IBM LinuxONE Emperor 4 running Red Hat OpenShift

Modernize with a sustainable infrastructure that provides consistent service and security for your open hybrid cloud

IBM LinuxONE Emperor 4™

IBM designed the LinuxONE Emperor 4 to enable businesses to innovate with flexibility and agility on their journey to an open hybrid cloud.

Red Hat® OpenShift® on LinuxONE Emperor 4 allows businesses to integrate and modernize their applications with a strong foundation built for a sustainable infrastructure, massive scalability, and cyber-resiliency.

Red Hat OpenShift Container Platform

The Red Hat OpenShift Container Platform on LinuxONE Emperor 4 empowers your organization to integrate and modernize your applications with agility through integrated tooling and a secure and resilient foundation for cloud-native development and resilient foundation for cloud-native development and deployment on IBM LinuxONE™.

Red Hat OpenShift is a trusted Kubernetes enterprise platform that supports, similar to IBM Cloud Paks®, modern, hybrid-cloud application development and a consistent foundation for enterprise applications anywhere – across physical, virtual, private, and public clouds.

Reduce your carbon footprint while improving your efficiency and performance

LinuxONE Emperor 4 is designed to make a powerful improvement in sustainability by decreasing electricity consumption, reducing the number of standing servers, and enabling high compute and resource utilization.

Its design is aligned with best practices for reducing electricity consumption[1], including that they require a small number of physical systems, that they are high energy-efficiency systems, and that they enable high compute and resource utilization.

A 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.[2]

Running workloads on a centralized infrastructure such as LinuxONE Emperor 4 can contribute to fewer greenhouse gas emissions and a more environmentally sustainable IT environment.

Consolidating Linux workloads on five LinuxONE Emperor 4 systems instead of running them on compared x86 servers under similar conditions can reduce energy consumption by 75%, space by 50%, and the CO2e footprint by over 850 metric tons annually. This is equivalent to consuming about 362,000 fewer litres (95,600 gallons) of gasoline each year.[3]

Highlights

- Hybrid cloud platform open to any application, team, or infrastructure
- Reduced carbon footprint while improving your efficiency and performance
- Consistent service delivery with a massively scalable system
- Build privacy and protection with a cyber-resilient system

"Technology should support people doing their jobs," says Thomas Taroni, CTO at Swiss cloud services provider Phoenix Systems. "At the end of the day — if you're not making someone's life easier, then what's the point?"

Deliver consistent service with a massively scalable system

The 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.

LinuxONE Emperor 4 is architected for balanced performance with multiple layers of cache, massive I/O capabilities, and integrated accelerators to drive high utilization and processor efficiency.

With LinuxONE Emperor 4, execute up to 20 billion HTTPS transactions per day with OLTP microservice applications running on Red Hat OpenShift.[4]

Organizations can scale up to millions of containers on a single LinuxONE Emperor 4 system for nondisruptive vertical and horizontal growth to accommodate increases of workloads on demand.

Co-locating Red Hat OpenShift workloads side-by-side with Linux workloads on a LinuxONE Emperor 4, benefits not only from low latency, high throughput, and operational efficiency, but also leverages investments in applications.

Accessing your database while running an OLTP workload on Red Hat OpenShift, requires up to 3.6x fewer cores running your workload when co-located on LinuxONE Emperor 4 versus running the workload on compared x86 platform connecting remotely to the LinuxONE Emperor 4.[5]

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

Using one Integrated Accelerator for AI on an OLTP workload on LinuxONE Emperor 4 matches the throughput of a compared remote x86 server running inferencing on 18 cores[6]*.*

LinuxONE Emperor 4 allows for high workload density, usually resulting in a streamlined infrastructure with fewer components, lower management effort, and fewer software licenses compared to other platforms.

On IBM LinuxONE Emperor 4, scale-out to 512 Red Hat OpenShift compute nodes and deploy up to 100.000 NGINX pods[7].

Build privacy and protection with a cyber-resilient system

The LinuxONE Emperor 4 represents a breakthrough in data security. Quantum-safe cryptography is embedded in the system to protect against quantum-computing attacks now and in the future.

On digital currency transactions run inferencing for fraud 85% faster by co-locating your application with SnapML on LinuxONE Emperor 4 versus running inferencing remotely using Scikit-learn on a compared x86 serve[78].

The 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.

On a single LinuxONE Emperor 4 drawer, generate up to 100,000 certificates per second using protected keys exploiting Crypto Express 8S adapters when running application pods on Red Hat OpenShift[9].

The LinuxONE Emperor 4 running Red Hat OpenShift is designed with 99.9999999 (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 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.

LinuxONE Emperor 4 systems, with IBM GDPS®, IBM DS8000® series with IBM HyperSwap® and running a Red Hat OpenShift environment, are designed to deliver 99.99999% availability[10].

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 LinuxONE Emperor 4 is integrated with the IBM LinuxONE Security and Compliance Center to monitor and record system, network and application data for changes. In addition, *on LinuxONE Emperor 4, use the Red Hat OpenShift Compliance Operator to run compliance scans without impacting the throughput of OLTP microservice applications running on Red Hat OpenShift[11].*

Why IBM?

LinuxONE Emperor 4 delivers this with scale, agility, resiliency, performance, a security-rich environment, and a lower overall Total Cost of Ownership. The LinuxONE Emperor 4 provides confidence in meeting the future, in a world of uncertainty.

Our experts can help you design, configure, and implement Red Hat OpenShift, as well as IBM Cloud Paks.

As you transform your business and differentiate yourself in a trust-based economy, IBM remains your partner.

For more information

To learn more about IBM LinuxONE Emperor 4 and Red Hat OpenShift, please contact your IBM representative, your Red Hat representative, or IBM Business Partner.

1. *https://www.ibm.com/downloads/cas/GYR3MWQN*
2. *IBM z16 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. 39 Cascade Lake and Ice Lake x86 servers configured to provide same performance. Annual energy required for server operations was 143,962 KW for IBM z16 with 125 cores and 566,448 KW for 39 x86 servers with 2072 cores. Due to the technical equivalence, the results are also valid for a LinuxONE Emperor 4 Max 125 system.*
3. *Compared 5 IBM z16 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 z16 power consumption was based on inputs to the IBM z16 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. Al l compared x86 servers were 2 or 4socket servers. IBM Z 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://uptimeinsti tute.com/about-ui/press-releases/uptime-institute-11th-annual-global -data-center-survey). CO2e and other equivalencies that are based on the EPA GHG calculator (https://www.epa.gov/energy/greenhousegas-equivalencies-calculator) use U.S. National weighted averages. Results may vary based on client -specific usage and location. Due to the technical equivalence, the results are also valid for LinuxONE Emperor 4 Max 125 systems.*
4. *Performance result is extrapolated from IBM internal tests running in an LinuxONE Emperor 4LPAR with 24 dedicated cores, 560 GB memory and DASD storage the Acme Air microservice benchmark (https://github.com/blueperf/acmeair-mainservice-java) on Red Hat OpenShift Container Platform (RHOCP) 4.9 using RHEL 8.4 KVM. On 4 RHOCP Compute nodes 4 Acme Air instances were running in parallel, each driven remotely from JMeter 5.2.1 with 384 parallel users. The KVM guests with RHOCP Compute nodes were configured with 12 vCPUs and 64 GB memory each. The KVM guests with RHOCP Management nodes and RHOCP Infrastructure nodes were configured with 4 vCPUs and 16 GB memory each. Results may vary.*
5. *This is an IBM internal study designed to replicate banking OLTP workload usage in the marketplace deployed on Red Hat OpenShift Container Platform (RHOCP) 4.9 on LinuxONE Emperor 4using z/VM versus on compared x86 platform using KVM accessing the same PostgreSQL 12 database running in an LinuxONE Emperor4LPAR. LinuxONE Emperor 4configuration: The PostgreSQL database ran in a PAR with 12 dedicated cores, 128 GB memory, 1TB IBM FlashSystem® 900 storage, RHEL 7.7 (SMT mode). The Compute nodes ran on z/VM 7.2 in a LPAR with 8 dedicated cores, 188 GB memory, DASD storage, and OSA connection to the PostgreSQL LPAR. The RHOCP Proxy server ran in an LPAR with 1 core, 4 GB memory and RHEL 8.5. x86 configuration: The Compute nodes ran on KVM on RHEL 8.5 on 32 Cascade Lake Intel® Xeon® Gold CPU @ 2.30GHz with Hyperthreading turned on, 192 GB memory, RAID5 local SSD storage, and 10Gbit Ethernet connection to the PostgreSQL LPAR. Both systems are delivering equal throughput. Results may vary.*
6. *Performance results is extrapolated from IBM internal tests running an OTLP workload with credit card transaction using the Credit Card Fraud Detection (https://github.com/IBM/ai-on-z-fraud-detection) model on LinuxONE Emperor 4 vs running the OLTP workload (https://github.com/IBM/megacard-standalone) on LinuxONE Emperor 4and running inferencing on a remote x86 server running TensorFlow serving. LinuxONE Emperor 4configuration: Ubuntu 20.04 in an LPAR with 6 dedicated cores, 256 GB memory, and IBM FlashSystem 900 storage. x86 configuration: Ubuntu 20.04 on 18IceLake Intel® Xeon® Gold CPU @ 2.80GHz with Hyperthreading turned on, 1 TB memory, local SSDs. Results may vary.*
7. *Performance result is extrapolated from IBM internal tests running in an LinuxONE Emperor 4LPAR with 24 dedicated cores, 1536 GB memory and FS9200 storage NGINX pods on Red Hat OpenShift Container Platform (RHOCP) 4.10 running on a RHEL 8.5 KVM host. 64 RHOCP compute nodes with 230 NGINX pods were running in parallel. The KVM guests with RHOCP compute nodes were configured with 2 vCPUs and 16 GB memory each. The KVM guests with RHOCP management nodes were configured with 16 vCPUs and 128 GB memory each. Results may vary.*
8. *Performance results based on IBM internal tests doing inferencing using a Scikit -learn Random Forest model with Snap MLv1.9.0 (tech preview) backend on LinuxONE Emperor 4 and with Scikit-learn v1.0.2backend on compared x86 server. The model was trained on the following public dataset https://www.kaggle.com/datasets/ellipticco/elliptic-data-set.BentoML v0.13.1 (https://github.com/bentoml/BentoML) was used on both platforms as model serving framework. LinuxONE Emperor 4 configuration: Ubuntu 20.04 in an LPAR with 2 dedicated cores, 256 GB memory. x86 configuration: Ubuntu 20.04 on91IceLake Intel® Xeon® Gold CPU @ 2.80GHz with Hyperthreading turned on, 1 TB memory.*
9. *Performance results is extrapolated from an IBM internal study designed to replicate secure certificate generation with Java on Red Hat OpenShift Container Platform (RHOCP) 4.10 on LinuxONE Emperor 4using KVM. 2 microbenchmark pods (Signature RSA 2048key is protected by AES master key in Crypto Express 8S adapters, certificate signatures are done with SHA-256for x509 certificates) were run in parallel per compute node each driven locally with 20 parallel threads. LinuxONE Emperor 4configuration: The RHOCP Management and Compute nodes ran on RHEL 8.5 KVM using macVTap in a LPAR with 24 dedicated cores, 256 GB memory, FlashSystem 9200 storage, CEX8S adapters in "2 HSM version" mode, one HSM per compute node. Packages used for benchmark: IBM Semeru Open 11 JDK 11.0.14.1.1 0.30.1-1 using Bouncy Castle packages for x509 certificate generation and SunPKCS11 JCE provider connected to openCryptoki 3.16.0 CCA token for cryptographic operations. Results may vary.*
10. *IBM internal data based on measurements and projections was used in calculating the expected value. Necessary components include LinuxONE Emperor 4; IBM z/VM V7.2 systems collected in a Single System Image, each running RHOCP 4.10 or above; IBM Operations Manager ; GDPS 4.5 for management of data recovery and virtual machine recovery across metro distance systems and storage, including Metro Multi -site workload and GDPS Global; and IBM DS8000 series storage with IBM HyperSwap. A MongoDB v4.2 workload was used. Necessary resiliency technology must be enabled, including z/VM Single System Image clustering, GDPS xDR Proxy for z/VM, and Red Hat OpenShift Data Foundation (ODF) 4.10 for management of local storage devices. Application-induced outages are not included in the above measurements. Other configurations (hardware or software) may provide different availability characteristics.*
11. *Performance result is extrapolated from IBM internal tests running in an LinuxONE Emperor 4LPAR with 24 dedicated cores, 560 GB memory and DASD storage the Acme Air microservice benchmark (https://github.com/blueperf/acmeair-mainservice-java) on Red Hat OpenShift Container Platform (RHOCP) 4.10 using RHEL 8.4 KVM. On 4 RHOCP compute nodes 4 Acme Air instances were running in parallel, each driven remotely from JMeter 5.2.1 with 384 parallel users. The KVM guests with OCP compute nodes were configured with 12 vCPUs and 64 GB memory each. The KVM guests with RHOCP Management nodes and RHOCP Infrastructure nodes were configured with 4 vCPUs and 16 GB memory each. Compliance Operator deployed a configured from (https://docs.openshift.com/containerplatform/4.10/security/compliance_operator/compliance-operator-release-notes.html). Results may vary.*

Learn more:

IBM LinuxONE Emperor 4

IBM Cloud Infrastructure Center

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