Container & Cloud Native Roadshow 2022

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Agenda

- Use Case
 - Requirements
 - Architectural proposal
- Quarkus

- Integration
 - Camel
 - AMQ
- Extending workloads to the Edge
- Red Hat Advanced Cluster Management for Kubernetes
- RHEL for Edge
- Emerging Technology: MicroShift



CCNR Contributors



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Use case







KubeBrick needs to modernize the application infrastructure and invest on OT processes to improve production efficiency. Wants to monitor and manage the application from the cloud but at the same time need to maintain part of the legacy systems.

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Requirements

- Reduce time to market for new features in production
- Less time to add and monitor the manufacturing of a new product
- Monitoring the status of production
- Single pane of glass to manage production
- Standardize systems communication
- Connect legacy systems and gradually modernize all software to the new Hybrid Cloud infrastructure
- Standardize devices and software lifecycle management
- Reduce software fragmentation
- Connect existing infrastructure at far edge providing end-to-end visibility and management





Hybrid Architecture





Software Architecture





Supersonic. Subatomic. Java.



Cloud Native Java Stack + Containers





CONTAINER ORCHESTRATION

"We could run 3 times denser deployments without sacrificing availability and response times of services"

https://developers.redhat.com/blog/2017/03/14/java-inside-docker/



Introducing Quarkus - Container First

How Does a Framework Start?





Introducing Quarkus - Container First

The Quarkus Way

Build Time

Runtime



Build Time

Runtime



Quarkus Extensions

- Framework to plug in dependencies exploiting compile and build time optimization
- Available and working both under JVM or GraalVM
- Available for developers to code their extensions optimized for Quarkus



An ahead-of-time, build-time, runtime





Introducing Quarkus - JVM and Native Mode

Container First

"We went from 1-min startup times to 400 milliseconds"

REST + CRUD



Introducing Quarkus - Native mode

Quarkus and GraalVM



GraalVM...

- 100% of the ecosystem supported on GraalVM
- Drives the gathering of metadata needed by GraalVM
 - based on framework knowledge
 - Classes using reflection, resources, etc
 - No need for agent + prerun, long JSON metadata or manual command lines
- Minimize dependencies
- Help dead code elimination



Developer Joy

"Our developers used to wait 2 to 3 mins to see their changes. Live coding does away with this."

A cohesive platform for optimized developer joy:

- Based on standards and more
- Unified configuration
- Live coding
- No hassle native executable generation
- IDEs Plug-in availability

WAIT. SO YOU JUST SAVE IT, AND YOUR CODE IS RUNNING? AND IT'S JAVA?!





Quarkus: Developer Joy

Dev Mode

Continuous Testing

- Quarkus detects correspondence between classes and tests
- Quarkus reruns only affected tests

Dev UI

- Display loaded extensions Status, information and documentation
- Allows extensions reconfiguration

Dev Services

- Docker powered lightweight throwaway instances of popular software to allow local integration tests
- Support Persistency, Messaging, Caching and others









code.quarkus.redhat.com

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- Getting started for RHBQ
 - · Generate Project archive
 - Copy snippets
- Updated list of supported extensions
- Different certified support level
 - Supported
 - Tech Preview
 - Dev supported
 - JVM Supported



Red Hat Integration

Camel

Camel



XML, YAML and Java

The Aller Westy Segunton .



Camel

Apache Camel

Swiss knife of integration







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Patterns

Solve integration problem by applying best practices out of the box. Even with microservice architectures.

300+ Components

Packed with 300+ components such as databases, message queues, APIs.

Lightweight Runtimes

Quarkus, Standalone, Spring Boot, Application Servers, and natively on Cloud.

Data Formats

Translate messages in multiple formats, and industry standard formats from finance, telco, health-care, and more





Apache Camel

Swiss knife of integration









DSLs

Simple, self-explained Domain Specific Language. Available in Java, YAML, XML

Reactive Routing Engine

Back pressure model. Smooth flow control. Better thread management.

Backlog Tracer/Tracer Capturing a trace inside and between Camel route. For better observibility

Comprehensive Tooling

Support autocomplete, correction on multiple IDE with LSP Server. Graphical data mapper.



Some use cases



Data Transformation



Cron Job execution

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Batch execution Positional flat files processing



Content Based Routing



ETL like data extraction JDBC support NoSQL connectors $\square \to \square$

Source - Sink paradigm

Messaging patterns Request - Reply Asynchronous messaging Fire and forget



Data aggregation



ReST integration



Camel: route





Camel Community to Red Hat family





Camel extension for Quarkus



Camel Extensions for Quarkus Drivers

- Containers in mind
- Serverless characteristics

Integration swiss knife

Super lightweight

300+ Connectors

Most popular

Integration

Framework

- Developer Joy
- Make Java relevant



Camel Extensions for Quarkus

- Latest Camel v3 (lighter, faster)
- Container-based environments
- Flash boot time
- Minimal memory footprint
- Standalone & Kubernetes
- Long-term support commitment



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Camel K



Serverless Operational Benefits





With Serverless

Red Hat

Kamek K





AMQ



AMQ

Event and Message based Integration





AMQ

Overview



Streams

Streams simplifies the deployment, configuration, management and use of Apache Kafka on OpenShift using the Operator concept



Broker

High-performance messaging implementation based on ActiveMQ Artemis



AMQ Broker Overview

- Full-featured, message-oriented middleware broker
 - Pure Java, high-performance message broker
 - Flexible persistence: high-performance journal or JDBC
 - High availability: shared SAN or shared-nothing replication
 - Flexible clustering
- Specialized queueing behaviors, message persistence, and manageability
- Multiple protocols and client languages are supported
 - Including AMQP 1.0, MQTT, STOMP, OpenWire, HornetQ
 - Java JMS, C++, .NET, Python, Javascript, NodeJS Clients





AMQ Streams Overview

Enterprise data streaming platform distribution based on Apache Kafka. Available standalone on Red Hat Enterprise Linux VMs/bare metal or on OpenShift (based on Strimzi project).




Apache Kafka (Community)





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AMQ Streams ecosystem





Extending workloads to the Edge



Create flexibility and opportunity with edge computing

Application flexibility

Deploy applications anywhere



Act with speed and agility and adapt to the needs of the business

Operational agility Minimize operational challenges



Provide new solutions for a variety of distributed application environments

Business innovation Address new opportunities



Enhance innovation, increase productivity, and offer better products and services



Extending Workloads to the Edge

Edge computing extends digital transformation to where business happens

Software-defined platforms

Software-defined everything

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- - Standard, scalable hardware
 - Cloud-native applications
 - Flexibility and agility
 - Convergence of data platforms

- Real-world, real-time interaction
- Convergence of planning and execution
- Implementation of data-driven insights
- Integration of formerly closed systems



*#





On-Prem computing with Red Hat OpenShift

Branch	site A - Remote Worker	
	CNFs/VNFs Security and Execution Systems	
	Red Hat OpenShift	
On-prem Networking, Services and Sensors		
Branch site B	- Three Nodes/Single Node	
PLC	CNFs/VNFs Security and Execution Systems	
Red Hat Enterprise Linux		
	Red Hat ACM agent OpenShift	
On-prem Networking, Services and Sensors		
Sensors		





Industrial use case

Red Hat OpenShift helping create the smart edge across industries

- Simplify the deployment and lifecycle management of Networking, Security, Al-powered applications, IoT and other Services
- Accelerate data gathering, preparation, and inferencing tasks
- Consistent development of platform and tools
- Turn insights into positive business outcomes faster

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Red Hat Advanced Cluster Management for Kubernetes



Where is the growth in cluster deployments?



Small Scale Dev teams

Managing and syncing across
 Dev/QE/Pre-Prod/Prod
 clusters can be difficult



Medium Scale Organizations

- Retail with small clusters across 100s of locations
- Organizations with plan for growth 10-15 clusters moving to 100s



Large Scale

- Global organizations with
 100s of clusters, hosting
 thousand of applications
- Large Retail with 1000s of stores



Edge Scale Telco

 100s of zones, 1000s of clusters and nodes across complex topologies



Multi-Cluster Management Use Cases



- Multicluster life-cycle management
- - Policy-driven governance, risk, and compliance
- Advanced application life-cycle management



Multicluster observability for health and optimization















Edge

Red Hat Advanced Cluster Management for Kubernetes

Unified Multi-Cluster Management

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- Centrally create, update and delete Kubernetes clusters across multiple private and public clouds
- **Hibernate / Resume** OCP Clusters across your domain
- Configure Cluster Sets & Cluster Pools for simplified OCP cluster management
- Search, find and modify **any** kubernetes resource across the **entire** domain.
- Quickly troubleshoot and resolve issues across your federated domain





Policy based Governance, Risk and Compliance

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- **Centrally** set & enforce policies for security, applications, & infrastructure
- Quickly visualize detailed auditing on configuration of apps and clusters
- Perform remediation actions by leveraging Ansible Automation Platform.
- Built-in **compliance policies** and audit checks.
- Immediate visibility into compliance posture based on users-defined standards





Advanced Application Lifecycle Management

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- **Easily** deploy an Application using the **Application Builder**
- Deploy Applications from Multiple Sources (GIT / HELM / Object Storage)
- Integrate with **OpenShift GitOps** (Argo CD).
- Automatically detect and visualize Argo CD Applications in RHACM
- Quickly **visualize** application relationships **across** clusters and those that **span** clusters



Multi-Cluster Observability

- Global Query view with Grafana for OCP Clusters
 - Out of the Box multi cluster health monitoring dashboards
 - PromQL compliant
- **Centralize Alerts** and notifications. Forward to 3rd Party Systems (PagerDuty / Slack)
- Centralized **Database**
 - Optimized set of metrics collected from managed clusters
 - Focused on Cluster Management
- Unlimited **Data Retention**
 - Observe Metric trends
 - Set Alert Patterns

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Red Hat Advanced Cluster Management for Kubernetes

Application Lifecycle Management



APPLICATION SUBSCRIPTION MODEL



Red Hat Advanced Cluster Management for Kubernetes

RHACM + ArgoCD Integration (=> ACM 2.4.x)









Small footprint edge OS



Red Hat Enterprise Linux at the edge ensures operational stability and flexibility to easily adapt deployments. Quick image generation, transactional OS updates, and intelligent OS rollbacks, provide both traditional and containerized workloads the additional security and resiliency required for edge environments.



RHEL for Edge use cases





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Fast and Reliable Release Workflow



RHEL for Edge simplifies the edge systems management by leveraging on an atomic, immutable approach.

The build and deployment workflow can be easily integrated into existing processes or automated in multi-stage pipelines, allowing to reach networked and non-networked environments.



Container Ready

RHEL for Edge provides **Podman** and container-common tools by default.

Containers are the best and fastest way to deploy and update custom services on edge nodes with a minimal OS footprint.

Systemd units are used to persist container configurations and to schedule automatic images updates.





Transactional OS Updates: rpm-ostree



Transactional Updates (A -> B model)

- OS binaries and libraries (/usr*) are immutable and read-only
- State (r/w) is maintained in /var & /etc
- No in-between state during updates
- Updates are staged in the background and applied upon reboot.
- Reboots can be scheduled with maintenance windows to ensure the highest possible uptime.



Efficient Over The Air (OTA) OS Updates



- Updates can be automated and applied upon reboot.
- Ideal for Disconnected, Intermittent, or Low-bandwidth (DIL) connections
- Transfers significantly less data over the network^{*}
- Only transfers updated bits of OS content
- Static-deltas can be created to further reduce network usage

Automatic Commit Rollbacks



RHEL for Edge uses the **GreenBoot** service to customize rollback conditions upon updates.

It provides custom health checks to determine proper functioning of nodes.

If a defined health check fails the system is automatically reverted to the latest working commit.



simpler stronger



Automatic Device Onboarding and Registration



The **FIDO** Device Onboarding (FDO) process automatically provision and onboard your Edge devices, and exchange data with other devices and systems connected on the networks.

The FDO process supports automated secure devices onboarding, zero touch installation and onboarding.

Available in Red Hat Enterprise Linux 9.0 and 8.6



Emerging Technology: Microshift



Requirements of Customer Edge Computing Use Cases





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What is Microshift?



MicroShift is a research project that is exploring how OpenShift and Kubernetes can be optimized for small form factor, edge computing, and headless devices with as conservative a resource overhead as possible.

NOTE: MicroShift is a Red Hat emerging technology and a community driven project in early days and moving fast. Production use is not recommended until the release of the first GA version of the downstream product.



Emerging Technology: MicroShift

Microshift Features

- Small form factor OpenShift (k8s) optimized for field deployed devices
- Provides a minimal OpenShift experience (limited OpenShift api resources, no operators, no OLM)
- Developed for resource constrained environments
- Can be managed by a multi cluster management tool such as Red Hat ACM
- Single binary deployed as rpm or container, supporting amd64 and arm64 architectures. Also deployable on RISC-V or POWER.









Simplified Architecture for Edge Workloads





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Multi-Cluster Management at the Edge





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Thank you

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