Agenda

- What is new in RHEL

- RHEL Image Mode overview

- RHEL Image Mode demo

- Q&A

The Route to RHEL 10

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

Upcoming:

- ▶ Insights
- ▶ Satellite 6.16
- ▶ RHEL Lightspeed
- ▶ RHEL AI
- ▶ RHEL 10 GA (Expected Mid–2025)
- ▶ **RHEL Image Mode**

Red Hat
Ansible Automation Platform

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.
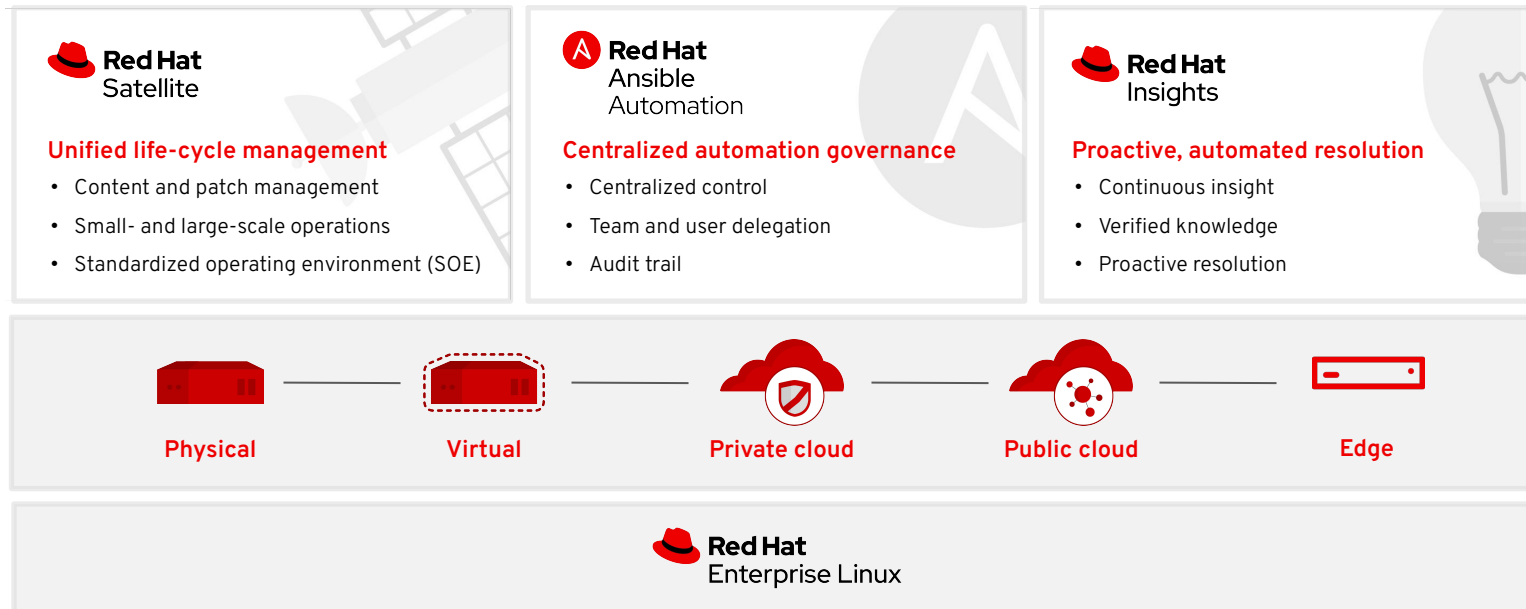
Physical & Edge

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

Red Hat

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

Physical — **Virtual** — **Private cloud** — **Public cloud** — **Edge**

Red Hat Enterprise Linux

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
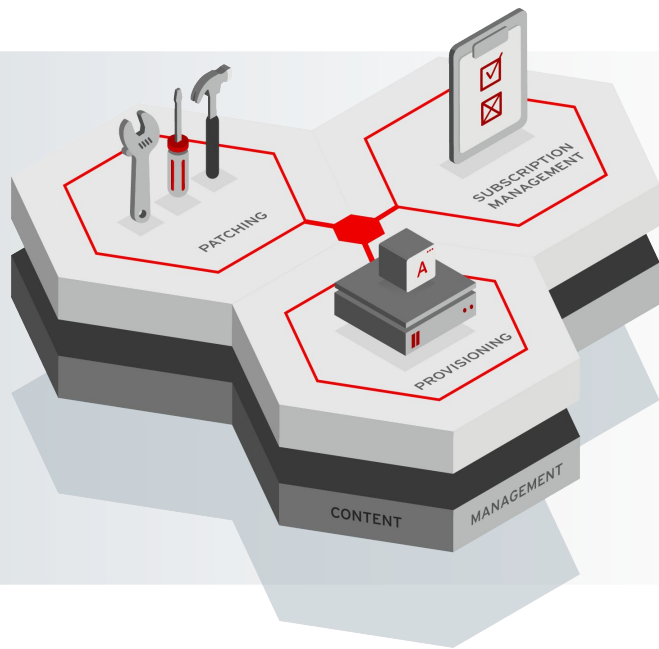▶ Task to initiate an update of image mode hosts

Red Hat Satellite

Standard Operating Environment hosts are the same across your environment

Reliable and Resilient Using Red Hat Insights

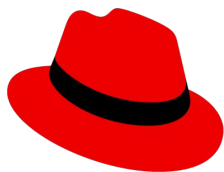**Secure** your systems are patched, up to date, and compliant with security policies
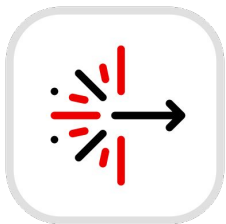
Confidence in your subscription utilization

Red Hat 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

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

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

/Keep your options open **Red Hat**

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!

Red Hat

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
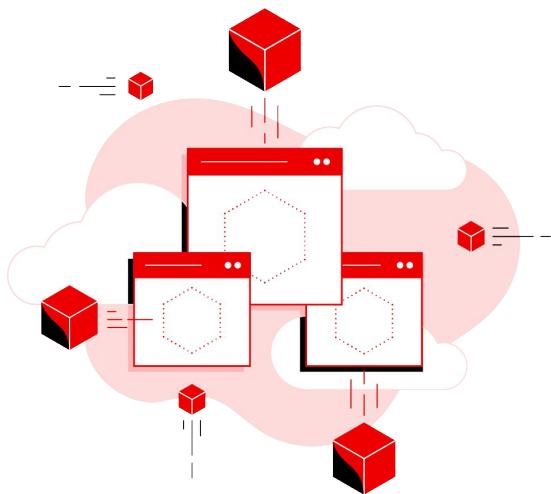
Move faster

Increase the speed of experimentation

Streamline process

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

Red Hat

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

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Containers revolutionized application deployment

App

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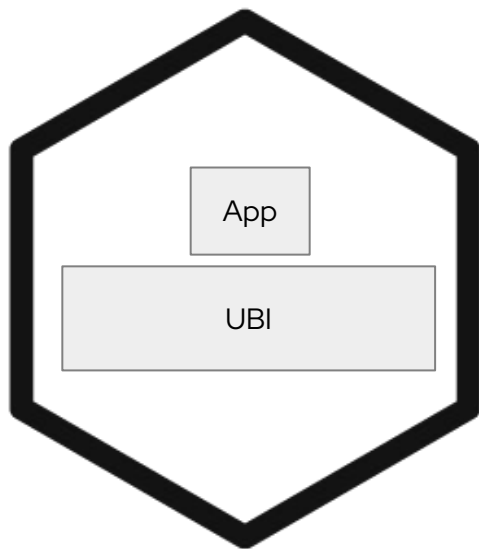
- Standardized packaging via OCI image format
- Standardized delivery via OCI registry
- Clarity and transparency with the container file
- Deployment portability & predictability
- Rich ecosystem of security, automation, & orchestration tooling
- Rapid adoption and pervasive

...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
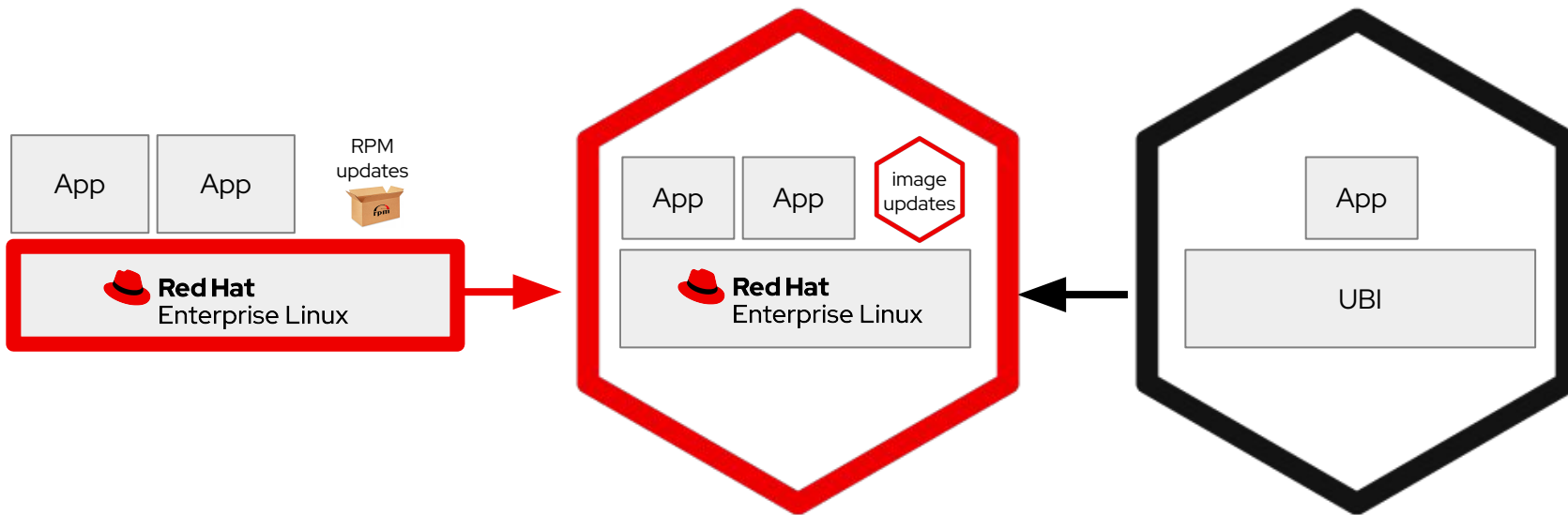
Package mode

Image mode

Application container

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
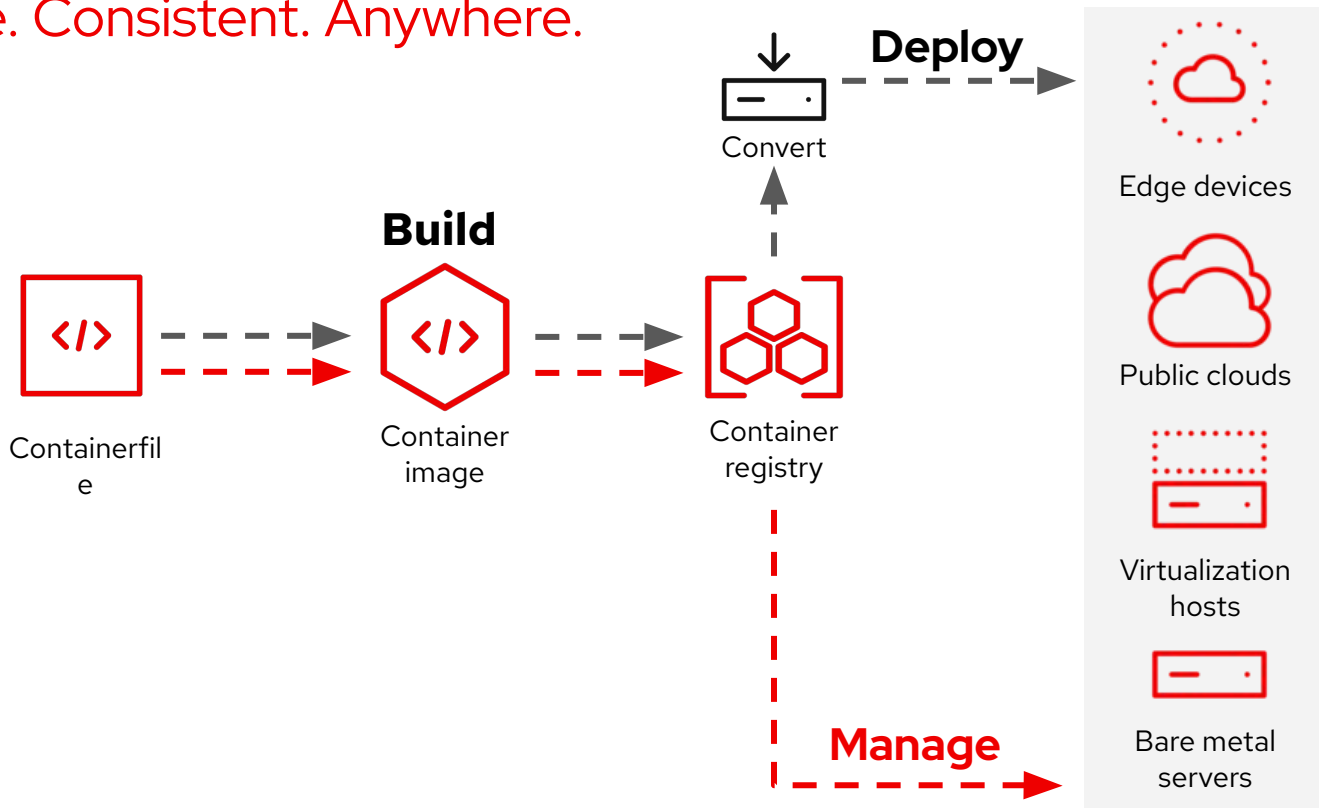## Simple. Consistent. Anywhere.

Deploy

Convert

Build

Containerfile

Container image

Container registry

Edge devices

Public clouds

Virtualization hosts

Manage

Bare metal servers

20

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.
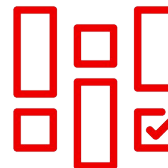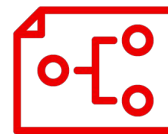
Red Hat

Build

Image mode for RHEL

Encapsulate differences in a sequence of builds

Tech Preview

```
# 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]
```

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

The RHEL bootc image is available in technology preview
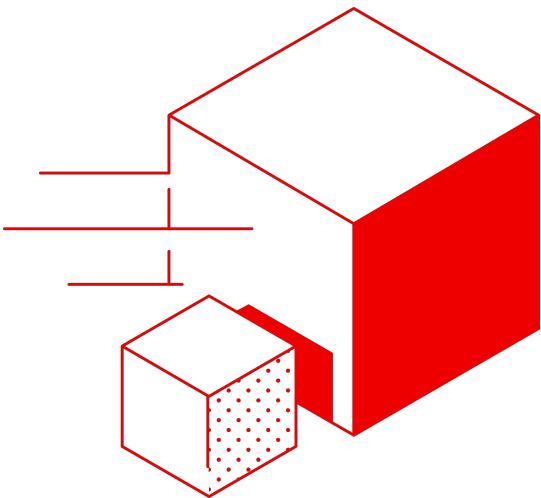
Tech Preview

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

Bootc image builder

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

Tech Preview

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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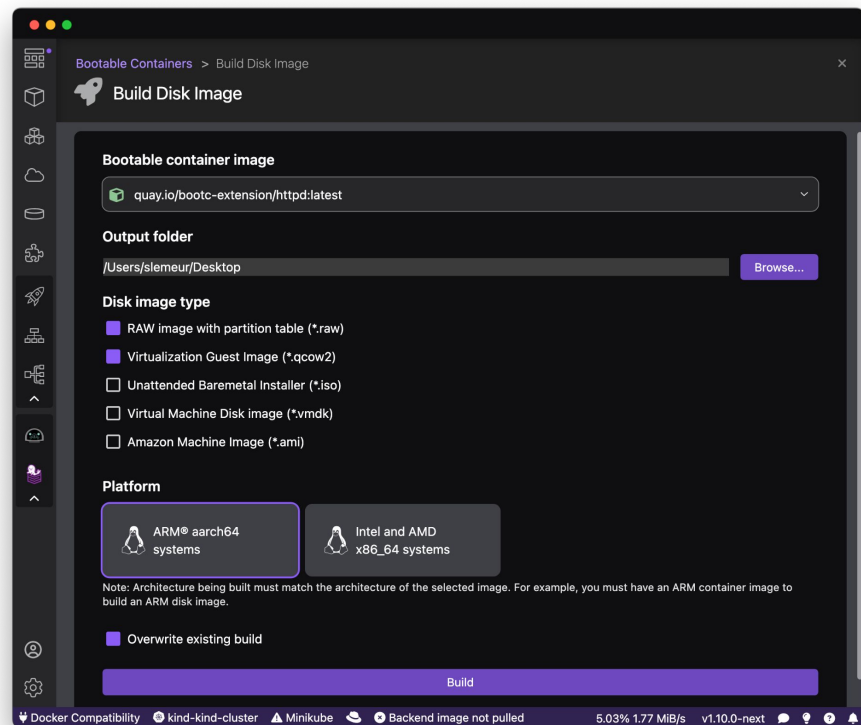
Bootc: Image–based updates perfected

Immutable by default - secure by design

Registry

Data

Container
image

Data

A   B

A   B
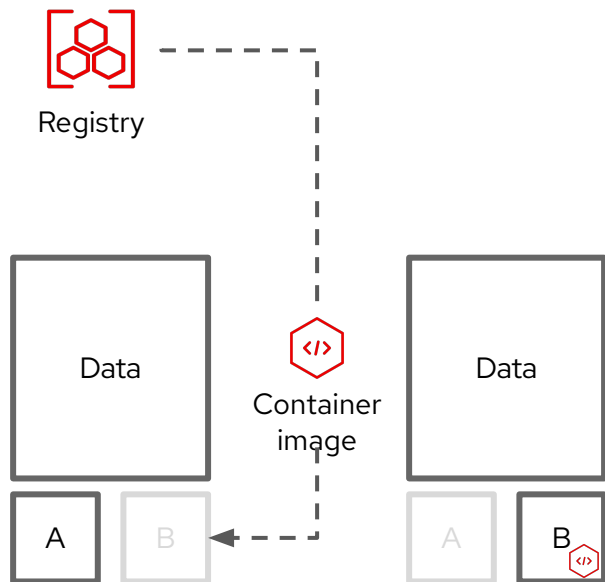
Transactional updates (A → B model)
Bootc uses composefs and ostree to convert the container image into the root filesystem on the host..

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)

bootc

A/B booting of container images

Tech Preview

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

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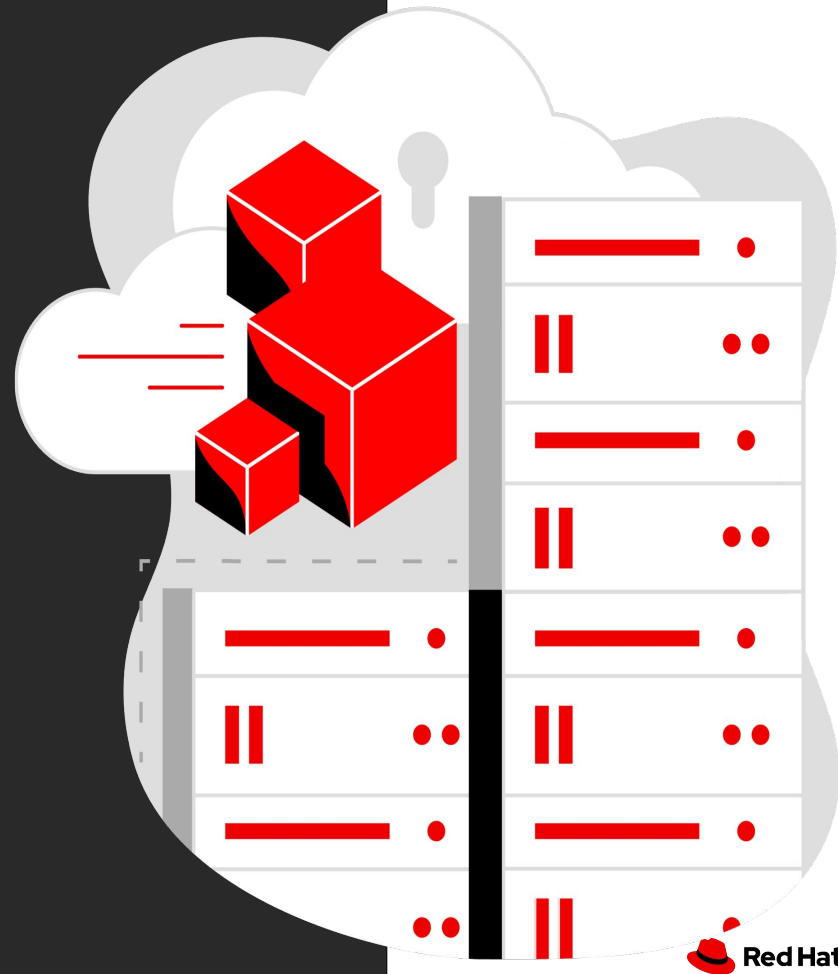Rollback to the previous state. Staged updates are discarded

`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

Red Hat
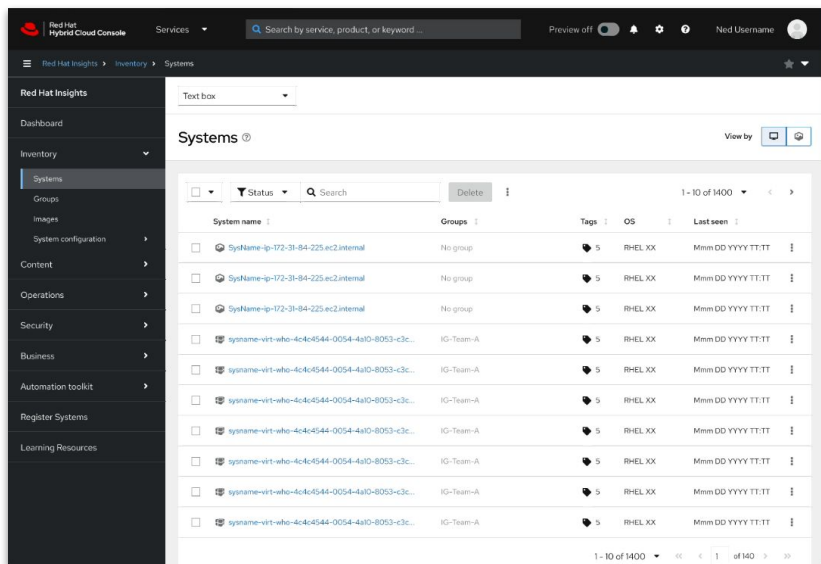
Manage

Red Hat

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

Build

Pull Image

Run Tests

Result

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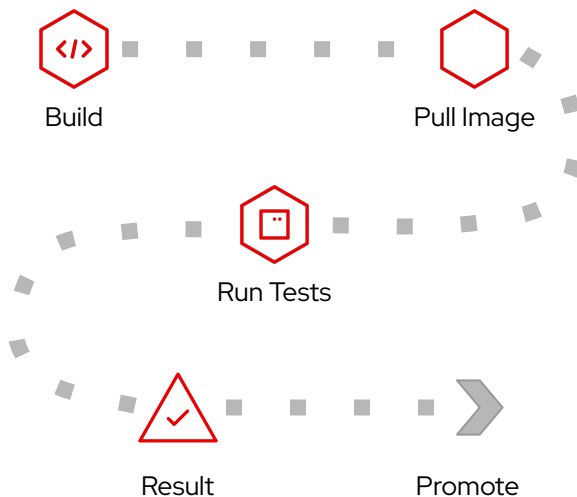
Test/validate as a container
Bootc images can run as bare metal, VMs, **and containers**. This enables faster and lighter weight testing/validation of each build's userspace.

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..
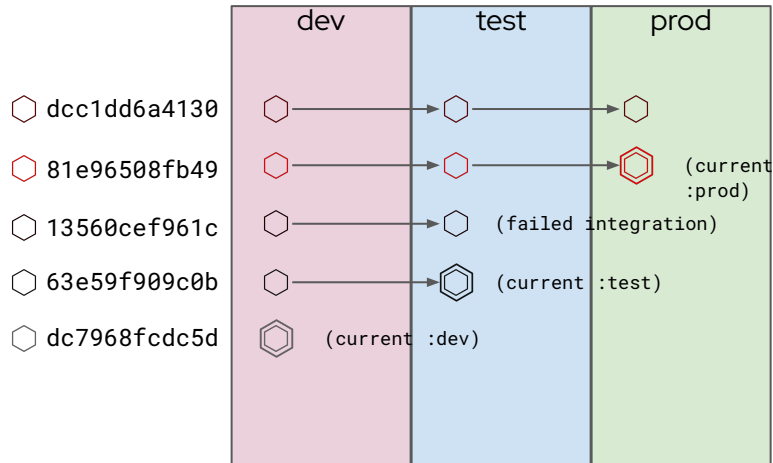
Simple promotion through registry tagging
Tags are a powerful tool to identify dev → test → prod promotions.

Red Hat

OS Updates via Container Registries

Tagging is powerful to version and promote updates

Unique Tags   Stable Tags

dev	test	prod

dcc1dd6a4130

81e96508fb49   `(current :prod)`

13560cef961c   `(failed integration)`

63e59f909c0b   `(current :test)`

dc7968fcdc5d   `(current :dev)`

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.

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 <u>and</u> app as a single unit

Edge appliances

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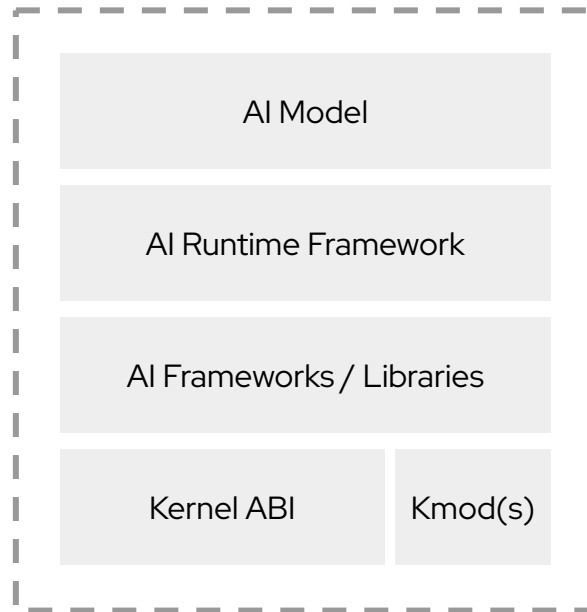
Container hosts

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

Red Hat

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.

AI Model

AI Runtime Framework

AI Frameworks / Libraries

| Kernel ABI	Kmod(s)

Red Hat

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
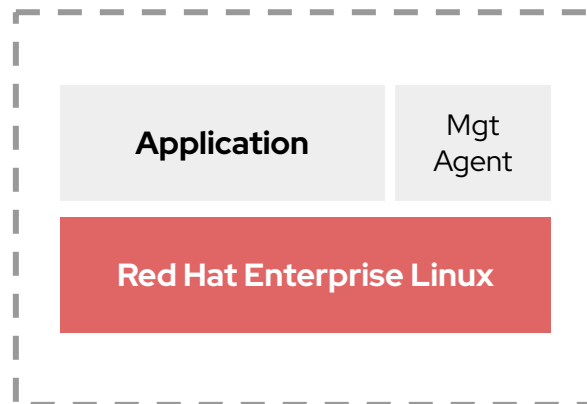
| Application	Mgt Agent
Red Hat Enterprise Linux	

Red Hat

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

Container Registry
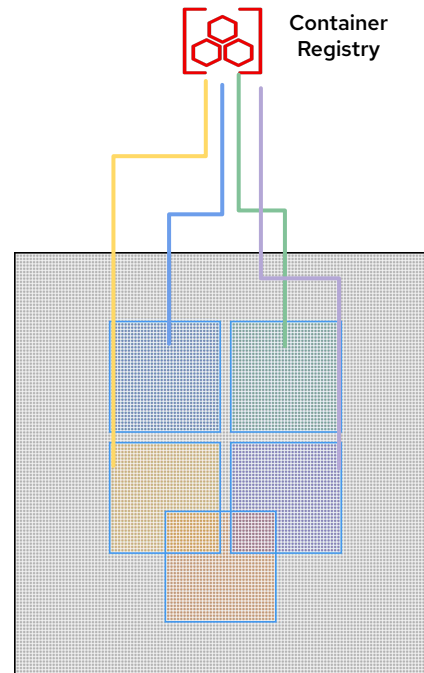
Standalone Container Hosts

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.

Container0	Container1

Red Hat Enterprise Linux
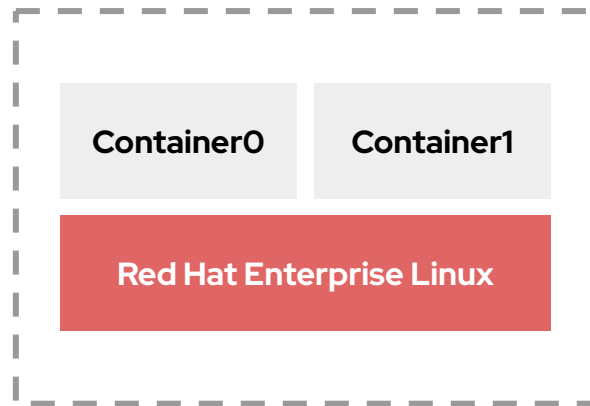
RHEL Image mode in action – Demo time!

Creation of an QCOW2 image from a RHEL Image Mode Container and deploy to KVM

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

Create and run a bootable RHEL container with Podman

Generate a QCOW2 image and spin a Virtual Machine on KVM

Install RHEL using Anaconda and Kickstart

Manage RHEL OS updates with bootc

Create and run a bootable RHEL container with Podman

Create and run a bootable RHEL container with Podman

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Generate a QCOW2 image and spin a Virtual Machine on KVM

Install RHEL using Anaconda and Kickstart

Manage RHEL OS updates with bootc

Wrap up

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.
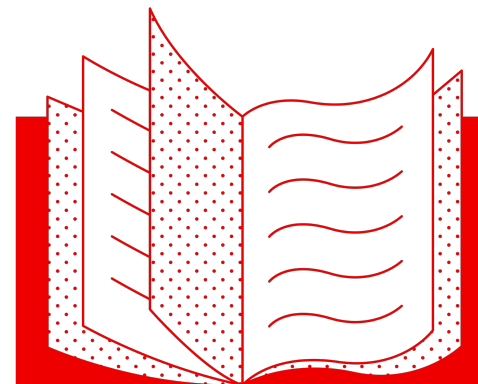
Red Hat

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/usin
    g_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-star
    t-guide

▸ RHEL Image mode overview - YouTube

  · https://www.youtube.com/watch?v=QZDaTHyl1Sk

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twitter.com/RedHat

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