

Meet the IBM LinuxONE Rockhopper II, designed for open, securable development and production workloads, maximized on a high-availability enterprise foundation

Table of contents

2 Overview	10 Product number
2 Key prerequisites	15 Publications
2 Planned availability date	17 Technical information
3 Description	25 Terms and conditions
8 Product positioning	26 Prices
9 Statement of general direction	38 Order now
	39 Corrections

At a glance

The Rockhopper II extends IBM^(R)'s enterprise Linux^(R) leadership with unmatched performance and vertical scale.

The new LinuxONE Rockhopper II Model LR1 combines all the elements of reliability and security for client and administrator peace of mind, with the agility and flexibility needed to capitalize on today's exploding opportunities for data and data intelligence. In place of sprawling x86 server farms, the Rockhopper II streamlines the management of production and development environments. It offers:

- Encryption and security tools to meet tomorrow's regulatory needs:
 - Advanced bulk symmetric encryption performance with IBM's unique Central Processor Assist for Cryptographic Functions (CPACF)
 - Support of dm-crypt for transparent file and volume encryption using industry-unique CPACF protected keys
 - Network security with enterprise-scale encryption and handshakes using CPACF and Single Instruction Multiple Data (SIMD) techniques
 - Secure Service Containers that can help protect data and code for a Docker and Kubernetes based environment without any application changes
 - FIPS 140-2 Level 4 Certification for the Crypto Express6S encryption key feature
- A unified, scalable approach for public, private, and hybrid cloud applications:
 - Industry-leading Java™ performance, up to 60% faster than on the prior Rockhopper server with enhanced Guarded Storage for Java 8 SR5 that reduces impacts of Java garbage collection
 - Dynamic Partition Manager to easily view and manage assets
 - Reduced administration overhead with fewer cores, licenses, and key management tools to keep up to common drivers and regulations
 - Up to 30 4.5 GHz processor cores and 8 TB RAIM memory, with capacity to quickly scale up to 40 LPARs and up to 330,000 Docker containers
 - Next-generation simultaneous multithreading (SMT) and System Assist Processors (SAPs) for your most demanding execution time requirements and service level agreements (SLAs)
 - On/Off Capacity on Demand ability to quickly address backup and recovery testing, or Dev Ops requirements changes on the fly

- Hardware that is both flexible and reliable:
 - Built on the reliability of Emperor II platform, with intelligent structures that keep the system running in ASHRAE A3 at high availability
 - Reimagined into a 19-inch rack footprint with power distribution unit support for data centre installation
 - Optional 16U Reserved feature to allow customer-supplied switch, server, and storage components in 16U of space in lieu of third and fourth PCIe+ I/O drawers
- Integrated functions, to enable smooth deployment transitions:
 - GUI management tools to make the most of your Linux skill base and improve time to value
 - Hardware Management Console (HMC) that includes new security features, push notifications, and mobile monitoring from anywhere
 - Support for data-in-memory applications across the 8 TB of memory, creating space for data intelligence and analytics
 - Support for a wide range of languages and APIs, for quick deployment of new opportunities, even across microservices developers

Overview

The new IBM Rockhopper II is a highly engineered system designed to protect the new business currency with speed and agility at scale.

The world is amidst a transformation to data as the new business currency. This change is having a profound effect on us as individuals, on how businesses are run, and on how business transactions are managed. In this ever-more-digital world, the new currency is data and the insights that data can provide. It is a world that requires ultimate trust in the data that businesses collect, create, and store.

As a natural evolution of the digital transformation, the complexity of the data value chain has also expanded. The expectations of consumers, suppliers, and business partners have grown. They demand security, transparency, and greater value in every interaction and transaction as this new currency is exchanged. Securing data from both internal and external threats is of utmost importance, yet only a portion of data is adequately protected today. Failure to secure such data has both financial and reputational consequences.

Digital experiences are no longer hosted entirely on premises through data centres but are delivered in combination with hybrid clouds. This is by design as businesses must be open and connected to drive innovation at speed. They must accelerate development and delivery of secure, scalable services to address new opportunities and challenges before a competitor steals the advantage.

IBM Rockhopper II is designed to provide highly securable data for businesses looking to thrive in a data-centric economy.

Key prerequisites

Refer to the [Hardware requirements](#) and [Software requirements](#) sections of this announcement.

Planned availability date

- May 31, 2018:
 - IBM LinuxONE Rockhopper™ II Model LR1
 - Features and functions for the IBM LinuxONE Rockhopper II Model LR1

- Field-installed features and conversions on LinuxONE Rockhopper II Model LR1 that are delivered solely through a modification to the machine's Licensed Internal Code (LIC)
- HMC (#0082)
- HMC Rack Mounted (#0083)
- TKE (#0086)
- TKE Rack Mounted (#0085)
- TKE Smart Card Reader (#0891)
- TKE Additional Smart Cards (#0892)
- TKE 9.0 LIC (#0879)
- HMC Table Top KMM (#0148) for LinuxONE Rockhopper II Model LR1
- TKE Table Top KMM (#0157) for LinuxONE Rockhopper II Model LR1
- September 17, 2018:
 - MES features for IBM LinuxONE Rockhopper II Model LR1

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

Description



IBM LinuxONE™ is an enterprise platform for open innovation that combines the best of Linux and open technology with the best of enterprise computing in ONE platform. Built on high-resiliency, high-speed processors, it is designed to be the backbone of

the interconnected data-driven era, setting new standards in transaction volume, speed, and trust.

The newest member of the IBM LinuxONE family, the IBM Rockhopper II (Rockhopper II), offers a lower entry point into the LinuxONE family. The system is built on the same technology as the IBM LinuxONE Emperor II™ ® (Emperor II) platform, allowing Rockhopper II to leverage the industry's leading data-serving capabilities and rich open ecosystem on the most securable Linux platform on the planet. Building on this foundation, Rockhopper II optimizes innovations in security, performance, and scale; all with improved overall economics in an industry-standard form factor and smaller footprint versus the Rockhopper I.

Today's announcement continues IBM's Linux enterprise server leadership with IBM Rockhopper II, offering:

- 10% more total system capacity for exceptional scale in a single footprint that is 40% smaller than the original LinuxONE Rockhopper.
- Faster uniprocessor performance as compared to the original LinuxONE Rockhopper.
- Up to 30 configurable cores versus 20 on the original LinuxONE Rockhopper.
- An upgrade from 4 to 8 terabytes (TB) of available Redundant Array of Independent Memory (RAIM) real memory per server to help improve transaction response times, lower CPU costs, simplify capacity planning, enlarge in-memory buffer pools, and ease deployment of memory-intensive workloads.
- 1.5x more on-chip cache per core, compared to the original LinuxONE Rockhopper, to minimise memory waits while maximizing the throughput of concurrent workloads -- optimised for data serving.
- A design for pervasive encryption allowing you to encrypt many new data sets transparently, which can help you to provide an envelope of protection around data placed on IBM LinuxONE Rockhopper II. This includes cryptographic performance improvements with the Crypto Express6S (#0893) and the Rockhopper II processor based cryptography with the Central Processor Assist for Cryptographic Function (CPACF) that helps enable the protection of in-flight or at-rest data.
- Hardware accelerated encryption on every core with the CPACF feature designed to provide faster encryption and decryption than previous servers.
- Next-generation simultaneous multithreading (SMT) with improved virtualization for Linux cores.
- New SMT support extended to dedicated I/O System Assist Processors (SAPs).
- Economies of scale with 2.3x AES performance over x86, a True Random Number Generator, SHA3 support, and RSA/ECC acceleration.
- New instructions in Single Instruction Multiple Data (SIMD) which are designed to give a performance boost.
- FICON[®] Express16S+ (#0427, 0428), designed with a boost in I/O rates and a reduction in single stream latency to help absorb large application and transaction spikes driven by large unpredictable analytic and mobile workloads.
- Improved compression ratio (using Huffman coding) and order-preserving compression for the on-chip compression coprocessor which results in fewer CPU cycles to enable further compression of data, improving memory, transfer, and disk efficiency.
- New 10 GbE RoCE Express[®] 2 (#0412) with 4x more virtual functions per adapter and a performance improvement, plus support for OSA-Express 6S, zEDC Express, zHPF, and iSCSI.
- New 16 Gb I/O channel with 3x faster start rate compared to the original Rockhopper.
- IBM Hardware Management Console (HMC) 2.14 with simplification updates to improve workspace and manage system time. New security features include Multifactor Authentication and a new HMC Mobile application for monitor and recover action controls.
- IBM Secure Service Container technology which is designed to create isolated partitions that help to protect data and applications automatically, helping to keep them safe from insider threats and external attacks.

- Enhanced security through protected key management that encrypts keys themselves so they are never in the clear and not accessible from memory scraping or dumps, supporting a pervasive encryption strategy.
- A design for the highest security rating (EAL5+) for a commercially available server and highest security level available for protected key management (FIPS 140-2 Level 4).
- IBM Dynamic Partition Manager (DPM) enhancements, which provide a simplified, consumable, enhanced IBM LinuxONE experience for new and existing Linux, KVM for IBM z Systems^(R), and z/VM^(R) clients.
- Trusted Key Entry (TKE) 9.0 License Internal Code (LIC).
- Improved Java 8 SR5 performance through support for reducing program pauses during Java garbage collection and through Galois Counter Mode (GCM) encryption for minimum latency.
- Industry-standard form factor in a 19-inch rack and PDU-based power.
- Optional top exit power and I/O cabling, designed to provide increased data centre flexibility.
- ASHRAE class A3 certification for robustness, data centre flexibility, and energy savings.
- The inclusion of the IBM zAware function for cutting-edge pattern recognition analytics for fast insight into system health as part of the IBM software product IBM Operations Analytics for z Systems^(R) V3.1.
- A design to run near 100% utilization, with redundant, self-healing, concurrently replaceable parts.

FICON Express16S+

With the introduction of **FICON Express16S+**, you now have additional growth opportunities.

FICON Express16S+ supports a link data rate of 16 gigabits per second (Gbps) and autonegotiation to 4 or 8 Gbps for synergy with existing switches, directors, and storage devices. The Rockhopper II helps you to prepare for an end-to-end 16 Gbps infrastructure to meet the lower latency and increased bandwidth demands of your applications.

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

Dynamic Partition Manager

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

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

A CPC can be configured in either the Dynamic Partition Manager mode or PR/SM™ mode. The mode is enabled prior to the CPC power-on reset (POR). Dynamic Partition Manager mode requires two OSA-Express 1000BASE-T Ethernet features for primary and backup connectivity (OSA-Express6S 1000BASE-T Ethernet, #0426 or OSA-Express5S 1000BASE-T Ethernet, #0417), along with associated cabling (HW for DPM, #0016).

The IBM Secure Service Container

The IBM Secure Service Container is planned to be expanded to integrate with the IBM Cloud Private platform for hybrid and private cloud deployments on IBM Z and LinuxONE. Now clients can deploy containerized IBM Middleware applications as well as utilize common management tooling for deploying homegrown or other third-party Docker and Kubernetes based applications.

IBM Secure Service Container is designed to support the deployment of software container technology without requiring application changes. This is especially useful considering the regulatory focus on protecting critical data from internal and external threats. Support features (#0103 and #0104) will ensure that Secure Service Container applications run smoothly, whether you have just one application type, or many.

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

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

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

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

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

z/VM support

- With the PTF for APAR VM65942, z/VM 6.4 provides support that will enable guests to exploit functions supported by z/VM.
 - **Support for Crypto Express6S:** z/VM support for the new Crypto Express6S (CEX6S) adapter is included for both shared and dedicated guest use. As with the prior crypto adapter support, the CEX6S adapter can be configured as an accelerator or as an IBM Common Cryptographic Architecture (CCA) coprocessor for shared or dedicated use by z/Architecture^(R) guests. When the CEX6S adapter is configured as an IBM Enterprise Public-Key Cryptography Standards (PKCS) #11 (EP11) coprocessor, the domains on the adapter can be dedicated to z/Architecture guests, but not shared. With Crypto Express6S support and support for the new and enhanced CPACF functions, z/VM V6.4 and V7.1 provide the prerequisite encryption support to enable exploitation by guests in support of pervasive encryption.
 - **Installing z/VM to Model LR1:** z/VM 6.4 can be installed directly on an IBM LinuxONE Rockhopper II Model LR1 server with an image obtained from IBM after August 25, 2017. The PTF for APAR VM65942 must be applied immediately after installing z/VM 6.4.
- **Support for OSA Express6S:** With the PTF for APAR PI73016, the TCP/IP stack and the NETSTAT OSAINFO command are updated to support OSA-Express6S adapters.
- **Guest exploitation support for Guarded Storage during Java garbage collection:** With APAR VM65987, z/VM V6.4 provides support for guest exploitation of the Guarded Storage Facility. This facility is designed to improve the performance of garbage-collection processing by Java8 SR5. Essentially, this function allows an area of storage to be identified as "do not disturb", and garbage collection will avoid that area until later. This new function significantly improves the user experience, reducing perceived hang or pause time during processing.
- **Encrypted paging support:** With the PTF for APAR VM65993, z/VM 6.4 provides support for encrypted paging, in support of the IBM pervasive encryption philosophy of encrypting data in flight and at rest. Cipherring will occur as data moves between active memory and a paging volume owned by z/VM. Included in the support is the ability to dynamically control whether a running z/VM system is encrypting this data.
- **IBM Hardware Management Console (HMC) 2.14.0 security enhancements:** New security features in the Hardware Management Console (HMC) 2.14.0 available with z14 include Multifactor Authentication, Enhanced Computing in support of NIST Standard 800-147B, Crypto Compliance Levels, FTP through HMC, SNMP/BCpii API Security Controls, Secure Console to Console Communication Enhancements, Remote Browser IP Address Limiting, and more.
- **Multifactor Authentication:** The Hardware Management Console will now offer an optional control of Multifactor Authentication in addition to the userid/password controls provided today. If the Multifactor option is selected for a given user, that user will now be required to enter a second authentication factor using a TOTP (Time-based One-Time Password) defined by RFC 6238. RFC 6238 is implemented by freely available smartphone and web apps utilizing a secret key provided per HMC user.
- **HMC Mobile for Z and LinuxONE:** New iOS and Android mobile apps are available for the HMC 2.14.0 supporting LinuxONE, z14, z13^(R), and z13sTM systems. HMC Mobile helps enable HMC users to monitor and manage systems from anywhere. The apps provide system and partition views, status monitoring, hardware messages, operating system messages, and the ability to receive push notifications from the HMC using the existing zRSF (z Systems Remote Support Facility) connection. HMC Mobile is disabled by default and, once enabled, provides a robust set of security controls. Administrators can restrict usage to specific HMC users and IP addresses, require the use of app passwords, enable multifactor authentication, restrict the app to read-only access, and more.
- **Firmware tamper detection:** z14 will also offer an enhancement on the Support Element that provides notification if tampering with booting of firmware

on the server (CPC) is detected. This enhancement is designed to meet the BIOS Protection Guidelines recommended and published by the National Institute of Standards and Technology (NIST) in Special Publication 800-147B. If tampering is detected, the Support Element will issue a user alert via a warning or a lock of the Support Element, depending on the configuration. If "call home" support is enabled on the LinuxONE Hardware Management Console managing the Support Element, additional analysis of the Support Element will be performed and displayed by IBM Resource Link^(R).

- **16U Reserved (#0617) hardware configuration flexibility**

For clients utilizing up to two PCIe+ drawers, there is a new option to hold 16U Reserved (#0617) space in the Model LR1 rack. This 16U of space in the frame can be populated by a client with other server elements such as switches, storage, or servers. These additional elements are beneficial when planning elements that will work together within a frame, while reducing the physical footprint required in a data centre.

When the 16U Reserved feature is ordered, the Model LR1 order will provide additional power ports in redundant power distribution units (PDUs), along with weight ballast, cable management support brackets, and air flow fillers as appropriate. Clients should take care to evaluate requirements of the *Installation Manual for Physical Planning* (IMPP), as there are requirements regarding additional element weight, air flow, power draw, and certification status. Note that IBM would first complete installation of the Rockhopper II and turn it over to client operation, and then the additional elements could be added if the 16U Reserved (#0617) has been ordered. This new hardware configuration flexibility feature is perfect for clients who fit into smaller IO configurations and need the additional ease of a single-footprint approach.

Accessibility by people with disabilities

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

Product positioning

Data has become the new global currency. The sheer volume of data is immense, fueled by the digital transformation of systems, services, and interconnected devices. Businesses must be able to manage, store, and protect this information, and, most importantly, use it for competitive advantage. This is creating the demand to apply intelligence and insight to the data to build new services wrapped for a customized user experience. From a user perspective, IT must create an environment where users have confidence that data is protected yet available from anywhere and any device. This ability to be fast and flexible in delivery of new services, with insight and security, will differentiate a business. The IBM Rockhopper II delivers unique capabilities to help with that differentiation.

The new Linux ONE Rockhopper II Model LR1 combines all the elements of reliability and security for client and administrator peace of mind, with the agility and flexibility needed to capitalize on today's exploding opportunities for data and data intelligence. In place of sprawling x86 server farms, the Rockhopper II streamlines the management of production and development environments, using easy provisioning via new functions, like the Dynamic Partition Manager for Linux and updates to Hardware Management Console (HMC) interfaces. The shared-everything architecture is key to the success of Rockhopper II flexibility, as it allows clients to quickly move between high- and low-volume transaction settings, and take advantage of seamless backup and recovery methods.

Security and encryption are also fundamentally applied to the base of the Rockhopper II via hardware-embedded encryption methods, designed to require no application changes when deploying Docker and Kubernetes based applications. In addition, support of dm-crypt tools, Crypto Express6S hardware, and management

tools can address security regulations at multiple levels. Building on our Blockchain experience, the new Secure Service Container extensions are designed to allow clients to house their own applications within a secure container, reducing the stress and cost of trying to separately keep applications up to date on regulatory requirements. What this means to a client is that the system is designed to allow base data and applications to be encrypted with no application changes, and can help address audit and regulation challenges, both today and tomorrow.

One motivator for security conversations around Rockhopper II are the regulatory changes being implemented in the EU. The new General Data Protection Regulation (GDPR) goes into effect May 2018 in all EU member countries and for companies outside of the EU that hold or process data for citizens of EU countries. This will be a new set of IT challenges where Rockhopper II can provide a holistic response.

Designed as an entry point into LinuxONE, Rockhopper II is the newest member of the product portfolio, built on the same technology as Emperor II at a lower price point. Rockhopper II is available with up to 8 TB of memory and 30 Linux cores, running at 4.5 GHz, supporting hundreds of production and development virtual machines on a single footprint. Reviewing opportunities for consolidation of x86 sprawl is key, considering not only the hardware but the software licenses and overhead management required to keep things running smoothly.

Collaborating closely with clients, the Rockhopper II is built on the same high-reliability technology base as Emperor II, while achieving a smaller footprint at a lower price point. Rockhopper II is easily integrated into a data centre environment, with an industry-standard 19-inch rack footprint and a common power distribution unit (PDU) approach. Planning the installation of a new Rockhopper II to a data centre is simplified over the initial Rockhopper release. For our clients, this new format translates to significant efficiency, and high-speed processing power packed into a footprint of just two data centre tiles.

The design teams for Rockhopper II also focused on creating a seamless integration for languages, applications, and programs that may originate in a variety of different formats for various clients. From languages like Go, Python, or Scala to applications like Docker containers, or MongoDB, PostgreSQL, and MariaDB, the Rockhopper II can maximise a client's ability to quickly develop and deploy new applications.

Overall, the Rockhopper II is positioned for clients who value scalability and high-resiliency, and are able to imagine the benefits of consolidating varied workloads in order to open windows of opportunity to grow and flex.

Statement of general direction

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

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

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

IBM Storage intends to deliver a high-performance, high-availability, ECKD™/ Distributed format flash storage that can be mounted in a z14 Model ZR1 or LinuxONE Rockhopper II server rack with the associated 16U Reserved (#0617) space inside the 19-inch rack. This new storage solution opens the opportunities for clients who require the high-availability, performance, and Z synergy functions of DS8880, and are looking for ways to increase their data centre flexibility.

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

future products is intended to outline our general product direction and it should not be relied on in making a purchasing decision. The information mentioned regarding potential future products is not a commitment, promise, or legal obligation to deliver any material, code, or functionality. Information about potential future products may not be incorporated into any contract. The development, release, and timing of any future features or functionality described for our products remain at our sole discretion.

Reference information

For more information on the IBM z^(R)/VM 7.1, see Software Announcement [A18-0230](#), dated April 10, 2018.

For more information on the IBM LinuxONE Emperor II™, see Hardware Announcement [A17-0572](#), dated September 12, 2017.

Product number

Description	Machine Type	Model	Feature
LinuxONE Rockhopper II	3907	LR1	
Model LR1			0300
CPC Drawer Max4			0636
CPC Drawer Max12			0637
CPC Drawer Max24			0638
CPC Drawer Max30			0639
MTU 1 --D			0001
MTU 100 --D			0002
MTU 1 --V			0003
MTU 100 --V			0004
GTU 1 -D			0005
GTU 100 -D			0006
GTU 1 -V			0007
GTU 100 -V			0008
GTU 1000 -D			0009
GTU 1000 -V			0010
Migration Offering Machine			0014
HW for DPM			0016
Manage FW Suite			0019
Automate FW Suite			0020
Ensemble Membership			0025
Non RSF On/Off CoD			0032
Serv Docs Optional Print			0033
RFID Tag			0035
RFID Tag			0036
HMC		0082	
HMC Rack Mount		0083	
TKE Rack Mount w/4768		0085	
TKE w/4768		0086	
WWPN Persistence		0099	
Linux Hosting Foundation		0103	
Container Hosting Foundation		0104	

1 CPE Capacity Unit-IFL	0119
100 CPE Capacity Unit-IFL	0120
1 CPE Capacity Unit-SAP	0127
100 CPE Capacity Unit-SAP	0128
HMC Table Top KMM	0148
HMC Rack Keybd/Monitor/Mouse	0154
TKE Rack Keybd/Monitor/Mouse	0156
TKE Table Top KMM	0157
PCIe Fanout Gen3	0173
Fanout Airflow PCIe	0174
Client Must Provide HMC KMM	0188
Client Must Provide TKE KMM	0190
2828 w/o TEIO & w/o HtR	0192
2828 w/o TEIO & w/ HtR	0193
2828 w/ TEIO & w/o HtR	0194
2828 w/ TEIO & w/ HtR	0195
2965 w/o TEIO & w/o HtR	0196
2965 w/o TEIO & w/ HtR	0197
2965 w/ TEIO & w/o HtR	0198
2965 w/ TEIO & w/ HtR	0199
US English	0235
France	0236
German/Austrian	0237
LA Spanish	0238
Spain	0239
Italian	0240
French Canadian	0241
Portuguese	0242
UK English	0243
Norwegian	0244
Sweden Finland	0245
Netherlands	0246
Belgian French	0247
Denmark	0248
Swiss French/German	0249
PCIe Interconnect Gen3	0401
10 GbE RoCE Express2	0412
zEDC Express ^(R)	0420
OSA-Express6S GbE LX	0422
OSA-Express6S GbE SX	0423
OSA-Express6S 10 GbE LR	0424
OSA-Express6S 10 GbE SR	0425
OSA-Express6S 1000BASE-T	0426
FICON ^(R) Express16S+ LX	0427
FICON Express16S+ SX	0428
IBM Virtual Flash Memory	0614
16U Reserved	0617
Switchable PDU	0622
Ethernet Switch	0623
CPC PSU	0641
Read Only Media Option	0845
TKE Addl Smart Cards	0892
32GB USB Backup Media	0848
TKE 9.0 LIC	0879
TKE Smart Card Reader	0891
Crypto Express6S	0893

UID Label for DoD	0998
STP Enablement	1021
IFL	1064
SAP (optional)	1066
Unassigned IFL	1068
CP-A	1069
CP-C	1071
0-Way Processor A00	1157
1-Way Processor C01	1160
A00 Capacity Marker	1340
C01 Capacity Marker	1343
32 GB Mem DIMM(5/feat)	1627
64 GB Mem DIMM(5/feat)	1628
128 GB Mem DIMM(5/feat)	1629
256 GB Mem DIMM(5/feat)	1630
512 GB Mem DIMM(5/feat)	1631
8GB Memory Capacity Incr	1739
8GB Memory Cap Incr>128GB	1740
16GB Memory Cap Incr>128GB	1741
32GB Memory Cap Incr>128GB	1742
LICCC Ship Via Net Ind	1750
8 GB Preplanned Memory	1993
16 GB Preplanned Memory	1996
Lift Tool Kit	3100
Extension Ladder	3101
64 GB Memory	3539
72 GB Memory	3540
80 GB Memory	3541
88 GB Memory	3542
96 GB Memory	3543
128 GB Memory	3544
160 GB Memory	3545
192 GB Memory	3546
224 GB Memory	3547
256 GB Memory	3548
288B Memory	3549
320 GB Memory	3550
352 GB Memory	3551
384 GB Memory	3552
448 GB Memory	3553
512 GB Memory	3554
576 GB Memory	3555
704 GB Memory	3556
832 GB Memory	3557
960 GB Memory	3558
1216 GB Memory	3559
1472 GB Memory	3560

1728 GB Memory		3561
1984 GB Memory		3562
2240 GB Memory		3563
2496 GB Memory		3564
2752 GB Memory		3565
3008 GB Memory		3566
3264 GB Memory		3567
3520 GB Memory		3568
3776 GB Memory		3569
4032 GB Memory		3570
4544 GB Memory		3571
5056 GB Memory		3572
5568 GB Memory		3573
6080 GB Memory		3574
6592 GB Memory		3575
7104 GB Memory		3576
7616 GB Memory		3577
8128 GB Memory		3578
CPACF Enablement		3863
PCIe+ I/O Drawer		4001
Additional CBU Test		6805
Total CBU Years Ordered		6817
CBU Records Ordered		6818
Single CBU IFL Year		6822
25 CBU IFL Year		6823
Single CBU SAP Year		6830
25 CBU SAP Year		6831
CBU Replenishment		6832
Capacity for Planned Event		6833
OPO Sales Flag		6835
OPO Sales Flag- Alteration		6836
Top Exit Cabling		7917
Bottom Exit Cabling		7919
FQC Bracket & Mounting Hdw		7934
LC Duplex 6.6ft Harness		7935
30A/208V 14ft w/ TwistLock		7937
30A/208V 14ft w/ Russelstoll		7938
32A/250V Cord EMEA & AP		7939
32A/250V Cord Aus & NZ		7940
32A/250V Cord Korea		7941
32A/250V LSZH Cord		7943
19" Frame Bolt Down Kit		8006

Multi Order Ship Flag			9000
Multi Order Rec Only Flag-NB			9001
Multi Order Rec Only Flag-MES			9002
RPO Action Flag			9003
Downgraded PUs Per Request			9004
On/Off CoD Act 100 IFL Day			9874
On/Off CoD Act 100 SAP Day			9878
19" Rack			9883
On/Off CoD Act IFL Day			9888
On/Off COD authorization			9896
Perm upgr authorization			9898
CIU Activation (Flag)			9899
On-Line CoD Buying (Flag)			9900
On/Off CoD Act. SAP Day			9909
CBU authorization			9910
CPE authorizataion			9912
OPO Sales authorization			9913
1 MSU day			9917
100 MSU days			9918
10000 MSU days			9919
1 IFL day			9920
100 IFL days			9921
1 SAP day			9928
100 SAP days			9929
Height Reduce Ship			9975
Height Reduce for Return			9976
LinuxONE Emperor II	3906	LM1	
		LM2	
		LM3	
		LM4	
		LM5	
Linux Hosting Foundation			0103
Container Hosting Foundation			0104

Note: Rockhopper II refresh does not support carry forward from prior models.

Model conversions

From Machine Type	From Model	To Machine Type	To Model	
3907	LR1	3907	ZR1	(*)

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

Feature conversions

There are no feature conversions into LinuxONE Rockhopper II Model LR1. The Rockhopper II can be converted into an IBM z14 Model ZR1 if desired.

The feature conversion list for z14 Model ZR1 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 3907 Installation manual for Physical Planning (IMPP)	GC28-6974
PR/SM TM Planning Guide	SB10-7169
IOCP User's Guide	SB10-7172
Planning for Fiber Optic Links (FICON ^(R) /FCP, Coupling Links, and OSA)	GA23-1408

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

Title	Order Number
IBM 3907 Installation Manual	GC28-6973
IBM 3907 Service Guide	GC28-6975
Service Guide for TKE Workstations (Version 7.0)	GC28-6980
Systems Safety Notices	G229-9054
IBM Important Notices	G229-9056
IBM 3907 Safety Inspection	GC28-6972
Systems Environmental Notices and User Guide	Z125-5823
IBM Z Statement of Limited Warranty	GC28-6979
License Agreement for Machine Code	SC28-6872
License Agreement for Machine Code Addendum for Elliptic Curve Cryptography	GC27-2635

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

Title	Order Number
IBM 3907 Parts Catalogue	GC28-6976
Service Guide for 2461 HMC	GC28-6990
Service Guide for 2461 Support Element	GC28-6991
Service Guide for HMCs and SEs	GC28-6983
SNMP Application Programming Interfaces	SB10-7171
Capacity on Demand User's Guide	SC28-6985
CHPID Mapping Tool User's Guide	GC28-6984
Hardware Management Console Web Services API (V2.14.0)	SC27-2636
IBM Dynamic Partition Manager (DPM) Guide	SB10-7170
Secure Service Container User's Guide	SC28-6978
Stand-Alone IOCP User's Guide	SB10-7173

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

Resource Link: Publications for IBM Z® can be obtained at the [Resource Link](#) website.

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

HMC and SE console documentation

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

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

The following Redbooks^(R) publications are available now for LinuxONE Models LM1 - LM5. These contain many features that are offered in LinuxONE Model LR1, and may be useful for planning and reference. Additional Redbooks offerings will be added to web links below.

Title	Order Number
IBM z14/LinuxONE Technical Introduction	SG24-8450-00
IBM z14/LinuxONE Technical Guide	SG24-8451-00
IBM z14/LinuxONE Configuration Setup	SG24-8460-00
IBM z Systems ^(R) Connectivity Handbook	SG24-5444-17
IBM z Systems Functional Matrix	REDP-5157-02
Practical Migration from x86 to LinuxONE	SG24-8377-00

To download these Redbooks publications, go to the [IBM zEnterprise^{\(R\)} System Redbooks](#) website. To order, contact your IBM representative.

For other IBM Redbooks publications, go to the main [IBM Redbooks](#) website.

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

To access the IBM Publications Center Portal, go to the [IBM Publications Center](#) website.

The Publications Center is a worldwide central repository for IBM product publications and marketing material with a catalogue of 70,000 items. Extensive

search facilities are provided. A large number of publications are available on-line 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

Physical specifications - IBM LinuxONE Rockhopper II Model LR1

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

Systems with all covers

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

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

Systems with all covers and height reduction

	Depth	Width	Height
Inches	42.1	23.6	74.7
Millimeters	1070	600	1898

Approximate weight:

	Newbuild Maximum Model LR1 Max # of I/O Drawers
kg	735
lb	1621
kg (O/H I/O cable exit)	740
lb (O/H I/O cable exit)	1634

Operating environment

Operating environment - LinuxONE Rockhopper II

Environmental class: ASHRAE A3

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

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

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

Electrical power considerations

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

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

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

Noise level for typical configuration Model LR1:

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

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

Hardware requirements

The hardware requirements for the IBM Z® and LinuxONE servers, features, and functions are identified.

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

HMC system support

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

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

Peripheral hardware and device attachments

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

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

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

Information on switches and directors qualified for IBM Z and LinuxONE FICON and FCP channels can be found in the *Library* section of [Resource Link](#).

Software requirements

IBM LinuxONE Rockhopper II Model LR1 requires at a minimum:

- z/VM^(R) V6.4 with PTFs.
- z/VM V7.1.
- Linux on Z -IBM plans to support running the following Linux on Z distributions on IBM z14:
 - SUSE SLES 12 SP2 with service and SUSE SLES 11 SP4 with service.
 - Red Hat RHEL 7.3 with service and Red Hat RHEL 6.9 with service.
 - Ubuntu 16.04 LTS (or higher) with service.
 - IBM is working to support the KVM hypervisor which was first offered with the following Linux distributions: SLES 12 SP2 with service, and Ubuntu 16.04 LTS (or higher) with service.

Note: For minimum required and recommended distribution levels refer to the [IBM Z](#) website.

The following software requirements are listed for features and capabilities supported on IBM LinuxONE Rockhopper II Model LR1.

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

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

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

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

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

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

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

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

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

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

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

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

- Ubuntu 16.04 LTS (or higher) with service (DIF and DIX).

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

CHPID type OSD:

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

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

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

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

CHPID type OSD:

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

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

- z/VM V6.4 to define, modify, and delete OSX CHPID types when z/VM is the controlling LPAR for dynamic I/O.
- Linux on Z:
 - SLES 12 SP2 with service and SLES 11 SP4 with service.
 - RHEL 7.3 with service and RHEL 6.9 with service.
 - Ubuntu 16.04 LTS (or higher) with service.

OSA-Express6S 100BASE-T Ethernet (#0426) requires at minimum:

CHPID type OSC supporting TN3270E and non-SNA DFT:

- z/VM V6.4 with PTFs.

CHPID type OSD with exploitation of two ports per CHPID:

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

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

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

Checksum offload for IPv6 packets (CHPID type OSD):

- z/VM V6.4 for guest exploitation.

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

- z/VM V6.4 for guest exploitation.

Large Send for IPv6 packets (CHPID type OSD):

- z/VM V6.4 for guest exploitation.

CHPID type OSE supporting 4 or 2 ports per feature:

- z/VM V6.4.

CHPID type OSM for intranode management network (INMN):

- z/VM V6.4 to define, modify, and delete CHPID type OSM when z/VM is the controlling LPAR for dynamic I/O.
- Linux on Z:
 - SLES 12 SP2 with service and SLES 11 SP4 with service.
 - RHEL 7.3 with service and RHEL 6.9 with service.
 - Ubuntu 16.04 LTS (or higher) with service.

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

- z/VM V6.4 with PTFs for guest exploitation and exploitation within the z/VM TLS/SSL server.
- Linux on Z: For the exact kernel levels refer to the [Linux on IBM Z](#) website.
- SLES 12 SP2 with service and SLES 11 SP4 with service.
- RHEL 7.3 with service and RHEL 6.9 with service.
- Ubuntu 16.04 LTS (or higher) with service.
- For secure-key cryptography with Linux on Z, CCA 5.2.23 (or later) is available and can be downloaded from the [CryptoCards](#) website.

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

- z/VM V6.4 with PTFs for guest exploitation.

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

- z/VM V6.4 with PTFs for guest exploitation and exploitation within the z/VM TLS/SSL server.
- Linux on Z:
 - SLES 12 SP2 with service and SLES 11 SP4 with service.

- RHEL 7.3 with service and RHEL 6.9 with service.
- Ubuntu 16.04 LTS (or higher) with service.

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

- z/VM 6.4 with PTFs for guest exploitation.
- Linux on Z: IBM is working with its Linux distribution partners to provide support in future distribution releases.

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

- z/VM 6.4 with PTFs for guest exploitation.

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

- z/VM V6.4 with PTFs for guest exploitation.
- Linux on Z: IBM is working with its Linux distribution partners to include support in future distribution releases.
 - SLES 12 SP3 includes support for Linux-to-Linux communication as a "Tech Preview."

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

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

Support for 256 Coupling CHPIDs requires at a minimum:

- z/VM V6.4 for guest exploitation.

zEDC Express (#0420) requires at a minimum:

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

Transactional memory requires at a minimum:

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

2 GB Large Pages requires at a minimum:

- Linux on Z:
 - SLES 12 SP3.
 - RHEL 7.4.

- Ubuntu 16.10 (or higher).

Guarded Storage requires at a minimum:

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

Instruction Execution Protection Facility requires at a minimum:

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

Planning information

Customer responsibilities

Information on customer responsibilities for site preparation can be found in the [Library](#) section of Resource Link.

Cable orders

Not applicable.

Installability

The average installation time for an IBM z14 LR1 is approximately 14 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 Rockhopper II uses the security and auditability features and functions of host hardware, host software, and application software.

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

IBM Systems Lab Services

For details on available services, contact your IBM representative or go to the [Lab Services](#) website.

IBM Electronic Services

IBM has transformed its delivery of hardware and software support services to help you achieve higher system availability. Electronic Services is a web-enabled solution that offers an exclusive, no-additional-charge enhancement to the service and support available for IBM servers. These services are designed to provide the opportunity for greater system availability with faster problem resolution and preemptive monitoring. Electronic Services comprises two separate, but complementary, elements: Electronic Services news page and Electronic Services Agent.

The Electronic Services news page is a single internet entry point that replaces the multiple entry points traditionally used to access IBM internet services and support. The news page enables you to gain easier access to IBM resources for assistance in resolving technical problems.

The Electronic Service Agent™ is no-additional-charge software that resides on your server. It monitors events and transmits system inventory information to IBM on a periodic, client-defined timetable. The Electronic Service Agent automatically reports hardware problems to IBM. Early knowledge about potential problems enables IBM to deliver proactive service that may result in higher system availability and performance. In addition, information collected through the Service Agent is made available to IBM service support representatives when they help answer your questions or diagnose problems. Installation and use of IBM Electronic Service Agent for problem reporting enables IBM to provide better support and service for your IBM server.

To learn how Electronic Services can work for you, go to the [IBM Electronic Support](#) website.

Terms and conditions

IBM Global Financing

Yes.

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.

Warranty service

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

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

Warranty service upgrades

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

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

The following service is provided.

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

Usage plan machine

No.

IBM hourly service rate classification

Three.

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

General terms and conditions

Field-installable features

Yes.

Model conversions

Yes.

Machine installation

Installation is performed by IBM. IBM will install the machine in accordance with the IBM installation procedures for the machine. In the United States, contact IBM at 1-800-IBM-SERV (426-7378). In other countries, contact the local IBM office.

Graduated program license charges apply

No.

Licensed Internal Code

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

Specific Machine Type Model:

- 3907-LR1

Licensed Machine Code

Not applicable.

Other Installed Licensed Code

None.

Educational allowance

Not applicable.

Prices

Prices are subject to change without notice.

GST, QST, and sales taxes, where applicable, are extra.

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

Product charges

Desc	Mach Type	Mod	Feat	**	EWFe	MMMC ind	INIT/MES
Rock hopper II	3907	LR1			**	X	
Model LR1 Air Cooled			0300		**	X	Both
CPC Drawer Max4			0636		**	X	Both
CPC Drawer Max12			0637		**	X	Both
CPC Drawer Max24			0638		**	X	Both
CPC Drawer Max30			0639		**	X	Both
MTU 1 -D			0001	**			MES
MTU 100 -D			0002	**			MES
MTU 1 -V			0003	**			Both
MTU 100 -V			0004	**			Both
GTU 1 -D			0005	**			MES
GTU 100 -D			0006	**			MES
GTU 1 -V			0007	**			MES
GTU 100 -V			0008	**			MES
GTU 1000 -D			0009	**			MES
GTU 1000 -V			0010	**			MES
Migration Offering Machine			0014	**			Init
HW for DPM			0016	**			Both
Manage FW Suite			0019	**			Both
Automate FW Suite			0020	**			Both
Ensemble Member			0025	**			Both
Non RSF			0032	**			Both

Desc	Mach Type	Mod	Feat	**	EWFe	MMMC ind	INIT/MES
On/Off CoD							
Serv Docs Optional Print			0033	**			Both
RFID Tag			0035	**			Both
RFID Tag			0036	**			Both
HMC			0082	**			Both
HMC Rack Mount			0083	**			Both
TKE Rack Mount w/4768			0085	**			Both
TKE w/4768			0086	**			Both
WWPN Persis			0099	**			Both
Linux Hosting Found			0103	**			Both
Contain Host Found			0104	**			Both
1 CPE Capacity Unit-IFL			0119	**			Both
100 CPE Capacity Unit-IFL			0120	**			Both
1 CPE Capacity Unit-SAP			0127	**			Both
100 CPE Capacity Unit-SAP			0128	**			Both
HMC Table Top KMM			0148	**			Both
HMC Rack Keybd/Monitor/Mouse			0154	**			Both
TKE Rack Keybd/Monitor/Mouse			0156	**			Both
TKE Table Top KMM			0157	**			Both

Desc	Mach Type	Mod	Feat	**	EWFe	MMMC ind	INIT/MES
PCIe fanout Gen3			0173	**			Both
Fanout Airflow PCIe			0174	**			Both
Client Must Provide HMC KMM			0188	**			Both
Client Must Provide TKE KMM			0190	**			Both
2828 w/o TEIO & w/o HtR Return Pkg		0192	**				Both
2828 w/o TEIO & w/HtR Return Pkg		0193	**				Both
2828 w/ TEIO & w/o HtR Return Pkg		0194	**				Both
2828 w/ TEIO & w/HtR Return Pkg			0195	**			Both
2965 w/o TEIO & w/o HtR Return Pkg		0196	**				Both
2965 w/o TEIO & w/HtR Return Pkg		0197	**				Both
2965 w/ TEIO & w/o HtR Return Pkg		0198	**				Both
2965 w/ TEIO & w/HtR Return Pkg			0199	**			Both

Desc	Mach Type	Mod	Feat	**	EWFe	MMMC ind	INIT/MES
US English			0235	**			Both
France			0236	**			Both
German/Austrian			0237	**			Both
LA Spanish			0238	**			Both
Spain			0239	**			Both
Italian			0240	**			Both
French Canadian			0241	**			Both
Portug			0242	**			Both
UK English			0243	**			Both
Norweg			0244	**			Both
Sweden Finland			0245	**			Both
Netherl			0246	**			Both
Belgian French			0247	**			Both
Denmark			0248	**			Both
Swiss French/German			0249	**			Both
PCIe Intercon Gen3			0401	**			Both
10 GbE RoCE Express2			0412	**			Both
zEDC Express			0420	**			Both
SOSA-Express 6S GbE LX			0422	**			Both
SOSA-Express 6S GbE SX			0423	**			Both
SOSA-Express 6S 10 GbE LR			0424	**			Both
SOSA-Express 6S 10 GbE SR			0425	**			Both
SOSA-Express 6S 1000 BASE-T			0426	**			Both
FICON Express 16S+ LX			0427	**			Both

Desc	Mach Type	Mod	Feat	**	EWFe	MMMC ind	INIT/MES
FICON Express 16S+ SX			0428	**			Both
IBM Virtual Flash Memory			0614	**			Both
16U Reserved			0617	**			Both
Switch PDU			0622	**			Both
Ethernet Switch			0623	**			Both
CPC PSU			0641	**			Both
4768 TKE Crypto Adapter			0844	**			Both
Read Only Media Option			0845	**			Both
32GB USB Backup Media			0848	**			Both
TKE 9.0 LIC			0879	**			Both
TKE Smart Card Reader			0891	**			Both
TKE addl smart cards			0892	**			Both
Crypto Express 6S			0893	**			Both
RCE Vendor 1			0901	**			Both
UID Label for DoD			0998	**			Both
STP Enable			1021	**			Both
IFL			1064	**			Both
SAP (option)			1066	**			Both
Unass IFL			1068	**			Both
CP-A			1069	**			Both
CP-C			1071	**			Both
0-Way Processor A00			1157	**			Both
1-Way Processor C01			1160	**			Both

Desc	Mach Type	Mod	Feat	**	EWFe	MMMC ind	INIT/MES
A00 Capacity Marker			1340	**			Both
C01 Capacity Marker			1343	**			Both
32 GB Mem DIMM (5/ feat)			1627	**			Both
64 GB Mem DIMM (5/ feat)			1628	**			Both
128 GB Mem DIMM (5/ feat)			1629	**			Both
256 GB Mem DIMM (5/ feat)			1630	**			Both
512 GB Mem DIMM (5/ feat)			1631	**			Both
8GB Memory Capacity Incr			1739	**			Both
8GB Memory Cap Incr> 128GB			1740	**			Both
16GB Memory Cap Incr> 128GB			1741	**			Both
32GB Memory Cap Incr> 128GB			1742	**			Both
LICCC Ship Via Net Ind			1750	**			Both
8 GB Prepl Memory			1993	**			Both
16GB Prepl Memory			1996	**			Both
Lift Tool Kit			3100	**			Both

Desc	Mach Type	Mod	Feat	**	EWFe	MMMC ind	INIT/MES
Extension Ladder			3101	**			Both
64 GB Memory			3539	**			Both
72 GB Memory			3540	**			Both
80 GB Memory			3541	**			Both
88 GB Memory			3542	**			Both
96 GB Memory			3543	**			Both
128 GB Memory			3544	**			Both
160 GB Memory			3545	**			Both
192 GB Memory			3546	**			Both
224 GB Memory			3547	**			Both
256 GB Memory			3548	**			Both
288B Memory			3549	**			Both
320 GB Memory			3550	**			Both
352 GB Memory			3551	**			Both
384 GB Memory			3552	**			Both
448 GB Memory			3553	**			Both
512 GB Memory			3554	**			Both
576 GB Memory			3555	**			Both
704 GB Memory			3556	**			Both
832 GB Memory			3557	**			Both
960 GB Memory			3558	**			Both
1216 GB Memory			3559	**			Both
1472 GB Memory			3560	**			Both

Desc	Mach Type	Mod	Feat	**	EWFe	MMMC ind	INIT/MES
1728 GB Memory			3561	**			Both
1984 GB Memory			3562	**			Both
2240 GB Memory			3563	**			Both
2496 GB Memory			3564	**			Both
2752 GB Memory			3565	**			Both
3008 GB Memory			3566	**			Both
3264 GB Memory			3567	**			Both
3520 GB Memory			3568	**			Both
3776 GB Memory			3569	**			Both
4032 GB Memory			3570	**			Both
4544 GB Memory			3571	**			Both
5056 GB Memory			3572	**			Both
5568 GB Memory			3573	**			Both
6080 GB Memory			3574	**			Both
6592 GB Memory			3575	**			Both
7104 GB Memory			3576	**			Both
7616 GB Memory			3577	**			Both
8128 GB Memory			3578	**			Both
CPACF Enable			3863	**			Both
PCIe + I/O Drawer			4001	**			Both
Flat Panel Display			6096	**			Both

Desc	Mach Type	Mod	Feat	**	EWFe	MMMC ind	INIT/ MES
Addition CBU Test			6805	**			Both
Total CBU Years Ordered			6817	**			Both
CBU Records Ordered			6818	**			Both
Single CBU IFL Year			6822	**			Both
25 CBU IFL Year			6823	**			Both
Single CBU SAP Year			6830	**			Both
25 CBU SAP Year			6831	**			Both
CBU Replenish			6832	**			MES
Capacity for Planned Event			6833	**			Both
OPO Sales Flag			6835	**			Both
OPO Sales Flag- Alteration			6836	**			MES
Top Exit Cabling			7917	**			Both
Bottom Exit Cabling			7919	**			Both
FQC Bracket & Mounting Hdw			7934	**			Both
LC Duplex 6.6ft Harness			7935	**			Both
30A/208 V 14ft w/ TwistLock			7937	**			Both
30A/208 V 14ft w/ Russel stoll			7938	**			Both
32A/250 V Cord			7939	**			Both

Desc	Mach Type	Mod	Feat	**	EWFe	MMMC ind	INIT/MES
EMEA & AP							
32A/250 V Cord Aus & NZ			7940	**			Both
32A/250 V Cord Korea			7941	**			Both
32A/250 V LSZH Cord			7943	**			Both
19" Frame Bolt Down Kit			8006	**			Both
Multi Order Ship Flag			9000	**			Both
Multi Order Rec Only Flag-NB			9001	**			Both
Multi Order Rec Only Flag-MES			9002	**			MES
RPO Action Flag			9003	**			MES
Downgr PUs Per Request			9004	**			Both
On/Off CoD Act 100 IFL Day			9874	**			MES
On/Off CoD Act 100 SAP Day			9878	**			MES
19" Rack			9883	**			Both
On/Off CoD Act IFL Day			9888	**			MES
On/Off COD author			9896	**			Both
Perm upgr author			9898	**			Both

Desc	Mach Type	Mod	Feat	**	EWFe	MMMC ind	INIT/MES
CIU Activ (Flag)			9899	**			MES
On- Line CoD Buying (Flag)			9900	**			Both
On/Off CoD Act. SAP Day			9909	**			MES
CBU author			9910	**			Both
CPE author			9912	**			Both
OPO author			9913	**			Both
1 MSU day			9917	**			MES
100 MSU days			9918	**			MES
10000 MSU days			9919	**			MES
1 IFL day			9920	**			MES
100 IFL days			9921	**			MES
1 SAP day			9928	**			MES
100 SAP days			9929	**			MES
Height Reduce Ship			9975	**			Both
Height Reduce for Return			9976	**			MES
Emperor II	3906	LM1					
		LM2					
		LM3					
		LM4					
		LM5					
Linux Hosting Found			0103	**			Both
Cont Host Found			0104	**			Both

** If field installed on a purchased machine, parts removed or replaced become the property of IBM and must be returned.

Maintenance charges

For additional information on maintenance and pricing, contact your IBM representative or your IBM Business Partner, or call 1-800-IBM-CALL (1-800-426-2255).

Annual minimum maintenance charges

Not applicable.

Model conversion purchase price

Contact your IBM representative for model conversion prices.

Model	
From	To
LM1	ZR1

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

IBM Global Financing

IBM Global Financing offers competitive financing to credit-qualified customers to assist them in acquiring IT solutions. Offerings include financing for IT acquisition, including hardware, software, and services, from both IBM and other manufacturers or vendors. Offerings (for all customer segments: small, medium, and large enterprise), rates, terms, and availability can vary by country. Contact your local IBM Global Financing organization or go to the [IBM Global Financing](#) website for more information.

IBM Global Financing offerings are provided through IBM Credit LLC in the United States and other IBM subsidiaries and divisions worldwide to qualified commercial and government customers. Rates are based on a customer's credit rating, financing terms, offering type, equipment type and options, and may vary by country. Other restrictions may apply. Rates and offerings are subject to change, extension, or withdrawal without notice.

Order now

To order, contact the IBM Digital Sales Center, your local IBM representative, or your IBM Business Partner. To identify your local IBM representative or IBM Business Partner, call 800-IBM-4YOU (426-4968). For more information, contact the IBM Digital Sales Center.

Phone: 800-IBM-CALL (426-2255)

Fax: 800-2IBM-FAX (242-6329)

For IBM representative: askibm@ca.ibm.com

For IBM Business Partner: pwcs@us.ibm.com

IBM Digital Sales Offices
3600 Steeles Ave. East
Markham, ON L3R 9Z7, CA
H7

The IBM Digital Sales Center, our national direct marketing organization, can add your name to the mailing list for catalogues of IBM products.

Note: Shipments will begin after the planned availability date.

Trade-marks

IBM LinuxONE Rockhopper, IBM LinuxONE, IBM LinuxONE Emperor II, ECKD, PR/SM, z13s, z10 and Electronic Service Agent are trade-marks of IBM Corporation in the United States, other countries, or both.

IBM, Resource Link, Global Technology Services, FICON, Express, IBM z Systems, z/VM, z Systems, z/Architecture, z13, IBM z, Redbooks and zEnterprise are registered trade-marks of IBM Corporation in the United States, other countries, or both.

Linux is a registered trade-mark of Linus Torvalds in the United States, other countries, or both.

Oracle and Java are trade-marks of Oracle and/or its affiliates in the United States, other countries, or both.

Other company, product, and service names may be trade-marks or service marks of others.

Trade-mark owned by International Business Machines Corporation and is used under license by IBM Canada Ltd.

® Registered trade-mark of International Business Machines Corporation and is used under license by IBM Canada Ltd.

(**) Company, product or service name may be a trade-mark or service mark of others.

Terms of use

IBM products and services which are announced and available in your country can be ordered under the applicable standard agreements, terms, conditions, and prices in effect at the time. IBM reserves the right to modify or withdraw this announcement at any time without notice. This announcement is provided for your information only. Additional terms of use are located at

[Terms of use](#)

For the most current information regarding IBM products, consult your IBM representative or reseller, or go to the [IBM worldwide contacts page](#)

[IBM Canada](#)

Corrections

(Corrected on October 29, 2018)

The name of feature #0103 was corrected.

(Corrected on October 24, 2018)

The name of feature #0104 was corrected.

(Corrected on June 6, 2018)

Updates were made to the Physical specifications and Prices sections.