IBM® LinuxONE running Red Hat OpenShift Container Platform

Effective application modernization with consistent DevSecOps with flexibility, security, and reliability

Modern business depends on applications. To stay ahead, you must continuously adapt, innovate, and deliver new products and services. Your core business applications and IT infrastructure are crucial to achieving these goals and can become a key differentiator that sets you apart from the competition.

Modernizing applications can unlock resources for enhancements and new applications that drive business growth. By adopting cloud-native and microservice architectures, your organization can achieve greater efficiency, flexibility, and scalability, enabling to innovate faster, adapt more easily, and stay ahead.

Container technologies and DevSecOps approaches are key components and can help to speed innovation and improve agility, giving a competitive advantage.

– Increase operational efficiency, resiliency, and adaptability with a platform and infrastructure that support both traditional and modernized applications.
– Deliver a consistent, streamlined developer experience with standardized workflows, continuous integration, and support for multiple environments.

IBM® LinuxONE running Red Hat® OpenShift® Container Platform

Red Hat OpenShift is a security-focused hybrid cloud platform that empowers to develop, deploy, and manage your applications across the IT environment. It is a trusted Kubernetes enterprise platform with support for cloud-native and containerized workloads.

The Red Hat OpenShift platform provides a comprehensive set of tools, including development frameworks, CI/CD pipelines, serverless development models, and service meshes, to accelerate application modernization.

The IBM® LinuxONE family of modern infrastructure provides a secure, resilient, and scalable foundation for integrating and modernizing applications.

With IBM® LinuxONE, you can deploy Red Hat OpenShift with flexibility, choosing from multiple deployment options on IFLs, including logical partitions (LPARs), virtual machines based on IBM z/VM® and Red Hat Enterprise Linux KVM. Additionally, IBM® LinuxONE supports key Red Hat OpenShift features, such as multi-architecture compute, single-node OpenShift, and Hosted Control Plane, and Red Hat OpenShift Virtualization to manage containers and virtual machines with the same tools.

Unlock the power of innovation and modernization by combining IBM® LinuxONE and Red Hat OpenShift, enabling you to accelerate transformation, integrate seamlessly into your hybrid cloud, and drive business agility.

Highlights

- Data protection and confidential computing
- Low latency and high throughput
- Consistent service delivery system
- Accelerated AI inferencing
- Consistent developer experience
- Cost savings

"The bank needed to increase their competitive business offerings by extending and modernizing integration with existing assets while optimizing SLAs and minimizing risk."

Data protection, privacy at scale, and confidential computing

IBM® LinuxONE represents a breakthrough in data security, providing a safe and tested infrastructure that can deploy the more sophisticated and complex cryptography needed to protect sensitive data from cyber risks.

Quantum-safe cryptography is embedded in the system, along with classical cryptography and confidential computing, to protect data and keys against a potential future quantum attack, such as "harvest now, decrypt later".

Integrity and confidentiality of data is protected with Crypto Express adapters (Hardware Security Modules) designed to meet the strong security requirements of Federal Information Processing Standards (FIPS) 140-2 Level 4.

Red Hat OpenShift containers can leverage the advanced security features of Crypto Express adapters.[1]

To confirm what has been said: up to 100,000 certificates per second can be generated using protected keys exploiting Crypto Express 8S adapters running application pods on Red Hat OpenShift.[2]

Confidential computing is a technology that protects data during processing by executing computations within a hardware-based, trusted execution environment (TEE), effectively eliminating the last remaining data security vulnerability. Confidential containers are based on 'confidential computing' and can be deployed with Red Hat OpenShift. [3]

IBM Z® Security and Compliance Center is the powerful tool to monitor and record system, network, and application data changes, streamlining audit preparation and reducing the time and staff required to complete it. It simplifies compliance with regulatory guidelines such as PCI-DSS and can even run compliance scans without impacting the performance of Red Hat OpenShift.[4]

In addition to IBM® LinuxONE capabilities, Red Hat OpenShift provides safer deployments with automated and secured orchestration and life-cycle management.

The unique combination of IBM® LinuxONE and Red Hat OpenShift creates a differentiated, security-rich hybrid cloud platform.

Low latency and high throughput with co-location

Co-locating Red Hat OpenShift workloads side-by-side with Linux workloads on IBM® LinuxONE, benefits from low latency, high throughput, operational efficiency, and fewer points of attack. Additionally, it enables a streamlined IT infrastructure and maximizes the value of existing applications, leveraging previous investments to drive greater returns.

The IBM® LinuxONE strengths are evident, for example, in a 4.2x more throughput by co-locating the workload on IBM® LinuxONE, versus running the workload on compared x86 platform connecting remotely to the IBM® LinuxONE.[5]

Deliver consistent service with a highly scalable and reliable system

IBM® LinuxONE ensures business continuity by minimizing disruptions with its built-in reliability and fault-tolerant capabilities, which enable rapid recovery from failures and reduce downtime. IBM® LinuxONE also enables concurrent maintenance and repair, ensuring high availability and minimizing downtime, allowing businesses to operate with minimal disruption.

IBM® LinuxONE running Red Hat OpenShift is designed with 99.999999 (8 9's) availability[6], seamless on-demand scalability, and rapid disaster recovery. When paired with IBM storage capabilities, this solution provides an exceptionally high availability solution, not only for mission-critical container workloads.

IBM® LinuxONE 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. To give an example: With IBM® LinuxONE Emperor 5, execute up to 35 billion HTTPS requests per day with OLTP microservice applications running on the Red Hat OpenShift Container Platform.[7]

Organizations can scale containers on IBM® LinuxONE for nondisruptive vertical and horizontal growth to accommodate increases of workloads on demand. Resources can be shared and prioritized dynamically and efficiently between workloads, providing agility by delivering them whenever and wherever they are needed. On IBM® LinuxONE Emperor 5 running Red Hat Enterprise Linux with KVM, deploy up to 3,000,000 NGINX containers[8], demonstrating exceptional scalability and flexibility.

Accelerated AI inferencing

The integration of AI into enterprise transactions has become a vital component for many workloads. With AI-driven solutions, such as fraud detection, delivering substantial benefits that transform business operations.

IBM announced the next generation of enterprise computing for the AI era with the IBM Telum® II processor[9]. The IBM Telum II is designed to support a broader, larger set of models with what's called ensemble AI method use cases. Using ensemble AI leverages the strength of multiple AI models to improve overall performance and accuracy of a prediction as compared to individual models.

An example of the IBM® LinuxONE strengths: Using a single Integrated Accelerator for AI on an OLTP workload on IBM® LinuxONE Emperor 5 matches the throughput of running inferencing on a compared remote x86 server with 13 cores.[10]

Consistent developer experience

Red Hat OpenShift Container Platform provides a comprehensive set of optimized tools to secure, protect, and manage applications, streamlining the development and administration process. This powerful toolset as part of the Red Hat OpenShift license is ideal for building, deploying, and maintaining applications, making work easier and more efficient.

The Red Hat OpenShift tool suite includes, for example: Red Hat OpenShift Pipelines, based on Tekton, enables rapid creation of independently scalable CI/CD pipelines. Red Hat OpenShift Serverless, built on Knative, abstracts infrastructure from application development, allowing for event-driven apps that scale dynamically and efficiently. Red Hat OpenShift Service Mesh provides a uniform way to connect, manage, and observe microservices-based applications. Red Hat Quay offers a trusted container image registry, accelerating developer's movement of code from development to deployment. Additionally, Red Hat OpenShift can be extended with Red Hat Advanced Cluster Security for vulnerability insights and threat detection, and Red Hat Advanced Cluster Management for unified multicluster management, policy-based governance, and extended application lifecycle management.

Cost savings

Considering all cost relevant aspects –privacy and protection, co-location benefits, scalability and reliability, streamlined development and administration efforts, accelerated AI inferencing, energy consumption and carbon footprint[11] – an economic advantage is likely when running Red Hat OpenShift on IBM® LinuxONE compared to running it on other platforms.

IBM® LinuxONE enables high workload density, typically leading to a simplified infrastructure with fewer components, reduced management effort, and lower software licensing costs compared to other platforms.

Seamlessly integrated into your hybrid cloud, IBM® LinuxONE can deliver far-reaching benefits across operations, cost optimization, and business growth, while also accelerating the modernization for a hybrid cloud environment.

Why IBM?

As you transform your business and differentiate yourself in a trust economy, IBM remains your partner. We have the total expertise in systems, software, delivery, and financing to help you create a secure and intelligent foundation for your on-premises containers and cloud on IBM® LinuxONE.

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

For more information

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

1.Kubernetes device plug-in for IBM Crypto Express (CEX) cards, https://catalog.redhat.com/software/container-stacks/detail/6310d036496edcd88344ab5a

2.On a single IBM 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 Container Platform. DISCLAIMER: 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 IBM LinuxONE Emperor 4 using KVM. 2 microbenchmark pods (Signature RSA 2048 key 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. IBM LinuxONE Emperor 4 configuration: The RHOCP Management and Compute nodes ran on RHEL 8.5 KVM using mac VTap 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 open Cryptoki 3.16.0 CCA token for cryptographic operations. Results may vary.
3.Confidential Containers with IBM Secure Execution for Linux, https://www.redhat.com/en/blog/confidential-containers-ibm-secure-execution-linux

4.On IBM LinuxONE Emperor 4, use the IBM Z Security and Compliance Center to run compliance scans on PostgreSQL without impacting the throughput of OLTP microservice applications running on Red Hat OpenShift Container Platform. DISCLAIMER: Performance result is based on IBM internal tests running on an IBM Machine Type 3931 LPAR with 24 dedicated cores, 560 GB memory and DASD storage an OLTP workload on Red Hat OpenShift Container Platform (RHOCP) 4.10 using RHEL 8.4 KVM. On 4 RHOCP Compute nodes 4 OLTP workload instances were running in parallel, each driven remotely from JMeter 5.2.1 with 128 parallel users. The KVM guests with RHOCP Compute nodes for the OLTP workload 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://www.ibm.com/docs/en/zscc/1.1.1). Results may vary.

5.When accessing your database while running an OLTP workload on Red Hat OpenShift Container Platform, achieve 4.2x more throughput by co-locating the workload on IBM® LinuxONE Emperor 4 versus running the workload on compared x86 platform connecting remotely to the IBM® LinuxONE Emperor 4. DISCLAIMER: 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 IBM LinuxONE Emperor 4 using z/VM versus on compared x86 platform using KVM accessing the same PostgreSQL 12 database running in an IBM LinuxONE Emperor 4 LPAR. IBM LinuxONE Emperor 4 configuration: The PostgreSQL database ran in a LPAR with 12 dedicated cores, 128 GB memory, 1TB FlashSystem 900 storage, RHEL 7.7 (SMT mode). The Compute nodes ran on z/VM 7.2 in a LPAR with 30 dedicated cores, 188 GB memory, DASD storage, and OSA connection to the PostgreSQL LPAR. LPAR with 2cores, 4GB memory and RHEL 8.5 with RHOCP Proxy server.x86 configuration: The Compute nodes ran on KVM on RHEL 8.5 on 32 Cascade Lake Intel® Xeon® Gold CPU @ 2.30GHz with Hyper-Threading turned on, 192 GB memory, RAID5 local SSD storage, and 10Gbit Ethernet connection to the PostgreSQL LPAR. Results may vary.

6.IBM LinuxONE Emperor 5 systems, with GDPS, IBM DS8000 series with HyperSwap and running a Red Hat OpenShift Container Platform environment, are designed to deliver 99.999999% availability. DISCLAIMER: IBM internal data based on measurements and projections was used in calculating the expected value. Necessary components include IBM LinuxONE Emperor 5; IBM z/VM V7.3 systems or above collected in a Single System Image, each running RHOCP 4.14 or above; IBM Operations Manager; GDPS 4.6 or above 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 v4.4 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) 4.14 or above 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.
7.Performance result is extrapolated from IBM® internal tests running on IBM Systems Hardware of machine type 9175. The Acme Air microservice benchmark (https://github.com/blueperf/acmeair-mainservice-java) was deployed on Red Hat® OpenShift® Container Platform (RHOCP) 4.17. The 3 RHOCP Compute nodes ran 3 Acme Air instances in parallel, each driven remotely from Apache JMeter™ 5.2.1 with 128 parallel users. IBM Systems Hardware configuration: 8 LPARs in total with 21 dedicated and 4 shared cores (SMT). 3 LPARs running RHOCP Compute nodes each with 7 dedicated cores (SMT), 64 GB memory and DASD storage. 5 LPARs each with 4 shared cores (SMT), 16 GB memory and DASD storage, providing 3 RHOCP Management nodes and 2 RHOCP Infrastructure nodes. The Network adapters were dedicated for NETH on Linux. Results may vary.
8.Performance result is extrapolated from IBM® internal tests running on IBM Systems Hardware of machine type 9175. 1 LPAR with 12 dedicated cores (SMT) and 1.2 TB memory running Red Hat® Enterprise Linux® (RHEL) 9.5 with KVM. 24 RHEL 9.5 virtual machines with 1 vCPU and 64 GB memory. On each virtual machine, 7813 NGINX® 1.26.2 containers were deployed. Results may vary.
9.New Telum II Processor and IBM Spyre Accelerator, https://www.ibm.com/new/announcements/telum-ii

10.Performance results are based on IBM® internal tests running on IBM Systems Hardware of machine type 9175. The OLTP application (https://github.com/IBM/megacard-standalone) and PostgreSQL was deployed on the IBM Systems Hardware. The Credit Card Fraud Detection (CCFD) ensemble AI setup consists of two models (LSTM: https://github.com/IBM/ai-on-z-fraud-detection, TabFormer: https://github.com/IBM/TabFormer). On IBM Systems Hardware, running the OLTP application with IBM Z Deep Learning Compiler (zDLC) compiled jar and IBM Z Accelerated for NVIDIA® Triton™ Inference Server locally and processing the AI inference operations on cores and the Integrated Accelerator for AI versus running the OLTP application locally and processing remote AI inference operations on a x86 server running NVIDIA Triton Inference Server with OpenVINO™ runtime backend on CPU (with AMX). Each scenario was driven from Apache JMeter™ 5.6.3 with 64 parallel users. IBM Systems Hardware configuration: 1 LPAR running Ubuntu 24.04 with 7 dedicated cores (SMT), 256 GB memory, and IBM FlashSystem® 9500 storage. The Network adapters were dedicated for NETH on Linux. x86 server configuration: 1 x86 server running Ubuntu 24.04 with 28 Emerald Rapids Intel® Xeon® Gold CPUs @ 2.20 GHz with Hyper-Threading turned on, 1 TB memory, local SSDs, UEFI with maximum performance profile enabled, CPU P-State Control and C-States disabled. Results may vary.

11.Save up to 65% of power consumption by moving cloud-native, containerized workloads from compared x86 solution to an IBM LinuxONE 5. DISCLAIMER: IBM® internal performance tests for the core consolidation study targeted a comparison of the following servers. IBM Machine Type 9175 MAX 136 system consisting of three CPC drawers containing 136 configurable processor units and six I/O drawers to support both network and external storage. The x86 solution used a commercially available enterprise server with two 5th generation Intel® Xeon® Platinum 8592+ processors, 64 cores per CPU. Both solutions had access to the same storage. The workloads consisted of a containerized online transaction processing (OLTP) WebSphere Liberty v25 application running on Red Hat OpenShift Container Platform (OCP) v4.17, and an EDB Postgres for Kubernetes v1.25 on the same OCP cluster simulating core online banking functions. Both solutions used Red Hat Enterprise Linux v9.5 and KVM. Results may vary. The test results were extrapolated to a typical, complete customer IT solution that includes isolated from each other production and non-production IT environments. TCO included software, hardware, energy, network, data center space, and labor costs. On the IBM LinuxONE 5 side the complete solution requires one IBM LinuxONE 5 Type 9175 MAX 136, and on x86 side, the complete IT solution requires 23 compared servers.

Learn more:

IBM LinuxONE

Red Hat OpenShift

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