

Trademarks

IBM, the IBM logo, and ibm.com are trademarks or registered trademarks of International Business Machines Corporation, registered in many jurisdictions worldwide. Other product and service names might be trademarks of IBM or other companies. A current list of IBM trademarks is available on the web at "Copyright and trademark information" at <http://www.ibm.com/legal/copytrade.shtml>

The following terms are trademarks or registered trademarks of International Business Machines Corporation, and might also be trademarks or registered trademarks in other countries.

AIX®	IBM Instana™	PowerHA®
DS8000®	IBM Security®	PowerPC®
Easy Tier®	IBM Spectrum®	PowerVM®
HyperSwap®	IBM Z®	QRadar®
IBM®	Instana®	Redbooks®
IBM Cloud®	Micro-Partitioning®	Redbooks (logo)  ®
IBM Cloud Pak®	POWER®	Storwize®
IBM Elastic Storage®	Power Architecture®	Tivoli®
IBM FlashCore®	Power8®	Turbonomic®
IBM FlashSystem®	Power9®	

The following terms are trademarks of other companies:

Intel, Intel logo, Intel Inside logo, and Intel Centrino logo are trademarks or registered trademarks of Intel Corporation or its subsidiaries in the United States and other countries.

The registered trademark Linux® is used pursuant to a sublicense from the Linux Foundation, the exclusive licensee of Linus Torvalds, owner of the mark on a worldwide basis.

LTO, Ultrium, the LTO Logo and the Ultrium logo are trademarks of HP, IBM Corp. and Quantum in the U.S. and other countries.

Red Hat, Ansible, OpenShift, are trademarks or registered trademarks of Red Hat, Inc. or its subsidiaries in the United States and other countries.

UNIX is a registered trademark of The Open Group in the United States and other countries.

VMware, and the VMware logo are registered trademarks or trademarks of VMware, Inc. or its subsidiaries in the United States and/or other jurisdictions.

Other company, product, or service names may be trademarks or service marks of others.

Preface

This IBM Redpaper publication is a comprehensive guide that covers the IBM Power E1050 (9043-MRX) server. The Power E1050 uses the latest IBM Power10 processor-based technology and supports IBM AIX® and Linux operating systems (OSs). The goal of this paper is to provide an analysis of the hardware architecture and highlight the changes, new technologies, and major features that are being introduced in this system, such as:

- ▶ The latest IBM Power10 processor design, including the dual-chip module (DCM) packaging, which is available in various configurations (12 - 24 cores per socket).
- ▶ Support of up to 16 TB of memory.
- ▶ Native Peripheral Component Interconnect Express (PCIe) 5th generation (Gen5) connectivity from the processor socket to deliver higher performance and bandwidth for connected adapters.
- ▶ Open Memory Interface (OMI) connected Differential Dual Inline Memory Module (DDIMM) memory cards delivering increased performance, resiliency, and security over industry-standard memory technologies,
- ▶ Transparent memory encryption that uses on-chip encryption acceleration to provide a high level of security without a performance impact.
- ▶ Enhanced internal storage performance by using native PCIe-connected Non-volatile Memory Express (NVMe) devices in up to 10 internal storage slots to deliver up to 64 TB of high-performance, low-latency storage in a single 4-socket system.
- ▶ Consumption-based pricing in the IBM Power Private Cloud with Shared Utility Capacity commercial model enables customers to consume resources more flexibly and efficiently, including AIX, Red Hat Enterprise Linux (RHEL), SUSE Linux Enterprise Server, and Red Hat OpenShift Container Platform workloads.

This publication is for professionals who want to acquire a better understanding of IBM Power products. The intended audience includes the following roles:

- ▶ IBM Power customers
- ▶ Sales and marketing professionals
- ▶ Technical support professionals
- ▶ IBM Business Partners
- ▶ Independent software vendors (ISVs)

This edition adds information about important new technology advancements that were introduced since the original announcement of the Power E1050:

- ▶ New DDR5 technology memory that provides higher memory throughput.
- ▶ A new PCIe Gen4 I/O Expansion Drawer that provides improved throughput and performance for attached devices.
- ▶ A new NVMe based disk drawer that provides additional native NVMe connected storage capacities.

This paper expands the set of IBM Power documentation by providing a desktop reference that offers a detailed technical description of the Power E1050 Midrange server model. This paper does not replace the current marketing materials and configuration tools. It is intended as an extra source of information that, together with existing sources, can be used to enhance your knowledge of IBM® server solutions.

Authors

This paper was produced by a team of specialists from around the world working at IBM Redbooks, Poughkeepsie Center.

Tim Simon is an IBM Redbooks® Project Leader who is based in Tulsa, Oklahoma, US. He has over 40 years of experience with IBM, primarily in a technical sales role working with customers to help them create IBM solutions to solve their business problems. He holds a BS degree in Math from Towson University in Maryland. He has worked with many IBM products and has extensive experience creating customer solutions by using IBM Power, IBM Storage, and IBM Z® throughout his career.

Dean Mussari is an IBM Power Brand Technical Specialist in the National Market in the US. He recently came to IBM, bringing 35 years of experience working with IBM servers and storage solutions in large retail environments. His main area of expertise is Power servers with a focus on IBM i. He holds a masters degree in computer science from Loyola University of Chicago.

Tsvetomir Spasov is a Power Servers Hardware Product Engineer in Sofia, Bulgaria. He has 8 years of experience with IBM in RTS, SME, and PE roles. His main area of expertise is Hardware Management Console (HMC), FSP, eBMC, POWERLC, and GTMS. He holds a masters degree in Electrical Engineering from Technical University of Sofia.

Thanks to the following people for their contributions to the previous edition of this publication REDP-5684-00 published August 31,2022.

Authors:

Scott Vetter, Giuliano Anselmi, Marc Gregorutti, Stephen Lutz, Michael Malicdem, Guido Somers, Tsvetomir Spasov

Additional contributors:

Jesse P Arroyo, Irving Baysah, Nigel Griffiths, Sabine Jordan, Charles Marino, Hariganesh Muralidharan, Hoa Nguyen, Ian Robinson, William Starke, Edward M.H. Tam, Madeline Vega

IBM

Vincencio Michaelis

Bosch

Now you can become a published author, too!

Here's an opportunity to spotlight your skills, grow your career, and become a published author—all at the same time! Join an IBM Redbooks residency project and help write a book in your area of expertise, while honing your experience using leading-edge technologies. Your efforts will help to increase product acceptance and customer satisfaction, as you expand your network of technical contacts and relationships. Residencies run from two to six weeks in length, and you can participate either in person or as a remote resident working from your home base.

Find out more about the residency program, browse the residency index, and apply online at:

ibm.com/redbooks/residencies.html

Comments welcome

Your comments are important to us!

We want our papers to be as helpful as possible. Send us your comments about this paper or other IBM Redbooks publications in one of the following ways:

- ▶ Use the online **Contact us** review Redbooks form found at:
ibm.com/redbooks
- ▶ Send your comments in an email to:
redbooks@us.ibm.com
- ▶ Mail your comments to:
IBM Corporation, IBM Redbooks
Dept. HYTD Mail Station P099
2455 South Road
Poughkeepsie, NY 12601-5400

Stay connected to IBM Redbooks

- ▶ Find us on LinkedIn:
<http://www.linkedin.com/groups?home=&gid=2130806>
- ▶ Explore new Redbooks publications, residencies, and workshops with the IBM Redbooks weekly newsletter:
<https://www.redbooks.ibm.com/Redbooks.nsf/subscribe?OpenForm>
- ▶ Stay current on recent Redbooks publications with RSS Feeds:
<http://www.redbooks.ibm.com/rss.html>

Summary of changes

This section describes the technical changes that were made in this edition of the paper and in previous editions. This edition might also include minor corrections and editorial changes that are not identified.

Summary of Changes
for IBM Power E1050 Technical Overview and Introduction
as created or updated on November 20, 2024.

November 2024, Second Edition

This revision includes the following new and changed information.

New information

- ▶ Added information about new DDR5 memory support.
- ▶ Added information about the PCIe Gen4 I/O Expansion Drawer.
- ▶ Added information about the NED24 NVMe Expansion Drawer.

Changed information

- ▶ Noted that the SAS24EX SAS expansion drawer was withdrawn from marketing.
- ▶ Noted that the PCIe Gen3 I/O expansion drawer was withdrawn from marketing.
- ▶ Updated the list of PCIe adapters that are supported.
- ▶ Other minor changes and corrections.



IBM Power E1050 overview

This chapter provides a general description of the new IBM Power E1050 (9043-MRX) server, which is a logical follow-on to the IBM Power E950. The IBM Power E1050 server is an enhanced enterprise class four-socket, 4U server that provides massive scalability and flexibility. These systems are agile and deliver extreme density in an energy-efficient design with best in class reliability and resiliency. They provide enterprise clients with a secure environment that balances mission-critical and modernization applications to deliver a frictionless, hybrid cloud experience.

The following topics are covered in this chapter:

- ▶ 1.1, “System overview” on page 2
- ▶ 1.2, “Operating environment” on page 6
- ▶ 1.3, “Physical package” on page 8
- ▶ 1.4, “System features” on page 9
- ▶ 1.5, “Minimum configuration” on page 11
- ▶ 1.6, “PCIe adapter slots” on page 13
- ▶ 1.7, “Operating system support” on page 15
- ▶ 1.8, “Hardware Management Console overview” on page 21
- ▶ 1.9, “IBM Power solutions” on page 29
- ▶ 1.10, “IBM Power platform modernization” on page 33

1.1 System overview

The Power E1050 server is suited for cloud deployments due to its built-in virtualization capabilities, flexible capacity, and high performance. The model number for this server is 9043-MRX. It features a single enclosure that is four EIA units (4U) and can be configured with two, three, or four dual-chip modules (DCMs). There are three processor options that are available for this server:

- ▶ Twelve cores running at a typical 3.35 - 4.00 GHz (max) frequency range
- ▶ Eighteen cores running at a typical 3.20 - 4.00 GHz (max) frequency range
- ▶ Twenty-four cores running at a typical 2.95 - 3.90 GHz (max) frequency range

A Power E1050 server with four 24-core DCMs offers the maximum of 96 cores and processor cores can run up to eight simultaneous threads to deliver greater throughput. All sockets must be populated with the same processor modules.

Figure 1-1 shows the Power E1050 server.



Figure 1-1 The Power E1050 server

Figure 1-2 shows a top view of the Power E1050 server with the top lid removed.

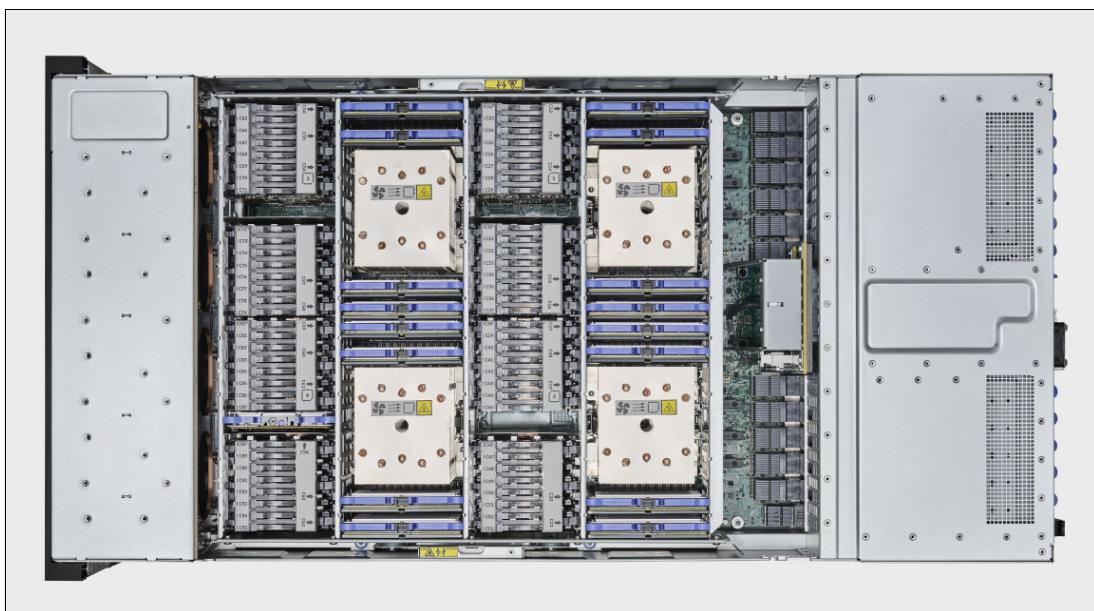


Figure 1-2 Top view of the Power E1050 server with the top lid removed

Under the left metal plate are the fans and Non-Volatile Memory Express (NVMe) slots, as depicted in Figure 1-3. Moving right, you next see the memory slots that are associated with the processors to the right of that memory column. Moving further to the right, there is another column of memory slots that are linked to the processors at the right of them. Under the metal plate at the right edge are the four Titanium-class 2300W power supplies and the 11 Peripheral Component Interconnect Express (PCIe) slots, as shown in Figure 1-4. The airflow direction is from the front to the rear of the server, which, in Figure 1-2 on page 2, is from left to right.

Figure 1-3 shows the front view of a Power E1050 server with the front bezel removed.

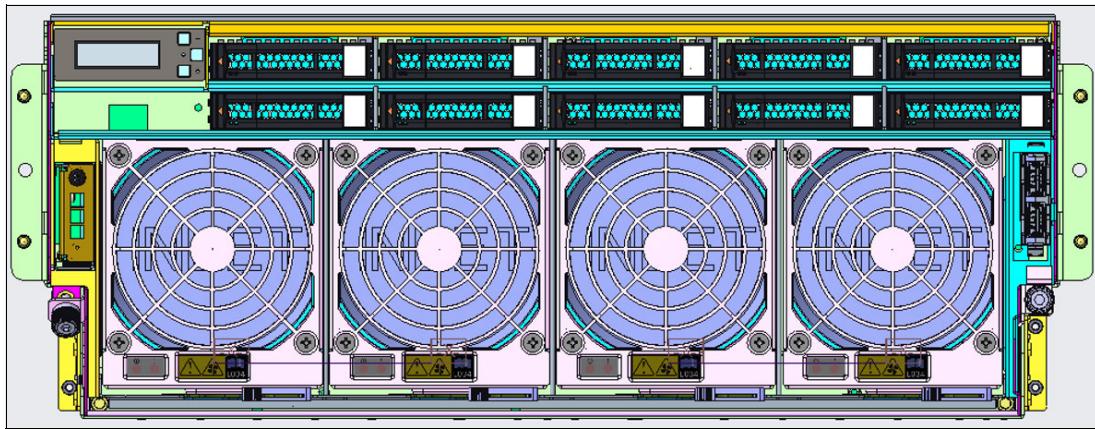


Figure 1-3 Front view of the Power E1050 server

Figure 1-4 shows the rear view of the Power E1050 server. The leftmost slot (P0-C0) is the enterprise Baseboard Management Controller (eBMC) Service Processor Card, and then there are five PCIe slots. On the right side are six more adapter slots.

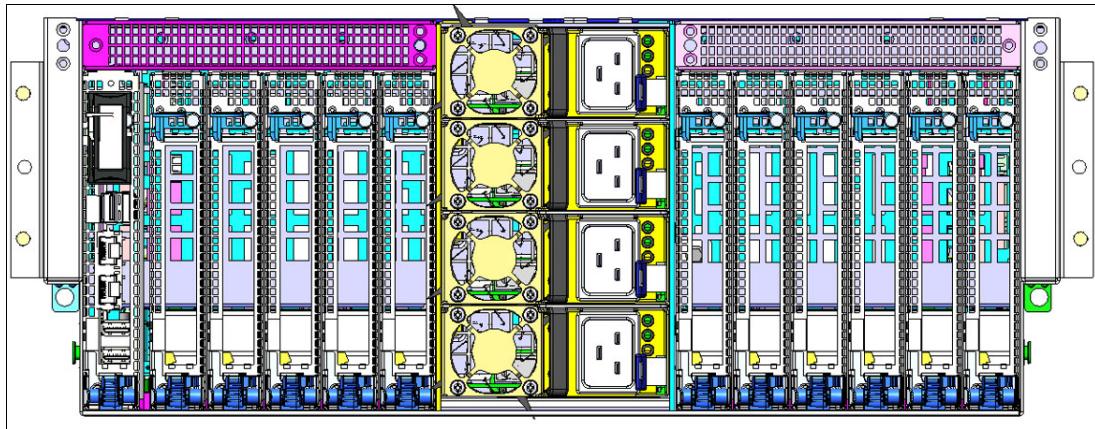


Figure 1-4 Rear view of the Power E1050 server

System features

Each processor module that is added to the system offers 16 Open Memory Interface (OMI) slots that can be populated with 4U Differential Dual Data Rate DIMMs (DDIMMs). These DDIMMs incorporate either Double Data Rate 4 (DDR4) or Double Data Rate 5 (DDR5) memory chips that deliver a memory bandwidth of up to 409 GBps peak transfer rates per socket for the DDR4-based memory and 819 GBps peak transfer for the DDR5-based memory. With four processor modules, the Power E1050 server provides 64 OMI slots that support up to 16 TB of memory and a maximum peak transfer rate of 3,276 GBps.

Restriction: An IBM Power E1050 can be configured only with DDR4-based memory or DDR5-based memory. Mixing of the two types of memory is not allowed.

The Power E1050 server provides state-of-the-art PCIe Gen5 connectivity. Up to 11 PCIe slots are provided in the system unit with different characteristics:

- ▶ Six PCIe Gen4 x16 or PCIe Gen5 x8 slots
- ▶ Two PCIe Gen5 x8 slots
- ▶ Three PCIe Gen4 x8 slots

The number of available slots depends on the number of available processor modules. For more information about the system diagram, see Figure 2-1 on page 36.

Note: Although some slots are x8 capable only, all connectors in the system have x16 connectors.

If more slots are needed, up to four I/O expansion drawers, either Gen4 or Gen3,¹ with two fanout modules each can be added to the system. Each fanout module provides six slots. With eight fanout modules in four I/O drawers, the maximum number of available slots is 51. It is possible to mix Gen3 and Gen4 drawers within a system.

The PCIe slots can be populated with a range of adapters covering local area network (LAN), Fibre Channel (FC), serial-attached SCSI (SAS), Universal Serial Bus (USB), and cryptographic accelerators. At least one network adapter must be included in each system.

The Power E1050 server offers up to 10 internal NVMe U.2 flash bays that can be equipped with 800 GB U.2 Mainstream NVMe drives or U.2 Enterprise class NVMe drives in different sizes up to 6.4 TB. Each NVMe device is connected as a separate PCIe endpoint and can be assigned individually to VMs for best flexibility. The 10 NVMe bays offer a maximum of 64 TB internal storage. For all 10 NVMe bays to be available, the server must be populated with all four processor cards. With two or three processor cards, the server can be populated with six NVMe devices.

The Power E1050 server does not have internal spinning SAS drives. However, it is possible to attach 19-inch disk expansion drawers that offer SFF Gen2-carrier bays for SAS disks. For more information, see 2.4, “Internal I/O subsystem” on page 66.

Dynamic configuration capabilities and virtualization

In addition to extensive hardware configuration flexibility, the Power E1050 server offers Elastic Capacity on Demand (Elastic CoD) to temporarily activate processor cores and memory. Also included is IBM Active Memory Expansion, which uses data compression to expand the available memory for AIX partitions; and Active Memory Mirroring (AMM), which mirrors critical memory segments that are used by the hypervisor.

For optimal flexibility, the Power E1050 server can be integrated into an IBM Power Private Cloud with Shared Utility Capacity pool, also known as IBM Power Enterprise Pool 2.0. This pool can include Power E1050 servers, Power E950 servers, or a combination of both. Within the pool, a base capacity (of processor cores, memory, and OS licenses or subscriptions) is purchased and available for usage across any servers in the pool.

¹ The PCIe Gen3 I/O drawer was withdrawn from marketing. It is still supported for use on the Power E1050.

All additional resources that are installed on the servers in the pool are activated as available for usage. If the total usage of resources in the pool (metered on a per-minute basis) exceeds the sum of the purchased Base Capacity within the pool, the excess usage is billed to the customer. Billing can be either prepaid by purchasing credits in advance or post-paid, with IBM generating a monthly invoice in the latter case. For more information about IBM Power Enterprise Pools see *IBM Power Systems Private Cloud with Shared Utility Capacity: Featuring Power Enterprise Pools 2.0*, SG24-8478,

The Power E1050 server includes IBM PowerVM® Enterprise Edition to deliver virtualized environments and support a frictionless hybrid cloud experience. Workloads can run the AIX, and Linux operating systems (OSs), including the Red Hat OpenShift Container Platform. IBM i is not a supported OS on the Power E1050 server.

The Power E1050 server also provides strong resiliency characteristics, which include Power10 chip capabilities and memory protection. The new 4U DDIMMs that are used in the Power E1050 server offer an enhanced buffer, N+1 voltage regulation, and spare dynamic RAM (DRAM) technology. Also, technologies like Chipkill with advanced error correction code (ECC) protection are included, and transparent Power10 memory encryption with no performance impact. This technology is the same enterprise class technology that is used in the Power E1080 server.

Other resiliency features that are available in the Power E1050 server are hot-plug NVMe bays, hot-plug PCIe slots, redundant and hot-plug power supplies, hot-plug redundant cooling fans, hot-plug Time of Day battery, and even highly resilient architecture for power regulators.

Table 1-1 shows a summary of features of the Power E1050 server.

Table 1-1 Power E1050 server feature summary

Feature	Comments
Processors	12, 18, or 24 CPU cores per socket.
Sockets	Four sockets are available. 2, 3, or 4 sockets may be populated.
Memory	<ul style="list-style-type: none"> ▶ Up to 64 OM1 slots that can be equipped with 4U DDIMMs. ▶ DDIMM sizes are 32, 64, 128, and 256 GB. ▶ 8 TB 16 TB maximum memory.
Integrated PCIe	<ul style="list-style-type: none"> ▶ Six PCIe Gen4 16-lane or PCIe Gen5 8-lane slots. ▶ Two PCIe Gen5 8-lane slots. ▶ Three PCIe Gen4 8-lane slots. ▶ PCIe slots are full-high and half-length, and use blind-swap cassettes (BSCs).
Internal NVMe Flash bays	Up to 10 U.2 NVMe bays for 15-mm NVMe drives or 7-mm NVMe drives in a 15-mm carrier.
Internal USB ports	USB 3.0. Two front and two rear.
Media bays	DVD through an external USB DVD.
Maximum I/O drawers	Four PCIe Gen3 I/O drawers (#EMX0).
External storage drawers	Up to 64 EXP12SX or ESP24SX drawers.

Table 1-2 shows the major differences between the Power E950 and Power E1050 servers.

Table 1-2 Comparing the Power E950 and Power E1050 servers

Features	Power E950 server	Power E1050 server
Processor	IBM Power9® (single-chip module (SCM))	Power10 (DCM)
Sockets	2 - 4	2 - 4
Maximum cores	32, 40, 44, or 48	48, 72, or 96
Maximum memory	16 TB	16 TB
DIMM type and DIMM slots count	Up to 128 industry-standard DIMMs	Up to 64 DDIMMs
L4 cache	Yes	Yes
Memory bandwidth	920 GBps	3.276 GBps
Memory DRAM spare	Yes	Yes
I/O expansion slots	Yes	Yes
PCIe slots	11 (eight Gen4 16-lane + two Gen4 8-lane + one Gen3 slots)	11 (six Gen5 x8/Gen4 x16 + two Gen5 x8 + three Gen4 x8 slots)
Acceleration ports	Eight (CAPI 2.0 + IBM OpenCAPI)	Six (IBM OpenCAPI)
PCIe hot-plug support	Yes + blind swap	Yes + blind swap
IO bandwidth	630 GBps	756 GBps
Internal storage bays	12 (eight SAS + four NVMe drives)	10 (10 NVMe drives)
Internal storage controllers	Optional Concurrently maintainable	Optional Concurrently maintainable

1.2 Operating environment

Table 1-3 details the operating environment for the Power E1050 server.

Table 1-3 Operating environment for the Power E1050 server

Power E1050 operating environment		
System	Power E1050 server	
Item	Operating	Non-operating
Temperature	Recommended: 18 - 27 °C (64.4 - 80.6 °F) Allowable: 5 - 40 °C (41.0 - 140.0 °F)	5 - 45 °C (41.0 - 113.0 °F)
Relative humidity	8 - 80%	5 - 85%
Maximum dew point	24 °C (75.2 °F)	27 °C (80.6 °F)
Operating voltage	200 - 240 V AC	N/A

Power E1050 operating environment		
System	Power E1050 server	
Operating frequency	50 - 60 Hz +/- 3 Hz AC	N/A
Maximum power consumption	5,200 W maximum	N/A
Maximum power source loading	5.36 kVA maximum	N/A
Maximum thermal output	17,742 BTU per hour	N/A
Maximum altitude	3,050 m (10,000 ft.)	N/A
Maximum noise level	8.2 bels LwAm (heavy workload on one maximally configured 4-socket enclosure, 2 TB memory, 25°C, 500 m)	N/A

Note: IBM does not recommend operation above 27 °C, but you can expect full performance up to 35 °C for these systems. Above 35 °C, the system is capable of operating, but possible reductions in performance might occur to preserve the integrity of the system components. Above 40 °C, there might be reliability concerns for components within the system.

Environmental assessment: The [IBM Systems Energy Estimator tool](#) can provide more accurate information about the power consumption and thermal output of systems that are based on a specific configuration, including adapters and I/O expansion drawers.

Note: The derate maximum allowable dry-bulb temperature is 1°C (1.8°F) per 175 m (574 ft) above 900 m (2,953 ft), with up to a maximum allowable elevation of 3050 m (10,000 ft).

Government regulations, such as those prescribed by the Occupational Safety and Health Administration (OSHA) or European Community Directives, may govern noise level exposure in the workplace, which might apply to you and your server installation. The Power E1050 is available with an optional acoustical door feature that can help reduce the noise that is emitted from this system.

The actual sound pressure levels in your installation depend upon various factors, including the number of racks in the installation, the size, materials, and configuration of the room where you designate the racks to be installed, the noise levels from other equipment, the ambient room temperature, and employees' location in relation to the equipment.

Compliance with such government regulations also depends on many more factors, including the duration of employees' exposure and whether employees wear hearing protection. As a best practice, consult with qualified experts in this field to determine whether you are in compliance with the applicable regulations.

1.3 Physical package

The system node requires 4U and the PCIe I/O expansion drawer requires 4U. Thus, a single-enclosure system with one PCIe I/O expansion drawer requires 8U.

Table 1-4 lists the physical dimensions of the system node and the PCIe Gen3 I/O Expansion Drawer.

Table 1-4 Physical dimensions of the system node and the PCIe Gen3 I/O Expansion Drawer

Dimension	Power E1050 system node	PCIe I/O expansion drawer
Width	448 mm (17.6 in.)	448 mm (17.6 in.)
Depth	902 mm (35.5 in.)	736.6 mm (29.0 in.)
Height	175 mm (6.9 in.) four EIA units	177.8 mm (7.0 in.) four EIA units
Weight	69 kg (153 lb)	54.4 kg (120 lb)

To help ensure installability and serviceability in non-IBM industry-standard racks, review the installation planning information for any product-specific installation requirements.

Note: The EMX0 remote I/O drawer connection in the T42 and S42 racks stops the rear door from closing, so you must have the 8-inch rack extensions.

Figure 1-5 shows the front view of the Power E1050 server.



Figure 1-5 Front view of the Power E1050 server

1.4 System features

This section covers the standard system features that are included in the Power E1050 server.

1.4.1 Power E1050 server features

This summary describes the standard features that are available on the Power E1050 (9043-MRX) server model:

- ▶ The Power E1050 supports 24 - 96 processor cores with 2 - 4 Power10 processor modules.
- ▶ The Power E1050 delivers 256 GB to 16 TB high-performance DDR4 or DDR5 memory with an L4 cache.
- ▶ A Power E1050 server supports up to 10 NVMe drives.
- ▶ Up to 11 hot-swap PCIe slots may be in the system unit:
 - Six PCIe Gen5 x8 or Gen4 x16 slots.
 - Three PCIe Gen4 x8 slots.
 - Two PCIe Gen5 x 8 slots.
 - With two processor modules, there are seven PCIe slots; with three modules and four modules, there are 11 PCIe slots.
- ▶ The PCIe I/O Expansion Drawer (#EMX0 or #EMZ0) expands the number of full-high, hot-swap slots:
 - Up to two PCIe drawers with two processor modules (a maximum of 31 slots on the server).
 - Up to four PCIe drawers with four processor modules (a maximum of 51 slots on the server).
- ▶ The IBM Power E1050 can support up to 64 EXP24SX SFF Drawers, providing a total of 1,536 SAS bays for disks or SSDs. Although the EXP24SX is no longer actively marketed, it remains a supported option.

For a more cost-effective and higher-performing solution, consider the NED24 NVMe Expansion Drawer. Each NED24 drawer can accommodate up to 24 NVMe drives, offering up to 154 TB of storage capacity. The Power E1050 can support a maximum of two NED24 drawers. Each drive in the NED24 is individually addressable and can be assigned to an AIX, Linux, or a Virtual I/O Server (VIOS) partition.

- ▶ System unit I/O (integrated I/O):
 - USB 3.0 ports: four 3.0 ports, two front and two rear.
 - USB 2.0 ports: two rear 2.0 ports for limited use.
 - HMC ports: two 1 GbE RJ45.
- ▶ Four hot-plug and redundant power supplies 2300 W (200 – 240 V AC) (#EB39).
- ▶ System unit only 4U in a 19 inch rack-mounted hardware.
- ▶ Primary OS:
 - AIX (#2146): small-tier licensing.
 - Linux (#2147): Red Hat Enterprise Linux (RHEL) and SUSE Linux Enterprise Server.

Processor modules

- ▶ The Power E1050 supports 24 - 96 processor cores:
 - Twelve-core typical 3.35 – 4.0 GHz (max) #EPEU Power10 processor.
 - Eighteen-core typical 3.20 – 4.0 GHz (max) #EPEV Power10 processor.
- ▶ Twenty-four-core typical 2.95 – 3.90 GHz (max) #EPGW Power10 processor.
- ▶ A minimum of two and a maximum of four processor modules are required for each system. The modules can be added to a system later through a Miscellaneous Equipment Specification (MES) upgrade, but the system requires scheduled downtime to install. All processor modules in one server must be of the same frequency (same processor module feature number), that is, you cannot mix processor modules of different frequencies.
- ▶ Permanent CoD processor core activations are required for the first processor module in the configuration and are optional for any additional modules. Specifically:
 - Two, three, or four 12-core typical 3.35 – 4.0 GHz (max) processor modules (#EPEU) require 12 processor core activations (#EPUR) at a minimum.
 - Two, three, or four 18-core typical 3.20 – 4.0 GHz (max) processor modules (#EPEV) require 18 processor core activations (#EPUS) at a minimum.
- ▶ Two, three, or four 24-core typical 2.95 – 3.90 GHz (max) processor modules (#EPGW) require 24 processor core activations (#EPYT) at a minimum.
- ▶ Temporary CoD capabilities are optionally available for processor cores that are not permanently activated. An HMC is required for temporary CoD.

System memory

- ▶ 256 GB - 16 TB high-performance memory up to 3200 MHz DDR4 or DDR5 OMI:
 - DDR5 options:
 - 64 GB DDIMM Memory (#EMFH)
 - 128 GB DDIMM Memory (#EMFJ)
 - 256 GB DDIMM Memory (#EMFK)
 - 512 GB DDIMM Memory (#EMFL)
 - DDR4 options:
 - 64 GB DDIMM Memory (#EM75)
 - 128 GB DDIMM Memory (#EM76)
 - 256 GB DDIMM Memory (#EM77)
 - 512 GB DDIMM Memory (#EM7J)
 - Optional Active Memory Expansion (#EMBM).
 - Mixed DIMM size support (#EMCM).²
- ▶ As your memory requirements increase, the system capabilities increase as follows:
 - With two processor modules installed, 32 DDIMM slots are available. The minimum memory is 256 GB.
 - With three processor modules installed, 48 DDIMM slots are available. The minimum memory is 384 GB.
 - With four processor modules installed, 64 DDIMM slots are available. The minimum memory is 512 GB. Sixteen DDIMMs are available per socket.
 - The more DDIMM slots that are filled, the larger the bandwidth that is available to the server.

² IBM now offers a mixed DIMM memory feature (#EMCM) for the Power E1050, which enables the mixing of 128 GB (#EM77) and 256 GB (#EMJ7) DIMMs in a 50:50 ratio.

Permanent CoD memory activations are required for at least 50% of the physically installed memory or 256 GB of activations, whichever is larger. Use 1 GB activation (#EMCP) and 100 GB activation (#EMCQ) features to order permanent memory activations.

Temporary CoD for memory is available for memory capacity that is not permanently activated. Temporary CoD activations are delivered through Virtual Capacity machine type and model (4586-COD) by using the IBM Entitled Systems Support process. An HMC is required for temporary CoD.

Notes: Memory is ordered in a quantity of eight of the same memory feature.

- ▶ The minimum memory that is supported per two Power10 processors that are installed is 256 GB.
- ▶ The minimum memory that is supported per three Power10 processors that are installed is 384 GB.
- ▶ The minimum memory that is supported per four Power10 processors that are installed is 512 GB.

Storage options

The Power E1050 supports up to 10 NVMe 7 mm or 15-mm drives:

- ▶ Six NVMe drives within a two or three-socket configuration
- ▶ Ten NVMe drives within a four-socket configuration

All NVMe drives are driven directly from the system backplane with no PCIe card or cables required.

The 7-mm NVMe drives from the IBM Power E950 are also supported on the Power E1050 with a carrier conversion feature that is offered to hold these drives.

1.5 Minimum configuration

Minimum configuration describes the most basic parts of the Power E1050 server in an initial order that are required to have a fully working environment. This configuration was tested, validated, and certified by an IBM development team. The Power E1050 server model belongs to the mid-range category, and it can scale up vertically through physical add-on upgrades and resource activations of inactive processors and memory capacity, otherwise known as Capacity Upgrade on Demand (CUoD).

The Power E1050 server is a 4-socket based processor where the first two sockets at a minimum must be populated. As for the memory DIMM slots, four out of 16 per socket must be inserted. The smallest set is 256 GB.

Table 1-5 lists the minimum features of a Power E1050 server configuration.

Table 1-5 Selecting the minimum configuration for the Power E1050 server

Feature	Feature Code	Feature Code description	Minimum quantity
Primary OS Feature Code	► #2146 ► #2147	► Primary OS Indicator-AIX ► Primary OS Indicator-Linux	1
Heat sink + thermal interface material (TIM) pad	► #EPLU ► #EPLV	► Front Heat Sink + TIM PAD (For MRX) ► Rear Heat Sink + TIM PAD (For MRX)	► 1 ► 1 Note: Applies to base two sockets populated.
Processor card	► #EPEU ► #EPEV ► #EPGW	► 12-core typical 3.35 - 4.0 GHZ (max) processor ► 18-core typical 3.20 - 4.0 GHZ (max) processor ► 24-core typical 2.95 - 3.90 GHZ (max) processor	Two of any processor Feature Code, and they must be the same.
Processor activation	AIX or Virtual I/O Server (VIOS): ► #EPUR ► #EPUS ► #EPYT Linux only: ► #EPUN ► #EPUP ► #EPUM	AIX or VIOS: ► One core Processor Activation for #EPEU ► One core Processor Activation for #EPEV ► One core Processor Activation for #EPGW Linux only: ► One core Processor Activation for #EPEU Linux only ► One core Processor Activation for #EPEV Linux only ► One core Processor Activation for #EPGW Linux only	AIX or VIOS: ► 12 ► 18 ► 24 Linux only: ► 12 ► 18 ► 24
Memory DIMM	► #EM75 ► #EM76 ► #EM77 ► #EM7J ► #EMFH ► #EMFJ ► #EMFK ► #EMFL	► 64 GB (2 x 32 GB) DDR4 Memory DIMM ► 128 GB (2 x 64 GB) DDR4 Memory DIMM ► 256 GB (2 x 128 GB) DDR4 Memory DIMM ► 512 GB (2 x 256 GB) DDR4 Memory DIMM ► 64 GB (2 x 32 GB) DDR5 Memory DIMM ► 128 GB (2 x 64 GB) DDR5 Memory DIMM ► 256 GB (2 x 128 GB) DDR5 Memory DIMM ► 512 GB (2 x 256 GB) DDR5 Memory DIMM	Four of the Feature Code for a base 2-socket. ^a
Memory activation	#EMCP	1 GB Memory Activation for MRX	256 GB or 50% memory that is installed, whichever is higher.
NVMe backplane	#EJ0Q	10 NVMe U.2 Flash Drive bays	1

Feature	Feature Code	Feature Code description	Minimum quantity
NVMe device	#EC5X #EC7T #ES1E #ES1G #ES3E	<ul style="list-style-type: none"> ► Mainstream 800 GB SSD PCIe3 NVMe U.2 module for AIX or Linux ► 800 GB Mainstream NVMe U.2 SSD 4k for AIX or Linux ► Enterprise 1.6 TB SSD PCIe4 NVMe U.2 module for AIX or Linux ► Enterprise 3.2 TB SSD PCIe4 NVMe U.2 module for AIX or Linux ► Enterprise 6.4 TB SSD PCIe4 NVMe U.2 module for AIX or Linux 	One of any of these Feature Codes. Note: As a best practice, use two for a mirrored copy. Not required if Feature Code # 0837 (SAN Boot Specify) is selected.
Network adapter	#EC2U #EC66 #EN0W	<ul style="list-style-type: none"> ► PCIe3 2-Port 25/10Gb NIC&ROCE SR/Cu Adapter ► PCIe4 2-port 100 Gb ROCE EN adapter ► PCIe2 2-port 10/1GbE BaseT RJ45 Adapter 	Choose one of any of these Feature Codes.
Power supplies	EB39	Power Supply - 2300W for Server (200 - 240 VAC)	4
Power cord	4558	Power cord To PDU/UPS (100 - 240V/16A)	4
Language group	9300	Language Group Specify - US English	One of any language

a. IBM now offers a mixed DIMM memory feature (#EMCM) for the Power E1050, which enables the mixing of 128 GB and 256 GB DIMMs in a 50:50 ratio.

1.6 PCIe adapter slots

The Power E1050 server has up to 11 PCIe slots in the systems drawer. A mix of PCIe Gen5 and Gen4 general-purpose hot-plug slots can deliver configuration flexibility and expandability. Two adapter slots are PCIe Gen5 8-lane, three adapter slots are PCIe Gen4 8-lane, and six adapter slots are Gen4 16-lane or Gen5 8-lane. All adapter slots are full-height, half-length in size. BSCs are used to house the adapter in the system unit for installation, removal, and service from the rear of the system. All the PCIe slots are single-root I/O virtualization (SR-IOV) capable.

The 16-lane slots can provide up to twice the bandwidth of the 8-lane slots because they offer twice as many PCIe lanes. PCIe Gen5 slots can support up to twice the bandwidth of PCIe Gen4 slots and up to four times the bandwidth of a PCI Gen3 slot, assuming an equivalent number of PCIe lanes. PCIe Gen1, PCIe Gen2, PCIe Gen3, PCIe Gen4, and PCIe Gen5 adapters can be plugged into a PCIe Gen5 slot, if that adapter is supported. The 16-lane slots can be used to attach PCIe Gen3 or PCIe Gen4 I/O expansion drawers.

Table 1-6 shows the number of slots that is supported by the number of processor modules.

Table 1-6 Available PCIe slots

Processor modules	2-socket	3-socket or 4-socket
x16 Gen5 or four slots (CAPI-capable)	2	6
x8 Gen4 slots	3	3
x8 Gen5 slots	2	2

Notes:

- ▶ The PCIe Genx8 slot, C1, is reserved for an Ethernet adapter to help ensure proper manufacture and test of the server.
- ▶ Each NVMe SSD interface is a Gen4 x4 PCIe bus. The NVMe drives can be in an OS-controlled RAID 0, RAID 1 array. Hardware RAID is not supported on the NVMe drives.
- ▶ This server has an energy-efficient design for cooling the PCIe adapter environment. The server can sense which IBM PCIe adapters are installed in their PCIe slots. If an adapter is known to require higher levels of cooling, the server automatically speeds up fans to increase airflow across the PCIe adapters.
- ▶ The terms “16-lane” and “x16” and “8-lane” and “x8” are interchangeably used in this case with the same meaning.

Figure 1-6 shows the 11 PCIe adapter slots location with labels for the Power E1050 server model.

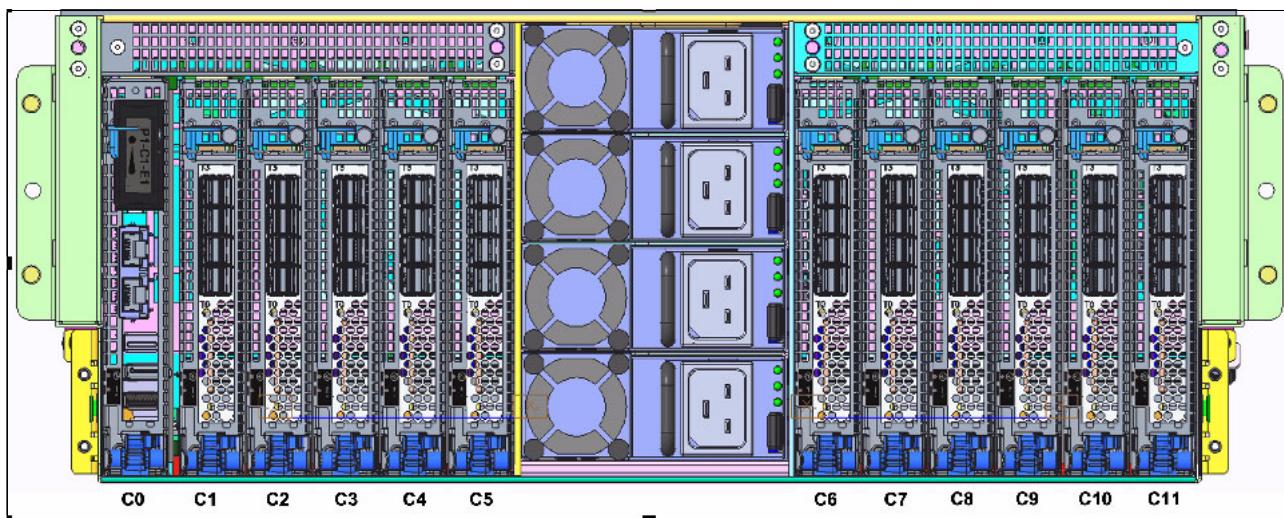


Figure 1-6 PCIe adapter slot locations on the Power E1050 server

Slot C0 is not included in the list. It is meant for only the eBMC service processor card. The total number of PCIe adapter slots that is available can be increased by adding one or more PCIe Gen3 I/O expansion drawers (#EMX0). The maximum number depends on the number of processor modules physically installed. The maximum is independent of the number of processor core activations.