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What is new in RHEL RHEL Image mode

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Solution Architect - RHEL
Red Hat

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RHEL Advocate

Red Hat

Agenda

- What is new in RHEL
- RHEL Image Mode overview
- RHEL Image Mode demo
- Q&A

What is new in RHEL

Use cases for the hybrid cloud

Consistency across all runtime environments

Public cloud

Accelerate cloud workload migrations and reduce provisioning time with build and push capabilities to AWS, Azure, and Google Cloud Platform.

Private cloud

Standardize private cloud infrastructure with consistent, streamlined images specifically optimized for virtual environments.

Physical & Edge

Save time and make the most of existing and future application investments by creating customized OS “Gold” images to deploy across physical systems.

Standard Operating Environment

Reduce complexity with Red Hat Enterprise Linux and its management ecosystem

Red Hat Satellite

Unified life-cycle management

- Content and patch management
- Small- and large-scale operations
- Standardized operating environment (SOE)

Red Hat Ansible Automation

Centralized automation governance

- Centralized control
- Team and user delegation
- Audit trail

Red Hat Insights

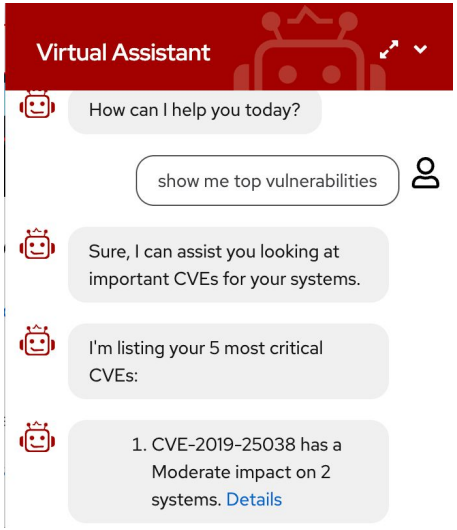
Proactive, automated resolution

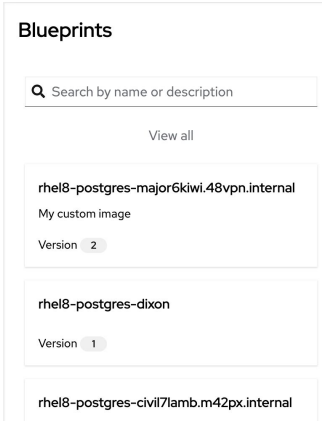
- Continuous insight
- Verified knowledge
- Proactive resolution

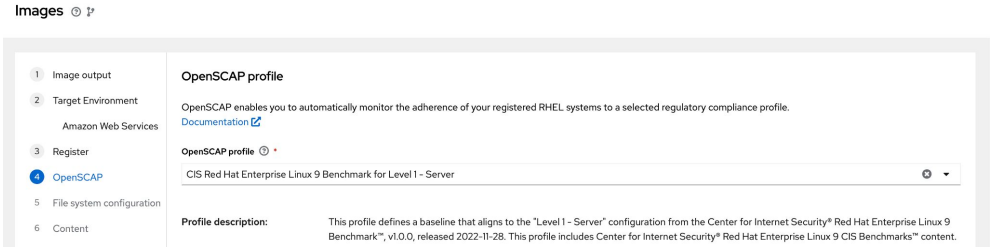
Red Hat Enterprise Linux

Red Hat

Red Hat Insights







Fedramp

- Fedramp High Authorization via Agency Authorization

Virtual Assistant

- AI Assistant to help with common issues

Image Blueprints

- Create blueprints for easily repeatable images

Build Compliant images

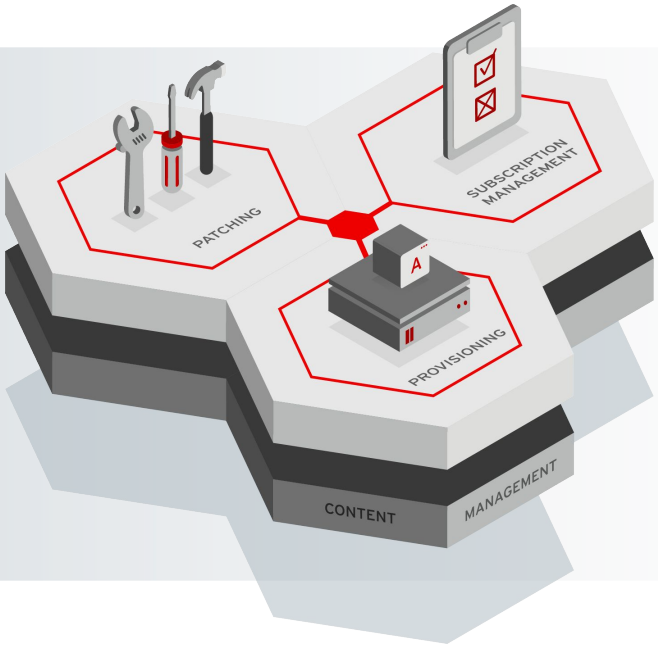
- Build images compliant to regulatory policies

Update RHEL Image Mode hosts

- Task to initiate an update of image mode hosts

Red Hat

Red Hat Satellite



Standard Operating Environment hosts are the same across your environment

Reliable and Resilient Using Red Hat Insights

Secure your systems are patched, up to date, and compliant with security policies

Confidence in your subscription utilization

Red Hat

Red Hat Satellite 6.16

- RHEL 9
- Ruby 3 and Postgress 13
- Simple Content Access ONLY
- Webhooks improvements
- Integrated OpenSCAP remediation
- Online Backup
- Container Push
- Improved LEAPP and Convert2RHEL
- Improved scalability and performance

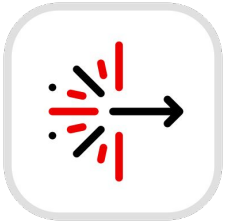
The Route to RHEL 10

We continue to depend on our open source development model from Fedora to CentOS Stream to RHEL.

Upcoming:

- CentOS Stream 10
- RHEL 10 Beta
- RHEL 10 GA (Expected Mid-2025)

RHEL Lightspeed vision



Unlock Red Hat's expertise

Provide Red Hat's decades of Linux experience to help enable your workloads to be successful

Proactive guidance

Proactively provide relevant information and guidance to make life easier for customers

Level up skills

Makes RHEL easier to use, secure, tune, and troubleshoot – for both new and experience users

Digital roadmap

Get relevant info on the RHEL roadmap and what's coming next, focused on what's most important to you

Red Hat Enterprise Linux AI

Foundation Model Platform

Seamlessly develop, test and run best of breed, open source Granite generative AI models to power your enterprise applications.

The model is the new platform.

Open Granite models

Highly performant, fully open source, collaboratively developed Granite language and code models from the community, fully supported & indemnified by Red Hat and IBM.

InstructLab model alignment

Scalable, cost-effective solution for enhancing LLM capabilities efficiently for a wide range of applications, making knowledge & skills contributions accessible to a wide range of users

Optimized bootable model runtime instances

Granite models & InstructLab tooling packaged as a bootable RHEL image, including Pytorch/runtime libraries, hardware optimized inference for Nvidia, Intel and AMD that can run anywhere and provides onramp to OpenShift AI for scale and lifecycle & watsonx for agent integration and governance.

Enterprise support, lifecycle & indemnification

Trusted enterprise platform, 24x7 production support, extended model lifecycle and model IP indemnification

RHEL Image Mode Overview

Infrastructure & organizational complexity

is still a problem...

Common challenges that involve the OS

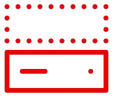
- Different platforms require different tools, teams and expertise
- Testing and validation are time consuming
- Application support matrix
- No one budgets for maintenance and upgrades
- Negotiating between stakeholders
- Drift between images, instances, and runtime
- Immutable aspirations vs. mutable realities
- Image inventory, versioning, and pruning
- Let's not forget security!

Outcomes

What does image mode fix today?

Less risk

Reduce the risk associated with updates with atomic transactions and rollbacks



Better builds

Improve the composability and repeatability of standard builds through layering

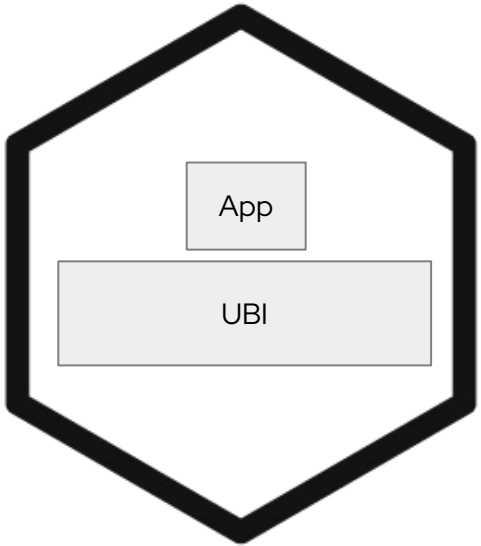
Move faster

Increase the speed of experimentation

Streamline process

Simplify end to end management with a single process for OS and applications

Containers revolutionized application deployment

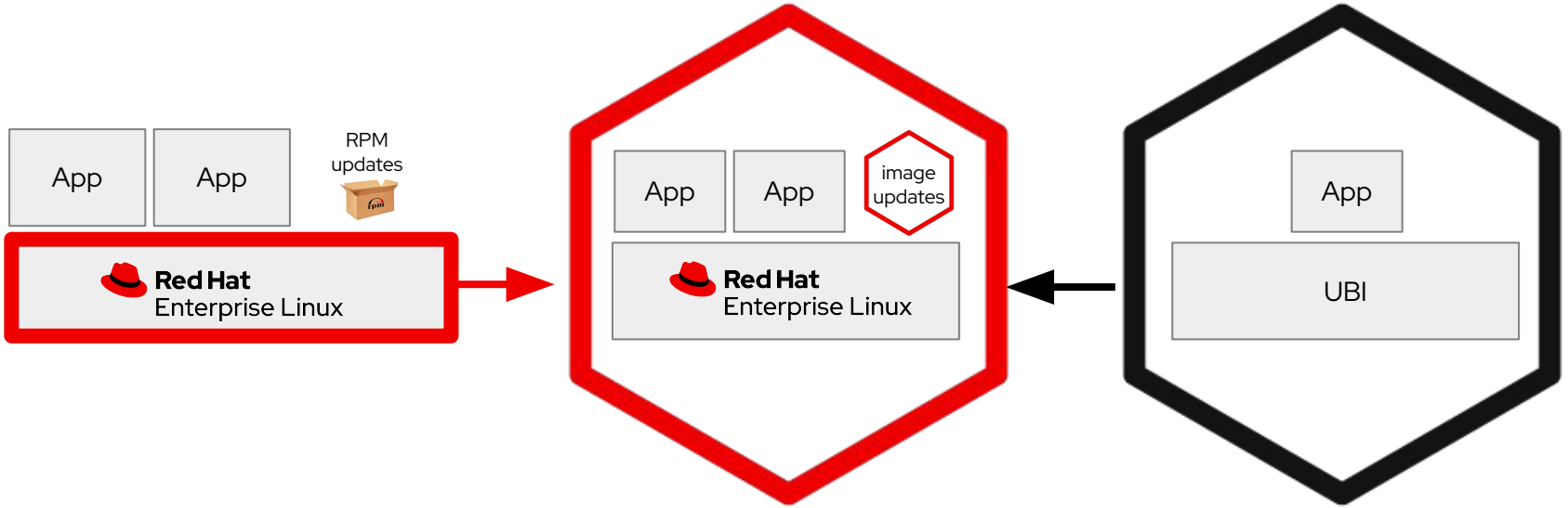


- Standardized packaging via OCI image format
- Standardized delivery via OCI registry
- Clarity and transparency with the container file
- Deployment portability & predictability
- Rich ecosystem of security, automation, & orchestration tooling
- Rapid adoption and pervasive

...and they will also become the language of modern IT

Introducing image mode for Red Hat Enterprise Linux

Combining the power of RHEL with the benefits of containers



Package mode | **Image mode** | **Application container**

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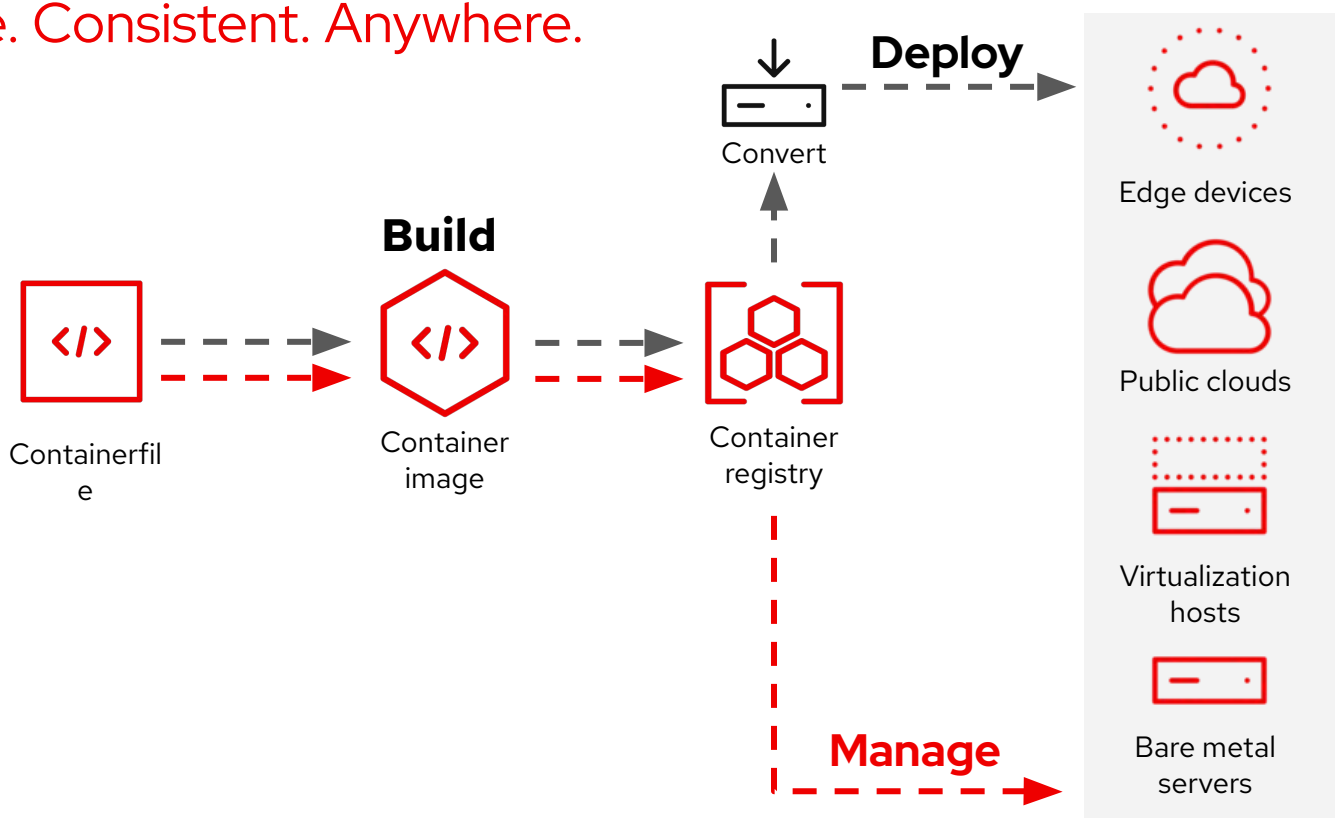
One RHEL, two modes

	Package mode	Image mode
Image creation	Image builder	Container tools
Updates	Packages (`dnf`)	Images (`bootc`)
Update distribution	rpm repository	Container registry
Management	Red Hat Insights, Satellite*, Ansible*	
Deployment footprint	Bare metal, VM, cloud, edge	

* On image mode roadmap

Image mode for Red Hat Enterprise Linux

Simple. Consistent. Anywhere.



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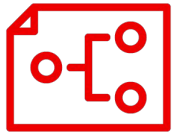
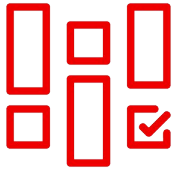
Build





Red Hat

Image mode for RHEL

A container-native workflow for the life cycle of a system

Tech Preview

```
FROM rhel9/rhel-bootc:latest

RUN dnf install -y [software]
[dependencies] && dnf clean all

ADD [application]
ADD [configuration files]

RUN [config scripts]
```

Build

A *bootc* base image & container file is all that's needed to describe a system, applications, and dependencies. Use your existing container tools or pipelines to quickly create and test images.

Deploy

Easily convert to a VM/cloud image or deploy on bare metal using RHEL's installer. The container image includes full hardware drivers, but not cloud agents by default.

Manage

Designed for modern GitOps & CI/CD driven environments. Systems will auto-update from the container registry by default. More advanced control and automation is available via custom rollouts (e.g. Ansible). Intelligence via Insights and on-prem content curation via Satellite are planned for the future.

Image mode for RHEL

Tech Preview

Encapsulate differences in a sequence of builds

```
# Derive standard operating environment
FROM rhel9/rhel-bootc:latest

RUN dnf install -y [system agents]
[dependencies] && dnf clean all

COPY [unpackaged application]
COPY [configuration files]

RUN [config scripts]
```

```
# Derive database server from SOE
FROM corp-repo/corp-soe:latest

RUN dnf install -y [database]
[dependencies] && dnf clean all

COPY [configuration files]

RUN [config scripts]
```

Tech Preview

registry.redhat.io/rhel9/rhel-bootc:9.4

The RHEL bootc image is available in technology preview

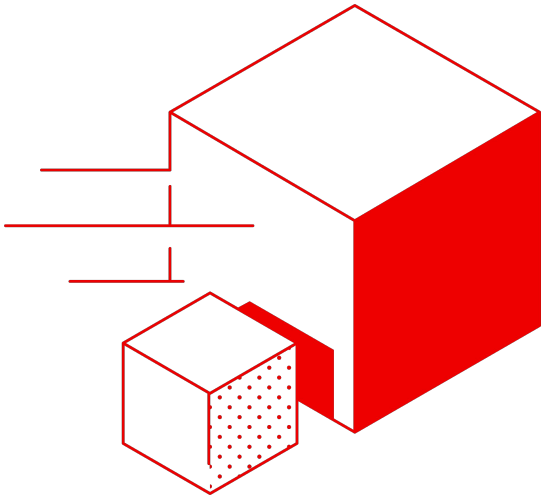


Image Specs:

- 439 rpms
- ~785M compressed
- ~2.2G on disk

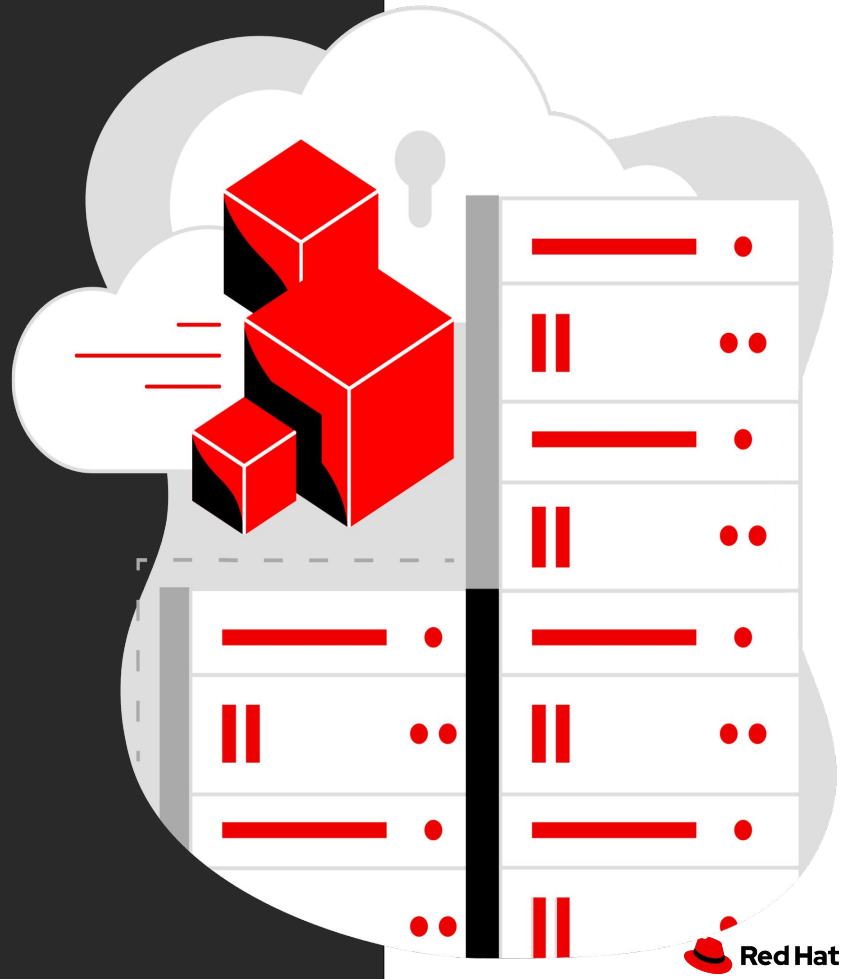
Primary contents:

- systemd, kernel, bootc
- rpm-ostree[1]
- linux-firmware
- NetworkManager
- podman
- python
- Misc CLI tools: jq, sos

No cloud-init or virt agents

Documentation

Deploy

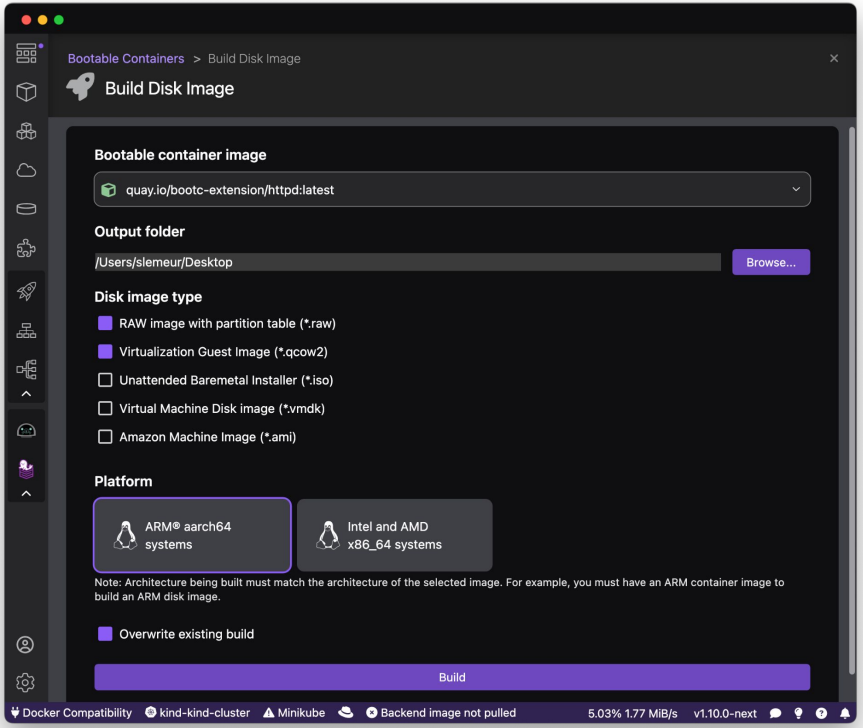


Tech Preview

Bootc image builder

Create **bootable container images** for bare metal to AWS and everywhere in between

`qcow2`	QEMU Disk Images
`ami`	Amazon Machine Images
`raw`	Raw disk image with MBR or GPT partition table
`anaconda-iso`	Unattended installation (USB Sticks / Install-on-boot)
`vmdk`	Virtual Machine Disk Image (vSphere, etc.)



- Designed for and only available as a container image:
  - registry.redhat.io/rhel9/bootc-image-builder
- Available extension for Podman Desktop
  - Build for Intel & Arm architectures

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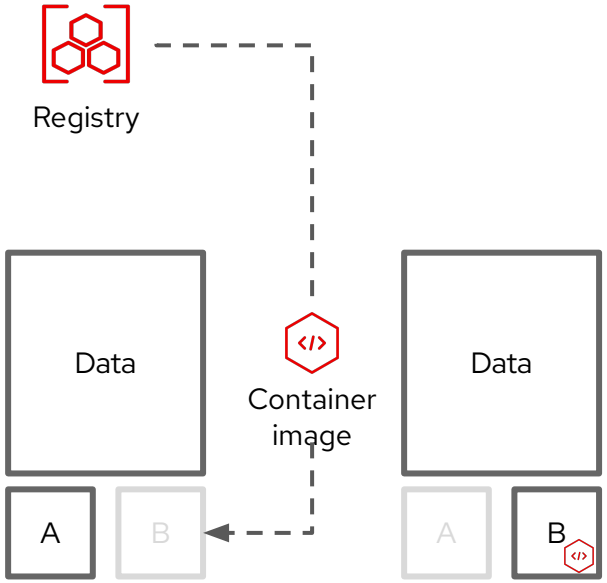
Bootc: Image-based updates perfected

Immutable by default - secure by design



Transactional updates (A → B model)

Bootc uses composefs and ostree to convert the container image into the root filesystem on the host..

Roll forward or backwards

Updates are staged in the background and applied when the system reboots. The transactional model enables rollbacks for additional assurance

Upgrades have never been easier

While there are some limits, bootc enables moving between minor releases of RHEL (9.4 → 9.5), as well as major releases (9.4 → 10.0)

Tech Preview

bootc

A/B booting of container images

`bootc upgrade`
Download and stage an updated container image.
- Automatic updates on by default. Configurable using bootc-fetch-apply-updates.timer

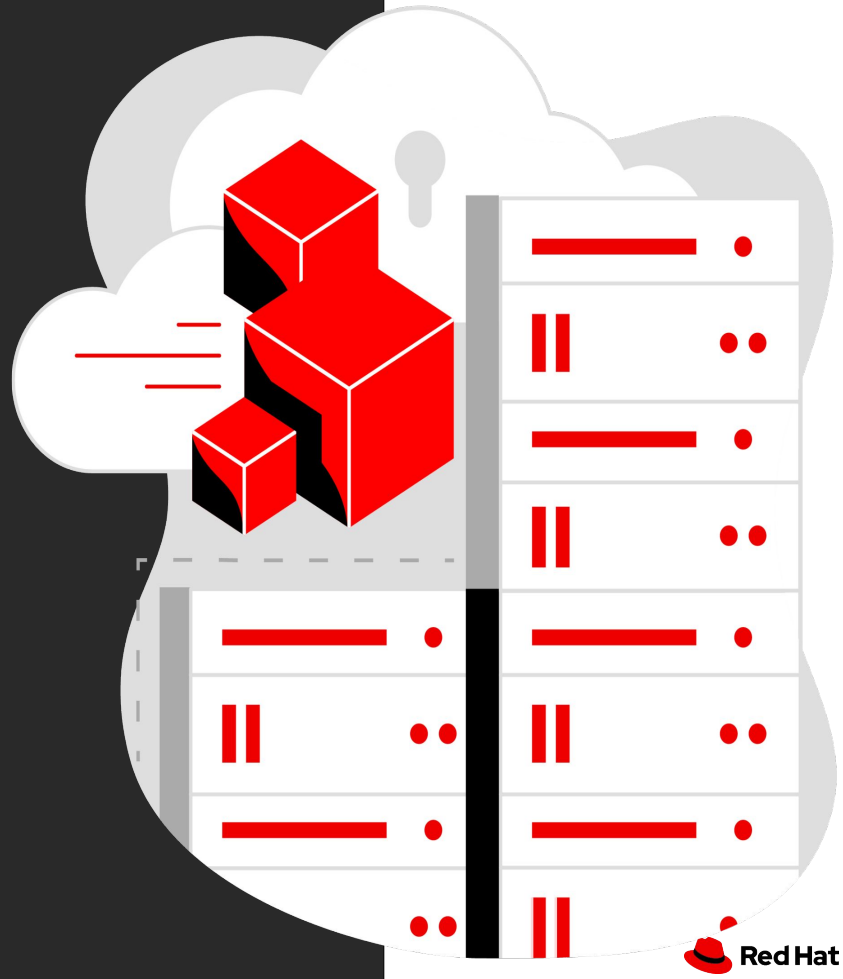
`bootc rollback`
Rollback to the previous state. Staged updates are discarded

`bootc switch`
Change to a different reference image

`bootc install`
Install container image **`to-disk`** or **`to-filesystem`**

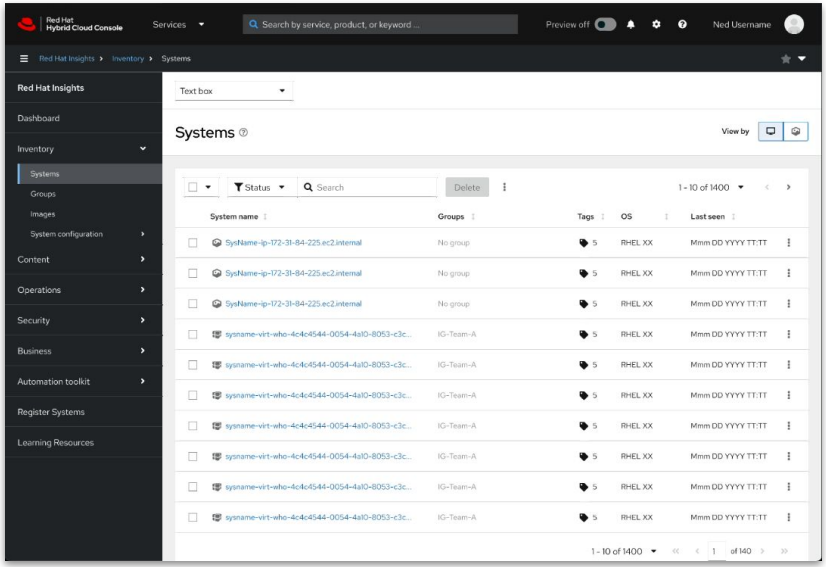
- Man page
- https://github.com/containers/bootc
- https://github.com/containers/podman-desktop-extension-bootc

Manage



Management with Red Hat Insights

Visibility and reporting made simple



RHEL is RHEL

Image mode systems appear in inventory like package based systems.

Registration is simple

Activation keys can be baked into images via Containerfile, allowing auto registration to Insights at boot time.

Insights has ... Insights

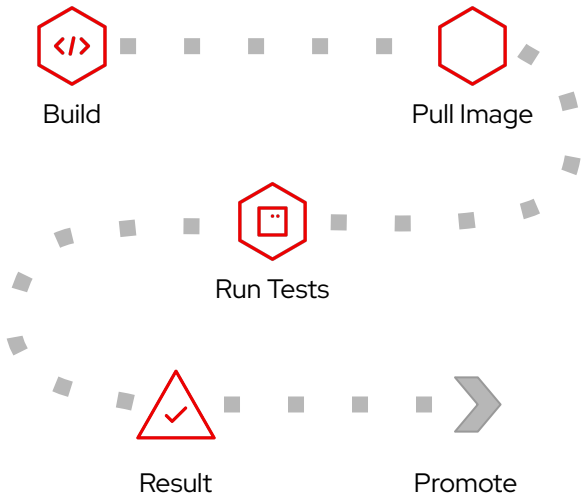
Image mode systems can be scanned for security and operational recommendations.

Updates on your terms

Image mode systems can be updated to new versions of images or remediated based on image-specific recommendations.

Validating OS updates has never been easier

CI pipelines used for apps now work with the OS



Test/validate as a container

Bootc images can run as bare metal, VMs, **and containers**. This enables faster and lighter weight testing/validation of each build's userspace.

Easy pipeline integration

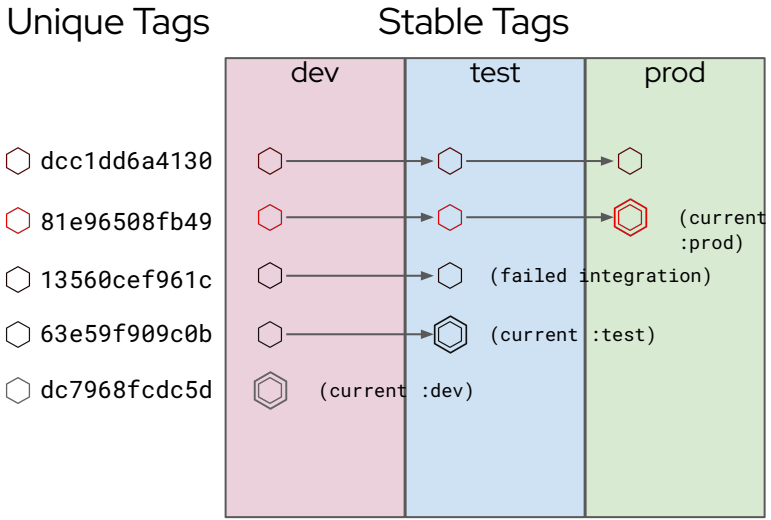
Containers have broad support across Github, Gitlab, Gitea, Circle CI, Jenkins, etc for the common container related tasks and testing. Use any system you like..

Simple promotion through registry tagging

Tags are a powerful tool to identify dev → test → prod promotions.

OS Updates via Container Registries

Tagging is powerful to version and promote updates



Tags offer simple versioning and visibility

Tags are simple to automate and use for promotions. Bootc will default to updating from a `repository:tag`.

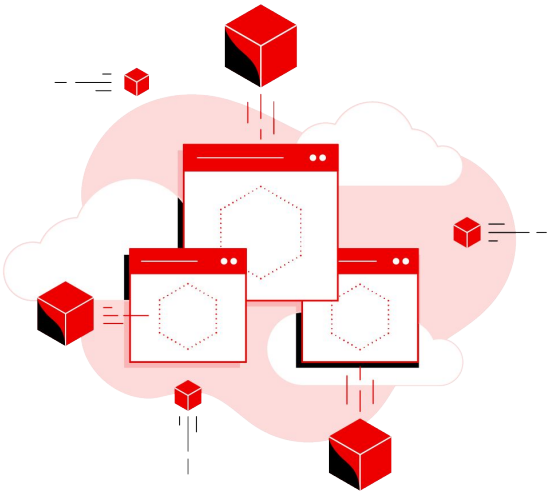
Control updates via tagging

Combine tagging with the optional automatic updates to control fleets of systems via registry tags.

Standardized & scaleable infra

Container registries scale very well and any standard registry can be used.

Image mode creates opportunities to think differently

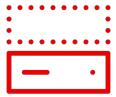


- **All RHEL users** will benefit from standardization, simplicity and portability across all of their environments that span the hybrid clouds
- **DevOps teams** can easily plug RHEL into their CI/CD & GitOps workflows, easing the friction that exists between the platform and the application.
- **Security teams** can apply container security tools, from scanning and validation to cryptography and attestation to the base elements of the operating system, making their jobs far less complex.
- **Solution providers** will love how easy it is to build and distribute their offerings on the trusted RHEL platform

Recommended use cases

AI/ML stacks

Perfectly version app dependencies from kernel, GPU & accelerator drivers, frameworks, runtimes, etc



1:1 App/Host

Manage the OS and app as a single unit

Edge appliances

Registries and auto-updates make managing a fleet of identical systems a snap

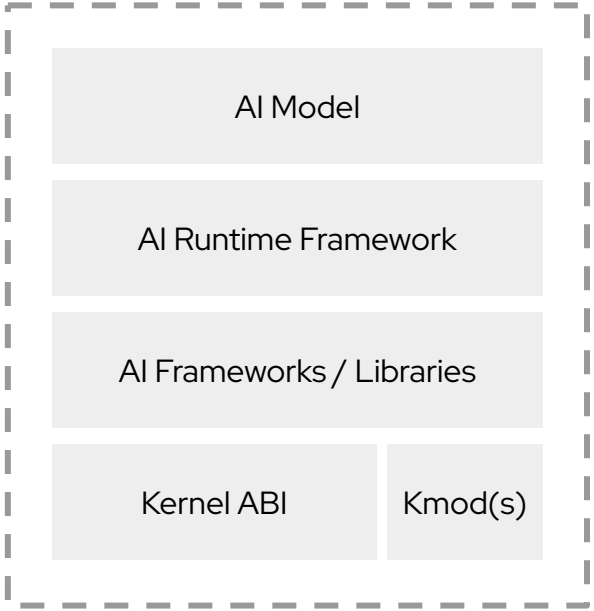
Container hosts

Simplify and manage the OS in the same way as your applications

AI/ML Stacks

Deploy AI stacks confidently with image mode

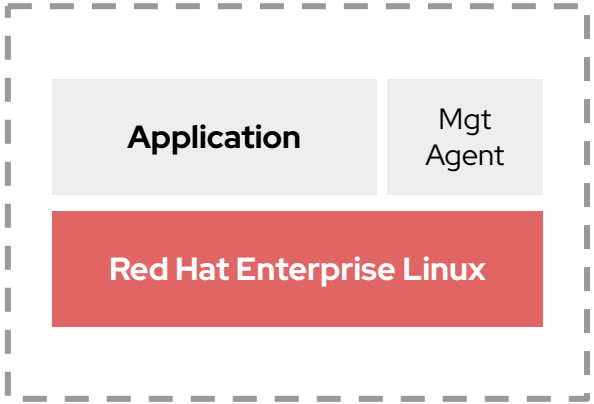
- **Simple:** Much of the AI world already leverages containers, image mode helps deploy AI stacks quickly and efficiently.
- **Portable:** AI workloads often need to run in close proximity to data sources and image mode helps target multiple environments (better way to say that?)
- **Easy experimentation:** Image layering makes it effortless to test different models & frameworks and helps brings order to image sprawl.
- **Limit downtime:** version & test components and dependencies at build time before they go to production.



1:1 App/Host

Version & manage OS + app as a single unit

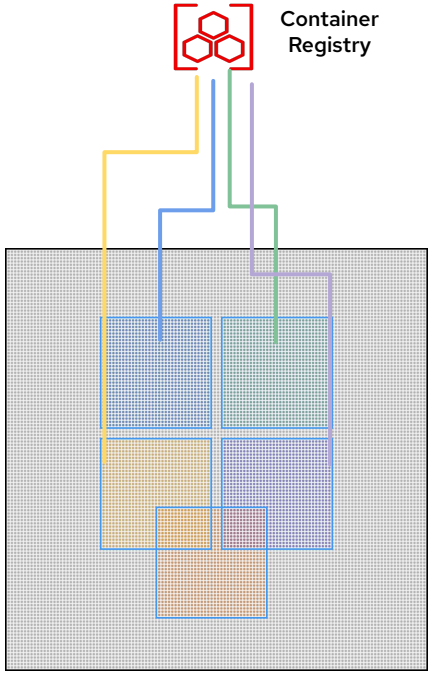
- **Efficient:** reduce the management footprint
- **Repeatable:** containers help enforce consistency and reproducibility making it easy to “scale up”
- **Control drift:** image mode encourages configuration at build time leading to a more consistent fleet.
- **Rollbacks**: A/B boot model means fast recoveries in the case of unforeseen issues.
- Leverage containers for the *uncontainerizable* apps



Edge Appliances

Registries and auto-updates make managing a fleet of identical systems a snap

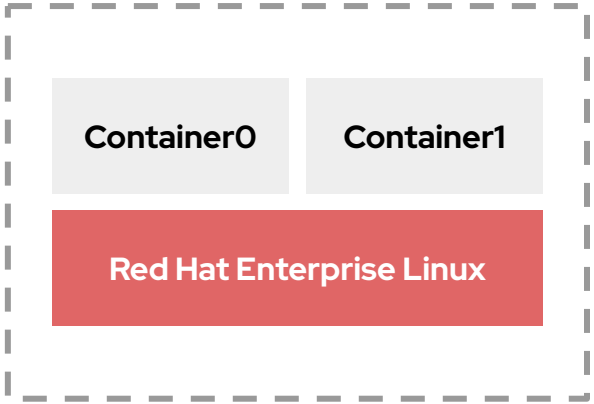
- **Image-based updates**: provide increased reliability over the life of the system.
- **Rollbacks**: A/B boot model means fast recoveries in the case of unforeseen issues.
- **Updates at scale**: Control OS & App container versioning through industry standard registries and tags.
- Support for air-gapped and DIL environments



Standalone Container Hosts

Simplify and manage the OS in the same way as your applications

- **Flexible**: image mode provides a higher degree of host-level customization than previous immutable OSs.
- **Common tools**: use existing container tools and pipelines to build applications and the OS for better compatibility
- Align teams & operations around tools and process.

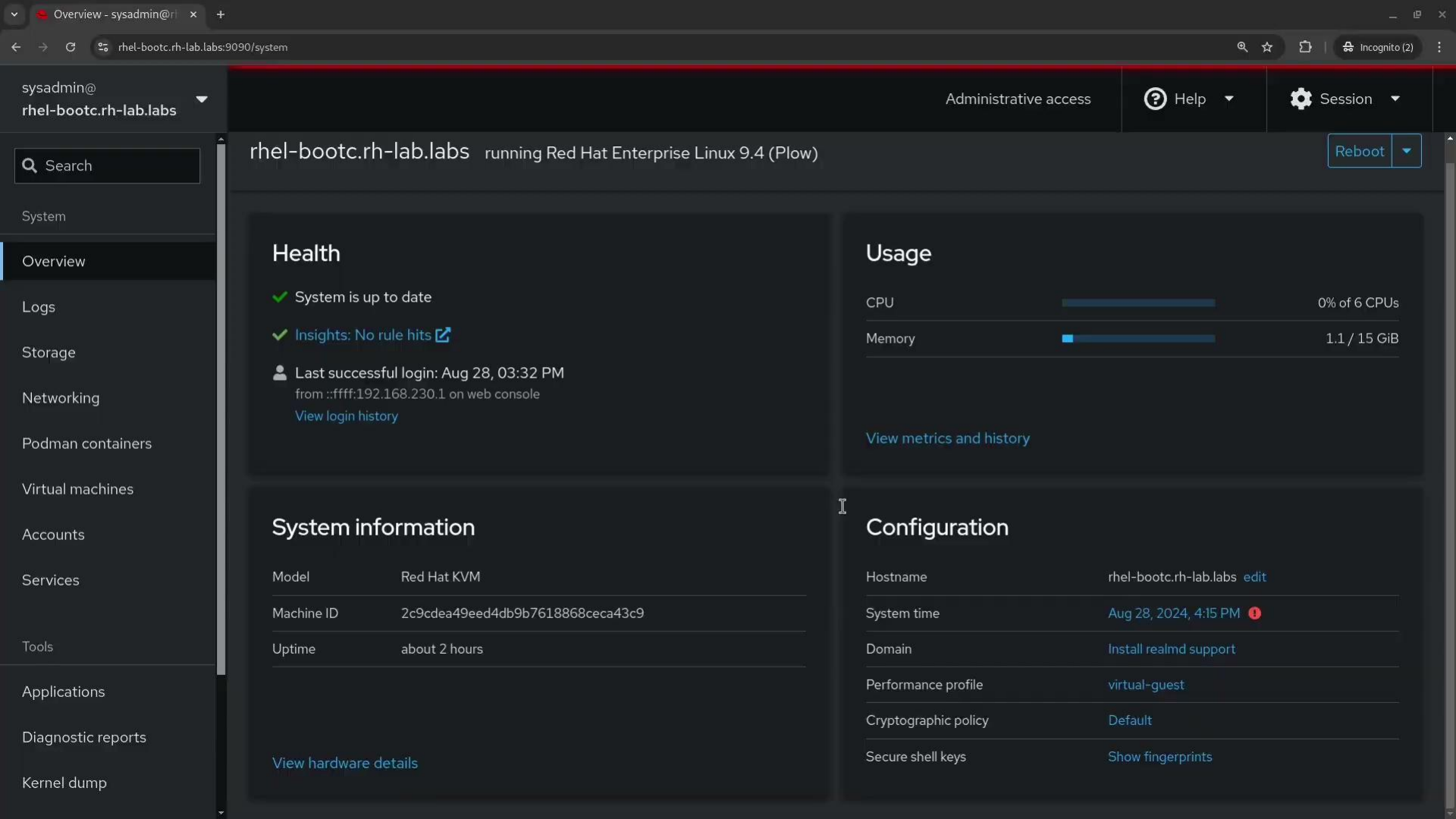


RHEL Image mode in action - Demo time!

Generate a QCOW2 image and spin a Virtual Machine on KVM

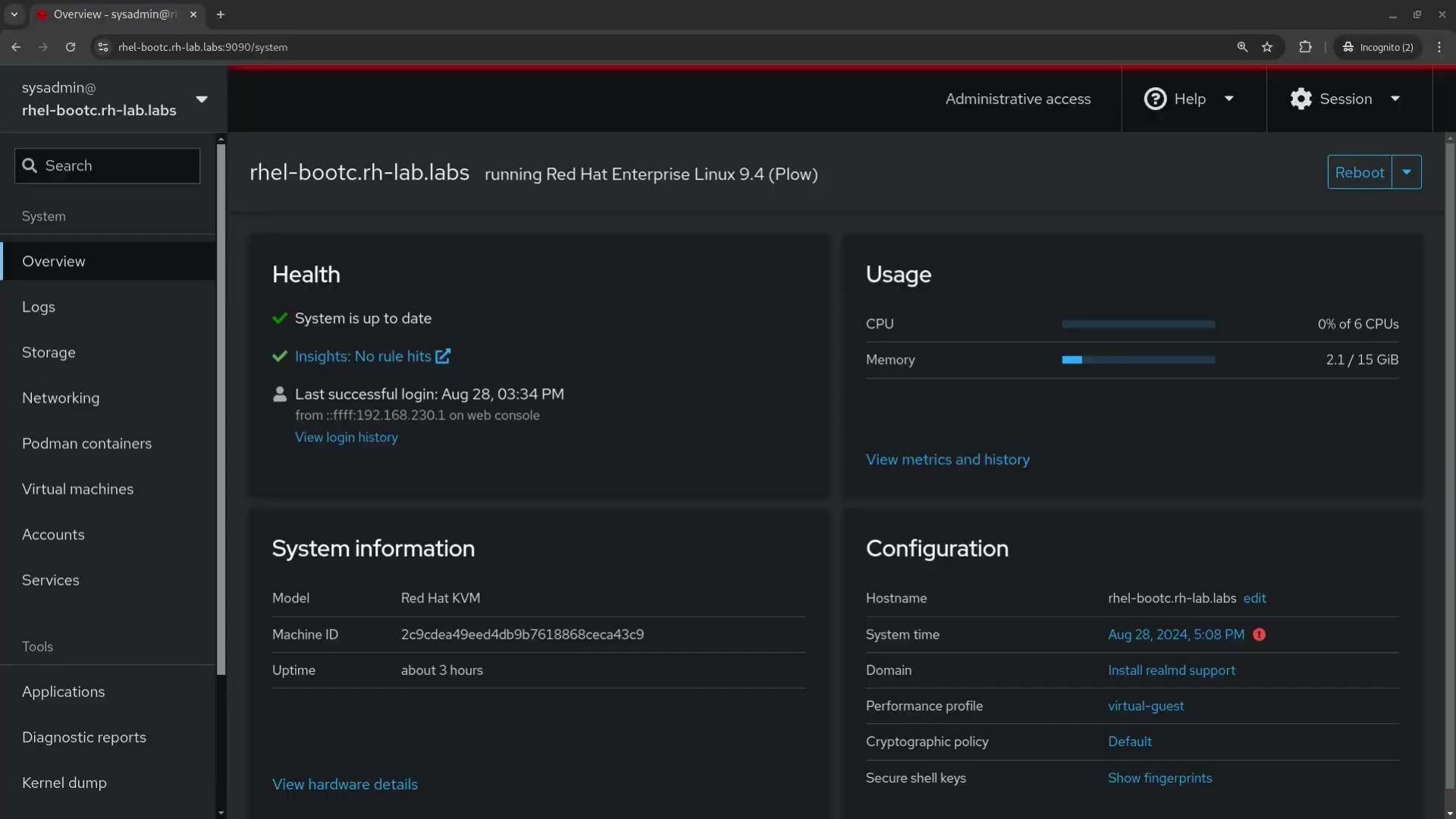
Manage RHEL OS updates with bootc

Generate a QCOW2 image and spin a Virtual Machine on KVM


Overview - sysadmin@rhel-bootc.rh-lab.labs:9090/system
rhel-bootc.rh-lab.labs:9090/system
Incognito (2)
sysadmin@
rhel-bootc.rh-lab.labs
Administrative access
Help
Session
Search
System
Overview
Logs
Storage
Networking
Podman containers
Virtual machines
Accounts
Services
Tools
Applications
Diagnostic reports
Kernel dump
rhel-bootc.rh-lab.labs running Red Hat Enterprise Linux 9.4 (Plow)
Reboot
Health
System is up to date
Insights: No rule hits
Last successful login: Aug 28, 03:32 PM
from ::ffff:192.168.230.1 on web console
View login history
Usage
CPU
0% of 6 CPUs
Memory
1.1 / 15 GiB
View metrics and history
System information
Model
Red Hat KVM
Machine ID
2c9cdea49eed4db9b7618868ceca43c9
Uptime
about 2 hours
View hardware details
Configuration
Hostname
rhel-bootc.rh-lab.labs edit
System time
Aug 28, 2024, 4:15 PM
Domain
Install realmd support
Performance profile
virtual-guest
Cryptographic policy
Default
Secure shell keys
Show fingerprints

Generate a QCOW2 image and spin a Virtual Machine on KVM

Manage RHEL OS updates with bootc


Overview - sysadmin@ri
rhel-bootc.rh-lab.labs:9090/system
Incognito (2)
sysadmin@
rhel-bootc.rh-lab.labs
Administrative access
Help
Session
Search
System
Overview
Logs
Storage
Networking
Podman containers
Virtual machines
Accounts
Services
Tools
Applications
Diagnostic reports
Kernel dump
rhel-bootc.rh-lab.labs running Red Hat Enterprise Linux 9.4 (Plow)
Reboot
Health
System is up to date
Insights: No rule hits
Last successful login: Aug 28, 03:34 PM
from ::ffff:192.168.230.1 on web console
View login history
Usage
CPU
0% of 6 CPUs
Memory
2.1 / 15 GiB
View metrics and history
System information
Model
Red Hat KVM
Machine ID
2c9cdea49eed4db9b7618868ceca43c9
Uptime
about 3 hours
View hardware details
Configuration
Hostname
rhel-bootc.rh-lab.labs edit
System time
Aug 28, 2024, 5:08 PM
Domain
Install realmd support
Performance profile
virtual-guest
Cryptographic policy
Default
Secure shell keys
Show fingerprints

Try it yourself!

The whole demo shown in this session and other use cases are available in the following Github repository:

https://red.ht/rhel-image-mode-demo

Everybody is welcome to use it, fork and suggest improvements.

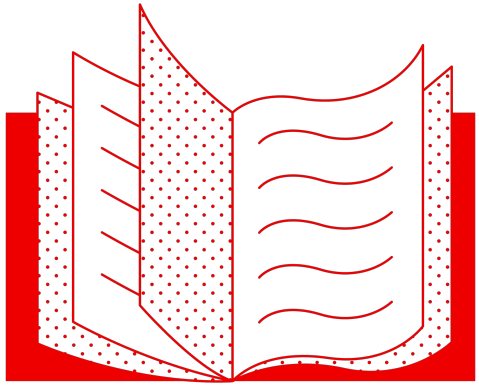
Useful resources

RHEL Image mode on Red Hat Developers

RHEL Image mode documentation

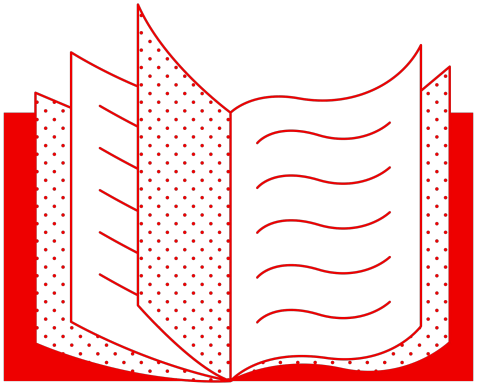
RHEL Image mode quickstart on Red Hat Blog

RHEL Image mode overview - YouTube



Useful resources

- RHEL Image mode on Red Hat Developers
  - https://developers.redhat.com/products/rhel-image-mode/overview
- RHEL Image mode documentation
  - https://docs.redhat.com/en/documentation/red_hat_enterprise_linux/9/html/using_image_mode_for_rhel_to_build_deploy_and_manage_operating_systems/index
- RHEL Image mode quickstart on Red Hat Blog
  - https://www.redhat.com/en/blog/image-mode-red-hat-enterprise-linux-quick-start-guide
- RHEL Image mode overview - YouTube
  - https://www.youtube.com/watch?v=QZDaTHyl1Sk



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