OpenShift e Container Storage
KUBERNETES ENTERPRISE PER LE GRANDI IDEE

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#RedHatOSD
... so you want to do containers and Kubernetes?
We were very lucky to be joined early on by the very capable OpenShift team ... without their perspective and contributions, I don’t think we would be standing here today.

Brendan Burns, co-creator of Kubernetes
OPENSHIFT IS KUBERNETES FOR THE ENTERPRISE

Security fixes
100s of defect and performance fixes
200+ validated integrations
Middleware integrations
(container images, storage, networking, cloud services, etc)
9 year enterprise lifecycle management
Certified Kubernetes
Kubernetes Workloads

MANAGE YOUR APPLICATIONS

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CONTROLLERS MATTERS!

Different types of applications (stateful, stateless, batch, agent, ...) require different orchestrator behaviors

Main controller types:
- Replica Sets
- Stateful Sets
- Daemon Sets
- Jobs (OneTime, Cron)

```go
def NewControllerInitializers(loopMode ControllerLoopMode) map[string]InitFunc{
    controllers := map[string]InitFunc{
        "endpoint" = startEndpointController
        "replicationcontroller" = startReplicationController
        "node" = startNodeController
    }
    return controllers
}
```
WHAT IS A POD?
CONTAINERS ARE WRAPPED IN PODS WHICH ARE UNITS OF DEPLOYMENT AND MANAGEMENT.
The controller-manager is the Master’s component that manages the controllers.

A controller is a loop that governs the status of Kubernetes resources (such as pods) in order to bring it from the current state to the desired state.

Controllers react to Kubernetes events and define how resources should be orchestrated.
CONTROLLER & CONTROLLER-MANAGER

- The **controller-manager** is the Master’s component that manage the controllers.
- A **controller** is a loop that governs the status of Kubernetes resources (such as pods) in order to bring it from the current state to the desired state.
- Controllers react to **Kubernetes events** and define how resources should be orchestrated.
DEPLOYMENT AND REPLICASET

- A Deployment controller provides declarative updates for Pods and ReplicaSets
- ReplicaSet controller ensures that a specified number of pod replicas are running at any given time
- Recommended to run stateless application
STATEFULSET

- A stateful set ensures:
  - Stable resource allocation such as name and storage
  - Ordered, graceful deployment, scaling up and termination

- Ideal for highly available workloads in a “clustered mode”

* x= index
**DAEMONSET**

- A daemon set ensure to have **just 1 copy** of a pod on every node

- Daemon set is useful for: Logging Aggregators, Monitoring, Load Balancers / Reverse Proxies / API Gateways, single host batch...

* x= available node count
REFERENCE ARCHITECTURE FOR ENTERPRISE KUBERNETES

Application Services
Middleware, Service Mesh, Functions, ISV

Cluster Services
Metrics, Chargeback, Registry, Logging

Developer Services
Dev Tools, Automated Builds, CI/CD, IDE

Automated Operations*

Kubernetes

Red Hat Enterprise Linux or Red Hat CoreOS

Best IT Ops Experience CaaS ↔ PaaS Best Developer Experience

*coming soon with OCP 4.0 (targeted for GA Dec 2018)
Istio Service Mesh
FOR SERVICE-TO-SERVICE COMMUNICATIONS

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OPENSHIFT SERVICE MESH: ISTIO*

Istio makes it easy to create a network of deployed services with load balancing, service-to-service authentication, monitoring, and more, helping to avoid operational nightmares.

- **POLICY**: Grants the ability to write policy that applies to all applications and is not language specific.
- **ROUTING**: Allows for the control of routing flows.
- **TELEMETRY**: Provides the observability needed to manage microservices, such as how services are invoked, communication flows, and points of latency.

* Technology Preview
ISTIO COMPANION: KIALI & JAEGE

Kiali and Jaeger make the perfect companion for Istio Service Mesh

VISUALIZATION

Kiali works with Istio to visualize the service mesh topology, features like circuit breakers or request rates.

TRACING

Kiali includes Jaeger Tracing, which provides distributed tracing out of the box.
SERVICE MESH ARCHITECTURE

SERVICE MESH
- Load Balancing
- Fault Tolerance
- Traceability
- Observability
- Service Security
- Infra Security
- Chaos Engineering
- Traffic Control

OPENSHEET
ENTERPRISE KUBERNETES
- Build Automation
- Logs
- Monitoring
- Infra Security
- CI/CD
- Load Balancing
- Deployment Resiliency
- Service Discovery
- Config
- Resource Management
- Elasticity

INFRA
- PHYSICAL
- VIRTUAL
- CLOUD

SERVICE OPS
INFRA OPS

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MICROSERVICES EVOLUTION
SERVICE MESH ARCHITECTURE

Applies security, route rules, policies and reports traffic telemetry at the pod level.
CIRCUIT BREAKERS WITH ISTIO

transparent to the services
SECURE COMMUNICATION WITH ISTIO

mutual TLS authentication, transparent to the services
DISTRIBUTED TRACING WITH ISTIO & JAEGGER

POD
SERVICE A
ENVOY

POD
SERVICE B
ENVOY

POD
SERVICE C
ENVOY

discovers service relationships and process times, transparent to the services

SERVICE A 210 ms SERVICE B 720 ms SERVICE C

930 ms
DEMO TIME:
Istio Internals
Prometheus Cluster Monitoring

PROVIDING ALERTS ALSO FOR OPENSSHIFT CONTAINER STORAGE

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The stack includes three distinct UIs:

- **Alertmanager** UI to manage alerts which have been fired
- **Prometheus** UI for querying and plotting any metrics
- **Grafana** to browse cluster-level dashboards

All UIs are accessible directly via the new admin console under the “Monitoring” menu.
DEMO TIME:
Cluster Console - EventFeed
https://youtu.be/MG-2s11uoPI
DEMO TIME:
Cluster Console - Monitoring
OpenShift Container Storage
SOFTWARE DEFINED STORAGE FOR YOUR KUBERNETES

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#RedHatOSD
RED HAT OPENSHEIFT CONTAINER STORAGE

Flexible deployment with the same user experience and features

Converged = in containers

Persona: DevOps, App Architects

- Highly scalable, scale app+storage, start small and scale fast
- Storage life cycle managed by OCP

Independent = for containers

Persona: Storage Admins, Infrastructure Admins

- Highly scalable, independent scalability from OCP platform
- Adaptative to in-place BC/DR strategies
DEMO TIME:
Monitoring - OpenShift Container Storage
https://youtu.be/35XimCphonM
## RHOCS: ANSIBLE ADVANCED DEPLOYMENT

Converged playbooks already available

<table>
<thead>
<tr>
<th>Deployment workflow</th>
<th>Registry</th>
<th>Metrics</th>
<th>Logging</th>
<th>Applications</th>
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<td>Deploying Red Hat OpenShift Container Storage in Converged Mode</td>
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[https://red.ht/2DaKPzg](https://red.ht/2DaKPzg)
Openshift Ansible Service Broker
And the road to Kubernetes Operators!
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WHAT IS A SERVICE BROKERAGE?

Automated, Standard and Consistent
A multi-vendor project to standardize how services are consumed on cloud-native platforms across service providers.
BROKERAGE WITH OPENSSHIFT

SERVICE CATALOG

Broker

OpenShift Template Broker

OpenShift Ansible Broker

AWS Service Broker

Other Service Brokers

Service

OPENShift Templates

Ansible Playbook Bundles

AWS Services

Other Services

OPEN SERVICE BROKER API

OPEN SERVICE BROKER API

OPEN SERVICE BROKER API

OPEN SERVICE BROKER API

OPEN SERVICE BROKER API
Anything you can do with Ansible, you can do with the Ansible Broker

- Use Ansible on OpenShift to
  - Deploy containerized applications
  - Manage external components (e.g. Oracle database)
  - Provision cloud services (e.g. AWS RDS)
  - Orchestrate multi-service solutions
  - Manage dependencies or other logics on deployments (e.g. database initialization)

TP available from version 3.6
GA from 3.7
ANSIBLE PLAYBOOK BUNDLES (APB)

- Packaged as a container image
- Embed Ansible runtime
- Use named playbooks for actions
- Fulfill Service Catalog dynamically with services and parameters
- Provide a command line tool to manage APBs
APB CREATION WORKFLOW

INIT
CUSTOMIZATION
PREPARE AND BUILD
PUSH

Site Reliability Engineer
playbooks and $vars
APB image
Service Catalog update

DEMO TIME:
MariaDB Provisioning on Remote RHEL
APB container runs provision.yaml playbook to install and configure MariaDB on external VM.
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<th>NAME</th>
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APB INTEGRATION WITH ANSIBLE GALAXY

Support discovering/running APB sources published to Ansible Galaxy from the OpenShift Ansible Service Broker.

How it works:

- APB’s can be now be created right from mazer command line tool using the init command and then pushed to Ansible Galaxy.
- Broker should now be able to discover and provision APB-based services published to Ansible Galaxy and also make them available in the service catalog.
What’s Next?
Operators!
KUBERNETES OPERATORS

THE EASE OF THE CLOUD EVERYWHERE

- encode human operational knowledge
- automatically patch, upgrade, recover, and tune apps and services
- Kubernetes-native
- Purpose-built for a specific application or service
ENCODING AND AUTOMATING OPS KNOWLEDGE WITH OPERATORS

WITHOUT OPERATORS
REACTIVE
- Continually checks for anomalies
- Alert humans for response
- Requires manual change to fix

WITH OPERATORS
PROACTIVE
- Continually adjusts to optimal state
- Automatically acts in milliseconds
OPERATOR FRAMEWORK
An open source toolkit to manage application instances on Kubernetes in an automated, scalable way

- **OPERATOR SDK**
  - Build Operators without specialized knowledge of the Kubernetes API

- **OPERATOR LIFECYCLE MANAGER**
  - Install, update, and manage Operators and their dependencies

- **OPERATOR METERING**
  - Enable usage reporting for Operators

https://github.com/operator-framework
OPERATOR IMPLEMENTATION PATHS

- Phase I: Installation
- Phase II: Upgrades
- Phase III: Lifecycle
- Phase IV: Insights
- Phase V: Auto-pilot

No custom Operator Required
Requires custom Operator - building simplified with SDK

HELM & GO AVAILABLE NOW
ANSIBLE IN 2019
OPERATORS IN PREVIEW IN OCP 3.11

APPLICATION OPERATORS
DEVELOPER PREVIEW

OPERATOR LIFECYCLE MANAGER (OLM)
TECH PREVIEW

Install, manage, and upgrade Operators and their dependencies

Portable application services across any infrastructure

PHYSICAL
VIRTUAL
PRIVATE CLOUD
PUBLIC CLOUD

#RedHatOSD
PORTABLE HYBRID CLOUD SERVICES WITH ISV OPERATORS

60+ Certified ISV Operators in Red Hat Early Access Program
Container-native Virtualization

THE FUTURE OF VIRTUALIZATION!

FEDERICO SIMONCELLI
CNV Engineering Manager
fsimonce@redhat.com

#RedHatOSD
Red Hat CloudForms + Red Hat Ansible® Automation
Red Hat Virtualization, Red Hat OpenStack® Platform, vSphere
AWS, Azure, GCP

Savings invested to develop cloud-native applications running on any footprint
Reduce costs by 40-50% in infrastructure by dependence on VMware
Increase investment in VMware, stay with traditional apps
CONTAINERS AND VIRTUAL MACHINES

CONTAINER INFRASTRUCTURE AND ORCHESTRATION
Containerized applications and Kubernetes container orchestration as provided by OpenShift are becoming the standard for new applications.

VIRTUALIZED WORKLOADS
Virtualized workloads are not going anywhere fast! Business reasons (cost, time to market) and technical reasons (different or older operating system)

BARE-METAL RESURGENCE
Increasingly customers are pursuing bare-metal clusters for net new business functionality being built in containers.

As the technology mix changes, you will reach a tipping point where containers are the default but some workloads are still more suited to run as VMs.
COMPONENTS OF CNV

- **KubeVirt**
  The virtual machine operator
  [https://github.com/kubevirt/kubevirt/](https://github.com/kubevirt/kubevirt/)

- **Containerized Data Importer (CDI)**
  Importing disks

- **OpenShift Web Console**
  With UI extensions
  [https://github.com/openshift/origin-web-console](https://github.com/openshift/origin-web-console)

- **Containerized Virt-v2v**
  Importing a whole virtual machine
  [https://github.com/kubevirt/v2v-job](https://github.com/kubevirt/v2v-job)

Leverages tried and trusted RHEL & RHV (KVM) virtualization capabilities.
Container-native Virtualization Demo

http://kubervirt.io/get_kubervirt/

Pre-requisites:

- kubectl
- minikube/minishift

Notes:

- Yes, we’re running nested virt here - fine for getting started!
- Using upstream bits, for now, in product preview coming!
Let's look at the new pods our KubeVirt CRDs are running in the kube-system namespace.

The CDI controller runs in the default namespace.

Our own namespace is as expected empty right now.

No resources found.

Let's look at a VM definition

Let's now create the VM

The VirtualMachine object is the persistent representation of our virtual machine.
Container-native Virtualization is **not** a drop-in replacement for traditional virtualization today.

---

**Technology Preview access in an upcoming release of OpenShift.**
OpenShift Container Platform 3.11

WHAT’S NEW?

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#RedHatOSD
NEW ADMIN-FOCUSED CONSOLE

Users have a choice of experience based on their role or technical abilities

- Admin/CaaS experience with heavy exposure to Kubernetes
- AppDev/PaaS experience with standard OpenShift UX
- Sessions are not shared across the Consoles but credentials are
- Both hosted on cluster, in openshift-console and openshift-webconsole namespaces
Visual management of the cluster’s RBAC Roles and RoleBindings

- Track down users and service accounts with a specific Role
- View cluster-wide or namespaced bindings
- Visually audit a Role’s verbs and objects

Project admins can self-manage roles and bindings scoped to their namespace
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<tr>
<th><strong>cri-o</strong></th>
<th><strong>buildah</strong></th>
<th><strong>podman</strong></th>
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<tbody>
<tr>
<td>Becoming the default for partners</td>
<td>Start from an existing image or from scratch</td>
<td>Podman is planned to GA with RHEL 7.6.</td>
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<td>Criclt for node debugging and troubleshooting</td>
<td>Generate new layers and/or run commands on existing layers</td>
<td>A daemon-less CLI/API for running, managing, and debugging OCI containers and pods</td>
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<tr>
<td>Podman for image tagging &amp; management</td>
<td>Commit storage and generate the image manifest</td>
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<td>Continues to mature with OpenShift online, customer, and community deployments</td>
<td>Deliver image to a local store or remote OCI / docker registry</td>
<td>VARLINK</td>
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**Kubelet**

- CNI Networking
- RunC
- Storage
- Image

**Kernel**
REFERENCE ARCHITECTURE GUIDES

Release: ocpsupplemental-3.11 (in 4-6 weeks after 3.11 GA)

Since 3.10, Reference Architecture Implementation guides are now part of the OpenShift product documentation (https://docs.openshift.com).

Documentation for deploying OCP 3.11 on: (not live yet)
- OpenShift 3.11 on Red Hat OpenStack Platform (RHOSP)
- OpenShift 3.11 on Amazon Web Services (AWS)
- OpenShift 3.11 on Microsoft Azure
- OpenShift 3.11 on VMware vSphere
- OpenShift 3.11 on Google Cloud Platform (GCP)
- OpenShift 3.9 on Red Hat Virtualization 4 (RHV) (update in progress)
LOCAL DEVELOPMENT

**CDK 3.6**
- OpenShift Container Platform v3.10.45 (and update to 3.11)
- Based on Minishift 1.24

**Minishift 1.24**
- Configuration used to start a profile is not saved
- Provide a way to modify the kube-apiserver config same as openshift-apiserver.
- Do not apply templates in xpaas addon one by one
- Local proxy server to handle proxy issues. (technology preview)

**kubectl**
- We always shipped kubectl for Linux on the master’s file system, but now we will offer it in the oc client downloads
... so you want to do containers and Kubernetes?
When faced with two or more alternatives that deliver roughly the same value:
Take the path that makes future changes easier.

Dave Thomas
Author of Manifesto for Agile Software Development
GRAZIE PER L’ATTENZIONE

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