, encrypting/decrypting, and otherwise manipulating smaller amounts of compressed data. IBM Integrated Accelerator for zEnterprise Data Compression interoperates compatibly with the zEDC compression used on previous IBM Z platforms and with industry-standard compression used on other platforms.
- Ready for the cloud data center, the IBM z15 is housed in a new standardized 19-inch frame (one to four frames, depending on the configuration) that makes it ready for colocation and standardized facilities management.

Overview

IBM z15 - The enterprise platform for mission-critical hybrid multicloud

The transformation of digital technologies continues to have a profound effect on business, creating and accelerating transformation of business activities, processes, competencies, and models.

To succeed, businesses must embrace this digital transformation, adopting agile processes and new technologies to deliver services and experiences that customers and clients demand.

Yet as they transform, enterprises must also ensure they maintain infrastructure security, protect data privacy, and meet increasing compliance requirements, all while providing 24x7 availability. These requirements apply extreme pressure on IT to securely deliver transformative services and provide ongoing management and support within tight time and budget constraints.

IBM z15: industry-leading privacy and resiliency for mission-critical workloads in the hybrid multicloud.

Key requirements

See the Hardware requirements and Software requirements sections of this announcement.

Planned availability date

September 23, 2019

New build systems:

- IBM z15 Model T01
- Features and functions for the IBM z15

Upgrades from z13(R) and z14:

- z13 air-cooled upgrades to IBM z15 air-cooled
- z13 air-cooled upgrades to IBM z15 water-cooled
- z13 water-cooled upgrades to IBM z15 water-cooled
- z13 water-cooled upgrades to IBM z15 air-cooled
- z14 air-cooled upgrades to IBM z15 air-cooled
- z14 air-cooled upgrades to IBM z15 water-cooled
- z14 water-cooled upgrades to IBM z15 water-cooled
- z14 water-cooled upgrades to IBM z15 air-cooled

MES orders for IBM z15 that include the following features:

- Field-installed features and conversions on IBM z15 that are delivered solely through a modification to the machine's Licensed Internal Code (LIC)
- HMC Table Top KMM (#0148) on IBM z15
- HMC Rack Mount KMM (#0154) on IBM z15
- Customer Supplied HMC KMM (#0188) on IBM z15
- HMC Tower (#0062) on IBM z15
- HMC Rack Mount (#0063) on IBM z15
- TKE Rack Mount (#0087) on IBM z15
- TKE (#0088) on IBM z15
- TKE 9.2 LIC (#0881) on IBM z15
- TKE Rack Mount KMM (#0156) on IBM z15
- TKE Table Top KMM (#0157) on IBM z15
- Customer Supplied TKE KMM (#0190) on IBM z15
- Smart Card Reader (#0891) on IBM z15
- Additional Smart Cards (#0900) on IBM z15

October 1, 2019 - orders cannot be placed until October 1, 2019

- HMC Tower (#0062) on IBM z14™ and IBM z14 ZR1
- HMC Rack Mount (#0063) on IBM z14 and IBM z14 ZR1
- TKE Rack Mount (#0087) on IBM z14 and IBM z14 ZR1
- TKE (#0088) on IBM z14 and IBM z14 ZR1
- TKE 9.2 LIC (#0881) on IBM z14 and IBM z14 ZR1

November 14, 2019 - orders cannot be placed until November 14, 2019

- IBM Z Hardware Management Appliance (#0100): HMC/SE housed in one physical server inside CPC frame
- Dynamic Partition Manager (DPM) on IBM z15 (#0016)
- zTPF exploitation of System Recovery Boost

December 31, 2019 - orders cannot be placed until December 31, 2019

- OOCoD for the People's Republic of China for IBM z15, IBM z14, and IBM z14 ZR1

January 29, 2020

- All remaining MES orders for IBM z15 Model T01

Description

The newest member of the IBM Z family, the IBM z15, uses a 19-inch form factor and industry-standardized power and networking hardware. The system is configurable as a one to four 19-inch frame system, which easily aligns with the modern cloud data center.

Today's announcement extends IBM Z leadership with IBM z15, offering:

Core system:

- 190 client configurable cores, an increase of 20 over the z14, with single processor capacity of z15 for equal n-way at common client configurations, approximately 14% greater than on z14 with some variation based on workload and configuration.
- 25% more total system capacity as compared to the z14 for exceptional scale in a single footprint.
- More on-chip cache per core, compared to z14, to help minimize memory waits while maximizing the throughput of concurrent workloads -- perfectly optimized for data serving.
- Up to 40 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, cache sysplex shared data and controls in Coupling Facilities, and ease deploying memory-intensive workloads.
- IBM Integrated Accelerator for zEnterprise Data Compression, designed to reduce the cost of storing, transporting, and processing data without changing applications. It replaces the zEDC Express(R) card on z14 and older generations of IBM servers, and interoperates compatibly with the zEDC compression used on previous IBM Z platforms and with industry-standard compression used on other platforms. Improved compression ratio (using Huffman coding) and order-preserving compression result in fewer CPU cycles to enable further compression of data, improving memory, transfer, and disk efficiency. With the IBM Z Integrated Accelerator for zEnterprise Data Compression you can achieve up to 17x more throughput capacity than the largest configured z14.
- The z15 has 30+ new instructions codesigned and exploited by Java™, new vector enhancements to improve analytics applications, and new instructions for sort acceleration.

Security and cryptography:

- A design for data protection and privacy allowing you to encrypt many new data sets transparently, which can help you to provide an envelope of protection around data placed on IBM Z. This includes cryptographic performance improvements with the Crypto Express7S (#0898 or #0899) and the IBM Z processor based cryptography with the CP Assist for Cryptographic Functions that helps enable the protection of data in flight or at rest.
- Hardware accelerated encryption on every core with the Central Processor Assist for Cryptographic Function (CPACF) feature.

- Processor improvements include Message-Security-Assist extension 9 providing support for elliptic curve cryptography authentication of messages, the generation of elliptic curve keys, and scalar multiplication. This is accomplished through a new instruction (Compute Digital Signature Authentication (KDSA)) which supports the ECDSA and EdDSA algorithms using curves P-256, P-384, P-521, Ed25519, and Ed448 and is in compliance with the Digital Signature Standard (DSS), National Institute of Standards and Technology (NIST) July 2013.
- IBM Z Data Privacy Passports which will protect data not only on IBM Z, but across multicloud environments without application changes. For more information about IBM Z Data Privacy Passports V1.0 beta program, see Software Announcement JP19-0548, dated September 12, 2019.

Network and I/O:

- OSA-Express7S GbE, 10GbE, 1000Base-T, and 25GbE SR1.1.
- FICON(R) Express16SA (#0436, 0437) to help absorb large application and transaction spikes driven by large unpredictable analytic and mobile workloads.
- An increase in the maximum number of coupling CHPIDs per CPC from 256 with z14 to 384 with z15, which provides for improved virtualization of physical ICA SR and CE LR coupling links.
- An increase in the maximum number of physical ICA SR coupling links per CPC from 80 on z14 to 96 on z15, and per drawer from 20 on z14 to 24 on z15.
- An increase in the maximum number of internal coupling CHPIDs per CPC from 32 on z14 to 64 on z15.
- A new level of Coupling Facility support, CFLEVEL 24, which provides optimized latch management, improved message path resiliency, and a change to the defaults for dynamic dispatching. For details see the "Parallel Sysplex(R) enhancements" section.
- IBM zHyperLink Express1.1 (#0451), which uses a direct connect short distance link (zHyperLink) to deliver low latency connectivity between z15 and FICON storage systems. Working in conjunction with your existing FICON SAN infrastructure, zHyperLink Express1.1 delivers the next generation of I/O for IBM Z storage.

Systems management and infrastructure:

- IBM Hardware Management Console (HMC) 2.15.0 with simplification updates to improve workspace and manage system time.
- IBM Z Hardware Management Appliance (#0100), which can be used to create isolated partitions for protecting data and applications from cybercriminals.
- Trusted Key Entry (TKE) 9.2 License Internal Code (LIC) (#0881).
- Flexible configuration; each frame is an industry-standardized 19-inch frame taking up only two floor tiles of space. The system expands from one to four frames based on your requirements and potential growth.
- System Recovery Boost which enables restoration of service from, and workload catch up after, both planned and unplanned outages faster than on any prior Z machine and with no additional IBM software costs, along with faster GDPS-orchestrated reconfiguration actions such as those involved in a planned or unplanned DR site switch.
- Non-raised floor option, offering flexible possibilities for the data center.
- Optional water cooling, providing the ability to cool systems with user-chilled water.
- Optional top exit power and I/O cabling designed to provide increased flexibility.
- ASHRAE class A3 for robustness, data center flexibility, and energy savings.
- Upgradability to IBM z15 from IBM z14 and IBM z13(R) and upgradability within the IBM z15 family.
- IBM Dynamic Partition Manager enhancements that provide a simplified, consumable, enhanced IBM Z experience, reducing the barriers of adoption for new and existing Linux on IBM Z and z/VM(R) clients.

The performance advantage

IBM's Large Systems Performance Reference (LSPR) method is designed to provide comprehensive z/Architecture(R) processor capacity ratios for different configurations of central processors (CPs) across a wide variety of system control programs and workload environments. For IBM z15, the z/Architecture processor capacity indicator is defined with a 4XX, 5XX, 6XX, or 7XX notation, where XX is the number of installed CPs.

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

The capacity per processor engine of an IBM z15 (8561) processor is expected to provide approximately a 14% increase over that of a z14 (3906), with some variation, based on workload and configuration. The largest IBM z15 (8561-7J0) is expected to provide up to 25% more capacity than the largest z14 (3906-7H0). The IFL and zIIP processors on the IBM z15 also provide an optional IBM z15 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 IBM z15 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

z15 merges the RAS characteristics from the performance-optimized z14 family with the 19-inch frame from the z14 Model ZR1. z15 introduces:

- The use of IBM System Recovery Boost which expedites planned operating system shutdown processing, operating system IPL (Initial Program Load), middleware/workload restart and recovery, and the client workload execution that follows. It will let businesses return their systems to work faster, not just in disaster recovery scenarios, but after all kinds of disruptions, both planned and unplanned. Another aspect of System Recovery Boost is to expedite and streamline the execution of GDPS recovery scripts which perform reconfiguration actions during various planned and unplanned operational scenarios.
- Processor and memory PU refresh, RAIM memory, and cache symbol ECC which are designed to provide a robust computing platform.
- PU sparing, array macro sparing, micro-array masking integrated sparing, and expanded optics as a FRU which are used to reduce repair actions.
- The wide use of redundancy in the power, cooling, and service network, which continues with the z15 family. A "power redundancy test" is provided so the customer can verify the server is power redundant before servicing their customer power feeds.
- The improved "fill and drain" tool which reduces the service time when handling water (including discontinuing a server).

A flexible and standardized configuration with IBM z15 provides offering simplification and allows you to flexibly scale up to four frames in a single system and integrate additional hardware appliances into an industry-standard form factor. This will benefit existing clients through potential consolidation down to fewer frames and allows an easier scale-up path for growth.

System Recovery Boost is a new capability which is designed to provide faster operating system and middleware shutdown, reIPL/restart, and service restoration

across both planned and unplanned operating system outages. During "boost periods" that apply during operating system shutdown and following a reIPL/ restart, the IBM z15 can make additional processing capacity available to the system in a variety of ways to not only help accelerate the system shutdown and restart processing itself, but also apply that same boosted capacity to help your business "catch up" on work that may have accumulated while the system was down, with substantially improved workload throughput and response time/elapsed time during the boost. Enhancements in Geographically Dispersed Parallel Sysplex (GDPS) automation are also designed to provide faster, more efficient, and more highly parallel orchestration of GDPS automated reconfiguration activities, such as activating or deactivating images, IPLing images, and the like. Such automated activities might take place during planned or unplanned DR site switches, for example.

System Recovery Boost is designed to provide an improved client experience across both planned and unplanned service disruptions. This will allow more flexibility in the management and achievement of ever-tightening service level agreements (SLAs) around maintenance and reconfiguration activities, at lower risk, and it will generally unlock the power of the z15 server to accelerate and simplify maintenance and change windows. System Recovery Boost is also designed to provide benefits in a wide range of activities, both planned and unplanned, single-system and multiple-system, and single-site and multiple-site. For example, System Recovery Boost can help accelerate single-system change windows to install operating system maintenance or make upgrades, rolling IPLs to install maintenance across multiple images in a Parallel Sysplex environment, restoration of a failed system after an unplanned system outage, planned site switches in order to conduct a disaster recovery test or flip-flop between the active site and the disaster recovery site, and even unplanned disaster recovery site switches involving multiple Parallel Sysplex environments!

System Recovery Boost can provide additional processing capacity during the limited-duration startup and shutdown "boost periods" in a variety of different ways, depending on the IBM z15 server configuration and on specific operating system exploitation capabilities. On subcapacity machine models (4xx, 5xx, and 6xx), System Recovery Boost can temporarily boost the processing capacity of general-purpose processors to run as if they were full-capacity processors, only in those system images that are actively experiencing a boost. This temporary increase in general-purpose processing capacity for the boosting images is not visible for pricing purposes, so it does not lead to IBM software licensing cost increases. (Where consumption-based pricing metrics are being used, it may of course allow more general-purpose processing capacity to be consumed in a shorter amount of time, as execution of work on the system is accelerated.) On servers with zIIP processors, System Recovery Boost is designed to help unlock the parallelism, capacity, and acceleration potential of those zIIP processors by temporarily allowing general-purpose workload to run on them during the boost period, only in the system images that are actively experiencing a boost. This use of zIIP processor capacity in a novel way applies only to operating systems that support zIIPs (for example, z/OS), and to system images that actually have zIIP processing capacity defined to them.

In addition to the base capabilities described above, System Recovery Boost can also optionally, via a priced Boost temporary capacity record requiring the use of feature #6802 and #9930, enable the temporary activation of additional physical zIIP processors on an IBM z15 server. Activation of these processors draws upon and makes use of unused processing cores in the machine, to provide yet more zIIP processing capacity that can then be used by boosting images to accelerate execution of their workload (both general-purpose workload, and workload that is already zIIP-eligible). Once the Boost temporary capacity record is activated for use during, for example, a planned maintenance window or for a planned site-switch activity, up to 20 additional zIIP engines may become available for a period of up to 6 hours for use on an IBM z15 server. This additional zIIP capacity is then shared across images in accordance with existing PR/SM management controls, making additional zIIP capacity available to individual system images. Images that wish to take advantage of this additional zIIP capacity should predefine reserved logical zIIP capacity in their PR/SM image profiles, so that the operating system can then bring those additional logical zIIP processors (with physical backing from the additional

physical zIIPs that were activated) online for use during the boost period, thereby providing the image with increased zIIP capacity and parallelism to accelerate the workload.

System Recovery Boost requires operating system exploitation. z/OS will fully support the boosting of general-purpose processors on subcapacity machine models to run as if they were full-capacity processors, and also the use of zIIP processors to run general-purpose work during boost periods, and will support such boosts during planned system shutdown and during system startup. Stand-Alone Dump (SADMP) will support boosting of general-purpose processors on subcapacity machine models only, to provide additional processor capacity for use in capturing diagnostic information for system failures. z/VM and z/TPF will also provide support for boosting of general-purpose processors on subcapacity machine models only, for both planned system shutdown and system startup. In the case of z/VM, the increased capacity of general-purpose processors during a z/VM system startup or shutdown can be "inherited" by z/VSE(R) and z/TPF guests, to also provide additional processing capacity to accelerate the guest startup and/or shutdown processing. Note that z/VM running on IFL processors will not experience any capacity boost for IFLs.

System Recovery Boost has the potential to benefit many IBM Z clients, through some combination of the boost capabilities described above (general-purpose processor boost, zIIP boost, improved GDPS automation and reconfiguration activities, or the zIIP boost activation of additional zIIP processors from unused processing capacity), and in a broad spectrum of planned and unplanned system recovery scenarios. The IBM z15, with operating system exploitation, provides the vehicle to take advantage of these boosts.

IBM Integrated Accelerator for zEnterprise Data Compression provides industry-standard DEFLATE compression and decompression acceleration at greater throughput than any software-based implementation. A processor chip based accelerator replaces the zEDC Express I/O card supported in previous IBM Z systems, delivering higher bandwidth without increasing CPU cost. Moving this functionality onto the IBM z15 processor chip allows for improved integration, better performance, and lower latency than other solutions available on the market.

Compression using the IBM Integrated Accelerator for zEnterprise(R) Data Compression allows the ability to reduce the amount of data to be processed, stored, and transferred. Doing so can help reduce storage cost, increase effective network bandwidth, and reduce overall CPU consumption for functions like encrypting data or performing I/O operations. The z15 compression design point builds on and extends the value provided by the previous zEDC Express design in z14, showing for example a net reduction of CPU cost for encrypting and storing compressed data compared to storing data uncompressed and unencrypted. These savings enhance the value created by the encryption itself and the reduced storage footprint.

Implemented as an architected instruction, the IBM Integrated Accelerator for zEnterprise Data Compression enables simplified exploitation and unconstrained virtualization compared to the previous design point. It can be utilized by an unlimited amount of partitions and guests, without the need for dedicated hypervisor or operating system support. The very high throughput and the removal of any restrictions for maximum number of guests eliminate any capacity planning requirements for compression acceleration in the z15 server. As an integrated part of the z15 processor chip, using the IBM Integrated Accelerator for zEnterprise Data Compression does not require the purchase of a hardware feature or usage of I/O slots.

IBM Integrated Accelerator for zEnterprise Data Compression is designed to ensure full interoperability and compatibility with DEFLATE-compliant data created and processed within and outside the IBM Z ecosystem. Support for this new accelerator is integrated into z/OS, maintaining existing APIs without requiring any updates or adaptations on an application level. The new design point allows for synchronous execution of compression for very low latency and high throughput by utilizing the zlib API support delivered with z/OS or the new instruction itself. In addition, IBM Integrated Acceleration for zEnterprise Data Compression continues to support an

asynchronous execution mode for authorized users under z/OS as an optimization for large data sets. There is no software feature required in order to use the hardware-accelerated zlib implementation under z/OS or the instruction itself. As a result, the IBM z15 server allows acceleration of compression for a number of applications, for example, Java based applications or IBM Sterling Connect:Direct(R) V5.2 instantly, out of the box to name a few.

Compression of data provides great potential for you in terms of cost saving and elapsed time reduction. The IBM Integrated Accelerator for zEnterprise Data Compression in z15 makes compression in z15 available, accessible, and at the same time more affordable than ever.

Enterprise data protection: IBM z15 extends the z14 pervasive encryption story throughout the enterprise to protect data not only on IBM Z, but across multicloud environments. You can control access to data shared with business partners and your ecosystem and begin the journey to dump protection on z/OS. This includes crypto enhancements, IBM Z Data Privacy Passports (requires additional software), and IBM Z Data Privacy for Diagnostics. For more information about IBM Z Data Privacy Passports V1.0 beta program, see Software Announcement JG19-0039, dated September 12, 2019.

Cloud transformation: IBM z15 enables your cloud transformation with industry-standard, do-it-yourself, IBM Z-backed cloud services including open containers, IBM cloud deployment, and ECC improvements for blockchain.

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

The IBM z15 is designed for Common Criteria Evaluation Assurance Level 5+ (EAL5+) certification for security of logical partitions. This means that the IBM z15 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

Enhancements with the z15 continue to deliver critical cryptographic capabilities which address the ever-changing security requirements across the globe around key management and distribution, data management and compliance, and protecting enterprise data. The Crypto Express7S is designed to meet the Federal Information Processing Standard (FIPS) 140-2 at Level 4 for cryptographic modules. IBM's Common Cryptographic Architecture Release 7.0 (CCA 7.0) is designed to be certified to meet the HSM requirements from the Payment Card Industry Security Standards Council (PCI-SSC). Its unique design eases migration of applications and keys and expands to add new cryptographic algorithm support. CCA 6.3 also meets the PCI HSM requirements. CCA 7.0 includes the enhancements from the limited availability release CCA 6.3. The release adds an additional key distribution method by including callable services in support of ASC X9 Technical Report 34. TR-34 outlines an interoperable protocol for secure distribution of symmetric keys using asymmetric techniques. This protocol can be used to distribute symmetric keys from host systems to key receiving devices such as ATMs or POS terminals. Using the protocol is expected to allow clients to eliminate costs associated with manual key loading by two separate employees who must physically load keys into the ATM or other key-receiving device. This feature facilitates a secure and cost-effective method for remote-managed rotation of encryption keys.

The release enhancements include complete native support for X.509 certificates for RSA or ECC public keys. All CCA services that accept public keys have been enhanced to accept an X.509 certificate. The X.509 certificate is validated and may be optionally authenticated against the Public Key Infrastructure (PKI) managed internally to the CEX6S / CEX7S. The trust anchors that underpin the PKI are loaded using security from a Trusted Key Entry (TKE) workstation to help enable a secured management path. This expansion of X.509 certificate support includes the new X9 TR-34 services mentioned above.

The release has also been enhanced to create PCI HSM compliant-tagged RSA and AES key tokens. A compliant-tagged key token is managed by CCA firmware

according to the requirements of PCI-HSM compliance mode. A coprocessor in compliance mode must be available to use compliant-tagged key tokens. Also, compliance-based methods to check master keys have been added to CCA. The Key Test2 callable service can now be used to verify the value of a master key as defined in ANS X9.24 Part 1, using either the NIST SP 800-38B block cipher-based MAC algorithm, called CMAC, or the encrypt zeros method. This will prove useful during compliance audits.

In addition, features that support the use of the AES algorithm in banking applications have been enhanced. This includes a new method for formatting the PAN data for authenticated PAN change requests based on the ISO 9564-1 standard. The new method includes an AES-based key management feature that enforces special usage for authentication keys for translation of PINs in ISO-4 PIN blocks. This increases the protection over this sensitive operation by adding an additional measure of control.

Finally, two new callable services are added in support of the German Banking Industry Committee *Die Deutsche Kreditwirtschaft* (DK) financial services requirements.

IBM continues to add enhancements as finance industry standards are released or updated with support for AES-based methods and protocols.

Enterprise PKCS #11 enhancements

EP11 is specifically designed for clients seeking support for open standards and enhanced security.

The EP11 library provides an interface very similar to the industry-standard PKCS #11 API. Existing applications using PKCS #11 will benefit from using EP11 as they can be migrated easily to IBM Z and by that benefit from enhanced security using secure key cryptography.

EP11 provides many interesting additions to the PKCS #11 with Login Sessions, attribute bound keys, and different operational modes.

EP11 (BSI-DSZ-CC-1094) is designed to meet the requirements of the BSI (Federal Office for Information Security in Germany) for conformance with common criteria in version 3.1 (rev. 4) with Evaluation Assurance Level (EAL) 4.

EP11 4.7 adds support for the Crypto Express7S adapter as well as support of the PKCS #11 v2.4 standard.

New functionality consists of support for SHA3, EdDSA (sign/verify with Ed25519 and Ed448), and EdDH (derive with C25519 and C448).

In addition, EP11 4.7 introduces support for EP11 key blobs (AES, TDES, and selected ECC) exportable to Central Processor Assist for Cryptographic Function (CPACF) for use in protected mode encryption, authorized with respective key attributes. With protected mode WrapKey the secure EP11 key is returned to the host caller reenciphered under the CPACF wrapping key for direct usage in a CPACF encryption instruction. The clear key value of the operational key is never available in host storage.

Furthermore, it adds support for a first quantum safe algorithm, Dilithium, an EUF-CMA secure digital signature scheme (sign and verify) based on Lattices.

Trusted Key Entry (TKE) 9.2 Licensed Internal Code (LIC) - The TKE 9.2 level of LIC is designed to support the following functions:

- TKE 9.2 is required to manage the Crypto Express7S running in Common Cryptographic Architecture (CCA) or IBM Enterprise PKCS #11 (EP11) mode if you manage your modules from the TKE. Remember, TKE is required to manage modules that run in EP11 mode or CCA domains in PCI-Compliant mode.
- With TKE 9.2, you can use AT-TLS connections between the TKE workstation and the host that is running the TKE host transaction program. If you configure the

TCP/IP port in the host transaction program to use AT-TLS, you must select the new check box in your TKE workstation host definition to specify you are using a TLS connection.

- TKE 9.2 can be used to exploit the following enhancements available in various releases of Common Cryptographic Architecture (CCA) firmware levels:
  - TKE 9.2 will allow you to create AES operational key parts with the PCI-compliant tag turned on. You can use these parts when you load your AES operational keys, if the CCA level supports the tag.
  - When you display Access Control Point (ACP) tracking information, tracking interval information will be included if the CCA firmware level returns the information. You will be able to tell when tracking was turned on, if or when tracking was turned off, and the number of times tracking was turned off and back on from the last time tracking data was cleared.
  - When you display master key information, you will have new options for selecting how the verification pattern is calculated if the CCA firmware supports the ENC-0 and CMAC calculations.
- With TKE 9.2, you can now select the IBM Enterprise PKCS #11 Transport Wrapping Key Policy. This policy is used to select the EP11 transport wrapping key strength. Select this policy if you require the EP11 transport wrapping key to be a true 256-bit AES key. If the policy is selected, the transport wrapping key is derived using Diffie-Hellman Key Exchange of 521-bit Elliptic Curve (EC) public keys between the TKE and the host crypto module running IBM Enterprise PKCS #11 (EP11). You can only select this policy when:
  - All your EP11 smart cards are at the minimum part level 00RY790 (Blue smart cards).
  - All your EP11 smart cards are at the minimum applet version V0.6. (The minimum applet support first appeared in TKE 9.2.)
  - All your host IBM Enterprise PKCS #11 modules are at API version 6.02 or later.
- TKE 9.2 has new features that simplify existing management tasks:
  - You can configure your host definition so that it will automatically accept modules that are successfully authenticated. You can select the option to automatically accept modules when you create a host definition or add the option to existing host definitions through the change host function.
  - The utility that allows you to copy key parts in binary files onto smart cards will allow you to select more than one file at a time. This will simplify the process of moving from binary key part files to smart card key part management.
  - With any attempt to delete a role or authority from a Common Cryptographic Architecture (CCA) mode host crypto module from inside of a TKE domain group, the delete will be attempted on every module included in the group. Previously the operation would stop the first time the role or authority was not found on a module in the group.
  - When TKE 9.2 detects that a Linux host supports long user IDs you will be able to enter user IDs with up to 32 characters.
  - The TKE Workstation Logon Wizard includes a new step that encourages you remove excess authority from the DEFAULT role after your TKE Workstation administrator profiles have been created.
- The following are important notes about upgrading existing TKE Workstations to TKE 9.2:
  - TKE workstations with feature codes 0847 and 0849 cannot be upgraded to TKE 9.2 LIC.
  - TKE workstations with feature code 0080, 0081, 0085, or 0086 can be upgraded to TKE 9.2 LIC only if the TKE Workstation feature is assigned to a z14 server or later.
  - You will have to buy a new local adapter crypto feature for the TKE if your TKE is at a pre-TKE 9.0 LIC level.

FICON Express16SA

FICON Express16SA supports a link data rate of 16 gigabits per second (Gbps) and autonegotiation to 8 Gbps for synergy with current-generation switches, directors,

and storage devices. With support for native FICON, High Performance FICON for z Systems(R) (zHPF), and Fibre Channel Protocol (FCP), the IBM z15 server is designed to help you to prepare for an end-to-end 16 Gbps infrastructure to meet the lower latency and increased bandwidth demands of your applications.

The FICON Express16SA adapter will work with your existing fiber optic cabling environment, both single-mode and multimode optical cables.

The zHPF protocol:

In laboratory measurements, using FICON Express 16SA in a z15 with the zHPF protocol and small data transfer I/O operations, FICON Express 16SA operating at 16 Gbps performs the same as FICON Express 16S+.

In laboratory measurements, using FICON Express 16SA in a z15 with the zHPF protocol and a mix of large sequential read and write data transfer I/O operations, FICON Express 16SA operating at 16 Gbps performs the same as FICON Express 16S+.

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.

The FCP protocol:

In laboratory measurements, using FICON Express 16SA in an IBM z15 with the FCP protocol for small data transfer I/O operations, FICON Express 16SA operating at 16 Gbps performs the same as FICON Express 16S+.

In laboratory measurements, using FICON Express 16SA in an IBM z15 with the FCP protocol and FICON Express 16SA operating at 16 Gbps, FICON Express 16SA performs the same as FICON Express 16S+.

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.

Cleaning discipline for FICON Express16SA fiber optic cabling: With the introduction of 16 Gbps link data rates, it is even more critical to ensure your fiber optic cabling infrastructure performs as expected. Proper fiber optic inspection, cleaning, and maintenance is required to help ensure that the "data gets through." With 16 Gbps link data rates over multimode fiber optic cabling, link loss budgets and distances are reduced. Single-mode fiber optic cabling is more "reflection sensitive." With high link data rates and single-mode fiber optic cabling there is also less margin for error. The cabling is no longer scratch-tolerant and contaminants such as dust and oil can present a problem. To keep the data flowing, proper handling of fiber trunks and jumper cables is critical as well as thorough cleaning of fiber optic connectors. Work with your data center personnel or IBM personnel to ensure you have fiber optic inspection and cleaning procedures in place.

Channel subsystem (CSS) scalability: The IBM z15 server, like the IBM z14 and z13 servers, has support for six logical channel subsystems (LCSSs) which are required to support the 85 LPARs for z15, and four subchannel sets.

OSA-Express7S - an Ethernet technology refresh

The OSA-Express7S 25 Gigabit Ethernet (25GbE) feature was introduced on z14, and with z15 additional features to complete the full family of the OSA-Express7S generation of adapters are being introduced: a new version of the 25GbE feature, 1000BASE-T Ethernet for copper environments, in addition to 10 Gigabit Ethernet

(10GbE) and Gigabit Ethernet (GbE) for single-mode and multimode fiber optic environments. The performance characteristics of the new features are comparable to their predecessor OSA-Express6S (for 1000BASE-T, GbE, and 10GbE) and 7S (for 25GbE) 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 and 25 Gigabit Ethernet features.

The new members of the OSA-Express7S family of features (#0442, #0443, #0444, #0445, #0446, #0449) are exclusive to the z15 and IBM LinuxONE III. 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 designed to help improve availability and handling of paging workload spikes when running z/OS V2.1 and higher. 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(R) 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.

IBM Virtual Flash Memory is the replacement for the Flash Express features (#0402, #0403) which were available on the IBM zEC12 and IBM z13. No application changes are required to change from IBM Flash Express to VFM.

IBM zHyperLink Express1.1

IBM zHyperLink Express 1.1 is a direct connect short distance, IBM Z I/O adapter offering extremely low latency connectivity to FICON storage systems. Working in conjunction with your existing FICON SAN infrastructure, zHyperLink fosters a new I/O paradigm for IBM mainframes. zHyperLink improves application response time, cutting I/O sensitive workload response time by up to 50% without requiring application changes. zHyperLink Express 1.1 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. It is fully compatible with zHyperLink Express on earlier machines and can interconnect with them.

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.

IBM Z Hardware Management Appliance

New with IBM z15, the HMC hardware will no longer have CD/DVD drives as part the HMC server hardware. A new optional IBM Z Hardware Management Appliance can be ordered with the z15 to provide HMC/SE functions within the CPC frame, eliminating the need for separate HMCs outside of the frame. Multiple new capabilities will be available on HMC 2.15.0, including:

- Delivering RSA SecurID authentication using that new centralized server on z/OS.
- New user management controls for both HMC and SE tasks, resulting in a better user experience and providing the desired user task/object protection across the HMC/SE.

- A new option for audit support for remote syslog/Splunk support.
- An improved dashboard status overview visible when viewing tasks on all tabs, not just when viewing the home tab.

z/OS support for the IBM z15

New functions in z/OS continue to enhance the role of IBM Z, with support for IBM z15 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 grow and secure their most critical transaction environments. In addition to base processor support, z/OS provides support for these IBM z15 functions and features:

- Cryptography enhancements available with Crypto Express 7S. With Cryptographic Support for V2R2 - V2R4 (ICSF FMID HCR77D1), ICSF will provide the following new features:
  - Support for the new Crypto Express7S adapter, configured as a CCA coprocessor, an EP11 coprocessor, or an accelerator.
  - The ability to use CP Assist for Cryptographic Functions (CPACF) for certain clear key ECC operations. ICSF can now call CPACF instructions to perform ECC key generation, key derivation, and digital signature generation and verification using a subset of the NIST curves. The CPACF on IBM z15 also supports the ed448 and ec25519 curves.
  - A new SMF record whenever a master key is changed. Certain compliance regulations mandate the periodic rotation of encryption keys, including the master keys loaded into coprocessors. As part of the master key change process, an SMF record will now be written every time the new master key is promoted to the current master key as part of the change master key ceremony.
  - A health check that verifies a system's ability to use the NIST recommended PSS signature algorithms. It is not obvious that the ECC master key is required when generating and using RSA keys enabled for PSS signatures, so a health check will help clients understand the need for this additional master key so they can begin to exploit the recommended algorithms.
  - New quantum safe algorithms for sign and verify operations. With this release of ICSF, it is now possible to use quantum safe encryption algorithms for digital signature operations, which also includes the ability to generate and store new keys. These algorithms will be clear key only and available via the PKCS #11 interfaces.
  - Support for CCA Release 5.5 and CCA Release 6.3 including:
    -- New services in support of ANSI TR-34 Remote Key Loading.
    -- PCI HSM Compliance for AES and RSA keys.
    -- Additional AES based financial services.
    -- Note: These functions were made available on ICSF FMD HCR77D0 with PTFs for APAR OA57089.
- Coupling Facility Level (CFLEVEL) 24.
- Additional new I/O attachment options including the OSA-Express7S.
- Exploitation of the IBM Integrated Accelerator for zEnterprise Data Compression, which replaces the zEDC Express card on z14 and older generations of servers. This includes both the synchronous execution through the z/OS provided zlib library as well as the asynchronous support for authorized programs. There are no required z/OS configuration changes for existing zEDC Express users. The existing z/OS license feature is required for the asynchronous support on z15.
- Exploitation of System Recovery Boost which is designed to enable restoration of service from, and workload catch up after, both planned and unplanned outages faster than on any prior Z machine and with no additional IBM software costs, along with faster GDPS-orchestrated reconfiguration actions such as those involved in a planned or unplanned DR site switch. Results may vary by customer based on individual workload, configuration, and software levels.

- Exploitation of IBM Z Data Privacy for Diagnostics, a new capability with z/OS which is designed to help tighten dump protection for data that will need to be shared with others. It allows a business to make informed decisions about sharing diagnostic data before it is sent.
- Furthering the IBM Z work on Linux, z/OS now includes Container Extensions, the ability to run Linux on z Docker containers in z/OS in addition to the existing ability to run Linux on z Docker containers natively, or with z/VM or KVM, or using LinuxONE or securely using Secure Services. For more information see Software Announcement JP19-0409, dated July 23, 2019.

See the Software requirements section of this announcement for the minimum z/OS requirements for IBM z15 and its features.

Compiler support for IBM z15: A key strength of the IBM enterprise compilers, Enterprise COBOL, Enterprise PL/I, and z/OS XL C/C++, is the continual support of the latest Z hardware architectures. The latest releases of the compilers (Enterprise COBOL for z/OS V6.3, Enterprise PL/I for z/OS V5.3, and z/OS V2R4 XL C/C++) make available a new ARCH(13) level to exploit the new hardware instructions available on the IBM z15 models in z/Architecture mode. Application developers can recompile using the new ARCH(13) compiler option to instruct the compiler to generate code for applications that exploits instructions available on z15. This translates into immediate support of z15 and improved application performance without any source code changes.

The latest release of IBM Automatic Binary Optimizer for z/OS (ABO) makes available a new ARCH(13) level to exploit the instructions available on the IBM z15 models in z/Architecture mode. Using ABO to optimize existing VS COBOL II to Enterprise COBOL V4.2 modules allows these modules to obtain improved computation performance without the need for recompilation on z15 hardware.

Node.js is one of the fastest growing language runtimes in the market with a large open source community. Available and supported on z15 and on z/OS, IBM SDK for Node.js -z/OS, V8.0 supports the open source Node.js V8.0 level which is designed to provide extra security and performance by leveraging the capabilities of IBM Z.

z/VM support for the IBM z15

With the PTF for APAR VM66248, planned to be available September 23, 2019, z/VM V6.4 and V7.1 will provide support to enable guests to exploit function on IBM z15, which includes:

- Synchronous execution support for on-chip data compression and DEFLATE conversion.
- Enhanced Vector and Vector packed decimal.
- Crypto Express7S adapter and cryptographic enhancements.
- FICON Express16SA adapter on z15.
- Dynamic I/O enhancements: Dynamic I/O support is provided for managing the configuration of Crypto Express 7S, OSA-Express 7S OSD CHPIDs, FICON Express 16SA FC and FCP CHPIDs, RoCE Express 2.1, and Coupling Express LR Adapters.

With the available PTF for APAR PI99085, the z/VM V6.4 and V7.1 TCP/IP stack and NETSTAT OSAINFO command have been updated to provide support for:

- OSA-Express7S GbE.
- OSA-Express7S 10GbE.
- OSA-Express7S 25GbE.
- OSA-Express7S 1000BASE-T.

With the PTF for APAR VM66283, planned to be available September 23, 2019, z/VM V7.1 will provide support for System Recovery Boost, including:

- General CPs running as subcapacity can be boosted to full capacity for a limited time during z/VM system initialization and workload bring-up, during workload quiesce and system shutdown, and during system abend processing.
- Speed change status can be logged in z/VM monitor data.
- Support for System Recovery Boost must be explicitly enabled in the z/VM system configuration file.
- z/VM System Recovery Boost support benefits the z/VSE and z/TPF guest environments.

For further details, review the z/VM website and the hardware PSP bucket 8561DEVICE z/VM subset.

z/VM new function portal:

The z/VM Continuous Delivery News web page will be the primary vehicle used by IBM to describe new functions that are planned for z/VM. It is the recommended way to keep track of future development and support plans for the z/VM product. IBM recommends subscribing to this page to be notified of changes. To subscribe, click the Notify Me link in the left-side navigation bar. Additional instructions are included on the VM Site File Change Notification web page.

Additional z/VM V7.1 enhancements during 2019:

The following enhancements for z/VM V7.1 are available or are planned to be available during 2019:

- Dynamic Crypto: With the PTF for APAR VM66266, planned to be available September 23, 2019, z/VM will provide dynamic crypto support, which enables dynamic changes to the AP Cryptographic (crypto) environment on a z/VM system, allowing the addition or removal of crypto hardware to be less disruptive to the system and its guests.
- VSwitch Priority Queuing support: With the available PTFs for APARs VM66219, VM66223, and PH04703, z/VM exploits OSA-Express Priority Queuing when it is available on a VSwitch's uplink port; currently all VSwitch outbound traffic to the external network is transmitted at the same priority. When VSwitch Priority Queuing is enabled, z/VM will establish multiple OSA QDIO output queues, and transmit data to the external network at different priorities.
- Support for 80 logical processors: With the available PTFs for APAR VM66265 and VM66296, z/VM supports 80 logical processors on z14 and IBM z15, relieving the previous limitation of 64 logical processors per LPAR. This will allow clients to run more workload on z/VM by increasing the number of supported logical processors, which is especially important when multithreading is enabled. From a client's perspective, this will allow defining more logical processors for running workload on each LPAR, possibly requiring fewer LPARs to support the same workload. Support for 80 logical processors is provided on z15, LinuxONE III, z14, LinuxONE Emperor II, and LinuxONE Rockhopper II servers.
- EAV paging: With the available PTFs for APARs VM66263 and VM66297, z/VM supports paging space that is located anywhere on Extended Address Volumes, allowing clients to define sufficient paging capacity for z/VM partitions with large memory sizes while reducing the burden of managing a larger number of smaller paging devices. As systems continue to grow, the need for paging space has increased. This z/VM support allows allocation and use of paging space on ECKD devices above cylinder 65520 up to the 1 TB (1,182,006 cylinder) limit.
- Fast minidisk erase: With the PTFs for APARs VM65784, VM66288, and PH14249, planned to be available December 15, 2019, z/VM provides a means to erase the data from an ECKD minidisk in a more efficient and quicker manner when a user is deleted.

z/VSE support for the IBM z15

z/VSE V6.2 and its stand-alone utilities run entirely in z/Architecture mode.

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 z15, z14, z14 ZR1, z13, and z13s(R) servers, Coupling Facilities, Server Time Protocol (STP), and ICA SR and CE LR coupling links 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** is designed to allow events occurring in different servers to be properly sequenced in time, by synchronizing the clocks of those servers. 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** - As announced in Hardware Announcement JG17-0065, dated July 17, 2017, IBM z14 introduced a new Graphical User Display for the STP network and configuration. As a result, with z15 the STP configuration panels will be removed from the SE. For more information, see the Hardware Management Console (HMC) HMC/SE section below, "Removal of System (Sysplex) Time Task."

  In order to match the new hardware and coupling changes, STP has been updated to make use of the Oscillators in Drawers 1 and 2 (up to a total of 4). Pulse Per Second connections on the first two Drawers can be selected from among the four oscillator cards in the first two drawers. STP may use the increased number of Coupling Channels that can be defined in z15.

- **Parallel Sysplex enhancements** - The IBM z15 provides a new level of Coupling Facility support, CFLEVEL 24, which provides the following Coupling Facility enhancements:
  - CFCC Fair Latch Manager provides improved work management efficiency contributing to better CF processor scaling as well as improved arbitration for internal CF serialization of resources.
  - CFCC Message Path Resiliency Enhancement provides improved resiliency of message path connectivity through new transparent recovery processing for certain types of link initialization errors that can occur as z/OS images in the Parallel Sysplex are being IPLed.
  - The CFCC dynamic dispatching option default is changed to make use of DYNDISP=THIN for CF images using shared processors. Support for Coupling Facility Thin Interrupts has been available since the IBM zEC12/ zBC12 generation of server, and provides by far the most efficient and well-performing option for coupling facility images using shared processors. Clients who have explicitly specified other DYNDISP options should also consider changing to explicitly specify DYNDISP=THIN, on CFLEVEL 24 or higher, making use of the new default.
- **Coupling link constraint relief** -IBM z15 provides additional physical and logical coupling link connectivity compared to z14. The maximum number of physical ICA SR coupling links (ports) is increased from a maximum of 80 per CPC to 96 per CPC. The maximum number of Internal Coupling Channels (ICP) is increased from 32 to 64, and the maximum overall number of allowed coupling channels (CHPIDs) per CPC is increased from 256 to 384. These higher limits on z15 support higher levels of connectivity and physical consolidation using ICA SR, as well as the concurrent use of ICA SR and CE LR links for coupling link technology.

  IBM has removed support for InfiniBand coupling links as noted in prior Statements of Direction. In Hardware Announcement JG17-0065, dated July 17, 2017, IBM stated that the z14 server is the last high-end IBM Z server to

support InfiniBand coupling links. In Hardware Announcement JG16-0002, dated February 16, 2016, IBM stated that the z13s server is the last midrange IBM Z server to support InfiniBand coupling links.

Hardware Management Console (HMC) HMC/SE: The IBM z15 Hardware Management Console and Support Element will support:

September 23, 2019 deliverables:

- **HMC Security Audit Enhancement: Remote Syslog/Splunk Support**
  - The HMC 2.15.0 release will provide a new option for audit support. Previously, the HMC users could use the Audit and Log Management task or Scheduled Operations to offload xml and html formatted logs. New HMC support will now be available to offload Security Logs, Audit Logs, Console Events, Hardware Messages, and SNMP and WebServices Automation Logs using a Remote SysLog Consolidation Server (for example, Splunk). In addition, SNMP API support was also added for offloading Audit Logs and Console Events while previously supporting Security Logs.
- **HMC Dashboard/Status Overview**
  - The HMC 2.15.0 has been enhanced to address the viewing of the Status Overview, Exceptions, Operating System Messages, and Hardware Messages indicator area in the Tabbed Workspace environment. That indicator area is now presented so that it is visible when viewing tasks on all tabs, not just when viewing the home tab. There will now be a Compact Masthead Status Bar display along with "Docked" and "Expanded" display areas.
- **HMC Remote Browser Window Sizing**
  - When using a remote browser connection into the HMC, there are now controls to persist the window size for subsequent browser connections into the HMC. Prior to HMC 2.15.0, the HMC browser connection into the HMC always launched a full-screen window, and while this could be resized, any subsequent initial HMC invocations would be a full-screen window size.
- **HMC/SE No DVD Support**
  - New-build HMCs shipped with the HMC 2.15.0 level will no longer have CD/DVD drives as part of the HMC server hardware. The HMC will now provide two main options for functional and service operations: USB media or electronic. Solutions will be provided for both for:
    - -- Firmware required for the HMC or Support Element/CPC
    - -- eBoD (eBusiness on Demand) records (for example, On Off Capacity on Demand, Capacity Backup Unit (Disaster Recovery))
    - -- Operating system code (used for Load from Removable Media or Server task)
  - USB Flash Memory Drive solutions are available, but if USB Flash Memory Drive is not acceptable for a client environment, there will be electronic network options to address those client environments.
  - If the client requires a non-USB solution, that client should order feature code 0846 (No Physical Media Option). This will then provide instructions on how to electronically deliver the required content via the network using various options: zRSF (Z Remote Support Facility), IBM Resource Link(R), and FTP/SFTP/FTPS Server connections from the HMC. Note that for an electronic-only delivery environment, there is a requirement that there are two HMCs on every unique network subnet where a Hardware Management Console, Support Element, or Trusted Key Entry workstation is connected.
  - If USB is acceptable, generally the appropriate USB Flash Memory Drive media will be shipped with whatever feature is being delivered. There are also two feature codes available for USB Flash Memory Drive Media, which can be ordered if required:
    - -- Feature code 0843: USB Load media which can be used for IBM Z operating system code
    - -- Feature code 0848: USB Backup media which can be used for HMC or SE Critical Data Backup task

- **HMC User Management Controls to Include HMC and SE Tasks**
  - Prior to HMC 2.15.0, there were a moderate number of client tasks that were available directly on the HMC, but were available only by using the Single Object Operations task to launch those tasks indirectly from the SE (Support Element). In addition, most clients don't create unique users for the SE environment, but only create users for the HMC. When SE-only tasks are launched via Single Object Operations, the user authority from User Management is inherited from default user roles on the SE (for example, SYSPROG, OPERATOR, and so on) rather than based on user controls for unique user roles on the HMC.
  - With HMC 2.15.0, most SE-only client tasks (for example, Channel Problem Determination, Crypto Config/Mgmt, Advanced Facilities, Perform Model Conversion (On/Off Capacity on Demand, Capacity Backup Unit, and so on)) are now available directly on the HMC without having to utilize Single Object Operations. This also includes physical channel objects (PCHIDs) being available directly on the HMC.
  - HMC 2.15.0 will also provide user management controls for both HMC and SE tasks based on HMC User Management definitions, and those HMC/SE user and object access controls can be replicated across all HMCs using the HMC Data Replication task. These two major enhancements will result in a better user experience as well as provide the desired user task/object protection across the HMC/SE that the clients require for all their uniquely defined users.
- **HMC Integrated 3270 Console Performance Enhancements**
  - For security reasons it is recommended to use the HMC Integrated 3270 Console rather than HMC Operating System Messages when managing IBM Z operating system environments via an HMC console window. This is a strong consideration when managing z/OS because the Integrated 3270 Console requires HMC users to log into their RACF(R) user IDs, but HMC Operating System Messages provides z/OS system console RACF user authority.
  - In HMC 2.15.0 further enhancements were made for the HMC Integrated 3270 Console which provide significant performance responsiveness for that task. These enhancements are present in the HMC 2.15.0 and will be effective not only when managing IBM z15 CPC LPARs, but also for z14 and z13 LPARs.
- **Removal of zBX Support**
  - HMC 2.15.0 no longer supports zBX (IBM z BladeCenter Extension). The HMC 2.15.0 removed the zEnterprise Unified Resource Manager and Ensemble support, and the z15 system no longer supports connections to zBX. If there is still a need for zBX support, the z14 HMC 2.14.1 or earlier levels can be used, and the zBX can only have connections to z14 CPCs or earlier.
- **HMC n-2 Legacy System Support**
  - HMC 2.15.0 supports only two previous generations of systems (z14 and z13) while also supporting IBM z15. This change will improve the number and extent of new features and functions that are able to be pretested and maintained in a given release with IBM's continued high-reliability qualification procedures. This change is also in alignment with the n-2 support strategy for sysplex coupling.
  - z14 HMC level 2.14.1 or earlier levels will continue to maintain support for n-4 systems, and can be used to support systems prior to z13.
- **Removal of System (Sysplex) Time Task**
  - The HMC 2.15.0 no longer supports the System (Sysplex) Time task on the Support Element. The System (Sysplex) Time task was replaced by the "Manage System Time" task on the Hardware Management Console 2.14.0 release as announced in Hardware Announcement JG17-0065, dated July 17, 2017. There are significant enhancements in the Manage System Time task which clients should utilize as part of their time management activities. More information on Manage System Time can be found in z14 publications as well as in YouTube video education modules on the HMC YouTube launching page.
- **HMC/SE Support for System Recovery Boost**
  - The Hardware Management Console and Support Element will provide a display indication when System Recovery Boost is active for a partition. This can be

seen at the main HMC/SE Tree UI view as well as on the Image Details and Monitors Dashboard panels.
  - In addition, an Audit Log entry is logged specifying which specific type of System Recovery Boost (zIIP capacity boost or speed boost) is turned on or off. Each log entry also includes the partition number.
  - There is also new Perform Model Conversion task support for activating a new temporary Boost record which can add additional temporary zIIPs in preparation for a zIIP boost event.
- **HW API Efficiency Enhancements as Part of GDPS for System Recovery Boost**
  - The Hardware Management Console and Support Element has implemented specific code enhancements in support of improving the efficiency of the system recovery image reconfiguration activities under the direction of GDPS. These enhancements include additional memory caching in SE memory, asynchronous HMC/SE security logging, and asynchronous updates of Activation Profiles.

November 14, 2019 deliverable:

- **IBM Z Hardware Management Appliance**
  - Starting with IBM z15 and IBM LinuxONE III, the IBM Z Hardware Management Appliance feature code 0100 can be ordered to provide the HMC/SE functionality to be contained within redundant physical servers inside the CPC frame. When you order the IBM Z Hardware Management Appliance feature, this will provide logically a Primary and Alternate Support Element and two peer Hardware Management Consoles on two physical servers in the CPC frame. This eliminates the need for having to manage a separate physical server or servers for one or more HMCs outside of the frame. For the User Interface experience you must use remote browsing controls from your own workstation into HMC within the IBM Z Hardware Management Appliance.
  - If you have multiple systems, you don't need to order the Hardware Management Appliance feature for all systems. The recommendation is that you consider having the IBM Z Hardware Management Appliance features on one or two CPCs, but the rest of the CPCs don't need to include Hardware Management Appliance features. (Those CPCs would have redundant Support Elements.)
  - The IBM Z Hardware Management Appliance feature is optional. Physical HMCs (both Mini Tower and rack mounted) are still available features to be used.

The Internal Battery Feature (IBF) available with z15 contains Lithium ion batteries greater than 300 Wh. They are fully regulated Dangerous Goods which means that you will incur premium costs associated with owning the IBF. The need for an IBF would be redundant if your location provides uninterruptible power. The IBF can be ordered only in conjunction with BPA bulk power not iPDU. In client locations without an uninterruptible power supply, there are resiliency advantages to using an IBF feature when a power failure occurs, for example, for preserving modified data in Coupling Facility images until power is restored.

z15 machines shipped with IBFs and IBF FRUs could be delayed due to availability of freight carriers rated for Dangerous Goods. IGF and any lessor may not get IBFs back. IBFs must be removed if the machine is moved in any fashion. If you, the client, are shipping the IBF, you will have to use a logistics provider that is certified in Dangerous Goods transportation to ship the IBFs. You are responsible to handle the IBF properly in accordance with all local, legal, and environmental requirements, for all removed IBFs from repair actions, relocations, or machine returns.

Where IBM has Extended Producer Product Take Back Responsibilities, the client should see the IBM Product Take Back Programs website.

The IBM 2819 model IBF feature code (#3211) makes a replacement Internal Battery Feature (IBF) battery pack available to those clients who want to relocate their IBM 8561 and had to remove their IBF battery packs because they couldn't be shipped.

BTA water - This announcement makes BTA water available to those clients who want to relocate their IBM 8561. Removed BTA water must be disposed of properly by the client. BTA water is a mixture of deionized (DI) water and 900-990 PPM benzotriazole (BTA), a corrosion inhibitor.

- IBM machine type 2819 model BTA feature #9849 provides three 20 liter jugs.
- Feature #9850 provides one 20 liter jug.
- IBM machine type 8561 with feature #4033, A Frame Radiator, needs one jug plus one spare jug.
- IBM machine type 8561 with feature #4034, A Frame Water, needs two jugs plus one spare jug.

Enhancements to software pricing Technology Transition Offerings:
Complementing the announcement of the IBM z15 server IBM is introducing:

- A new Technology Transition Offering (TTO) called Technology Update Pricing for the IBM z15.
- New and revised Transition Charges for Sysplexes or Multiplexes TTOs for actively coupled Parallel Sysplexes (z/OS), Loosely Coupled Complexes (z/TPF), and Multiplexes (z/OS and z/TPF).
- z15 server eligibility for Tailored Fit Pricing for IBM Z offerings.

Technology Update Pricing for the IBM z15 extends the software price/performance provided by AWLC and CMLC for z15 servers. The new and revised Transition Charges for Sysplexes or Multiplexes offerings provide a transition to Technology Update Pricing for the IBM z15 for clients who have not yet fully migrated to z15 servers. This ensures that aggregation benefits are maintained and also phases in the benefits of Technology Update Pricing for the IBM z15 pricing as clients migrate.

When a z15 server is in an actively coupled Parallel Sysplex or a Loosely Coupled Complex, you may choose either aggregated Advanced Workload License Charges (AWLC) pricing or aggregated Parallel Sysplex License Charges (PSLC) pricing, subject to all applicable terms and conditions.

When a z15 server is part of a Multiplex under Country Multiplex Pricing (CMP) terms, Country Multiplex License Charges (CMLC), Multiplex zNALC (MzNALC), and Flat Workload License Charges (FWLC) are the only pricing metrics available, subject to all applicable terms and conditions.

For additional information about software pricing for the z15 server, see Software Announcement JP19-0495, dated September 12, 2019, Technology Transition Offerings for the IBM z15 offer price-performance advantages.

When a z15 server is running z/VSE, you may choose Mid-Range Workload License Charges (MWLC), subject to all applicable terms and conditions.

For more information about AWLC, CMLC, Tailored Fit Pricing for IBM Z, MzNALC, PSLC, MWLC, or the Technology Update Pricing and Transition Charges for Sysplexes or Multiplexes TTO offerings, see the IBM Z software pricing website.

Machines eligible to participate in Country Multiplex Pricing

At the time a client first implements a Multiplex, machines currently eligible to be included in the new Multiplex cannot be older than two generations prior to the most recently available server. The most recent server at any given point in time will be considered generation N, and the prior two generations as N-1 and N-2 respectively.

IBM z Systems(R) hardware family generations concurrent with the general availability of the z15:

Full name	Short name	Machine type	CMP machine generation as of 23 Sep 2019
IBM z15	z15	8561	N
IBM z14	z14	3906	N-1

Full name	Short name	Machine type	CMP machine generation as of 23 Sep 2019
IBM z14 ZR1	z14 ZR1	3907	N-1
IBM z13	z13	2964	N-2
IBM z13s(R)	z13s	2965	N-2
IBM zEnterprise EC12	zEC12	2827	N-3
IBM zEnterprise BC12	zBC12	2828	N-3
IBM zEnterprise 196	z196	2817	N-4
IBM zEnterprise 114	z114	2818	N-4

Concurrent with the general availability of the z15, the zEC12 and zBC12 machines will be designated as previously eligible CMP machines.

Clients are not eligible to create a Multiplex until machines running z/OS or z/TPF (along with any associated CBU machines) that are older than generation N-2 are upgraded, or that workload is transferred to eligible machines, or the older ineligible machines are converted to no longer run z/OS nor z/TPF software. Once a client establishes a Multiplex they may keep the machines originally included in their Multiplex indefinitely, including any machines subsequently designated as previously eligible. Going forward, any machine to be added to an existing Multiplex must conform to the machine types that satisfy the generation N, N-1, and N-2 criteria at the time that machine is added.

Upon the general availability of the z15 (generation N), clients who are still using a generation N-3 machine (zEC12 or zBC12) will have a 3-month grace period to transition into CMP while including that generation N-3 machine. This means the client's first CMP invoice must happen the month following 90 days from the general availability of the z15 (23 September 2019) which means any transition into CMP for a client with a zEC12 or zBC12 machine running z/OS or z/TPF must occur no later than 1 January 2020.

Product positioning

IBM z15 is built for a secure, "always on" world because customers need assurance that their data is safe, and services are always on and fulfilled instantly.

The IBM z15 is designed to help clients reduce instances of downtime, reduce the length of downtime, and mitigate the impact of downtime. IBM System Recovery Boost is a new function on IBM z15 that is available with z/OS and with z/VM(R) when running on general-purpose processors. It will also be available in z/TPF environments when running on general-purpose processors beginning on November 14, 2019. It can help clients recover workloads faster than on prior Z machines. System Recovery Boost expedites system shutdown processing, system IPL (Initial Program Load), middleware/workload restart and recovery, and the client workload execution that follows. It provides higher processor capacity for a limited period of time, called the "Boost period."

IBM System Recovery Boost will let you return your system to normal work faster, not just following a disaster, but after all kinds of disruptions, both planned and unplanned. It can help businesses catch up for lost time and get back to production more quickly and can recover lost business transactions faster than previously possible, reducing impacts to service level agreements (SLAs) for recovery in multisite environments. It also provides clients with the optional ability to allocate additional resources of the IBM z15 to get the system back and ready for work faster and catch up for lost time, without increasing IBM software costs.

Key to a strong security position is being able to control access to data shared with business partners and ecosystems. A new capability with z/OS helps by tightening

dump protection for data that will need to be shared with others. IBM Z Data Privacy for Diagnostics allows a business to make informed decisions about sharing diagnostic data before it is sent. When sending diagnostic information to vendors, there is a risk of accidentally sharing sensitive data. This often poses a problem for organizations that must comply with the GDPR laws and/or other data privacy laws. Because of this, organizations are often forced to make a choice between serviceability or compliance when it comes to requesting help in diagnosing system problems. Now sensitive data can be tagged such that it can be identified in dumps with no impact to dump capture times. Tagged sensitive data in dumps can be secured and redacted before sending to third-party vendors.

Introduced on IBM z14, pervasive encryption easily encrypts all data associated with an application, database, or cloud service -- whether on premises or in the cloud, at rest or in flight. IBM Z has taken the next step of the journey on the IBM z15 by extending this data protection throughout the enterprise. The goal is protection of data beyond the platform and into distributed and hybrid cloud environments.

IBM Z Data Privacy Passports is planned to be available to set up low-level data privacy protection throughout the lifecycle of the data. As a result, only the authorized application or user can view subsections of the data. This technology is intended to be implemented on the IBM z15 to enable data protection that can span hybrid and multiparty computing environments, including data stored in public cloud deployments or shared with third parties. For more information about IBM Z Data Privacy Passports V1.0 beta program, see Software Announcement JP19-0548, dated September 12, 2019.

The IBM z15 provides the infrastructure to meet the demands of digital transformation in a hybrid cloud world. The z15 processor chip runs at a 5.2 GHz processor frequency and delivers 1.8 times more on-chip cache per core than the IBM z14 (z14) and a maximum of 40 TB of RAIM memory per machine. There are up to 85 logical partitions available and up to 190 configurable cores. The z15 server comes in a single model (Model T01) with processor capacity represented by feature codes.

The z15 integrates new file compression capabilities with an on-chip compression coprocessor. The IBM Integrated Accelerator for zEnterprise Data Compressioncan help reduce data storage requirements and costs, as well as increase data transfer rates to boost throughput without adversely impacting response times. The IBM Integrated Accelerator for zEnterprise Data Compressionreplaces the IBM zEDC Express(R) adapter on earlier Z servers. It interoperates compatibly with the zEDC compression used on previous platforms and with industry-standard compression used on other platforms. Database query processing, utility processing, analytics, and batch workloads make up a significant part of IBM Z workloads. The processor chip provides a new hardware-accelerated approach using a new coprocessor designed to reduce elapsed and CPU times for many Db2(R) batch workloads. (Results may vary by client based on individual workload, configuration, and software levels.)

The IBM z15 is available with one to four frames within a single system built on standardized 19-inch frames. This new design offers a data-center-friendly footprint. The 19-inch frames on the IBM z15 are available in two power and cooling options. The first is the Intelligent Power Distribution Unit (iPDU). Use of iPDU on the IBM z15 may enable fewer frames, allow for additional I/O slots, and improve power efficiency to lower overall energy costs. It offers some standardization and ease of data center installation planning. A Bulk Power Assembly (BPA) is required for clients who order an Internal Battery Feature (IBF), Water Cooling Unit (WCU), or Balanced Power.

IBM z/OS Parallel Sysplex(R) technology allows users across multiple systems to access the same databases concurrently, with database access controlled at the record level. Innovative multisystem data sharing technology allows linking up to 32 z/OS systems as a single, highly scalable, highly available logical computing facility. Following the model of the z14 ZR1, the z15 completes the transition from Parallel Sysplex InfiniBand coupling links to IBM Internal Coupling Adapter Short Reach (ICA SR) and Coupling Express LR (long reach) coupling interconnects. Host Channel Adapter (HCA) for InfiniBand is no longer supported. z15 also provides significantly

increased physical and logical coupling connectivity compared to previous machines. z15 increases the maximum number of logical coupling CHPIDs per CPC from 256 to 384, allowing for better virtualization of the physical coupling link resources. The per-LPAR limit on the maximum number of coupling CHPIDs remains at 128. In terms of physical coupling link connectivity, IBM z15 also provides more connectivity on both a per-drawer and per-CPC basis. The maximum number of ICA SR features increases from 40 to 48 per system (and from 80 to 96 ports / physical ICA SR coupling links), while the per-drawer limit increases from 20 to 24 ports / physical ICA SR coupling links. The increase in the per-drawer coupling link connectivity may be especially interesting for clients with smaller machines coupled into larger sysplex environments. Additionally, the maximum number of internal coupling (ICP) CHPIDs per CPC, used for LPAR-to-LPAR connectivity within the machine, is increased with z15 from 32 to 64 CHPIDs.

The z15 provides a new level of Coupling Facility support, CFLEVEL 24, which provides the following Coupling Facility enhancements:

- CFCC Fair Latch Manager provides improved work management efficiency contributing to better CF processor scaling as well as improved arbitration for internal CF serialization of resources.
- CFCC Message Path Resiliency Enhancement provides improved resiliency of message path connectivity through new transparent recovery processing for certain types of link initialization errors that can occur as z/OS images in the Parallel Sysplex are being IPLed.
- The CFCC dynamic dispatching option default is changed to make use of DYNDISP=THIN for CF images using shared processors. Support for Coupling Facility Thin Interrupts has been available since the IBM zEC12/zBC12 generation of server, and provides by far the most efficient and well-performing option for Coupling Facility images using shared processors. Clients who have explicitly specified other DYNDISP options should also consider changing to explicitly specify DYNDISP=THIN, on CFLEVEL 24 or higher, making use of the new default.

IBM Z has taken the next step of the secure, resilient hybrid cloud infrastructure journey with the IBM z15. The z15 delivers the platform that is powerful, integrated, and agile with the operational efficiency that maximizes your bottom line.

Statement of general direction

Removal of the z/VM PAGING63 IPL parameter: z/VM V7.1 will be the last z/VM release to support use of the PAGING63 IPL parameter. This parameter directed the paging subsystem to perform as it had in releases prior to z/VM V6.4. It also prevented use of z/VM V6.4 and V7.1 paging subsystem improvements, which include support for High Performance FICON(R), HyperPAV, encryption, and EAV.

Prepaid OOCoD tokens: Beginning with IBM z15, new prepaid OOCoD tokens purchased will not carry forward to future systems.

The conditional-SSKE facility: IBM z15 will be the last high end server to support the conditional-SSKE facility.

IEEE 1588 Precision Time Protocol (PTP): In the future IBM plans to introduce PTP as an external time source for IBM Z Server Time Protocol (STP) for an IBM Z Coordinated Timing Network (CTN). The initial implementation will be for PTP connectivity via the IBM Z HMC/SE. At that time there will be no change to the use of STP CTNs for time coordination, other than the potential to use a PTP-based external time source. Future implementation is planned to include full connectivity of an external PTP time source directly to the IBM Z CPC, and re-introduction of the concept of a mixed CTN, with support for traditional STP and native PTP implementations. Beyond that, the goal is to enhance the role of IBM Z machines in a PTP environment that addresses the many governmental regulations and security concerns that our clients are facing.

Operational Data Generation and Analytics: In the future IBM intends to deliver z/OS and Middleware interdependency data generation, and automated z/OS cross

stack analytics to reduce skill requirements level and amount of time required to perform problem definition.

z/VSE(R) exploitation of System Recovery Boost: In the future, IBM intends to deliver native z/VSE exploitation of System Recovery Boost, which is expected to enable restoration of service from, and catch up after, both planned and unplanned outages faster than on any prior Z machine.

Fibre Channel Endpoint Security: In the future IBM intends to provide Fibre Channel Endpoint Security to extend pervasive encryption on IBM Z, providing additional data protection and helping to achieve compliance mandates.

Statements by IBM regarding its plans, directions, and intent are subject to change or withdrawal without notice at the sole discretion of IBM. Information regarding potential future products is intended to outline general product direction and 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 IBM products remain at the sole discretion of IBM.

Reference information

For more information about the IBM z13, see Hardware Announcement JG15-0001, dated January 14, 2015.

For more information about "Software withdrawal and support discontinuance: IBM z Systems(R) platform selected products," see Withdrawal Announcement JP15-0054, dated February 03, 2015.

For more information about z/OS V2.2, see Software Announcement JP15-0366, dated July 28, 2015.

For more information on the IBM z13s(R) and IBM LinuxONE, see Hardware Announcement JG16-0002, dated February 16, 2016.

For more information on the enhanced support for shipping of IBM z13(R) and z13s(R) servers, see Hardware Announcement JG16-0075, dated June 07, 2016.

For more information about z/VM 6.4, see Software Announcement JP16-0109, dated October 25, 2016.

For more information about z Systems Long Distance Coupling, see Hardware Announcement JG17-0038, dated March 14, 2017.

For more information about "IBM z/OS Version 2 Release 3 -- Engine for digital transformation," see Software Announcement JP17-0306, dated July 17, 2017.

For more information about sub-capacity pricing terms for z/VM and z/VM-based programs, see Software Announcement JP17-0336, dated July 17, 2017.

For more information about the IBM z14, see Hardware Announcement JG17-0065, dated July 17, 2017.

For more information about the IBM Emperor II, see Hardware Announcement JG17-0090, dated September 12, 2017.

For more information about the IBM z14 Model ZR1, see Hardware Announcement JG18-0022, dated April 10, 2018.

For more information about the IBM LinuxONE Rockhopper II, see Hardware Announcement JG18-0025, dated April 10, 2018.

For more information about "z/VM V7.1 ushers in the z/VM Continuous Delivery era," see Software Announcement JP18-0375, dated August 07, 2018.

For more information about the "IBM z14 features enhance performance, encryption, and flexibility to accelerate your digital transformation," see Hardware Announcement JG18-0102, dated October 02, 2018.

For more information about "Preview: IBM z/OS Version 2 Release 4," see Software Announcement JP19-0012, dated February 26, 2019.

For more information about "Tailored Fit Pricing for IBM Z," see Software Announcement JP19-0013, dated May 14, 2019.

For more information about "Preview and statement of direction: IBM z/OS hybrid cloud enablement," see Software Announcement JP19-0278, dated May 14, 2019.

For more information about "IBM z/OS Version 2 Release 4 - Unleashing innovation through an agile, optimized, and resilient platform," see Software Announcement JP19-0409, dated July 23, 2019.

For more information about IBM LinuxONE III, see Hardware Announcement JG19-0017, dated September 12, 2019.

For more information about IBM Data Privacy Passports V1.0 beta program, see Software Announcement JP19-0548, dated September 12, 2019.

For more information about IBM Wave for z/VM V1.2, see Software Announcement JP19-0499, dated September 12, 2019.

Product number

Description	Machine type	Model	Feature number
IBM z15	8561	T01	
MTU 1 - D			0001
MTU 100 -D			0002
MTU 1 -V			0003
MTU 100 -V			0004
GTU 1 - D			0005
GTU 100 - D			0006
GTU 1 -V			0007
GTU 100 -V			0008
GTU 1000 - D			0009
GTU 1000 - V			0010
Exchange Pgm Machine			0012
Exchange Pgm Machine + Covers			0013
Migration Offering Machine			0014
Blue Letter Internal			0015
HW for DPM			0016
Non RSF On/Off CoD			0032
Serv Docs Optional Print			0033
OSA-ICC 3215 Enablement			0034
RFID Tag			0035
RFID Tag			0036
HMC			0062

Description	Machine type	Model	Feature number
HMC Rack Mount			0063
TKE Rack Mount			0087
TKE			0088
WWPN Persistence			0099
IBM Z HW Mgmt Appliance			0100
Linux Hosting Foundation			0103
Container Hosting Foundation			0104
2964 Air w/o TEIO & w/o HtrR			0105
2964 Air w/o TEIO & w/HtR			0106
2964 Air w/TEIO & w/o HtR			0107
2964 Air w/TEIO & w/HtR			0108
2964 Wat w/o TEIO & w/o HtrR			0109
2964 Wat w/o TEIO & w/HtR			0110
2964 Wat w/TEIO & w/o HtR			0111
2964 Wat w/TEIO & w/HtR			0112
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- CF			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 Rack Keybd/ Monitor/Mouse			0154
TKE Rack Keybd/ Monitor/Mouse			0156
ICA SR fanout			0172
PCIe fanout Gen3			0173
Fanout Airflow PCIe			0174
PCIe + Fanout			0175
ICA SR1.1			0176
Client Must Provide HMC KMM			0188

Description	Machine type	Model	Feature number
Client Must Provide TKE KMM			0190
3906 w/o TEIO & w/o HtR			0201
3906 w/TEIO & w/o HtR			0202
3906 w/o TEIO & w/HtR			0203
3906 w/TEIO & w/HtR			0204
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
Returning MT Digit 1			0389
Returning MT Digit 2			0390
Returning MT Digit 3			0391
Returning MT Digit 4			0392
Plant of MFG Digit 1			0393
Plant of MFG Digit 2			0394
Serial Number Digit 1			0395
Serial Number Digit 2			0396
Serial Number Digit 3			0397
Serial Number Digit 4			0398
Serial Number Digit 5			0399
OSA-Express 5S GbE LX			0413
OSA-Express 5S GbE SX			0414
OSA-Express 5S 10 GbE LR			0415
OSA-Express 5S 10 GbE SR			0416
OSA-Express 5S 1000 BASE-T			0417
FICON Express 16S LX			0418

Description	Machine type	Model	Feature number
FICON Express 16S SX			0419
PCIe Interconnect(R) Gen4			0421
OSA-Express 6S GbE LX			0422
OSA-Express 6S GbE SX			0423
OSA-Express 6S 10 GbE LR			0424
OSA-Express 6S 10 GbE SR			0425
OSA-Express 6S 1000 BASE-T			0426
FICON Express 16S+ LX			0427
FICON Express 16S+ SX			0428
10 GbE RoCE Express2.1			0432
Coupling Express LR			0433
FICON Express16SA LX			0436
FICON Express16SA SX			0437
OSA-Express7S GbE LX			0442
OSA-Express7S GbE SX			0443
OSA-Express7S 10 GbE LR			0444
OSA-Express7S 10 GbE SR			0445
OSA-Express7S 1000BASE-T			0446
OSA-Express7S 25 GbE SR1.1			0449
25GbE RoCE Express2.1			0450
zHyperLink Express1.1			0451
Model T01			0503
200-208V 30/60A, 3 Ph PDU			0629
380-415V 32A, 3 Ph WYE PDU			0630
Ethernet Switch			0631
Bulk Power Assembly			0640
IBM Virtual Flash Memory			0643
Max34			0655
Max71			0656
Max108			0657
Max145			0658
Max190			0659
CPC PSU			0666
32GB USB Load Media			0843

Description	Machine type	Model	Feature number
4768 Crypto Adapter			0844
No Physical Media			0846
32GB USB Backup Media			0848
TKE 9.2 LIC			0881
TKE Smart Card Reader			0891
Crypto Express7S (2 port)			0898
Crypto Express7S (1 port)			0899
TKE addl smart cards			0900
UID Label for DoD			0998
STP Enablement			1021
EMEA Special Operations			1022
VFM/Flash Converted, 1to1			1121
VFM/Flash Converted, 1to2			1122
VFM/Flash Converted, 1to3			1123
512 GB Memory			1515
576 GB Memory			1516
640 GB Memory			1517
704 GB Memory			1518
768 GB Memory			1519
896 GB Memory			1520
1024 GB Memory			1521
1152 GB Memory			1522
1280 GB Memory			1523
1408 GB Memory			1524
1536 GB Memory			1525
1664 GB Memory			1526
1792 GB Memory			1527
1920 GB Memory			1528
2048 GB Memory			1529
2304 GB Memory			1530
2560 GB Memory			1531
2816 GB Memory			1532
3072 GB Memory			1533
3328 GB Memory			1534
3584 GB Memory			1535
3840 GB Memory			1536
4352 GB Memory			1537
4864 GB Memory			1538
5376 GB Memory			1539
5888 GB Memory			1540
6400 GB Memory			1541
6912 GB Memory			1542
7424 GB Memory			1543
7936 GB Memory			1544
8448 GB Memory			1545
8960 GB Memory			1546
9472 GB Memory			1547

Description	Machine type	Model	Feature number
9984 GB Memory			1548
10496GB Memory			1549
11008 GB Memory			1550
11520 GB Memory			1551
12032 GB Memory			1552
12544 GB Memory			1553
13056 GB Memory			1554
13568 GB Memory			1555
14080 GB Memory			1556
14592 GB Memory			1557
15104 GB Memory			1558
15616 GB Memory			1559
16128 GB Memory			1560
16640 GB Memory			1561
17152 GB Memory			1562
18176 GB Memory			1563
19200 GB Memory			1564
20224 GB Memory			1565
21248 GB Memory			1566
22272 GB Memory			1567
23296 GB Memory			1568
24320 GB Memory			1569
25344 GB Memory			1570
26368 GB Memory			1571
27392 GB Memory			1572
28416 GB Memory			1573
29440 GB Memory			1574
30464 GB Memory			1575
31488 GB Memory			1576
32512 GB Memory			1577
34560 GB Memory			1578
36608 GB Memory			1579
38656 GB Memory			1580
40704 GB Memory			1581
32 GB Mem DIMM (5/feat)			1642
64 GB Mem DIMM (5/feat)			1643
128 GB Mem DIMM (5/feat)			1644
256 GB Mem DIMM (5/feat)			1645
512 GB Mem DIMM (5/feat)			1631
LICCC Ship Via Net Ind			1750
CP4			1941
CP5			1942
CP6			1943
CP7			1944
IFL			1945
ICF			1946
zIIP			1947
Unassigned IFL			1948
SAP (optional)			1949
32GB Flex Memory			1951

Description	Machine type	Model	Feature number
64GB Flex Memory			1952
256GB Flex Memory			1953
64GB VFM Flex Memory			1954
32GB Memory Cap Incr			1984
64GB Memory Cap Incr			1985
256GB Memory Cap Incr			1986
32GB FTR Converted Mem			1987
64GB FTR Converted Mem			1988
256GB FTR Converted Mem			1989
CPC1 Reserve			2271
CPC2 Reserve			2272
Balanced Power Plan Ahead			3003
BPR Pair			3016
Lift Tool Kit			3100
Extension Ladder			3101
Internal Battery IBF			3217
Fill and Drain Kit			3393
MSS Sales Flag A			3668
CPACF Enablement			3863
PCIe+ I/O Drawer			4021
B Frame			4031
A Frame Radiator			4033
A Frame Water			4034
B Frame Radiator			4035
B Frame Water			4036
Z Frame			4037
C Frame			4038
Zero-Way Processor CP4			4188
1-Way Processor CP4			4189
2-Way Processor CP4			4190
3-Way Processor CP4			4191
4-Way Processor CP4			4192
5-Way Processor CP4			4193
6-Way Processor CP4			4194
7-Way Processor CP4			4195
8-Way Processor CP4			4196
9-Way Processor CP4			4197
10-Way Processor CP4			4198

Description	Machine type	Model	Feature number
11-Way Processor CP4			4199
12-Way Processor CP4			4200
13-Way Processor CP4			4201
14-Way Processor CP4			4202
15-Way Processor CP4			4203
16-Way Processor CP4			4204
17-Way Processor CP4			4205
18-Way Processor CP4			4206
19-Way Processor CP4			4207
20-Way Processor CP4			4208
21-Way Processor CP4			4209
22-Way Processor CP4			4210
23-Way Processor CP4			4211
24-Way Processor CP4			4212
25-Way Processor CP4			4213
26-Way Processor CP4			4214
27-Way Processor CP4			4215
28-Way Processor CP4			4216
29-Way Processor CP4			4217
30-Way Processor CP4			4218
31-Way Processor CP4			4219
32-Way Processor CP4			4220
33-Way Processor CP4			4221
34-Way Processor CP4			4222
1-Way Processor CP5			4223
2-Way Processor CP5			4224
3-Way Processor CP5			4225
4-Way Processor CP5			4226
5-Way Processor CP5			4227
6-Way Processor CP5			4228
7-Way Processor CP5			4229

Description	Machine type	Model	Feature number
8-Way Processor CP5			4230
9-Way Processor CP5			4231
10-Way Processor CP5			4232
11-Way Processor CP5			4233
12-Way Processor CP5			4234
13-Way Processor CP5			4235
14-Way Processor CP5			4236
15-Way Processor CP5			4237
16-Way Processor CP5			4238
17-Way Processor CP5			4239
18-Way Processor CP5			4240
19-Way Processor CP5			4241
20-Way Processor CP5			4242
21-Way Processor CP5			4243
22-Way Processor CP5			4244
23-Way Processor CP5			4245
24-Way Processor CP5			4246
25-Way Processor CP5			4247
26-Way Processor CP5			4248
27-Way Processor CP5			4249
28-Way Processor CP5			4250
29-Way Processor CP5			4251
30-Way Processor CP5			4252
31-Way Processor CP5			4253
32-Way Processor CP5			4254
33-Way Processor CP5			4255
34-Way Processor CP5			4256
1-Way Processor CP6			4257
2-Way Processor CP6			4258
3-Way Processor CP6			4259
4-Way Processor CP6			4260

Description	Machine type	Model	Feature number
5-Way Processor CP6			4261
6-Way Processor CP6			4262
7-Way Processor CP6			4263
8-Way Processor CP6			4264
9-Way Processor CP6			4265
10-Way Processor CP6			4266
11-Way Processor CP6			4267
12-Way Processor CP6			4268
13-Way Processor CP6			4269
14-Way Processor CP6			4270
15-Way Processor CP6			4271
16-Way Processor CP6			4272
17-Way Processor CP6			4273
18-Way Processor CP6			4274
19-Way Processor CP6			4275
20-Way Processor CP6			4276
21-Way Processor CP6			4277
22-Way Processor CP6			4278
23-Way Processor CP6			4279
24-Way Processor CP6			4280
25-Way Processor CP6			4281
26-Way Processor CP6			4282
27-Way Processor CP6			4283
28-Way Processor CP6			4284
29-Way Processor CP6			4285
30-Way Processor CP6			4286
31-Way Processor CP6			4287
32-Way Processor CP6			4288
33-Way Processor CP6			4289
34-Way Processor CP6			4290
1-Way Processor CP7			4291

Description	Machine type	Model	Feature number
2-Way Processor CP7			4292
3-Way Processor CP7			4293
4-Way Processor CP7			4294
5-Way Processor CP7			4295
6-Way Processor CP7			4296
7-Way Processor CP7			4297
8-Way Processor CP7			4298
9-Way Processor CP7			4299
10-Way Processor CP7			4300
11-Way Processor CP7			4301
12-Way Processor CP7			4302
13-Way Processor CP7			4303
14-Way Processor CP7			4304
15-Way Processor CP7			4305
16-Way Processor CP7			4306
17-Way Processor CP7			4307
18-Way Processor CP7			4308
19-Way Processor CP7			4309
20-Way Processor CP7			4310
21-Way Processor CP7			4311
22-Way Processor CP7			4312
23-Way Processor CP7			4313
24-Way Processor CP7			4314
25-Way Processor CP7			4315
26-Way Processor CP7			4316
27-Way Processor CP7			4317
28-Way Processor CP7			4318
29-Way Processor CP7			4319
30-Way Processor CP7			4320
31-Way Processor CP7			4321
32-Way Processor CP7			4322

Description	Machine type	Model	Feature number
33-Way Processor CP7			4323
34-Way Processor CP7			4324
35-Way Processor CP7			4325
36-Way Processor CP7			4326
37-Way Processor CP7			4327
38-Way Processor CP7			4328
39-Way Processor CP7			4329
40-Way Processor CP7			4330
41-Way Processor CP7			4331
42-Way Processor CP7			4332
43-Way Processor CP7			4333
44-Way Processor CP7			4334
45-Way Processor CP7			4335
46-Way Processor CP7			4336
47-Way Processor CP7			4337
48-Way Processor CP7			4338
49-Way Processor CP7			4339
50-Way Processor CP7			4340
51-Way Processor CP7			4341
52-Way Processor CP7			4342
53-Way Processor CP7			4343
54-Way Processor CP7			4344
55-Way Processor CP7			4345
56-Way Processor CP7			4346
57-Way Processor CP7			4347
58-Way Processor CP7			4348
59-Way Processor CP7			4349
60-Way Processor CP7			4350
61-Way Processor CP7			4351
62-Way Processor CP7			4352
63-Way Processor CP7			4353

Description	Machine type	Model	Feature number
64-Way Processor CP7			4354
65-Way Processor CP7			4355
66-Way Processor CP7			4356
67-Way Processor CP7			4357
68-Way Processor CP7			4358
69-Way Processor CP7			4359
70-Way Processor CP7			4360
71-Way Processor CP7			4361
72-Way Processor CP7			4362
73-Way Processor CP7			4363
74-Way Processor CP7			4364
75-Way Processor CP7			4365
76-Way Processor CP7			4366
77-Way Processor CP7			4367
78-Way Processor CP7			4368
79-Way Processor CP7			4369
80-Way Processor CP7			4370
81-Way Processor CP7			4371
82-Way Processor CP7			4372
83-Way Processor CP7			4373
84-Way Processor CP7			4374
85-Way Processor CP7			4375
86-Way Processor CP7			4376
87-Way Processor CP7			4377
88-Way Processor CP7			4378
89-Way Processor CP7			4379
90-Way Processor CP7			4380
91-Way Processor CP7			4381
92-Way Processor CP7			4382
93-Way Processor CP7			4383
94-Way Processor CP7			4384

Description	Machine type	Model	Feature number
95-Way Processor CP7			4385
96-Way Processor CP7			4386
97-Way Processor CP7			4387
98-Way Processor CP7			4388
99-Way Processor CP7			4389
100-Way Processor CP7			4390
101-Way Processor CP7			4391
102-Way Processor CP7			4392
103-Way Processor CP7			4393
104-Way Processor CP7			4394
105-Way Processor CP7			4395
106-Way Processor CP7			4396
107-Way Processor CP7			4397
108-Way Processor CP7			4398
109-Way Processor CP7			4399
110-Way Processor CP7			4400
111-Way Processor CP7			4401
112-Way Processor CP7			4402
113-Way Processor CP7			4403
114-Way Processor CP7			4404
115-Way Processor CP7			4405
116-Way Processor CP7			4406
117-Way Processor CP7			4407
118-Way Processor CP7			4408
119-Way Processor CP7			4409
120-Way Processor CP7			4410
121-Way Processor CP7			4411
122-Way Processor CP7			4412
123-Way Processor CP7			4413
124-Way Processor CP7			4414
125-Way Processor CP7			4415

Description	Machine type	Model	Feature number
126-Way Processor CP7			4416
127-Way Processor CP7			4417
128-Way Processor CP7			4418
129-Way Processor CP7			4419
130-Way Processor CP7			4420
131-Way Processor CP7			4421
132-Way Processor CP7			4422
133-Way Processor CP7			4423
134-Way Processor CP7			4424
135-Way Processor CP7			4425
136-Way Processor CP7			4426
137-Way Processor CP7			4427
138-Way Processor CP7			4428
139-Way Processor CP7			4429
140-Way Processor CP7			4430
141-Way Processor CP7			4431
142-Way Processor CP7			4432
143-Way Processor CP7			4433
144-Way Processor CP7			4434
145-Way Processor CP7			4435
146-Way Processor CP7			4436
147-Way Processor CP7			4437
148-Way Processor CP7			4438
149-Way Processor CP7			4439
150-Way Processor CP7			4440
151-Way Processor CP7			4441
152-Way Processor CP7			4442
153-Way Processor CP7			4443
154-Way Processor CP7			4444
155-Way Processor CP7			4445
156-Way Processor CP7			4446

Description	Machine type	Model	Feature number
157-Way Processor CP7			4447
158-Way Processor CP7			4448
159-Way Processor CP7			4449
160-Way Processor CP7			4450
161-Way Processor CP7			4451
162-Way Processor CP7			4452
163-Way Processor CP7			4453
164-Way Processor CP7			4454
165-Way Processor CP7			4455
166-Way Processor CP7			4456
167-Way Processor CP7			4457
168-Way Processor CP7			4458
169-Way Processor CP7			4459
170-Way Processor CP7			4460
171-Way Processor CP7			4461
172-Way Processor CP7			4462
173-Way Processor CP7			4463
174-Way Processor CP7			4464
175-Way Processor CP7			4465
176-Way Processor CP7			4466
177-Way Processor CP7			4467
178-Way Processor CP7			4468
179-Way Processor CP7			4469
180-Way Processor CP7			4470
181-Way Processor CP7			4471
182-Way Processor CP7			4472
183-Way Processor CP7			4473
184-Way Processor CP7			4474
185-Way Processor CP7			4475
186-Way Processor CP7			4476
187-Way Processor CP7			4477

Description	Machine type	Model	Feature number
188-Way Processor CP7			4478
189-Way Processor CP7			4479
190-Way Processor CP7			4480
400 Capacity Marker			4481
401 Capacity Marker			4482
402 Capacity Marker			4483
403 Capacity Marker			4484
404 Capacity Marker			4485
405 Capacity Marker			4486
406 Capacity Marker			4487
407 Capacity Marker			4488
408 Capacity Marker			4489
409 Capacity Marker			4490
410 Capacity Marker			4491
411 Capacity Marker			4492
412 Capacity Marker			4493
413 Capacity Marker			4494
414 Capacity Marker			4495
415 Capacity Marker			4496
416 Capacity Marker			4497
417 Capacity Marker			4498
418 Capacity Marker			4499
419 Capacity Marker			4500
420 Capacity Marker			4501
421 Capacity Marker			4502
422 Capacity Marker			4503
423 Capacity Marker			4504
424 Capacity Marker			4505
425 Capacity Marker			4506
426 Capacity Marker			4507
427 Capacity Marker			4508

Description	Machine type	Model	Feature number
428 Capacity Marker			4509
429 Capacity Marker			4510
430 Capacity Marker			4511
431 Capacity Marker			4512
432 Capacity Marker			4513
433 Capacity Marker			4514
434 Capacity Marker			4515
501 Capacity Marker			4516
502 Capacity Marker			4517
503 Capacity Marker			4518
504 Capacity Marker			4519
505 Capacity Marker			4520
506 Capacity Marker			4521
507 Capacity Marker			4522
508 Capacity Marker			4523
509 Capacity Marker			4524
510 Capacity Marker			4525
511 Capacity Marker			4526
512 Capacity Marker			4527
513 Capacity Marker			4528
514 Capacity Marker			4529
515 Capacity Marker			4530
516 Capacity Marker			4531
517 Capacity Marker			4532
518 Capacity Marker			4533
519 Capacity Marker			4534
520 Capacity Marker			4535
521 Capacity Marker			4536
522 Capacity Marker			4537
523 Capacity Marker			4538
524 Capacity Marker			4539

Description	Machine type	Model	Feature number
525 Capacity Marker			4540
526 Capacity Marker			4541
527 Capacity Marker			4542
528 Capacity Marker			4543
529 Capacity Marker			4544
530 Capacity Marker			4545
531 Capacity Marker			4546
532 Capacity Marker			4547
533 Capacity Marker			4548
534 Capacity Marker			4549
601 Capacity Marker			4550
602 Capacity Marker			4551
603 Capacity Marker			4552
604 Capacity Marker			4553
605 Capacity Marker			4554
606 Capacity Marker			4555
607 Capacity Marker			4556
608 Capacity Marker			4557
609 Capacity Marker			4558
610 Capacity Marker			4559
611 Capacity Marker			4560
612 Capacity Marker			4561
613 Capacity Marker			4562
614 Capacity Marker			4563
615 Capacity Marker			4564
616 Capacity Marker			4565
617 Capacity Marker			4566
618 Capacity Marker			4567
619 Capacity Marker			4568
620 Capacity Marker			4569
621 Capacity Marker			4570

Description	Machine type	Model	Feature number
622 Capacity Marker			4571
623 Capacity Marker			4572
624 Capacity Marker			4573
625 Capacity Marker			4574
626 Capacity Marker			4575
627 Capacity Marker			4576
628 Capacity Marker			4577
629 Capacity Marker			4578
630 Capacity Marker			4579
631 Capacity Marker			4580
632 Capacity Marker			4581
633 Capacity Marker			4582
634 Capacity Marker			4583
701 Capacity Marker			4584
702 Capacity Marker			4585
703 Capacity Marker			4586
704 Capacity Marker			4587
705 Capacity Marker			4588
706 Capacity Marker			4589
707 Capacity Marker			4590
708 Capacity Marker			4591
709 Capacity Marker			4592
710 Capacity Marker			4593
711 Capacity Marker			4594
712 Capacity Marker			4595
713 Capacity Marker			4596
714 Capacity Marker			4597
715 Capacity Marker			4598
716 Capacity Marker			4599
717 Capacity Marker			4600
718 Capacity Marker			4601

Description	Machine type	Model	Feature number
719 Capacity Marker			4602
720 Capacity Marker			4603
721 Capacity Marker			4604
722 Capacity Marker			4605
723 Capacity Marker			4606
724 Capacity Marker			4607
725 Capacity Marker			4608
726 Capacity Marker			4609
727 Capacity Marker			4610
728 Capacity Marker			4611
729 Capacity Marker			4612
730 Capacity Marker			4613
731 Capacity Marker			4614
732 Capacity Marker			4615
733 Capacity Marker			4616
734 Capacity Marker			4617
735 Capacity Marker			4618
736 Capacity Marker			4619
737 Capacity Marker			4620
738 Capacity Marker			4621
739 Capacity Marker			4622
740 Capacity Marker			4623
741 Capacity Marker			4624
742 Capacity Marker			4625
743 Capacity Marker			4626
744 Capacity Marker			4627
745 Capacity Marker			4628
746 Capacity Marker			4629
747 Capacity Marker			4630
748 Capacity Marker			4631
749 Capacity Marker			4632

Description	Machine type	Model	Feature number
750 Capacity Marker			4633
751 Capacity Marker			4634
752 Capacity Marker			4635
753 Capacity Marker			4636
754 Capacity Marker			4637
755 Capacity Marker			4638
756 Capacity Marker			4639
757 Capacity Marker			4640
758 Capacity Marker			4641
759 Capacity Marker			4642
760 Capacity Marker			4643
761 Capacity Marker			4644
762 Capacity Marker			4645
763 Capacity Marker			4646
764 Capacity Marker			4647
765 Capacity Marker			4648
766 Capacity Marker			4649
767 Capacity Marker			4650
768 Capacity Marker			4651
769 Capacity Marker			4652
770 Capacity Marker			4653
771 Capacity Marker			4654
772 Capacity Marker			4655
773 Capacity Marker			4656
774 Capacity Marker			4657
775 Capacity Marker			4658
776 Capacity Marker			4659
777 Capacity Marker			4660
778 Capacity Marker			4661
779 Capacity Marker			4662
780 Capacity Marker			4663

Description	Machine type	Model	Feature number
781 Capacity Marker			4664
782 Capacity Marker			4665
783 Capacity Marker			4666
784 Capacity Marker			4667
785 Capacity Marker			4668
786 Capacity Marker			4669
787 Capacity Marker			4670
788 Capacity Marker			4671
789 Capacity Marker			4672
790 Capacity Marker			4673
791 Capacity Marker			4674
792 Capacity Marker			4675
793 Capacity Marker			4676
794 Capacity Marker			4677
795 Capacity Marker			4678
796 Capacity Marker			4679
797 Capacity Marker			4680
798 Capacity Marker			4681
799 Capacity Marker			4682
7A0 Capacity Marker			4683
7A1 Capacity Marker			4684
7A2 Capacity Marker			4685
7A3 Capacity Marker			4686
7A4 Capacity Marker			4687
7A5 Capacity Marker			4688
7A6 Capacity Marker			4689
7A7 Capacity Marker			4690
7A8 Capacity Marker			4691
7A9 Capacity Marker			4692
7B0 Capacity Marker			4693
7B1 Capacity Marker			4694

Description	Machine type	Model	Feature number
7B2 Capacity Marker			4695
7B3 Capacity Marker			4696
7B4 Capacity Marker			4697
7B5 Capacity Marker			4698
7B6 Capacity Marker			4699
7B7 Capacity Marker			4700
7B8 Capacity Marker			4701
7B9 Capacity Marker			4702
7C0 Capacity Marker			4703
7C1 Capacity Marker			4704
7C2 Capacity Marker			4705
7C3 Capacity Marker			4706
7C4 Capacity Marker			4707
7C5 Capacity Marker			4708
7C6 Capacity Marker			4709
7C7 Capacity Marker			4710
7C8 Capacity Marker			4711
7C9 Capacity Marker			4712
7D0 Capacity Marker			4713
7D1 Capacity Marker			4714
7D2 Capacity Marker			4715
7D3 Capacity Marker			4716
7D4 Capacity Marker			4717
7D5 Capacity Marker			4718
7D6 Capacity Marker			4719
7D7 Capacity Marker			4720
7D8 Capacity Marker			4721
7D9 Capacity Marker			4722
7E0 Capacity Marker			4723
7E1 Capacity Marker			4724
7E2 Capacity Marker			4725

Description	Machine type	Model	Feature number
7E3 Capacity Marker			4726
7E4 Capacity Marker			4727
7E5 Capacity Marker			4728
7E6 Capacity Marker			4729
7E7 Capacity Marker			4730
7E8 Capacity Marker			4731
7E9 Capacity Marker			4732
7F0 Capacity Marker			4733
7F1 Capacity Marker			4734
7F2 Capacity Marker			4735
7F3 Capacity Marker			4736
7F4 Capacity Marker			4737
7F5 Capacity Marker			4738
7F6 Capacity Marker			4739
7F7 Capacity Marker			4740
7F8 Capacity Marker			4741
7F9 Capacity Marker			4742
7G0 Capacity Marker			4743
7G1 Capacity Marker			4744
7G2 Capacity Marker			4745
7G3 Capacity Marker			4746
7G4 Capacity Marker			4747
7G5 Capacity Marker			4748
7G6 Capacity Marker			4749
7G7 Capacity Marker			4750
7G8 Capacity Marker			4751
7G9 Capacity Marker			4752
7H0 Capacity Marker			4753
7H1 Capacity Marker			4754
7H2 Capacity Marker			4755
7H3 Capacity Marker			4756

Description	Machine type	Model	Feature number
7H4 Capacity Marker			4757
7H5 Capacity Marker			4758
7H6 Capacity Marker			4759
7H7 Capacity Marker			4760
7H8 Capacity Marker			4761
7H9 Capacity Marker			4762
7i0 Capacity Marker			4763
7i1 Capacity Marker			4764
7i2 Capacity Marker			4765
7i3 Capacity Marker			4766
7i4 Capacity Marker			4767
7i5 Capacity Marker			4768
7i6 Capacity Marker			4769
7i7 Capacity Marker			4770
7i8 Capacity Marker			4771
7i9 Capacity Marker			4772
7J0 Capacity Marker			4773
SRB Upgrade Record			6802
PRC Tokens			6803
PRC Tokens Alteration			6804
Additional CBU Test			6805
PRC 1 MSU day			6806
PRC 100 MSU days			6807
PRC 10000 MSU days			6808
PRC 1 IFL day			6809
PRC 100 IFL days			6810
PRC 1 ICF day			6811
PRC 100 ICF days			6812
PRC 1 zIIP day			6813
PRC 100 zIIP days			6814
PRC 1 SAP day			6815
PRC 100 SAP days			6816
Total CBU Years Ordered			6817
CBU Records Ordered			6818
Single CBU CP Year			6820
25 CBU CP Year			6821

Description	Machine type	Model	Feature number
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
14Ft Water Hose			7801
Top Exit Cabling			7917
Bottom Exit Cabling			7919
Top Exit Cabling w/o Tophat			7928
30A/400V 3Ph Wye w/Hubbell			7946
32A/380-415V 3Ph Wye			7947
32A/380-415V 3Ph Wye LSZH			7948
60A/250V 3Ph w/ Hubbell			7950
60A/250V 3Ph w/ Cut End			7951
60A/250V w/ Hubbell			7954
60A/250V w/Cut End			7955
30A/400V Hubbell			7956
32A/380-415V Cut End			7957
32A/380-415V Cut End LSZH			7958
30A/480V Hubbell			7959
FQC Bracket & Mounting Hdw			7960
LC Duplex 6.6 ft Harness			7961
60A/250V 3P w/ Cut End LSZH			7962
60A/250V w/Cut End LSZH			7965
Non Raised Floor Support			7998
19in Earthquake Kit, RF			8010
19in Earthquake Kit, NRF			8011
Multi Order Ship Flag			9000

Description	Machine type	Model	Feature number
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 Days			9874
On Off CoD Act 100 ICF Days			9875
On Off CoD Act 100 CP Days			9876
On Off CoD Act 100 zIIP Days			9877
On Off CoD Act 100 SAP Days			9878
On Off CoD Act IFL Days			9888
On Off CoD Act ICF Days			9889
On Off COD authorization			9896
On Off CoD Act Cap CP Days			9897
Perm upgr authorization			9898
CIU Activation (Flag)			9899
On-Line CoD Buying (Flag)			9900
PRC Tokens Authorization			9904
On Off CoD Act zIIP Days			9908
On Off CoD Act SAP Days			9909
CBU authorization			9910
CPE authorization			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
SRB Upgrade Authorization			9930
Height Reduce Ship			9975
Height Reduce for Return			9976

Description	Machine type	Model	Feature number
IBM z14	3906	M01	

Description	Machine type	Model	Feature number
		M02	
		M03	
		M04	
		M05	
IBM z14 ZR1	3907	ZR1	
PRC Tokens Authorization			9904
PRC Tokens			6803
PRC Tokens Alteration			6804
PRC 1 MSU day			6806
PRC 100 MSU days			6807
PRC 10000 MSU days			6808
PRC 1 IFL day			6809
PRC 100 IFL days			6810
PRC 1 ICF day			6811
PRC 100 ICF days			6812
PRC 1 zIIP day			6813
PRC 100 zIIP days			6814
PRC 1 SAP day			6815
PRC 100 SAP days			6816
HMC Tower			0062
HMC Rack Mount			0063
TKE Rack Mount			0087
TKE Rack Mount			0088
32GB USB Load Media			0843
TKE 9.2 LIC			0881

Description	Machine type	Model	Feature number
Site prep/install support	2819	IBF	
Single Internal Battery Unit			3211
BTA Water Single Container	2819	BTA	9850

Features that may carry forward:

The following features may be retained if they are installed at the time of an upgrade to the IBM z15.

Description	Machine type	Model	Feature number
IBM z15	8561	T01	
TKE Rack Mount w/4768			0080
TKE w/4768			0081
HMC			0082
HMC Rack Mount			0083
TKE Rack Mount			0085
TKE			0086
HMC Tower			0095
HMC Rack Mount			0096
HMC Rack KMM			0154
TKE Rack Keybd/ Monitor/Mouse			0156
ICA SR fanout			0172

Description	Machine type	Model	Feature number
Fanout Airflow PCIe			0174
FICON Express8S LX			0409
FICON Express8S SX			0410
10 GbE RoCE Express			0411
10 GbE RoCE Express2			0412
OSA-Express5S GbE LX			0413
OSA-Express5S GbE SX			0414
OSA-Express5S 10 GbE LR			0415
OSA-Express5S 10 GbE SR			0416
OSA-Express5S 1000BASE-T			0417
FICON Express16S LX			0418
FICON Express16S SX			0419
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
OSA-Express7S 25 GbE SR			0429
25GbE RoCE Express2			0430
zHyperLink Express			0431
Coupling Express LR			0433
Addl smart cards			0884
TKE Smart Card Reader			0885
Crypto Express5S			0890
TKE Smart Card Reader			0891
NXP Smart Card w/FIPS			0892
Crypto Express6S			0893
512 GB MEM DIMM(5/FEAT)			1631

Model conversions

From machine type	From model	To machine type	To model	Note
2964	N30	8561	T01	(*)
2964	N63	8561	T01	(*)
2964	N96	8561	T01	(*)
2964	NC9	8561	T01	(*)
2964	NE1	8561	T01	(*)
3906	M01	8561	T01	(*)
3906	M02	8561	T01	(*)
3906	M03	8561	T01	(*)
3906	M04	8561	T01	(*)
3906	M05	8561	T01	(*)

(*) Parts removed as a result of a model conversion become the property of IBM.

Feature conversions

The feature conversion list for IBM z15 Model T01 is now available in the Library section of Resource Link(R). 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.

Publications

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

Title	Order number
IBM 8561 Installation Manual for Physical Planning (IMPP)	GC28-7002
IBM 8561 Installation Manual for Physical Planning (IMPP) -- Russian version	GC28-7004
PR/SM Planning Guide	SB10-7175
IOCP User's Guide for ICP IOCP	SB10-7172
Planning for Fiber Optic Links (FICON/ FCP, Coupling Links, OSA, and zHyperLink Express)	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 8561 Installation Manual	GC28-6997
IBM 8561 Service Guide	GC28-6998
IBM 8561 Safety Inspection	GC28-6996
Service Guide for TKE Workstations (Version 7.0)	GC28-6980
Systems Safety Notices	G229-9054
IBM Important Notices	G229-9056
IBM Z Statement of Limited Warranty	GC28-6979
License Agreement for Machine Code	SC28-6872
License Agreement for Machine Code Addendum for Cryptography	GC27-2635
Systems Environmental Notices and User Guide	Z125-5823

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

Title	Order number
IBM 8561 Parts Catalog	GC28-7003
Service Guide for 2461 Hardware Management Console	GC28-6990
Service Guide for 2461 Support Element	GC28-6991
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 (V2.15.0)	SC27-2638
IBM Dynamic Partition Manager (DPM) Guide	SB10-7176
Secure Service Container User's Guide	SC28-7005
Stand-Alone IOCP User's Guide	SB10-7173
FICON CTC Reference	SB10-7174
Maintenance Information for Fiber Optics (FICON/FCP, Coupling Links, OSA, and zHyperLink Express)	SY27-7696
Integrating the HMC's Broadband RSF into your Enterprise	SC28-6986
Hardware Management Console Security	SC28-6987
SCSI IPL -- Machine Loader Messages	SC28-7006
OSA-Express Customer's Guide and Reference	SA22-7935
OSA/SF on the Hardware Management Console	SC14-7580
OSA Integrated Console Controller User's Guide	SC27-9003

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 2.15.0) will be available from IBM Resource Link and the consoles.

You can also find HMC videos at the IBM Z Hardware Management Console Videos website.

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

The following Redbooks(R) publications are available now. To order, contact your IBM representative.

Title	Order number
IBM z15 Technical Introduction	SG24-8850-00
IBM z15 Technical Guide	SG24-8851-00
IBM z15 Configuration Setup	SG24-8860-00
IBM z15 Connectivity Handbook	SG24-5444-20
IBM Z Functional Matrix	REDP-5157-04

To download these Redbooks publications, go to the IBM Z 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 IBM Knowledge Center.

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.

Services

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(R) 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.

Technical information

Specified operating environment

Physical specifications

The physical specifications for IBM z15 Model T01 are now available in the "Library" section of Resource Link in the *Installation Manual for Physical Planning* (IMPP).

This information 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.

Operating environment

The operating environment information for IBM z15 Model T01 is now available in the "Library" section of Resource Link in the *Installation Manual for Physical Planning* (IMPP).

This information 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.

Hardware requirements

The hardware requirements for the IBM Z servers, features, and functions are identified. A new driver level is required.

HMC (V2.15.0) plus MCLs and the Support Element (V2.15.0) are planned to be available on September 23, 2019. You should review the PSP buckets for minimum Machine Change Levels (MCLs) and software PTF levels before IPLing operating systems.

The new functions available on the Hardware Management Console (HMC) version 2.15.0, as described, apply exclusively to IBM z15. However, the HMC version 2.15.0 will also support the systems listed in the table below.

Machine family	Machine type	Firmware driver	SE version
z14	3906	36	2.14.1
z14	3906	32	2.14.0
z14 ZR1	3907	36	2.14.1
z14 ZR1	3907	32	2.14.0
z13	2964	27	2.13.1
z13s	2965	27	2.13.1

Software requirements

IBM z15 requires at a minimum:

- z/OS V2.4 with PTFs.*
- z/OS V2.3 with PTFs.*
- z/OS V2.2 with PTFs.
- z/OS V2.1 (compatibility only, extended support contract for IBM Software Support Services for z/OS required with PTFs).
- z/VM V7.1 with PTFs.
- z/VM V6.4 with PTFs.
- z/VSE V6.2 with PTFs.
- z/TPF V1.1 with PTFs (compatibility, including Crypto Express7S and OSA-Express7S support).
- Linux on IBM Z-IBM plans to support running the following Linux on IBM Z distributions on IBM z15:
  - SUSE SLES 15 SP1 with service, SUSE SLES 12 SP4 with service, and SUSE SLES 11 SP4 with service.
  - Red Hat RHEL 8.0 with service, Red Hat RHEL 7.7 with service, and Red Hat RHEL 6.10 with service.
  - Ubuntu 18.04.1 LTS with service and Ubuntu 16.04.6 LTS with service.
  - The support statements for z15 also cover the KVM hypervisor on distribution levels that have KVM support.

For minimum required and recommended distribution levels see the IBM Z website.

Note: The IBM product "KVM for IBM Z " is out of service and no longer available from IBM. KVM technology is now provided as part of the distributions.

* IBM z/OS V2.3 or higher with IBM z15 will require a minimum of 8 GB of memory. When running as a z/VM guest or on an IBM System z(R) 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 was introduced for z/OS V2.2 and z/OS V2.1 with PTFs to warn you when an LPAR on an IBM z15 system has been configured with less than 8 GB.

The following software requirements are listed for features and capabilities supported on IBM z15:

FICON Express16SA (CHPID type FC) when utilizing FICON or Channel-To-Channel (CTC), requires at a minimum:

- z/OS V2.4 with PTFs.
- z/OS V2.3 with PTFs.
- z/OS V2.2 with PTFs.
- z/OS V2.1 (compatibility only, extended support contract for IBM Software Support Services for z/OS required with PTFs).
- z/VM V7.1.
- z/VM V6.4.
- z/VSE V6.2 with PTFs.
- z/TPF V1.1 with PTFs (compatibility, including Crypto Express7S and OSA-Express7S support).
- Linux on IBM Z-IBM plans to support running the following Linux on IBM Z distributions on IBM z15:
  - SUSE SLES 15 SP1 with service, SUSE SLES 12 SP4 with service, and SUSE SLES 11 SP4 with service.
  - Red Hat RHEL 8.0 with service, Red Hat RHEL 7.7 with service, and Red Hat RHEL 6.10 with service.
  - Ubuntu 18.04.1 LTS with service and Ubuntu 16.04.6 LTS with service.

FICON Express16SA (CHPID type FC) for support of zHPF single track operations requires at a minimum:

- z/OS V2.4 with PTFs.
- z/OS V2.3 with PTFs.
- z/OS V2.2 with PTFs.
- z/OS V2.1 (compatibility only, extended support contract for IBM Software Support Services for z/OS required with PTFs).
- z/VM V7.1.
- z/VM V6.4.
- z/VSE V6.2 with PTFs.
- z/TPF V1.1 with PTFs (compatibility, including Crypto Express7S and OSA-Express7S support).
- Linux on IBM Z-IBM plans to support running the following Linux on IBM Z distributions on IBM z15:
  - SUSE SLES 15 SP1 with service, SUSE SLES 12 SP4 with service, and SUSE SLES 11 SP4 with service.
  - Red Hat RHEL 8.0 with service, Red Hat RHEL 7.7 with service, and Red Hat RHEL 6.10 with service.

- Ubuntu 18.04.1 LTS with service and Ubuntu 16.04.6 LTS with service.

  Note: For minimum required and recommended distribution levels see the IBM Z website.

FICON Express16SA (CHPID type FC) for support of zHPF multitrack operations requires at a minimum:

- z/OS V2.4 with PTFs.
- z/OS V2.3 with PTFs.
- z/OS V2.2 with PTFs.
- z/OS V2.1 (compatibility only, extended support contract for IBM Software Support Services for z/OS required with PTFs).
- z/VM V7.1.
- z/VM V6.4.
- z/VSE V6.2 with PTFs.
- z/TPF V.1 with PTFs (compatibility, including Crypto Express7S and OSA-Express7S support).
- Linux on IBM Z-IBM plans to support running the following Linux on IBM Z distributions on IBM z15:
  - SUSE SLES 15 SP1 with service, SUSE SLES 12 SP4 with service, and SUSE SLES 11 SP4 with service.
  - Red Hat RHEL 8.0 with service, Red Hat RHEL 7.7 with service, and Red Hat RHEL 6.10 with service.
  - Ubuntu 18.04.1 LTS with service and Ubuntu 16.04.6 LTS with service.

FICON Express16SA (CHPID type FCP) for support of SCSI devices requires at a minimum:

- z/VM V7.1.
- z/VM V6.4.
- z/VSE V6.2 with PTFs.
- Linux on IBM Z-IBM plans to support running the following Linux on IBM Z distributions on IBM z15:
  - SUSE SLES 15 SP1 with service, SUSE SLES 12 SP4 with service, and SUSE SLES 11 SP4 with service.
  - Red Hat RHEL 8.0 with service, Red Hat RHEL 7.7 with service, and Red Hat RHEL 6.10 with service.
  - Ubuntu 18.04.1 LTS with service and Ubuntu 16.04.6 LTS with service.

FICON Express16SA (CHPID type FCP) support of hardware data router requires at a minimum:

- z/VM V7.1 for guest exploitation.
- z/VM V6.4 for guest exploitation.
- Linux on IBM Z-IBM plans to support running the following Linux on IBM Z distributions on IBM z15:
  - SUSE SLES 15 SP1 with service, SUSE SLES 12 SP4 with service, and SUSE SLES 11 SP4 with service.
  - Red Hat RHEL 8.0 with service, Red Hat RHEL 7.7 with service, and Red Hat RHEL 6.10 with service.
  - Ubuntu 18.04.1 LTS with service and Ubuntu 16.04.6 LTS with service.

T10-DIF support by the FICON Express16SA features when defined as CHPID type FCP requires at a minimum:

- z/VM V7.1 for guest exploitation.

- z/VM V6.4 for guest exploitation.
- Linux on IBM Z-IBM plans to support running the following Linux on IBM Z distributions on IBM z15:
  - SUSE SLES 15 SP1 with service, SUSE SLES 12 SP4 with service, and SUSE SLES 11 SP4 with service.
  - Red Hat RHEL 8.0 with service, Red Hat RHEL 7.7 with service, and Red Hat RHEL 6.10 with service.
  - Ubuntu 18.04.1 LTS with service and Ubuntu 16.04.6 LTS with service.

OSA-Express7S GbE LX (#0442) and GbE SX (#0443) require at a minimum:

CHPID type OSC:

- z/OS V2.4.
- z/OS V2.3 with PTFs.
- z/OS V2.2 with PTFs.
- z/OS V2.1 (compatibility only, extended support contract for IBM Software Support Services for z/OS required).
- z/VM V7.1 with PTFs.
- z/VM V6.4 with PTFs.
- z/VSE V6.2 with PTFs.
- z/TPF V1.1 with PTFs.
- Linux on IBM Z-IBM plans to support running the following Linux on IBM Z distributions on IBM z15:
  - SUSE SLES 15 SP1 with service, SUSE SLES 12 SP4 with service, and SUSE SLES 11SP4 with service.
  - Red Hat RHEL 8.0 with service, Red Hat RHEL 7.7 with service, and Red Hat RHEL 6.10 with service.
  - Ubuntu 18.04.1 LTS with service and Ubuntu 16.04.6 LTS with service.

CHPID type OSD:

- z/OS V2.4.
- z/OS V2.3 with PTFs.
- z/OS V2.2 with PTFs.
- z/OS V2.1 (compatibility only, extended support contract for IBM Software Support Services for z/OS required with PTFs).
- z/VM V7.1 with PTFs.
- z/VM V6.4 with PTFs.
- z/VSE V6.2 with PTFs.
- z/TPF V1.1 with PTFs.
- Linux on IBM Z-IBM plans to support running the following Linux on IBM Z distributions on IBM z15:
  - SUSE SLES 15 SP1 with service, SUSE SLES 12 SP4 with service, and SUSE SLES 11 SP4 with service.
  - Red Hat RHEL 8.0 with service, Red Hat RHEL 7.7 with service, and Red Hat RHEL 6.10 with service.
  - Ubuntu 18.04.1 LTS with service and Ubuntu 16.04.6 LTS with service.

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

- z/OS V2.4.
- z/OS V2.3 with PTFs.
- z/OS V2.2 with PTFs.

- z/OS V2.1 (compatibility only, extended support contract for IBM Software Support Services for z/OS required with PTFs).
- z/VM V7.1 with PTFs.
- z/VM V6.4 with PTFs.
- z/VSE V6.2 with PTFs.
- z/TPF V1.1 with PTFs.
- Linux on IBM Z-IBM plans to support running the following Linux on IBM Z distributions on IBM z15:
  - SUSE SLES 15 SP1 with service, SUSE SLES 12 SP4 with service, and SUSE SLES 11 SP4 with service.
  - Red Hat RHEL 8.0 with service, Red Hat RHEL 7.7 with service, and Red Hat RHEL 6.10 with service.
  - Ubuntu 18.04.1 LTS with service and Ubuntu 16.04.6 LTS with service.

OSA-Express7S 10 GbE LR (#0444) and 10 GbE SR (#0445) require at a minimum:

CHPID type OSD:

- z/OS V2.4.
- z/OS V2.3 with PTFs.
- z/OS V2.2 with PTFs.
- z/OS V2.1 (compatibility only, extended support contract for IBM Software Support Services for z/OS required with PTFs).
- z/VM V7.1 with PTFs.
- z/VM V6.4 with PTFs.
- z/VSE V6.2 with PTFs.
- z/TPF V1.1 with PTFs.
- Linux on IBM Z-IBM plans to support running the following Linux on IBM Z distributions on IBM z15:
  - SUSE SLES 15 SP1 with service, SUSE SLES 12 SP4 with service, and SUSE SLES 11 SP4 with service.
  - Red Hat RHEL 8.0 with service, Red Hat RHEL 7.7 with service, and Red Hat RHEL 6.10 with service.
  - Ubuntu 18.04.1 LTS with service and Ubuntu 16.04.6 LTS with service.

OSA-Express7S 25 GbE SR (#0449) requires at a minimum:

CHPID type OSD:

- z/OS V2.4.
- z/OS V2.3 with PTFs.
- z/OS V2.2 with PTFs.
- z/OS V2.1 with PTFs.
- z/VM V7.1 with PTFs.
- z/VM V6.4 with PTFs.
- z/VSE V6.2 with PTFs.
- z/TPF V1.1 with PTFs.
- Linux on IBM Z-IBM plans to support running the following Linux on IBM Z distributions on IBM z15:
  - SUSE SLES 15 SP1 with service, SUSE SLES 12 SP4 with service, and SUSE SLES 11 SP4 with service.
  - Red Hat RHEL 8.0 with service, Red Hat RHEL 7.7 with service, and Red Hat RHEL 6.10 with service.
  - Ubuntu 18.04.1 LTS with service and Ubuntu 16.04.6 LTS with service.

OSA-Express7S 1000BASE-T Ethernet (#0446) requires at a minimum:

CHPID type OSC supporting TN3270E and non-SNA DFT:

- z/OS V2.4.
- z/OS V2.3.
- z/OS V2.2.
- z/OS V2.1 (compatibility only, extended support contract for IBM Software Support Services for z/OS required).
- z/VM V7.1 with PTFs.
- z/VM V6.4 with PTFs.
- z/VSE V6.2 with PTFs.
- z/TPF V1.1 with PTFs.
- Linux on IBM Z-IBM plans to support running the following Linux on IBM Z distributions on IBM z15:
  - SUSE SLES 15 SP1 with service, SUSE SLES 12 SP4 with service, and SUSE SLES 11 SP4 with service.
  - Red Hat RHEL 8.0 with service, Red Hat RHEL 7.7 with service, and Red Hat RHEL 6.10 with service.
  - Ubuntu 18.04.1 LTS with service and Ubuntu 16.04.6 LTS with service.

CHPID type OSD with exploitation of two ports per CHPID:

- z/OS V2.4.
- z/OS V2.3.
- z/OS V2.2.
- z/OS V2.1 (compatibility only, extended support contract for IBM Software Support Services for z/OS required).
- z/VM V7.1 with PTFs.
- z/VM V6.4 with PTFs.
- z/VSE V6.2 with PTFs.
- z/TPF V1.1 with PTFs.
- Linux on IBM Z-IBM plans to support running the following Linux on IBM Z distributions on IBM z15:
  - SUSE SLES 15 SP1 with service, SUSE SLES 12 SP4 with service, and SUSE SLES 11 SP4 with service.
  - Red Hat RHEL 8.0 with service, Red Hat RHEL 7.7 with service, and Red Hat RHEL 6.10 with service.
  - Ubuntu 18.04.1 LTS with service and Ubuntu 16.04.6 LTS with service.

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

- z/OS V2.4.
- z/OS V2.3.
- z/OS V2.2.
- z/OS V2.1 (compatibility only, extended support contract for IBM Software Support Services for z/OS required).
- z/VM V7.1 with PTFs.
- z/VM V6.4 with PTFs.
- z/VSE V6.2 with PTFs.
- z/TPF V1.1 with PTFs.
- Linux on IBM Z-IBM plans to support running the following Linux on IBM Z distributions on IBM z15:

  - SUSE SLES 15 SP1 with service, SUSE SLES 12 SP4 with service, and SUSE SLES 11 SP4 with service.
  - Red Hat RHEL 8.0 with service, Red Hat RHEL 7.7 with service, and Red Hat RHEL 6.10 with service.
  - Ubuntu 18.04.1 LTS with service and Ubuntu 16.04.6 LTS with service.

Checksum offload for IPv6 packets (CHPID type OSD):

- z/OS V2.4.
- z/OS V2.3.
- z/OS V2.2.
- z/OS V2.1 (compatibility only, extended support contract for IBM Software Support Services for z/OS required).
- z/VM V7.1 for guest exploitation.
- z/VM V6.4 for guest exploitation.
- Linux on IBM Z-IBM plans to support running the following Linux on IBM Z distributions on IBM z15:
  - SUSE SLES 15 SP1 with service.
  - Red Hat RHEL 8.0 with service.
  - Ubuntu 18.04.1 LTS with service.

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

- z/OS V2.4.
- z/OS V2.3.
- z/OS V2.2.
- z/OS V2.1 (compatibility only, extended support contract for IBM Software Support Services for z/OS required).
- z/VM V7.1 for guest exploitation.
- z/VM V6.4 for guest exploitation.
- Linux on IBM Z-IBM plans to support running the following Linux on IBM Z distributions on IBM z15:
  - SUSE SLES 15 SP1 with service.
  - Red Hat RHEL 8.0 with service.
  - Ubuntu 18.04.1 LTS with service.

Large Send for IPv6 packets (CHPID type OSD):

- z/OS V2.4.
- z/OS V2.3.
- z/OS V2.2.
- z/OS V2.1 (compatibility only, extended support contract for IBM Software Support Services for z/OS required).
- z/VM V7.1 for guest exploitation.
- z/VM V6.4 for guest exploitation.
- Linux on IBM Z-IBM plans to support running the following Linux on IBM Z distributions on IBM z15:
  - SUSE SLES 15 SP1 with service.
  - Red Hat RHEL 8.0 with service.
  - Ubuntu 18.04.1 LTS with service.

CHPID type OSE supporting 4 or 2 ports per feature:

- z/OS V2.4.
- z/OS V2.3.
- z/OS V2.2.
- z/OS V2.1 (compatibility only, extended support contract for IBM Software Support Services for z/OS required).
- z/VM V7.1 for guest exploitation.
- z/VM V6.4 for guest exploitation.
- z/VSE V6.2 with PTFs.

Crypto Express7S (2 port) (#0898) Toleration, which treats Crypto Express7S cryptographic coprocessors and accelerators as Crypto Express6 coprocessors and accelerators, requires at a minimum:

- z/VM V7.1 with PTFs for guest exploitation.
- z/VM V6.4 with PTFs for guest exploitation.
- z/VSE V6.2 with PTFs.
- z/TPF V1.1.
- Linux on IBM Z-IBM plans to support running the following Linux on IBM Z distributions on IBM z15:
  - SUSE SLES 15 SP1 with service, SUSE SLES 12 SP4 with service, and SUSE SLES 11 SP4 with service.
  - Red Hat RHEL 8.0 with service, Red Hat RHEL 7.7 with service, and Red Hat RHEL 6.10 with service.
  - Ubuntu 18.04.1 LTS with service and Ubuntu 16.04.6 LTS with service.

Crypto Express7S (1 port) (#0899) Toleration, requires at a minimum:

- z/OS V2.4.
- z/OS V2.3.
- z/OS V2.2.
- z/OS V2.1.
- z/VM V7.1 with PTFs for guest exploitation.
- z/VM V6.4 with PTFs for guest exploitation.
- z/VSE V6.2 with PTFs.
- z/TPF V1.1.
- Linux on IBM Z-IBM plans to support running the following Linux on IBM Z distributions on IBM z15:
  - SUSE SLES 15 SP1 with service, SUSE SLES 12 SP4 with service, and SUSE SLES 11 SP4 with service.
  - Red Hat RHEL 8.0 with service, Red Hat RHEL 7.7 with service, and Red Hat RHEL 6.10 with service.
  - Ubuntu 18.04.1 LTS with service and Ubuntu 16.04.6 LTS with service.

Crypto Express7S (1 port) (#0899) support of VISA Format Preserving Encryption requires at a minimum:

- z/OS V2.4.
- z/OS V2.3.
- z/OS V2.2 with the Enhanced Cryptographic Support for z/OS V2.2 (HCR77B0) web deliverable installed.
- z/VM V7.1 with PTFs for guest exploitation.
- z/VM V6.4 with PTFs for guest exploitation.

Crypto Express7S (1 port) (#0899) Exploitation requires at a minimum:

- z/OS V2.4 with Cryptographic Support for z/OS V2.2 --z/OS V2.4 (HCR77D1).

- z/OS V2.3 with Cryptographic Support for z/OS V2.2 --z/OS V2.4 (HCR77D1).
- z/OS V2.2 with Cryptographic Support for z/OS V2.2 --z/OS V2.4 (HCR77D1).
- z/VM V7.1 with PTFs for guest exploitation and exploitation within the z/VM TLS/SSL server.
- z/VM V6.4 with PTFs for guest exploitation and exploitation within the z/VM TLS/SSL server.
- z/TPF V1.1 with support for Crypto Express7S.
- Linux on IBM Z-IBM is working with its Linux distribution partners to provide support in future distribution releases.

Crypto Express7S (1 port) (#0899) support of PCI-HSM compliance requires at a minimum:

- z/OS V2.4 with Cryptographic Support for z/OS V2.2 --z/OS V2.4 (HCR77D1).
- z/OS V2.3 with Cryptographic Support for z/OS V2.2 --z/OS V2.4 (HCR77D1).
- z/OS V2.2 with Cryptographic Support for z/OS V2.2 --z/OS V2.4 (HCR77D1).
- z/VM V7.1 with PTFs for guest exploitation.
- z/VM V6.4 with PTFs for guest exploitation.

10 GbE RoCE Express2 (#0432) for Shared Memory Communications - Remote Direct Memory Access (SMC-R) requires at a minimum:

- z/OS V2.4.
- z/OS V2.3 with PTFs.
- z/OS V2.2 with PTFs.
- z/VM V7.1 with PTFs for guest exploitation.
- z/VM V6.4 with PTFs for guest exploitation.
- Linux on IBM Z-IBM plans to support running the following Linux on IBM Z distributions on IBM z15:
  - SUSE SLES 15 SP1 with service.
  - Red Hat RHEL 8.0 with service.
  - Ubuntu 18.04.5 LTS with service.

10 GbE RoCE Express2 (#0432) for Ethernet communications (which does not require a peer OSA) including Single Root I/O Virtualization (SR-IOV) requires at a minimum:

- z/VM V7.1 with PTFs for guest exploitation.
- z/VM V6.4 with PTFs for guest exploitation.
- Linux on IBM Z-IBM plans to support running the following Linux on IBM Z distributions on IBM z15:
  - SUSE SLES 15 SP1 with service.
  - Red Hat RHEL 8.0 with service.
  - Ubuntu 18.04.1 LTS with service.

10 GbE RoCE Express2 (#0432) for TCP/IP requires at a minimum:

- z/VM V7.1 with PTFs for guest exploitation.
- z/VM V6.4 with PTFs for guest exploitation.
- Linux on IBM Z-IBM plans to support running the following Linux on IBM Z distributions on IBM z15:
  - SUSE SLES 15 SP1 with service and SUSE SLES 12 SP4 with service.
  - Red Hat RHEL 8.0 with service and Red Hat RHEL 7.7 with service.
  - Ubuntu 18.04.1 LTS with service and Ubuntu 16.04.6 LTS with service.

25 GbE RoCE Express2 (#0450) for Shared Memory Communications - Remote Direct Memory Access (SMC-R) requires at a minimum:

- z/OS V2.4.
- z/OS V2.3 with PTFs.
- z/OS V2.2 with PTFs.
- z/VM V7.1 with PTFs for guest exploitation.
- z/VM V6.4 with PTFs for guest exploitation.
- Linux on IBM Z-IBM plans to support running the following Linux on IBM Z distributions on IBM z15:
  - SUSE SLES 15 SP1 with service.
  - Red Hat RHEL 8.0 with service.
  - Ubuntu 18.04.5 LTS with service.

25 GbE RoCE Express2 (#0450) for Ethernet communications (which does not require a peer OSA) including Single Root I/O Virtualization (SR-IOV) requires at a minimum:

- z/VM V7.1 with PTFs for guest exploitation.
- z/VM V6.4 with PTFs for guest exploitation.
- Linux on IBM Z-IBM plans to support running the following Linux on IBM Z distributions on IBM z15:
  - SUSE SLES 15 SP1 with service.
  - Red Hat RHEL 8.0 with service.
  - Ubuntu 18.04.1 LTS with service.

25 GbE RoCE Express2 (#0450) for TCP/IP requires at a minimum:

- z/VM V7.1 with PTFs for guest exploitation.
- z/VM V6.4 with PTFs for guest exploitation.
- Linux on IBM Z-IBM plans to support running the following Linux on IBM Z distributions on IBM z15:
  - SUSE SLES 15 SP1 with service and SUSE SLES 12 SP4 with service.
  - Red Hat RHEL 8.0 with service and Red Hat RHEL 7.7 with service.
  - Ubuntu 18.04.1 LTS with service and Ubuntu 16.04.6 LTS with service.

IBM Integrated Coupling Adapter Fanout (ICA SR1.1) (#0176) requires at a minimum:

- z/OS V2.4.
- 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 V7.1 to define, modify, and delete CHPID type CS5 when z/VM is the controlling LPAR for dynamic I/O.
- z/VM V6.4 to define, modify, and delete CHPID type CS5 when z/VM is the controlling LPAR for dynamic I/O.

Support for 384 Coupling CHPIDs, 96 physical ICA SR coupling links, and 64 ICP internal coupling channels requires at a minimum:

- z/OS V2.4 with PTFs.
- z/OS V2.3 with PTFs.

- z/OS V2.2 with PTFs.
- z/OS V2.1 with PTFs.

Support for CFLEVEL 24 coupling facility enhancements requires at a minimum:

- z/OS V2.4 with PTFs.
- z/OS V2.3 with PTFs.
- z/OS V2.2 with PTFs.
- z/OS V2.1 with PTFs.

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

- z/OS V2.4.
- 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 V7.1 with PTFs to define, modify, and delete CL5 CHPID types when z/VM is the controlling LPAR for dynamic I/O.
- 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.

zHyperLink Express1.1 (#0451) Reads support requires at a minimum:

- z/OS V2.4.
- z/OS V2.3 with PTFs.
- z/OS V2.2 with PTFs.
- z/OS V2.1 with PTFs.

zHyperLink Express1.1 (#0451) Writes support requires at a minimum:

- z/OS V2.4.
- z/OS V2.3 with PTFs.
- z/OS V2.2 with PTFs.

IBM Virtual Flash Memory (VFM) (#0604) requires at a minimum:

- z/OS V2.4.
- z/OS V2.3.
- z/OS V2.2.
- z/OS V2.1.

XL C/C++ support of ARCH(13) and TUNE(13) parameters requires at a minimum:

- z/OS V2.4 with PTFs.

CPU Measurement Facility requires at a minimum:

- z/OS V2.4 with PTFs.
- z/OS V2.3 with PTFs.
- z/OS V2.2 with PTFs.
- z/VM V7.1 with PTFs.
- z/VM V6.4 with PTFs.

Integrated Accelerator for zEnterprise Data Compression requires at a minimum:

- z/OS V2.4 with PTFs.
- z/OS V2.3 with PTFs.
- z/OS V2.2 with PTFs.
- z/VM V7.1 with PTFs for guest exploitation.
- z/VM V6.4 with PTFs for guest exploitation.

System Recovery Boost requires at a minimum:

- z/OS V2.4 with PTFs.
- z/OS V2.3 with PTFs.
- z/VM V7.1 with PTFs.
- z/TPF V7.1 with PTFs.

IBM Z Data Privacy for Diagnostics requires at a minimum:

- z/OS V2.4 with PTFs.
- z/OS V2.3 with PTFs.

Quantum Safe Support requires at a minimum:

- z/OS V2.4 with PTFs and with Cryptographic Support for z/OS V2.2 --z/OS V2.4 (HCR77D1).
- z/OS V2.3 with coexistence PTFs for SMF and with Cryptographic Support for z/OS V2.2 --z/OS V2.4 (HCR77D1).
- z/OS V2.2 with coexistence PTFs for SMF and with PTFs and with Cryptographic Support for z/OS V2.2 --z/OS V2.4 (HCR77D1).
- z/VM V7.1 with PTFs for guest exploitation.
- z/VM V6.4 with PTFs for guest exploitation.

Planning information

Client responsibilities

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

Installability

The average installation time for an IBM z15 is approximately 22 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 z15 uses the security and auditability features and functions of host hardware, host software, and application software.

The client 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.

Terms and conditions

Products - terms and conditions

Warranty period

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.

International Warranty Service

International Warranty Service allows you to relocate any machine that is eligible for International Warranty Service and receive continued warranty service in any country where the IBM machine is serviced. If you move your machine to a different country, you are required to report the machine information to your Business Partner or IBM representative.

The warranty service type and the service level provided in the servicing country may be different from that provided in the country in which the machine was purchased. Warranty service will be provided with the prevailing warranty service type and service level available for the eligible machine type in the servicing country, and the warranty period observed will be that of the country in which the machine was purchased.

The following types of information can be found on the International Warranty Service website:

- Machine warranty entitlement and eligibility
- Directory of contacts by country with technical support contact information
- Announcement Letters

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

If required, IBM will provide repair service depending on the types of maintenance service specified for the machine. Contact your local representative.

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:

- 8561-T01

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

Prices

For all local charges, contact your IBM representative.

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IBM Japan

Corrections

(Corrected on February 19, 2020)

The "Product number" section was revised.

(Corrected on November 21, 2019)

The titles of feature codes 6802 and 9930 were revised.

(Corrected on November 13, 2019)

The "Product number" section was revised.