



# IBM LinuxONE Emperor 4



The digital transformation of business, institutions and society is accelerating faster than ever. A sustainable IT infrastructure is a component in business strategy, providing essential capabilities to deliver scalable value and services in highly competitive markets in the digital economy, while protecting our environment.

IBM® created the new IBM® LinuxONE Emperor 4 system to enable organizations to innovate and meet the needs of their customers and stakeholders with confidence and impact.

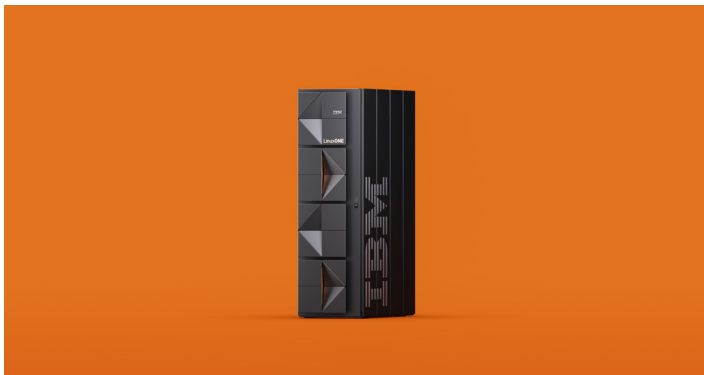
**Reduce your carbon footprint and reduce cost with an energy-efficient system.**

The new core IBM Telum™ dual processor chip on the IBM® LinuxONE Emperor 4 has 16 cores, leverages the density and efficiency of 7nm chip technology, runs at 5.2 GHz, and delivers incredible performance and massively scalable capacity to support a wide range of workloads, in an energy efficient manner.

An IBM® LinuxONE Emperor 4 can reduce the CO2e footprint by approximately 75% each year versus compared x86 servers running the same Linux® workloads under similar conditions. This is equivalent to consuming about 77,600 fewer liters (20,500 gallons) of gasoline each year (+ vehicle and home equivalencies).

IBM® LinuxONE Emperor 4 comes with up to 200 configurable cores in a single model. The IBM® LinuxONE Emperor 4 is available with five options of core capacity – Max39, Max82, Max125, Max168 and Max200.

The system offers up to 40 TB of Redundant Array of Independent Memory (RAIM) per system.

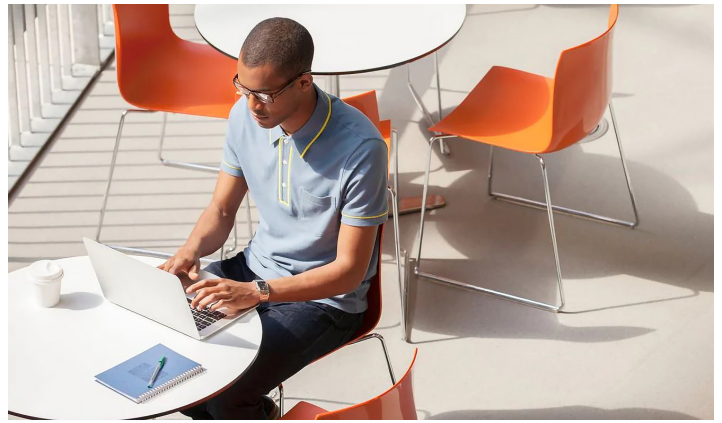


**IBM® LinuxONE Emperor 4 1-frame configuration**

**Highlights**

- Consolidating Linux workloads on 5 IBM® LinuxONE Emperor systems instead of running them on comparable x86 servers under similar conditions can reduce energy consumption by 75%, space by 50%, and the CO2e footprint by over 850 metric tons annually.<sup>1</sup>
- Reduce your I/T infrastructure costs, including software licensing, staffing and maintenance by consolidating x86 server workloads onto an IBM® LinuxONE Emperor 4 system.<sup>2</sup>
- Deliver consistent service to your customers with a massively scalable system
- Protect data now and in the future with quantum-safe cryptography<sup>4</sup>
- Build a cyber resilient environment
- Modernize for hybrid cloud to deliver new value

*Is this the world's greenest server?  
With IBM® LinuxONE Emperor 4, process up to 300 billion inference operations/day with 1ms response time using a Credit Card Fraud Detection model.<sup>3</sup>*



**Deliver consistent service with a massively scalable system**

The IBM® LinuxONE Emperor 4 is designed to deliver superior performance for mission-critical applications in transaction processing, data sharing and mixed workloads, where nothing can be compromised. The system is massively scalable with the ability to add capacity on demand and grow processing with minimal impact to energy usage, floor space and staffing.

IBM® LinuxONE is architected for balanced performance with multiple layers of cache, massive I/O capabilities, and integrated accelerators to drive high utilization and processor efficiency.

**The Integrated Accelerator for zEnterprise Data Compression (zEDC)**

The Integrated Accelerator for zEDC function can reduce your carbon footprint further by using high performance data compression to decrease data storage and communications requirements and costs, as well as increase data transfer rates to boost throughput without adversely impacting response times. The Integrated Accelerator for zEDC improves systems performance for pervasive encryption, so that customers can encrypt 100% of their data, 100% the time.

**Data privacy and protection for today and tomorrow**

The IBM® LinuxONE Emperor 4 represents a breakthrough in data security. Quantum-safe cryptography is embedded in the system to improve the resiliency to cyber-attacks from bad actors with future access to quantum computing resources. Today's cyber threats often involve harvesting encrypted data for decryption later when these resources can break today's encryption algorithms. The IBM® LinuxONE Emperor 4 represents a step forward as customers have a safe and tested infrastructure that can deploy the more sophisticated and complex cryptography needed to protect today's sensitive data from cyber risks as they emerge.

IBM continues its leadership in data security with quantum- safe security on the IBM® LinuxONE Emperor 4, extending pervasive encryption, Fibre Channel Endpoint Security and other innovative advancements that make it the most securable computing platform in the industry.

**The Integrated Accelerator for IBM AI**

The IBM® LinuxONE Emperor 4 integrates new Artificial Intelligence (AI) acceleration via an on-chip AI coprocessor to reduce latency and deliver outstanding performance for in transaction inferencing.

Now organizations can embed AI directly into business processes and existing IBM® LinuxONE applications to improve business outcomes and deliver customer value in each interaction at unprecedented scale and speed within stringent SLA response time guidelines.

### **Cyber resilient infrastructure**

The IBM® LinuxONE architecture is different by design, intentionally. Rather than being designed as a commodity, it is engineered to meet the most challenging demands of mission-critical workloads in a digital economy.

The IBM® LinuxONE Emperor 4 is designed for “7 9’s” application availability, seamless on-demand scalability and to execute disaster recovery actions to respond to unplanned events.

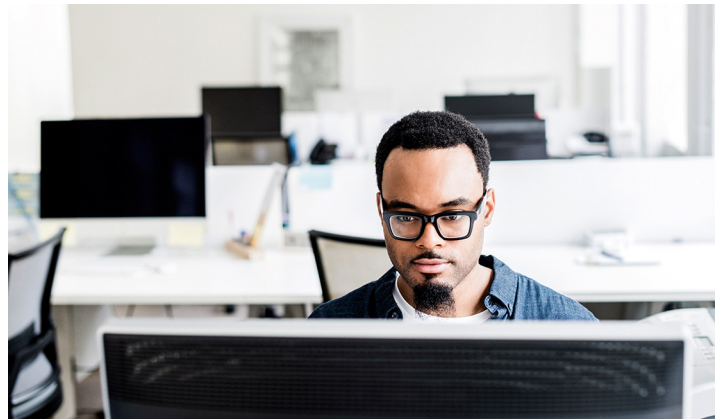
Flexible Capacity for Cyber Resiliency on the IBM® LinuxONE Emperor 4 enables customers to transfer capacity easily and efficiently between different data centers for disaster recovery, regulatory compliance, maintenance, and other business needs. Combined with IBM storage, capabilities, this function delivers an extremely high availability solution for mission critical workloads.

Remote Code Load for IBM® LinuxONE Firmware optimizes resilience and keeps your system up to date with the latest features, fixes, and maintenance without requiring someone to be physically in the data center to install and monitor planned updates to your system. This optional feature provides secure, remote installation and monitoring by IBM for planned updates to your IBM® LinuxONE system.

The IBM® LinuxONE Emperor 4 is built with a 19” frame that flexibly scales from one to four frames depending on the configuration.

Customers migrating from x86 systems and consolidating Linux workload from distributed systems will achieve significant sustainability improvements, including improved environmental efficiencies and floor space reduction for most customers. Changes to the footprint mean:

- The Central Processing Complex (CPC) drawer design has relocated the long-distance coupling to the PCIe+ I/O drawer.
- The frame no longer requires the PCIe+ I/O drawers to be locked into fixed locations.
- Support continues for both raised and non-raised floors as well as top and bottom exit I/O and power. All cabling is routed to the back of the frame with new brackets to contain cables.
- There are two power options - intelligent power distribution unit (iPDU) and Bulk Power Assembly (BPA).
- The doors are designed for acoustics and optimized for airflow. The frame requires 3-phase power.
- The use of the iPDU power may improve power efficiency and lower overall energy costs dependent on the required configuration.



The 19” frame technology supports the A3 operating class as defined by the American Society of Heating, Refrigerating and Air-conditioning Engineers (ASHRAE). The benefit of having an A3 class rating is being able to save on Heat, Ventilation, and Air Conditioning (HVAC) costs due to the wide range of operating conditions that will now be available.

The optional Hardware Management Appliance can be ordered with the IBM® LinuxONE Emperor 4 to provide Hardware Management Console (HMC)/ SE functions within the 19” frame, eliminating the need for a separate HMC outside of the server.

### **Continuous compliance**

The IBM® LinuxONE Emperor 4 contains new capabilities to make compliance to PCI-DSS regulatory guidelines easier and more productive. Audit preparation times can be significantly reduced and require less staff to complete. The IBM® LinuxONE Emperor 4 is integrated with the IBM® LinuxONE Security and Compliance Center to monitor and record system, network and application data for changes and adherence to PCI-DSS standards. A user-friendly dashboard enables infrastructure personnel to easily and quickly generate reports that auditors need and to ensure a continuous compliance posture that mitigates the potential for noncompliance regulatory fines.

Tailored Fit Pricing for IBM® LinuxONE Emperor 4 enables price stability, particularly in an unpredictable hybrid cloud environment. The Tailored Fit Pricing and Hardware Consumption solutions are transformational pricing options for this platform. It provides simple, transparent, and predictable pricing for hardware when running the IBM® LinuxONE platform. The Tailored Fit Pricing options maximize cost predictability, while still supporting optimal response times and Service Level Agreements (SLA) compliance.

The Tailored Fit Pricing for IBM® LinuxONE Hardware Consumption Solution provides instantaneous access to additional capacity for short, unpredictable spikes in business-critical workloads. It was designed to meet the demands of hybrid cloud workload on the platform. To meet these demands, the IBM® LinuxONE Emperor 4 can now include, on top of the base capacity that you own, a fixed corridor of pay for use capacity. This always on corridor of consumption priced capacity will help you to alleviate the impact of short unpredictable spikes in workloads that are becoming more common in today's digital world.

IBM announced several open-source compilers to leverage the Integrated Accelerator for AI on the IBM® LinuxONE Telum processor chip, enabling programmers to embed inferencing easily and at scale in applications, using common open-source languages. This capability allows them to deliver cross-platform development and integration, operate with Java™, Swift or Node.JS and optimize enterprise workload performance without recompiling, as well as reduce the central processing unit (CPU) cycles needed to complete the job.

The IBM® LinuxONE Emperor 4 system provides Linux deployments with more cores, more memory and cache innovations. The IBM® LinuxONE Emperor 4 provides the platform for modernizing, developing, and managing on-premises, containerized applications.

### **Fast and secure access to data**

High-speed connectivity to data is critical to achieve balanced performance with storage device and exceptional transaction throughput. The IBM® LinuxONE Emperor 4 offers:

- A 2-port FICON Express32S adapter that connects your IBM® LinuxONE Emperor 4 to switches, directors, and storage devices at up to 32 Gbps. With support for native FICON®, High Performance FICON for IBM Z® (zHFP) and Fibre Channel Protocol (FCP), the adapter helps meet the low latency and increased bandwidth demands of applications. When the Fibre Channel connection endpoints use the FICON Express 32S adapter or FICON Express16SA adapters to the IBM DS8900F storage, authentication of the endpoints is enabled.
- A set of OSA-Express7S 1.2 adapters that meet the increased networking bandwidth demands driven by high-speed processors and faster network-attached storage devices.
- Support for IBM zHyperLink™ 1.1, a direct connect, short distance, I/O adapter offering extremely low latency connectivity to FICON storage systems. The IBM Washington Systems Center offers the zBNA tool to help determine workload candidates that can benefit from this adapter.
- Shared memory communications that are used for either direct memory placement of data within the IBM® LinuxONE Emperor 4, or host-to-host memory communications, using Remote Direct Memory Access over Converged Ethernet (RoCE) Express adapters, without significant TCP/IP processing costs.
- Support memory-memory communications is available for Linux on the IBM® LinuxONE Emperor 4.

With the internal configuration implemented for the 19" rack, the amount of I/O that can be attached is dependent on the type of power that is selected. There is a maximum of twelve PCIe+ I/O drawers when iPDU power is selected (11 on Max125) or a maximum of ten PCIe+ I/O drawers when BPA is selected.

## Why IBM?

### Position for today and tomorrow

Success in the digital economy is contingent on making IT a creator of value internally and externally. Fundamental to this is a flexible infrastructure that positions organizations strategically, leveraging AI and hybrid cloud, while protecting existing investments and improving sustainability.

The new IBM® LinuxONE Emperor delivers this with scale, agility, resiliency, performance, a security-rich environment, and a lower overall Total Cost of Ownership. The IBM® LinuxONE Emperor provides confidence in meeting the future, in a world of uncertainty.

### For more information

Detailed IBM® LinuxONE Emperor 4 specifications table:

<https://www.ibm.com/downloads/cas/DVZEL8BR>

Additionally, IBM Global Financing provides numerous payment options to help you acquire the technology you need to grow your business. We provide full lifecycle management of IT products and services, from acquisition to disposition. For more information, visit: [ibm.com/financing](https://www.ibm.com/financing)

## Learn more:

<https://www.ibm.com/products/linuxone-emperor-4>

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- 1. DISCLAIMER: Compared 5 IBM Machine Type 3931 Max 125 model consists of three CPC drawers containing 125 configurable cores (CPs, zIIPs, or IFLs) and two I/O drawers to support both network and external storage versus 192 x86 systems with a total of 10364 cores. IBM Machine Type 3931 power consumption was based on inputs to the IBM Machine Type 3931 IBM Power Estimation Tool for a memo configuration. x86 power consumption was based on March 2022 IDC QPI power values for 7 Cascade Lake and 5 Ice Lake server models, with 32 to 112 cores per server. All compared x86 servers were 2 or 4 socket servers. IBM® LinuxONE Emperor 4 and x86 are running 24x7x365 with production and non-production workloads. Savings assumes a Power Usage Effectiveness (PUE) ratio of 1.57 to calculate additional power for data center cooling. PUE is based on Uptime Institute 2021 Global Data Center Survey (<https://uptimeinstitute.com/about-iii/press-releases/uptime-institute-11th-annual-global-data-center-survey>). CO<sub>2</sub>e and other equivalencies that are based on the EPA GHG calculator (<https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>) use U.S. National weighted averages. Results may vary based on client-specific usage and location.*
- 2. Disclaimer: On IBM LinuxONE Emperor 4 with 6 cores in total, run the Yahoo Cloud Serving Benchmark on MongoDB with no sharding and achieve the same throughput as compared x86 system running MongoDB with 4 shards and 144 cores in total, a 24:1 core consolidation ratio in favor of IBM® LinuxONE Emperor 4. Performance results based on IBM internal tests running YCSB 0.10.0 benchmark (read-mostly) on MongoDB Enterprise Release 5.0.6 with 3-node replication. On IBM LinuxONE Emperor 4 MongoDB was setup without sharding but with two replicas. IBM LinuxONE Emperor 4 configuration: LPAR with 4 dedicated cores and 2 LPARs with each 1 core, each with SMT and 128 GB memory, 1 TB FlashSystem 900. x86 config: 9 Intel® Xeon® Gold 5218 CPU @ 2.30GHz with Hyperthreading turned on with 144 cores in total on 5 servers, 5x 192 GB memory, 5x 1 TB local RAID5 SSD storage, RHEL 8.4 running MongoDB, driven remotely by YCSB using 2 x86 server with total 128 threads. Results may vary.*
- 3. DISCLAIMER: Performance result is extrapolated from IBM internal tests running local inference operations in an IBM® LinuxONE Emperor 4 LPAR with 48 IFLs and 128 GB memory on Ubuntu 20.04 (SMT mode) using a synthetic credit card fraud detection model (<https://github.com/IBM/ai-on-z-fraud-detection>) exploiting the Integrated Accelerator for AI. The benchmark was running with 8 parallel threads each pinned to the first core of a different chip. The lscpu command was used to identify the core-chip topology. A batch size of 128 inference operations was used. Results were also reproduced using a z/OS V2R4 LPAR with 24 CPs and 256GB memory on IBM LinuxONE Emperor 4. The same credit card fraud detection model was used. The benchmark was executed with a single thread performing inference operations. A batch size of 128 inference operations was used. Results may vary.*
- 4. DISCLAIMER: IBM LinuxONE Emperor 4 with the Crypto Express 8S card provides quantum- safe APIs providing access to quantum- safe algorithms which have been selected as finalists during the PQC standardization process conducted by NIST. <https://csrc.nist.gov/Projects/post-quantum-cryptography/round-3-submissions>. Quantum-safe cryptography refers to efforts to identify algorithms that are resistant to attacks by both classical and quantum computers, to keep information assets secure even after a large-scale quantum computer has been built. Source: <https://www.etsi.org/technologies/quantum-safe-cryptography>. These algorithms are used to help ensure the integrity of a number of the firmware and boot processes. IBM LinuxONE Emperor 4 is the Industry-first system protected by quantum-safe technology across multiple layers of firmware.*