Red Hat OpenShift

ARCHITECTURAL OVERVIEW

Alfred Bach
Principal Solution Architect

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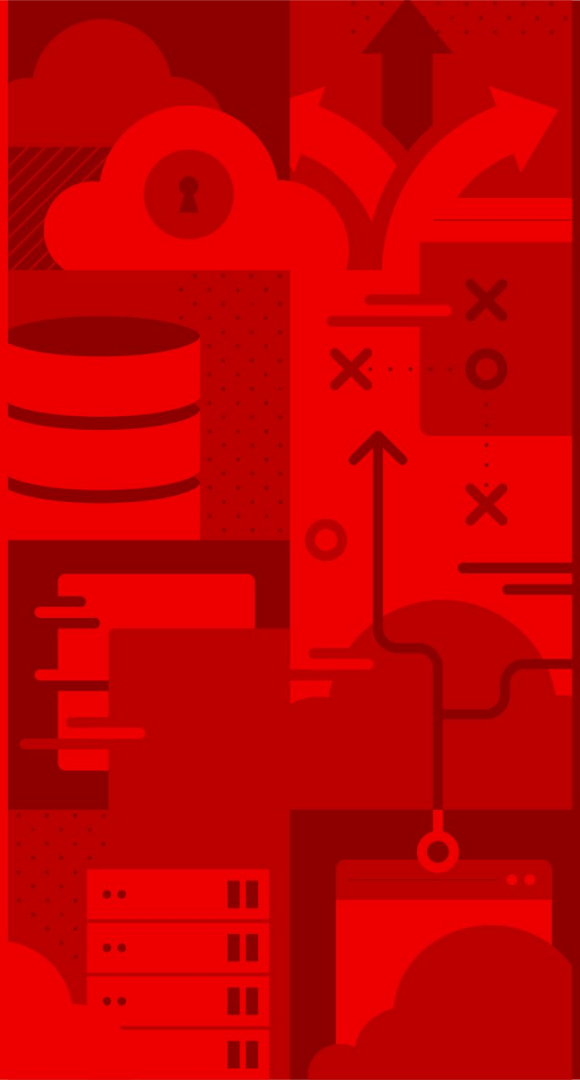
Red Hat



Functional overview

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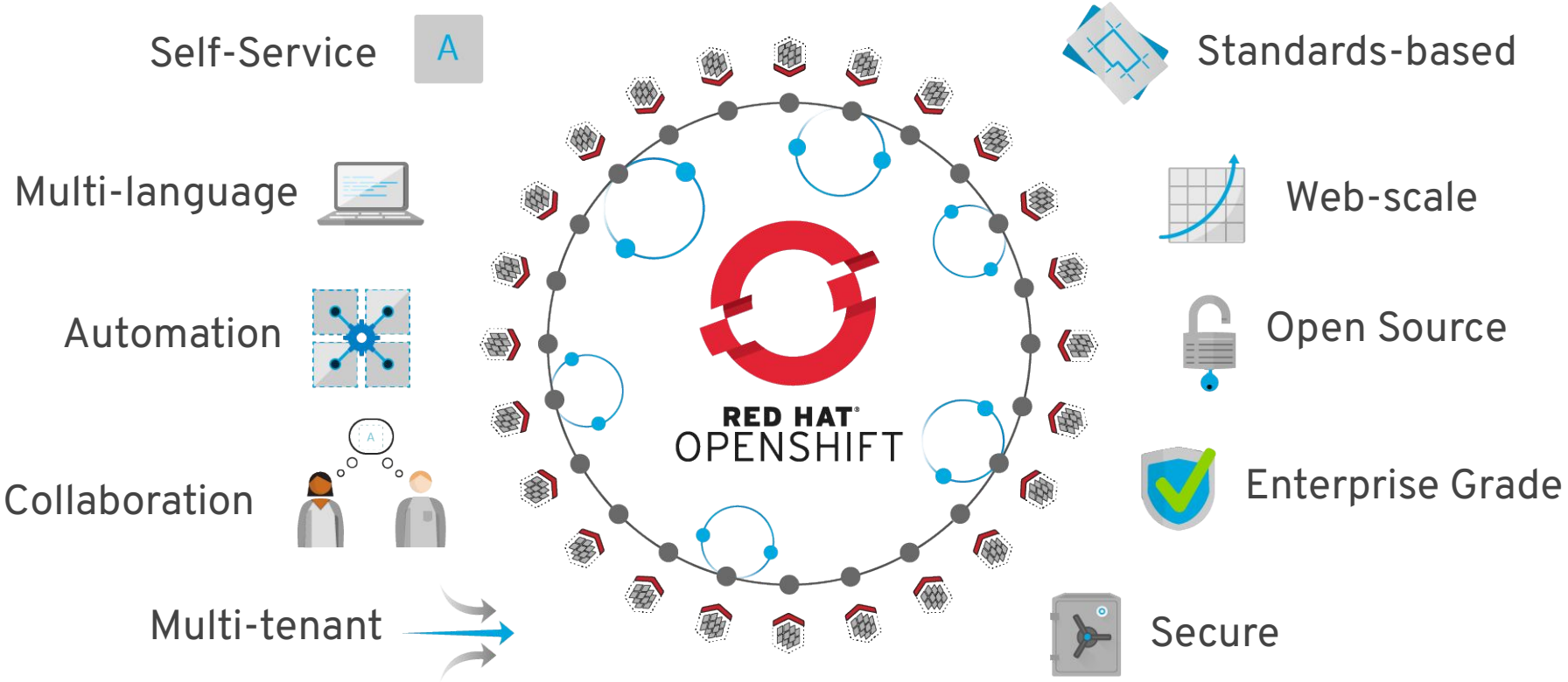
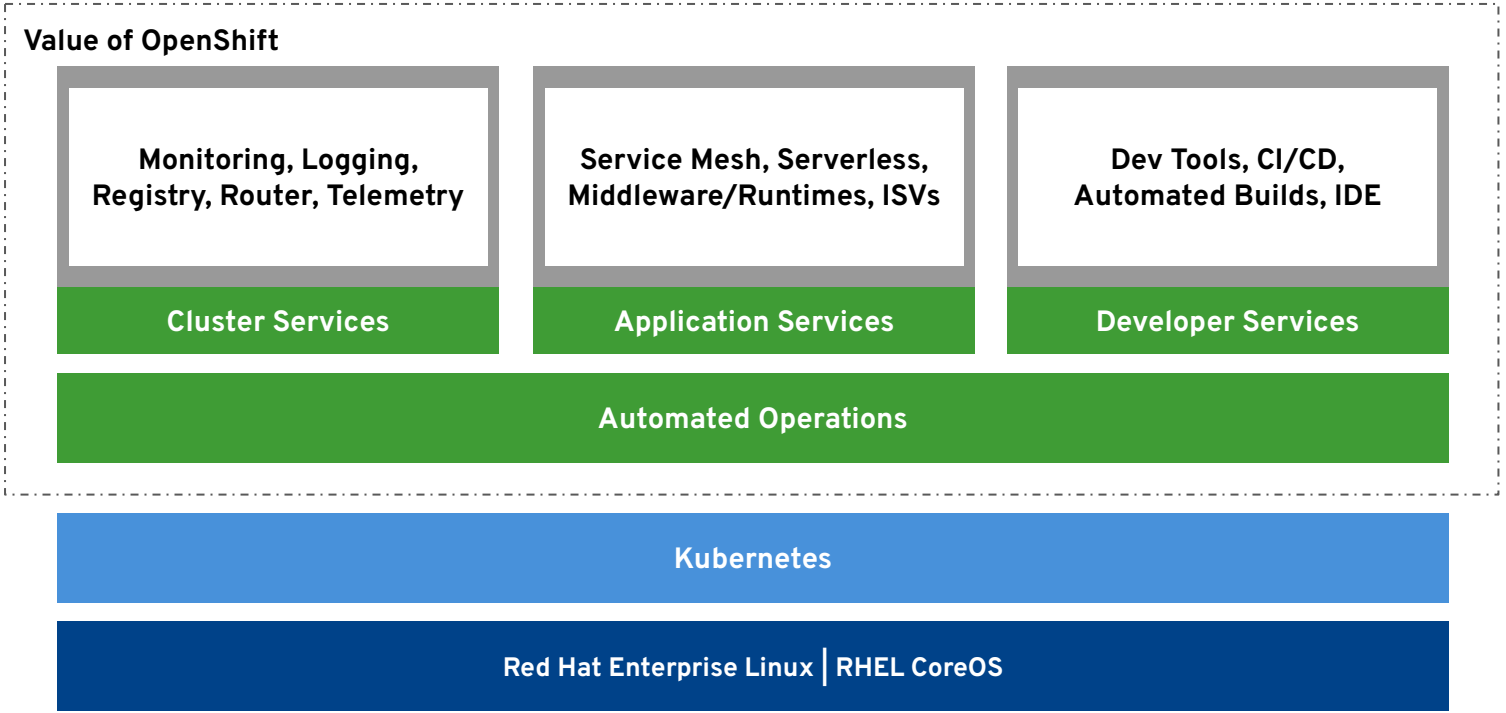

Self-Service
Multi-language
Automation
Collaboration
Multi-tenant
RED HAT
OPENSHIFT
Standards-based
Web-scale
Open Source
Enterprise Grade
Secure



Best IT Ops Experience

CaaS ⟷ PaaS ⟷ FaaS

Best Developer Experience

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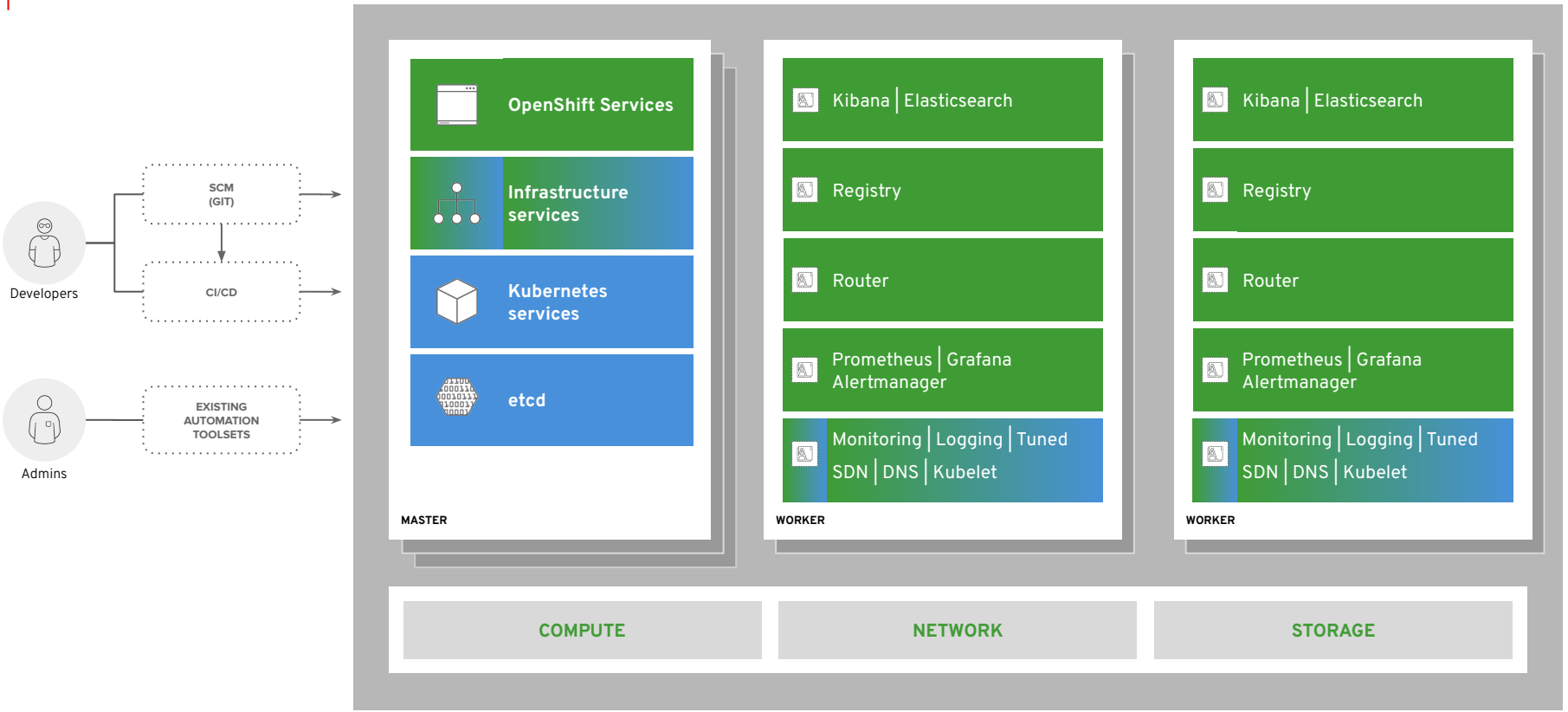
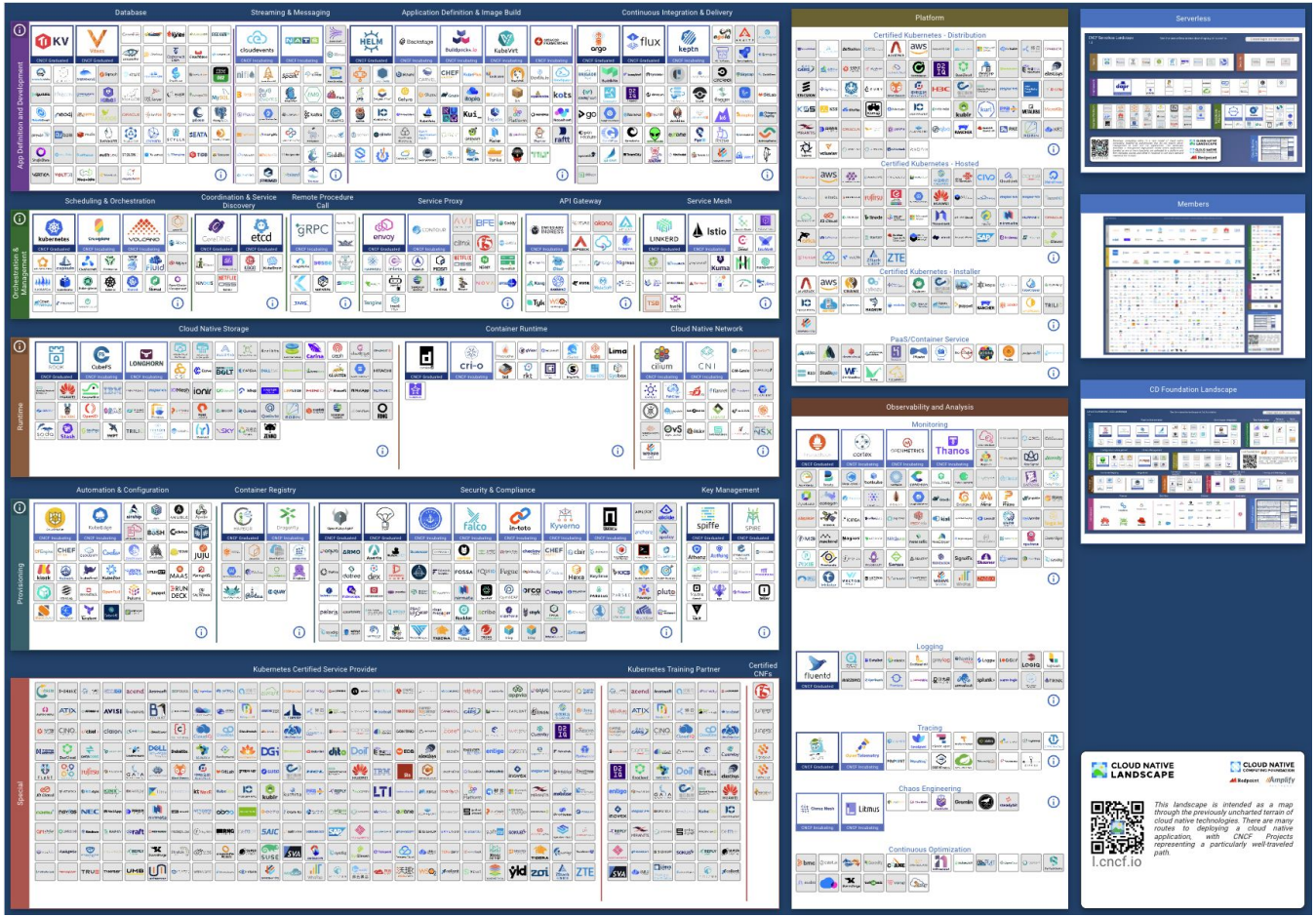

SCM (GIT)
CI/CD
Developers
EXISTING AUTOMATION TOOLSETS
Admins
OpenShift Services
Infrastructure services
Kubernetes services
etcd
MASTER
Kibana | Elasticsearch
Registry
Router
Prometheus | Grafana Alertmanager
Monitoring | Logging | Tuned
SDN | DNS | Kubelet
WORKER
Kibana | Elasticsearch
Registry
Router
Prometheus | Grafana Alertmanager
Monitoring | Logging | Tuned
SDN | DNS | Kubelet
WORKER
COMPUTE
NETWORK
STORAGE

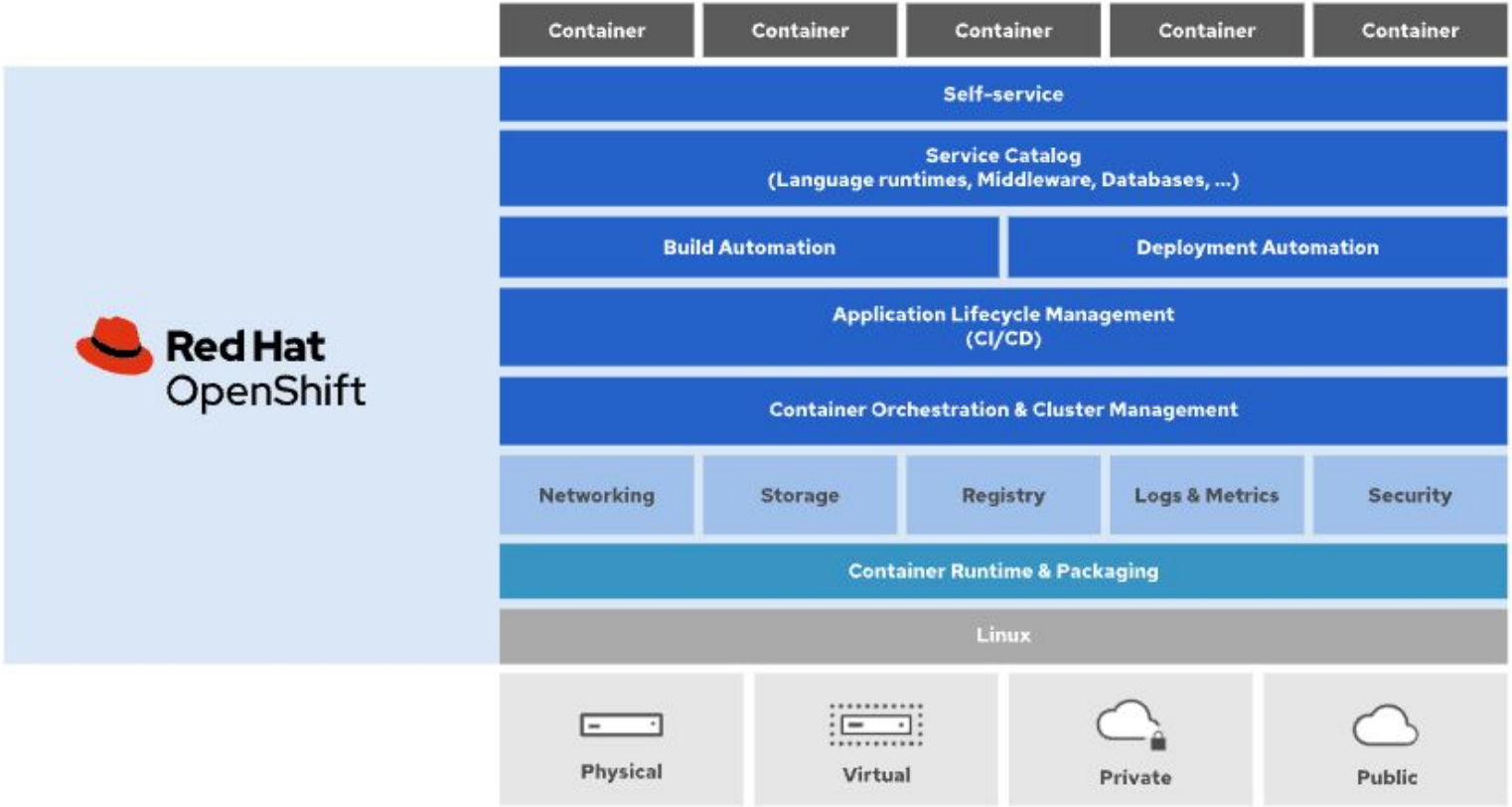
Red Hat

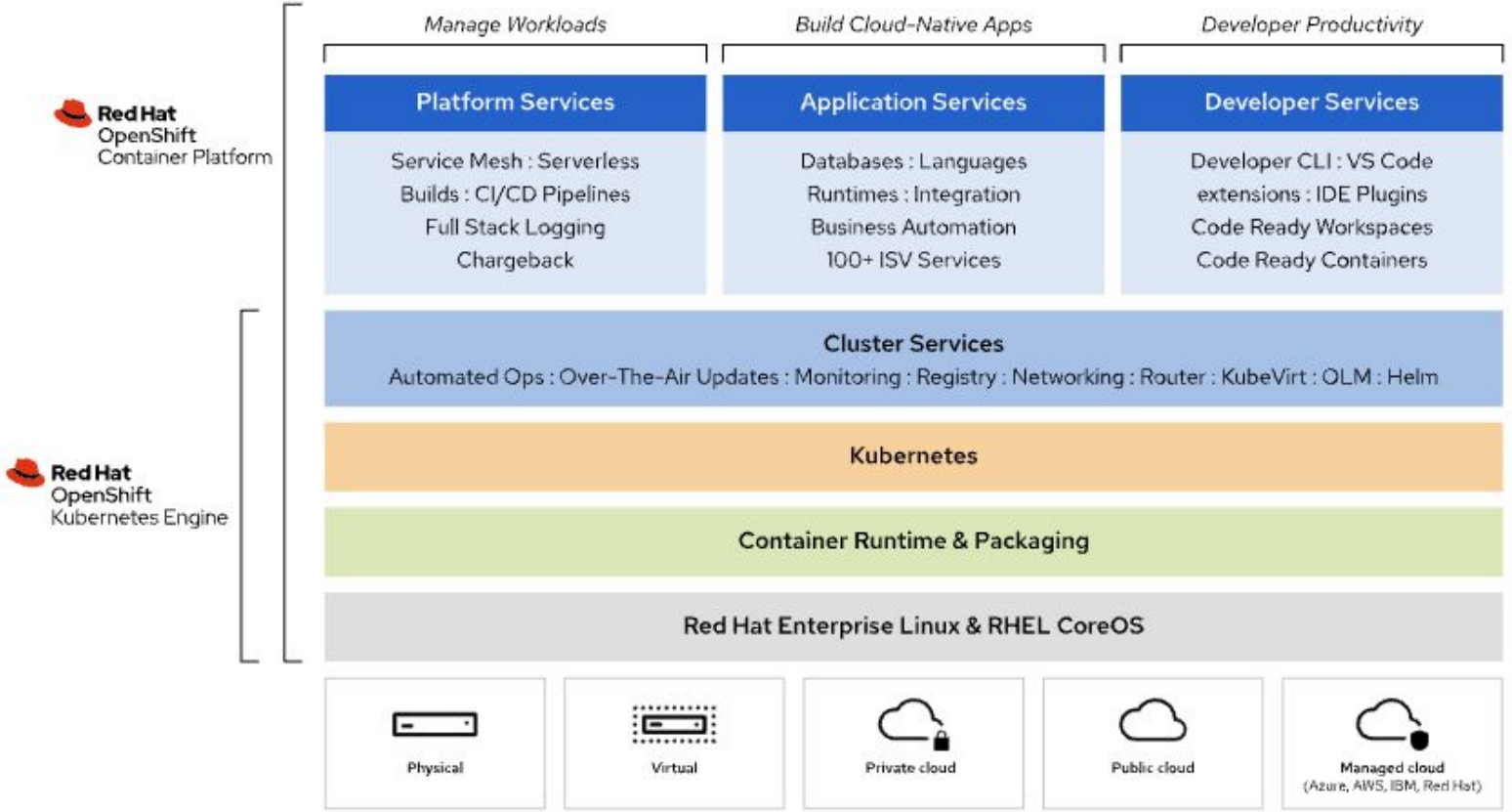
CLOUD NATIVE LANDSCAPE

CNCF Ecosystem Slide



Red Hat


Container
Container
Container
Container
Container
Self-service
Service Catalog
(Language runtimes, Middleware, Databases, ...)
Build Automation
Deployment Automation
Application Lifecycle Management
(CI/CD)
Container Orchestration & Cluster Management
Networking
Storage
Registry
Logs & Metrics
Security
Container Runtime & Packaging
Linux
Red Hat
OpenShift
Physical
Virtual
Private
Public


Red Hat OpenShift Container Platform
Red Hat OpenShift Kubernetes Engine
Manage Workloads
Build Cloud-Native Apps
Developer Productivity
Platform Services
Service Mesh : Serverless
Builds : CI/CD Pipelines
Full Stack Logging
Chargeback
Application Services
Databases : Languages
Runtimes : Integration
Business Automation
100+ ISV Services
Developer Services
Developer CLI : VS Code
extensions : IDE Plugins
Code Ready Workspaces
Code Ready Containers
Cluster Services
Automated Ops : Over-The-Air Updates : Monitoring : Registry : Networking : Router : KubeVirt : OLM : Helm
Kubernetes
Container Runtime & Packaging
Red Hat Enterprise Linux & RHEL CoreOS
Physical
Virtual
Private cloud
Public cloud
Managed cloud
(Azure, AWS, IBM, Red Hat)

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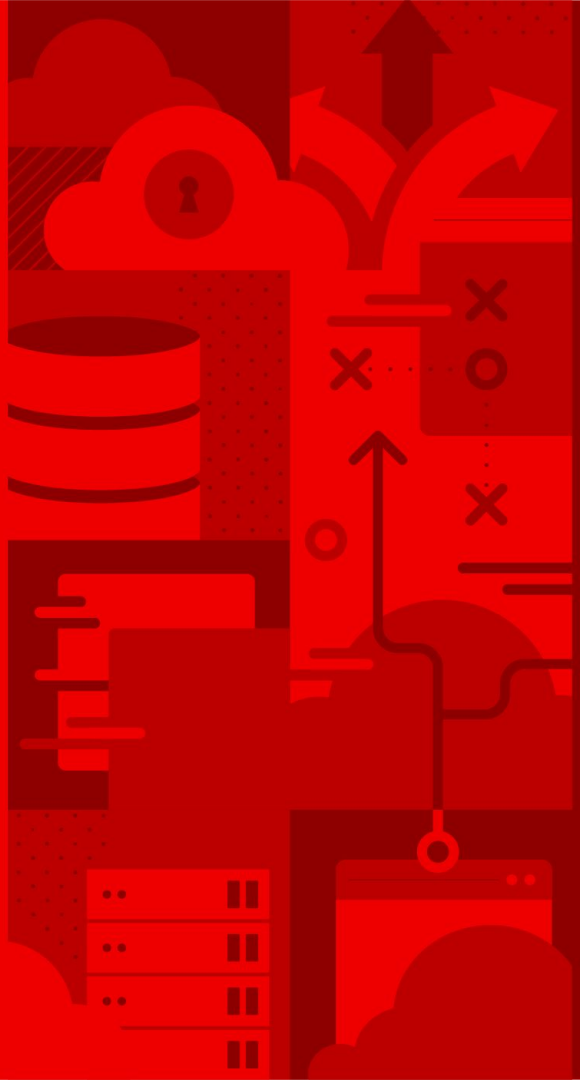

OpenShift 4 Architecture

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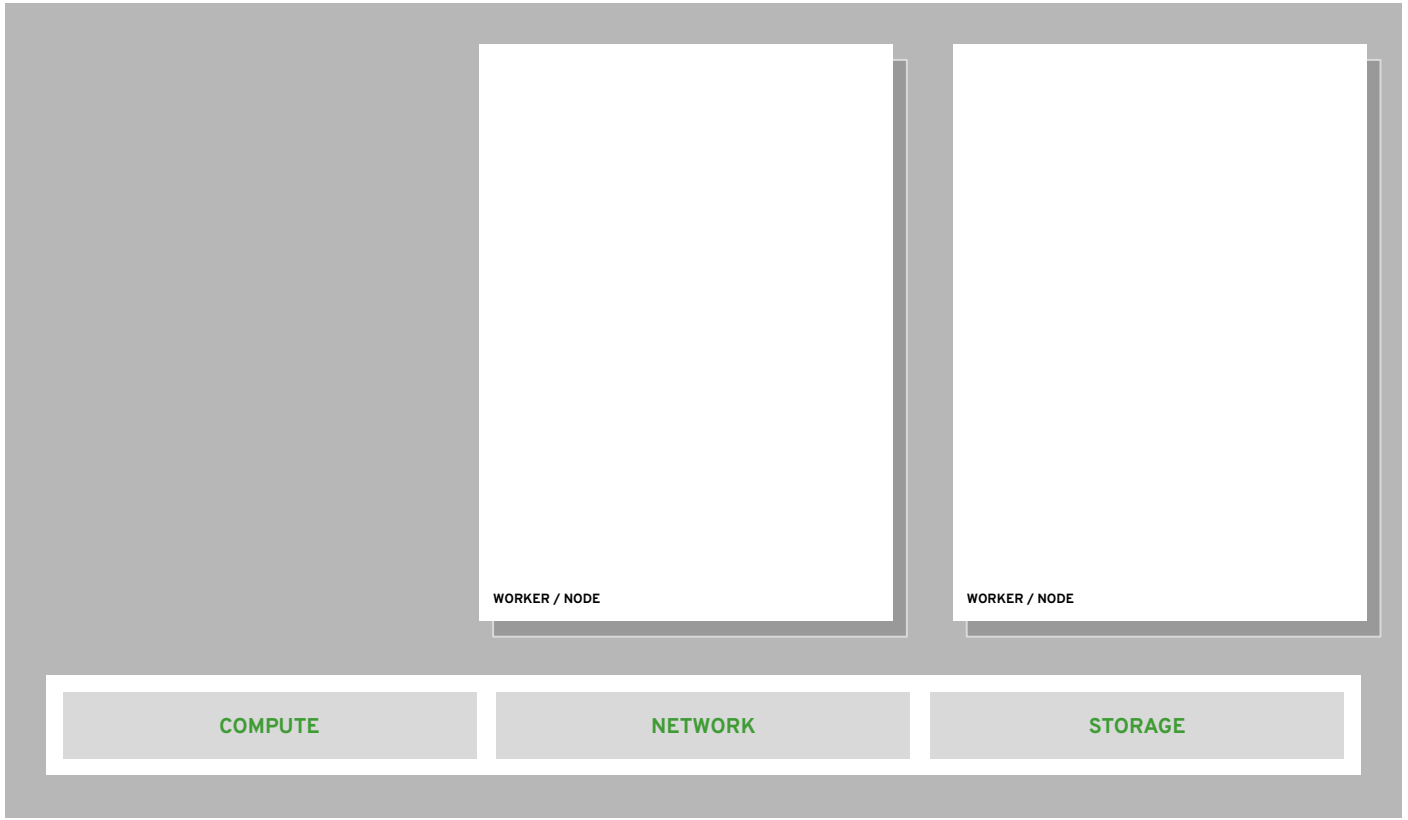
your choice of infrastructure

COMPUTE

NETWORK

STORAGE

workers run workloads



masters are the control plane

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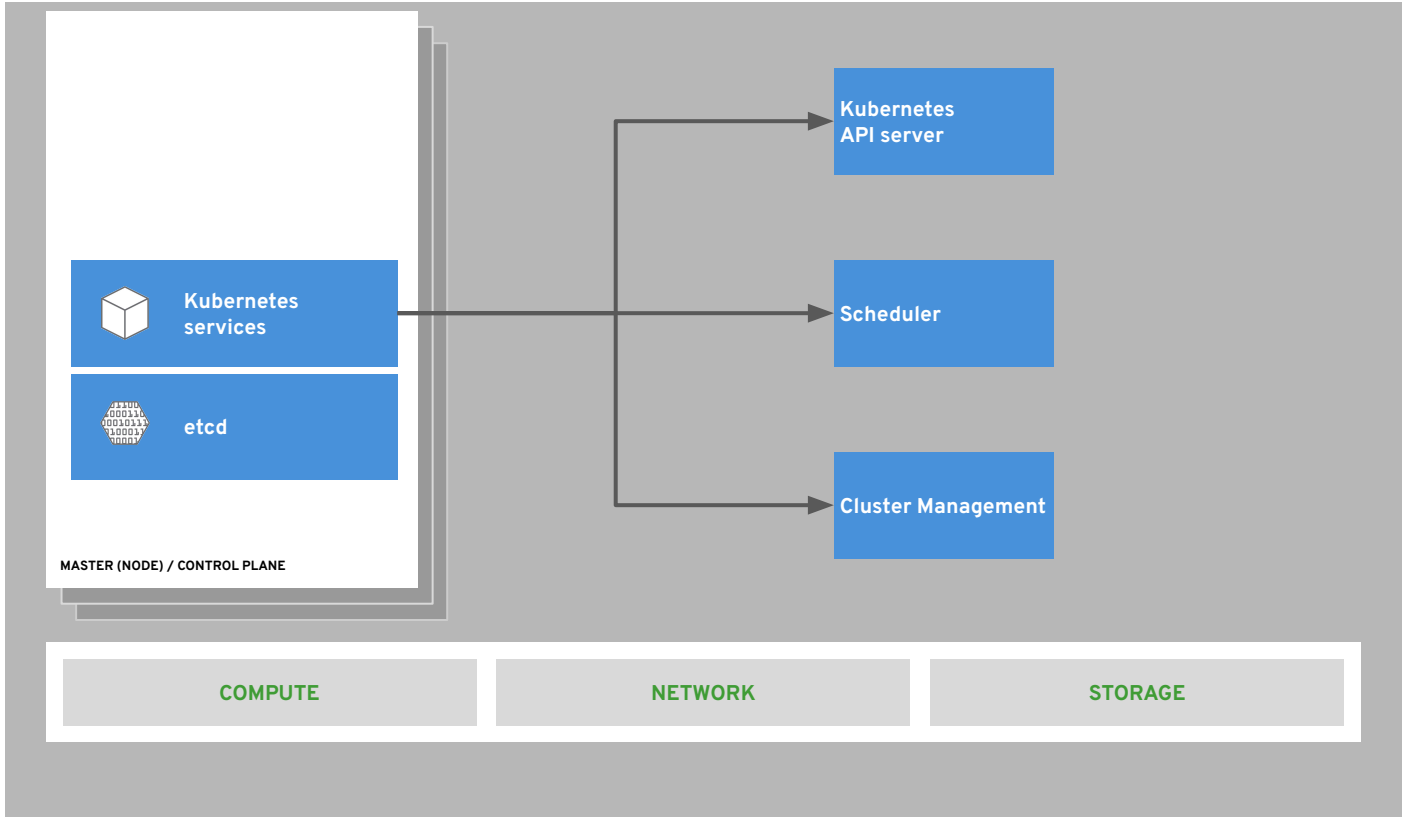
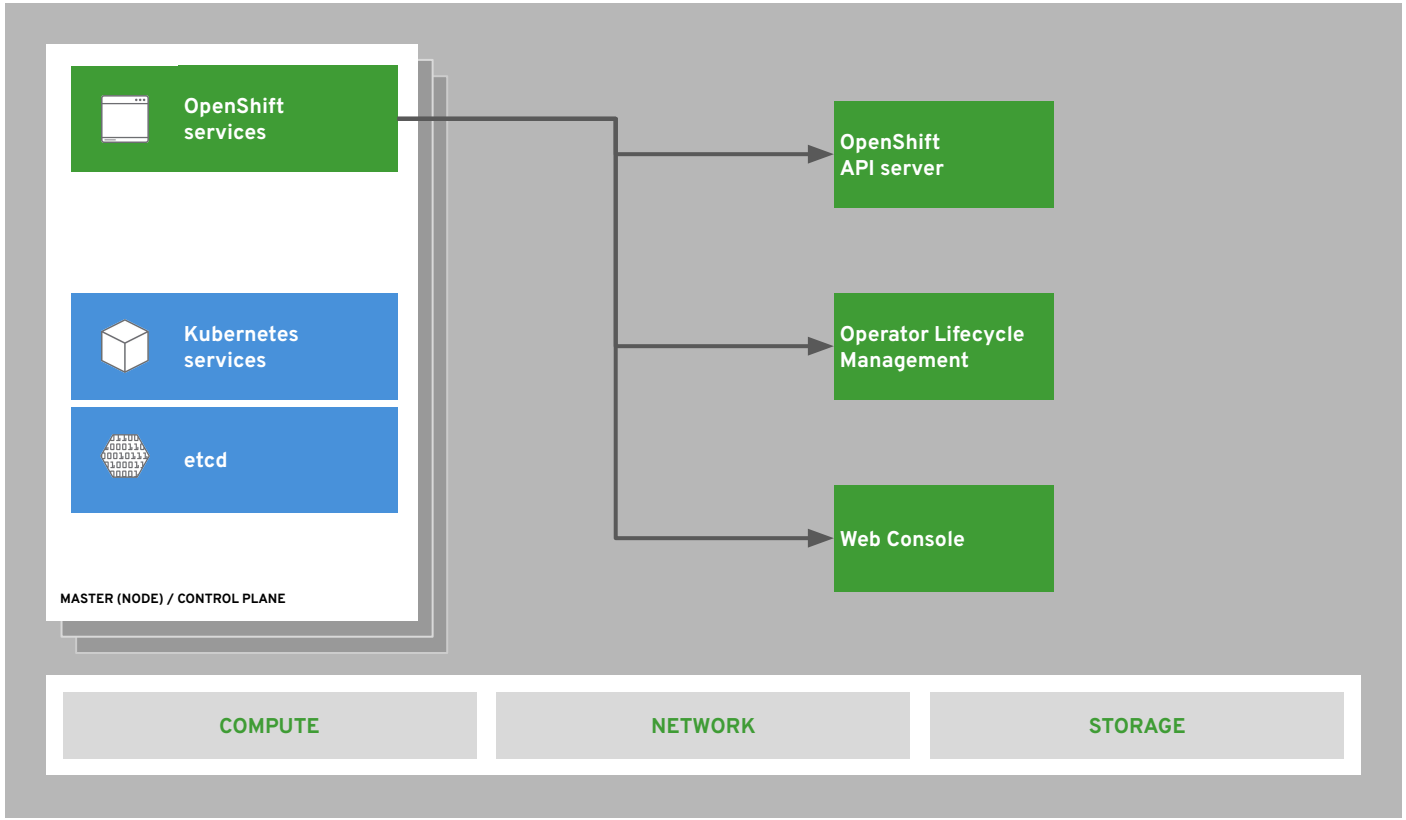
state of everything

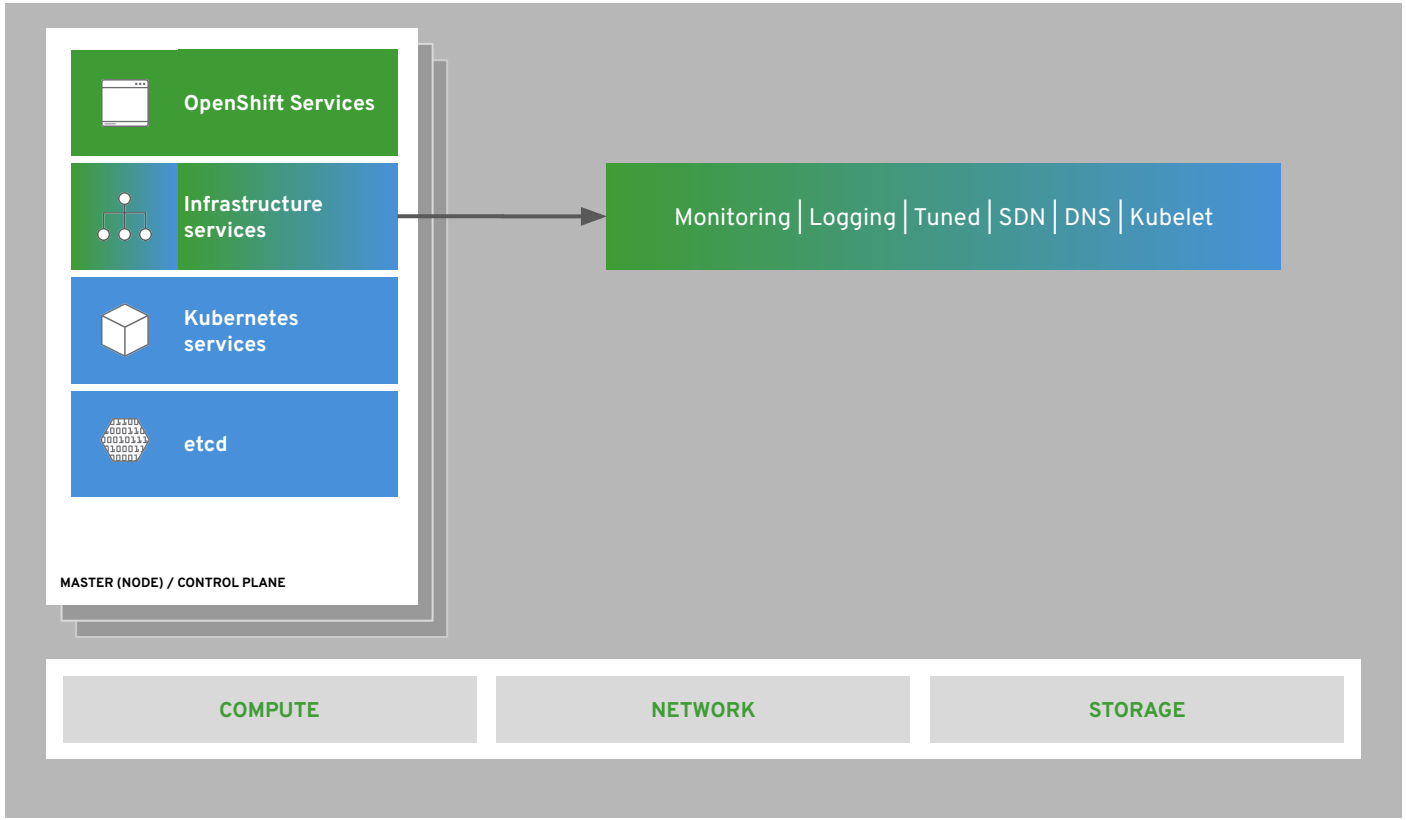
core kubernetes components



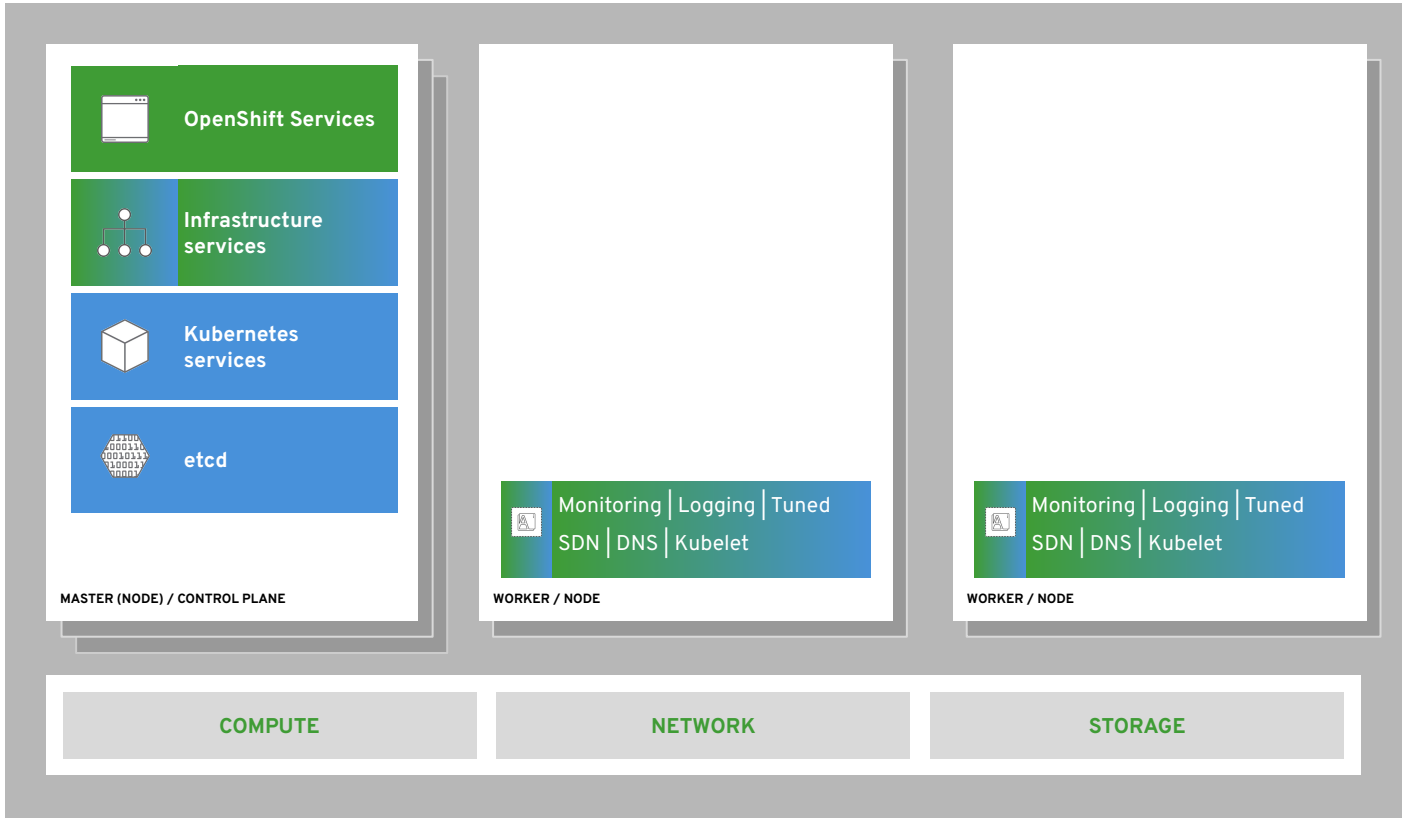
core OpenShift components



internal and support infrastructure services



run on all hosts



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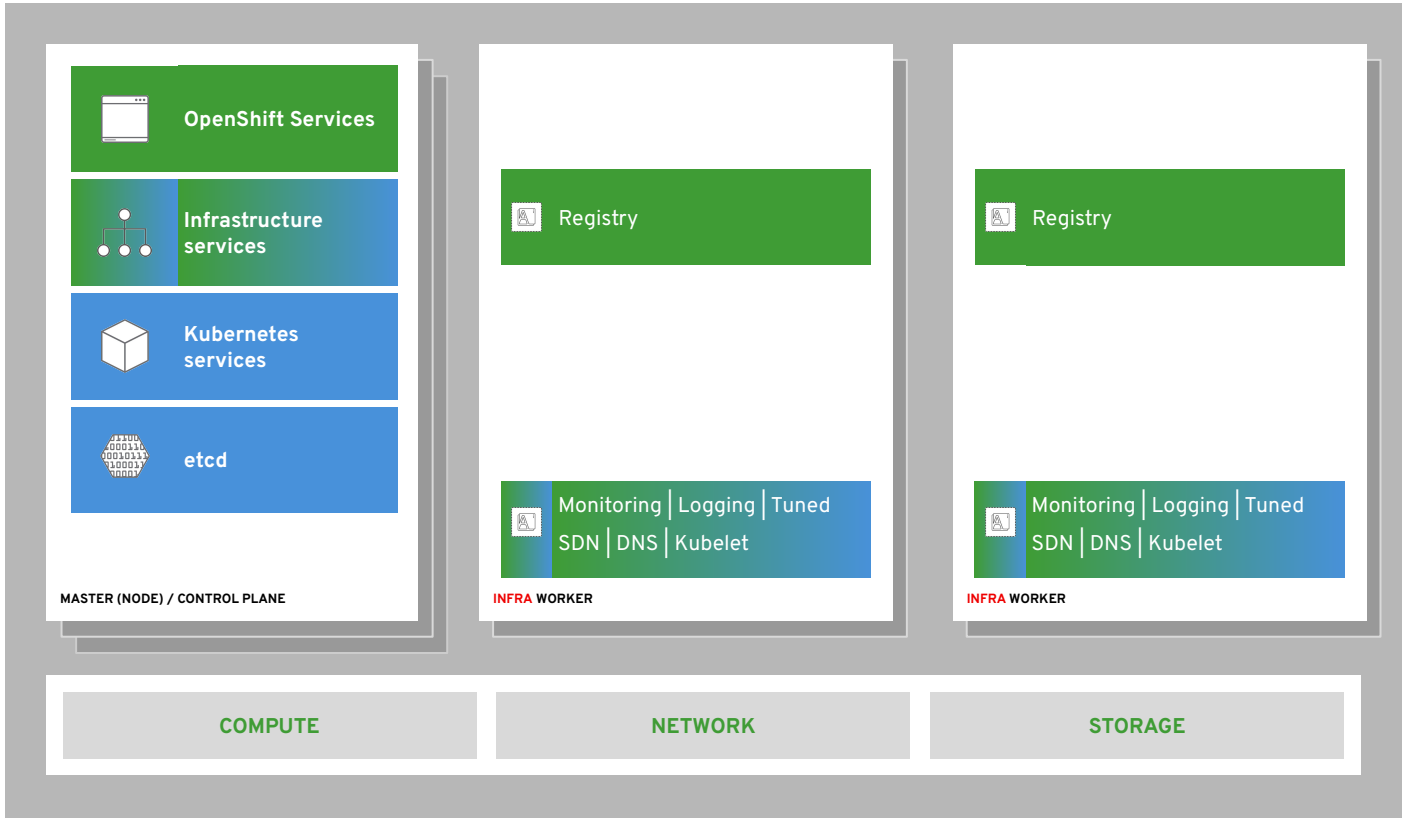
integrated image registry



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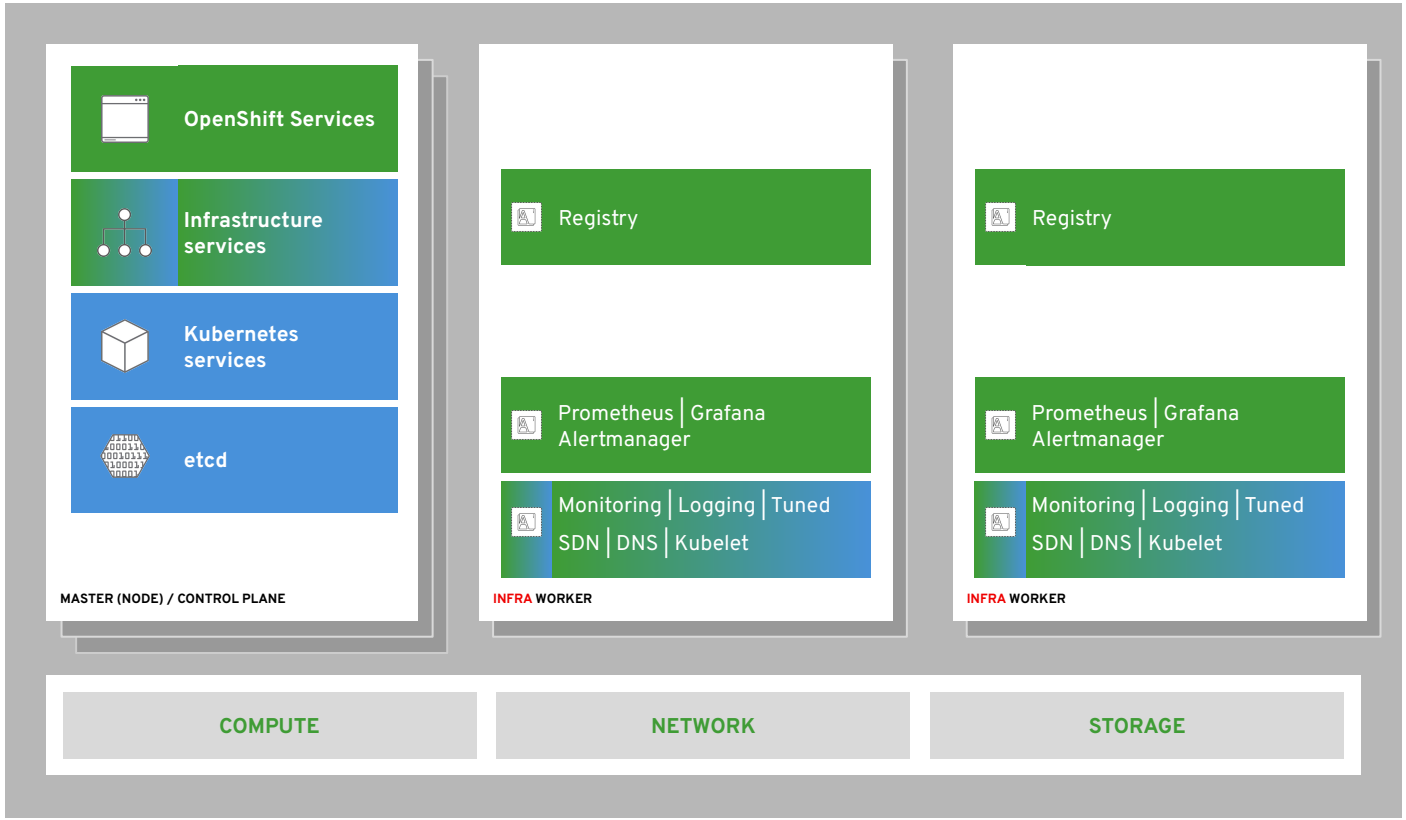
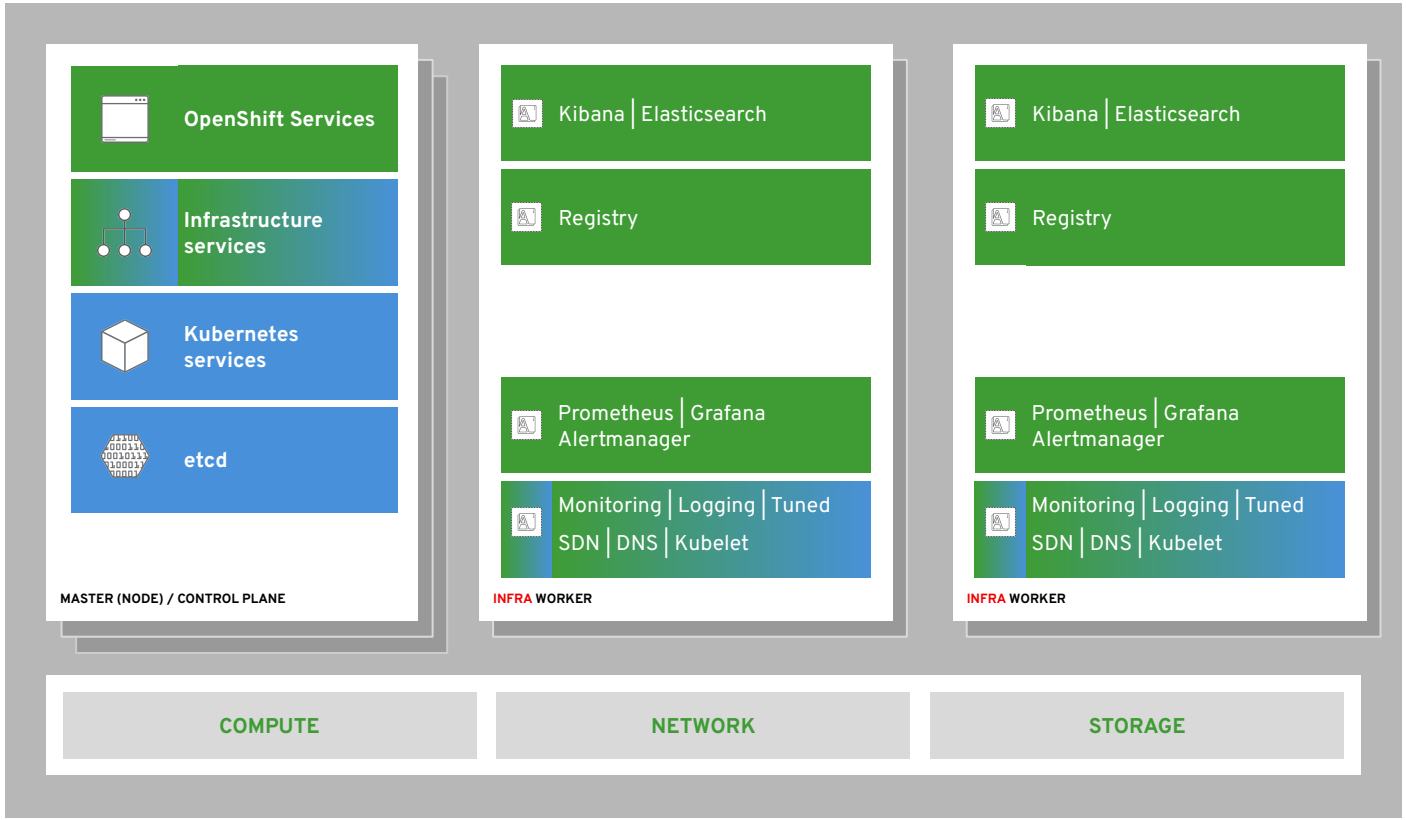
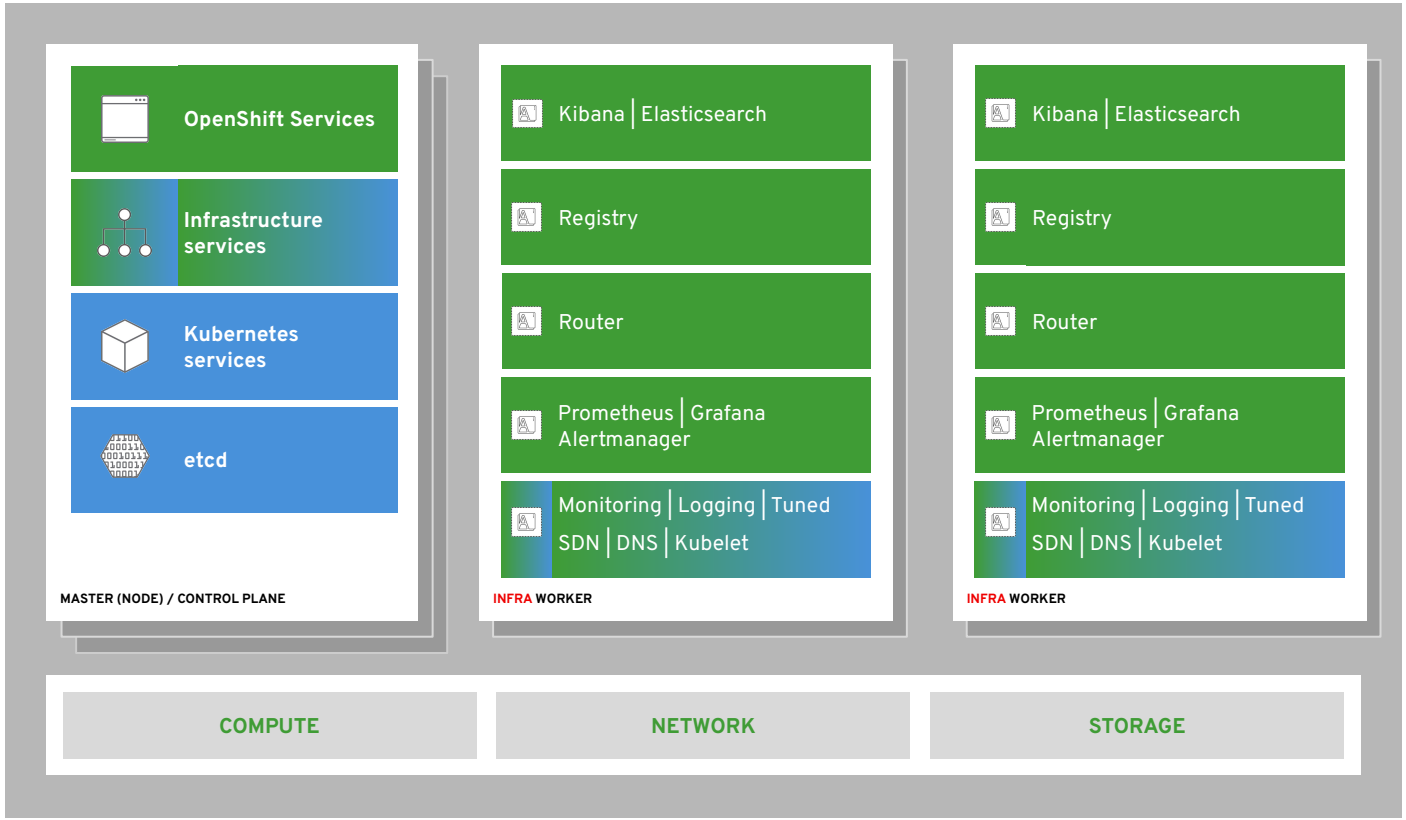
cluster monitoring



log aggregation



integrated routing



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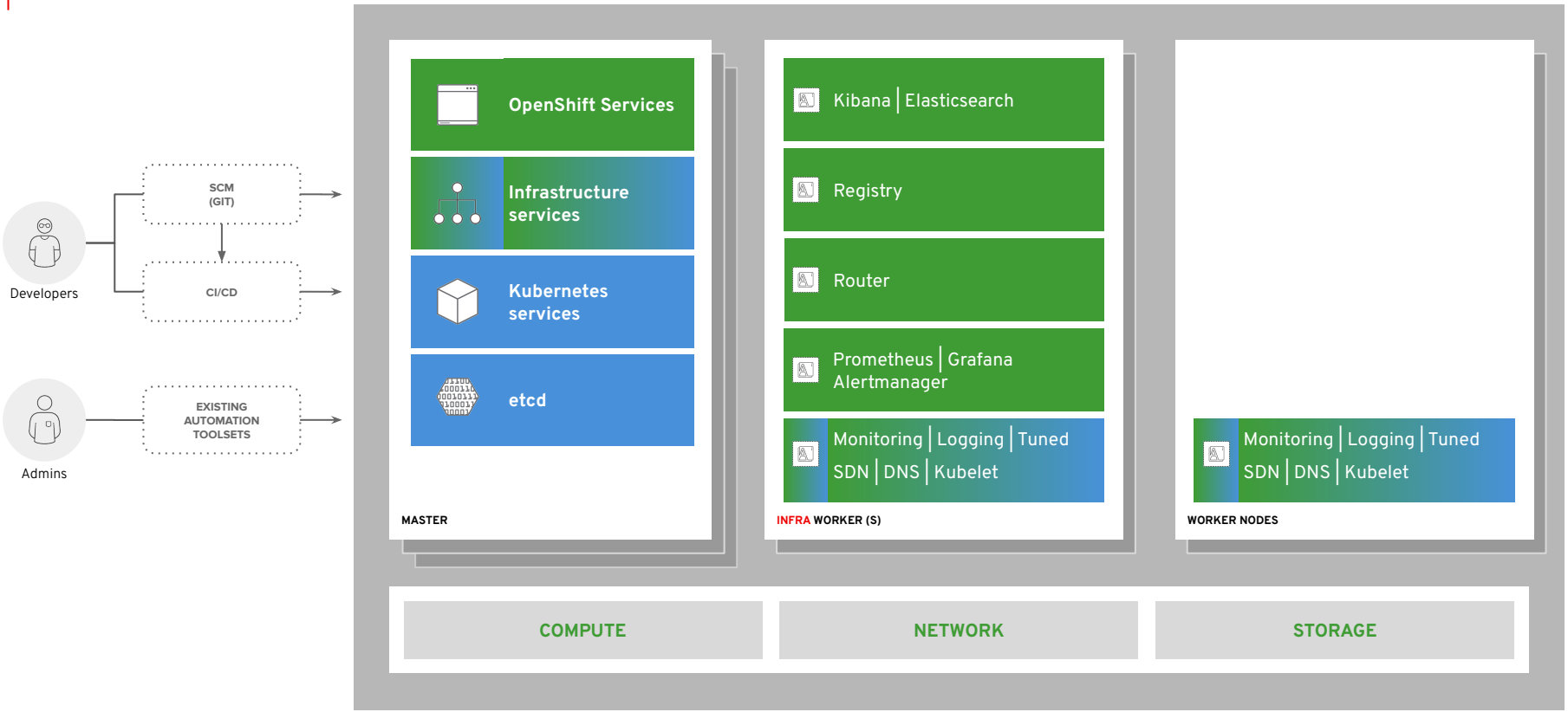
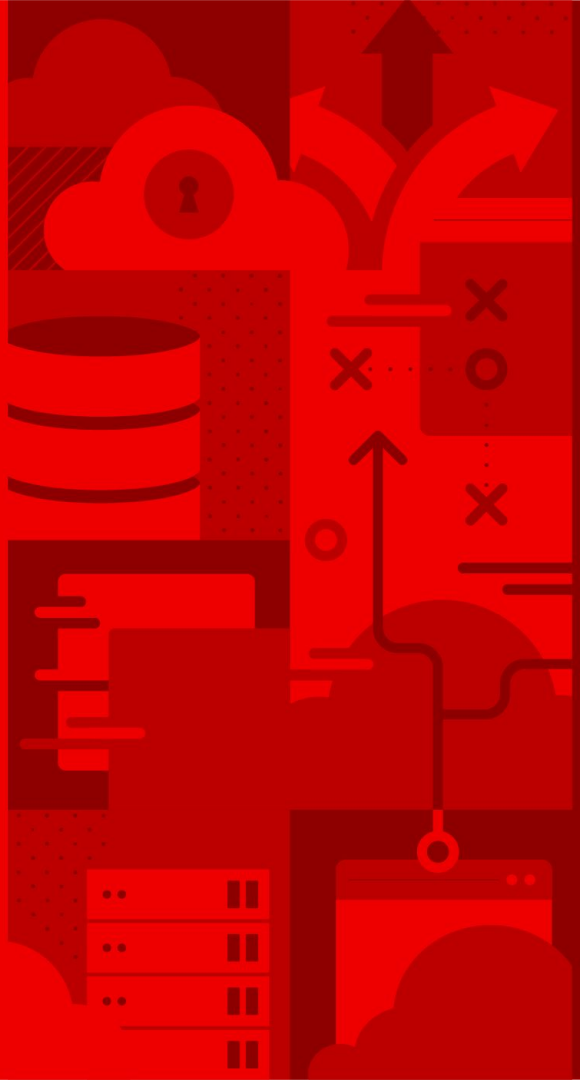
dev and ops via web, cli, API, and IDE



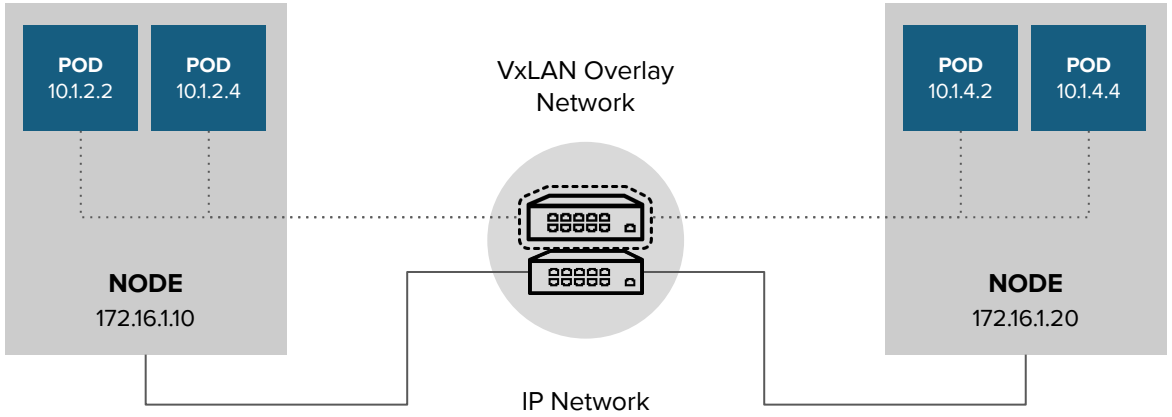


Networking

A pluggable model for network interface controls in kubernetes

Red Hat

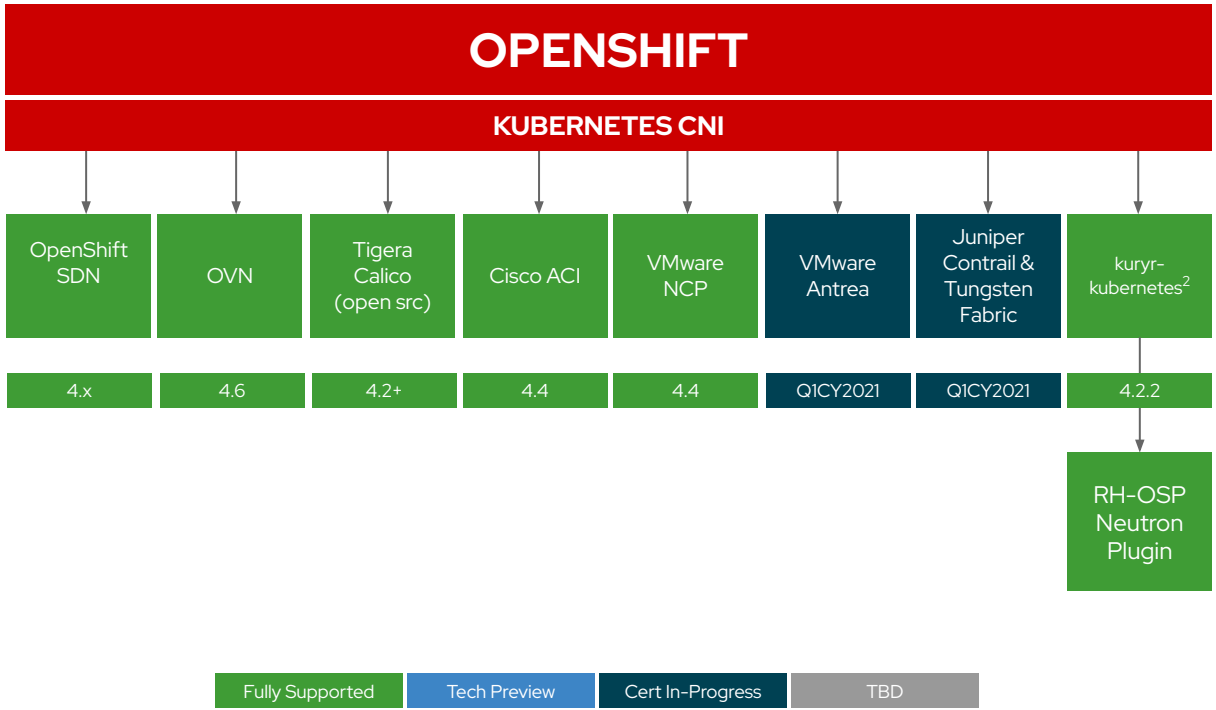
OpenShift SDN high-level architecture



OpenShift Networking Plug-ins

3rd-party Kubernetes CNI plug-in certification primarily consists of:

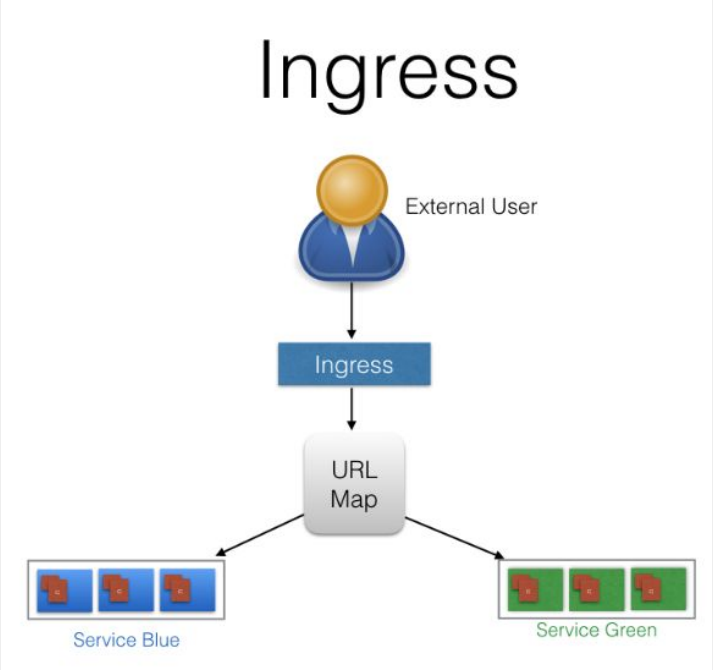
1. Formalizing the partnership
2. Certifying the container(s)
3. Certifying the Operator
4. Successfully passing the same Kubernetes networking conformance tests that OpenShift uses to validate its own SDN



Product Manager: Marc Curry

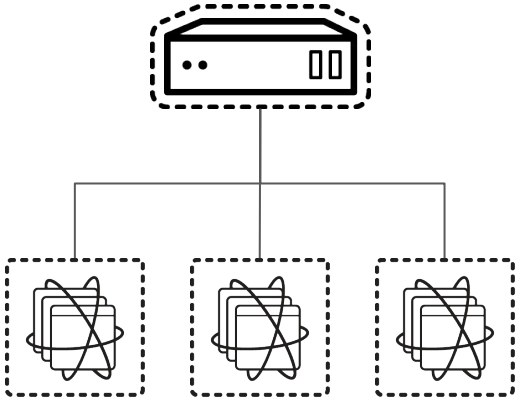
routes and ingress

How traffic enters the cluster



Routing and Load Balancing

- Pluggable routing architecture
  - HAProxy Router
  - F5 Router
- Multiple-routers with traffic sharding
- Router supported protocols
  - HTTP/HTTPS
  - WebSockets
  - TLS with SNI
- Non-standard ports via cloud load-balancers, external IP, and NodePort

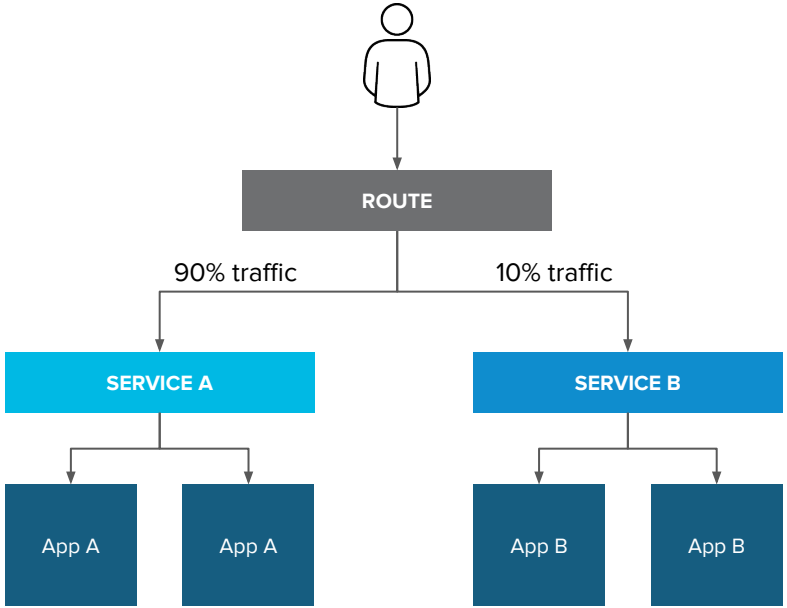


Routes vs Ingress

Feature	Ingress	Route
Standard Kubernetes object	X	
External access to services	X	X
Persistent (sticky) sessions	X	X
Load-balancing strategies (e.g. round robin)	X	X
Rate-limit and throttling	X	X
IP whitelisting	X	X
TLS edge termination	X	X
TLS re-encryption	X	X
TLS passthrough	X	X
Multiple weighted backends (split traffic)		X
Generated pattern-based hostnames		X
Wildcard domains		X

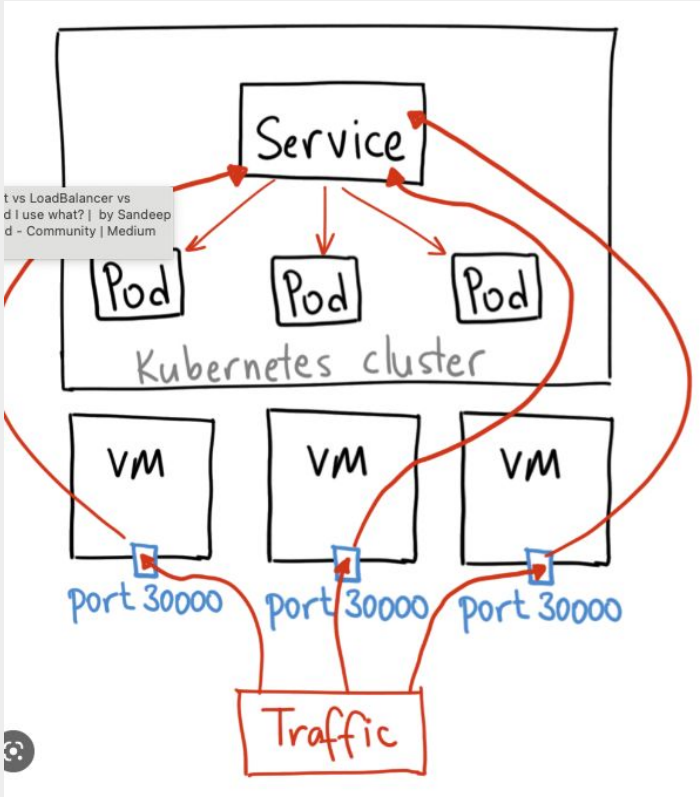
Router-based deployment methodologies

Split Traffic Between Multiple Services For A/B Testing, Blue/Green and Canary Deployments



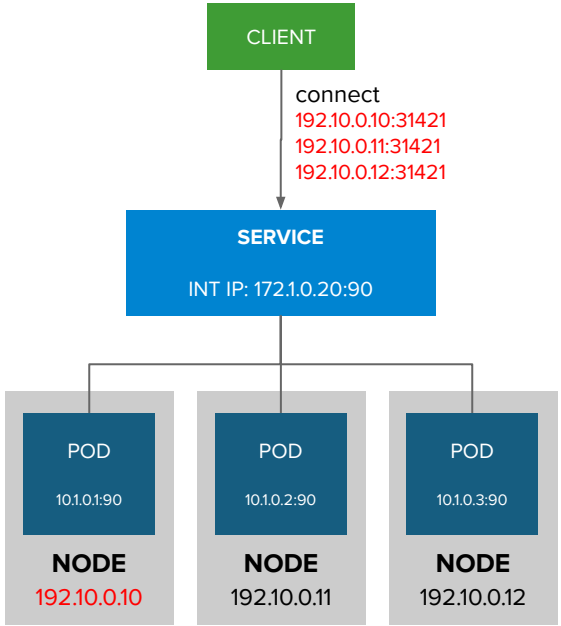
Alternative methods for ingress

Different ways that traffic can enter the cluster without the router



Entering the cluster on a random port with service nodeports

- NodePort binds a service to a unique port on all the nodes
- Traffic received on any node redirects to a node with the running service
- Ports in 30K-60K range which usually differs from the service
- Firewall rules must allow traffic to all nodes on the specific port



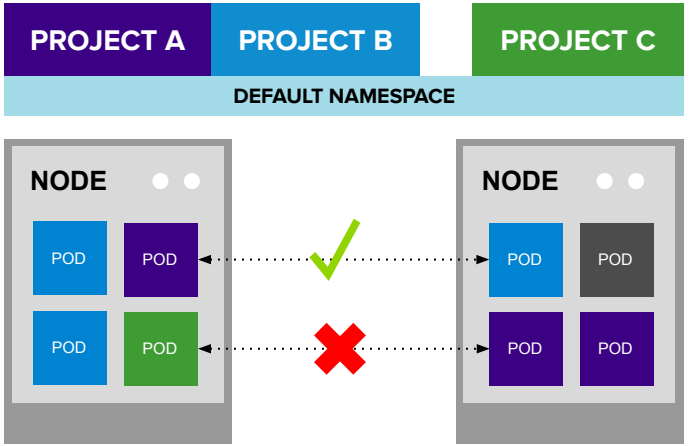
OpenShift SDN “flavors”

OPEN NETWORK **(Default)**

- All pods can communicate with each other across projects

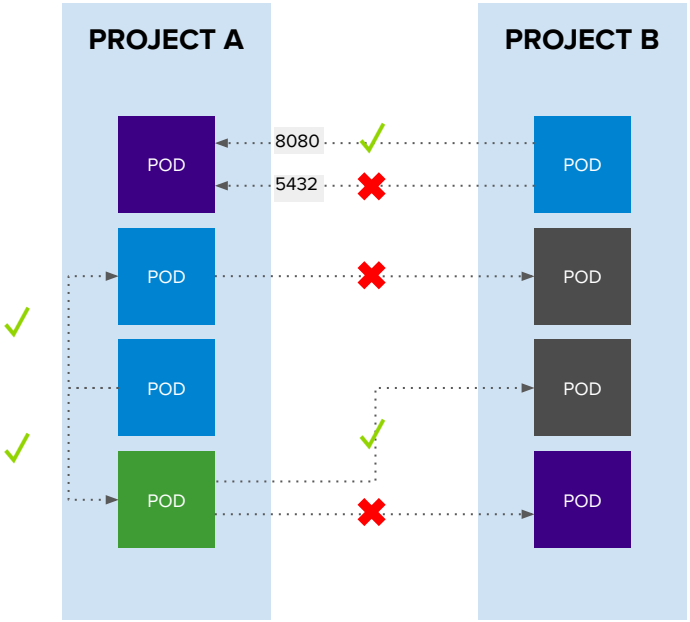
MULTI-TENANT NETWORK

- Project-level network isolation
- Multicast support
- Egress network policies



Multi-Tenant Network

NetworkPolicy



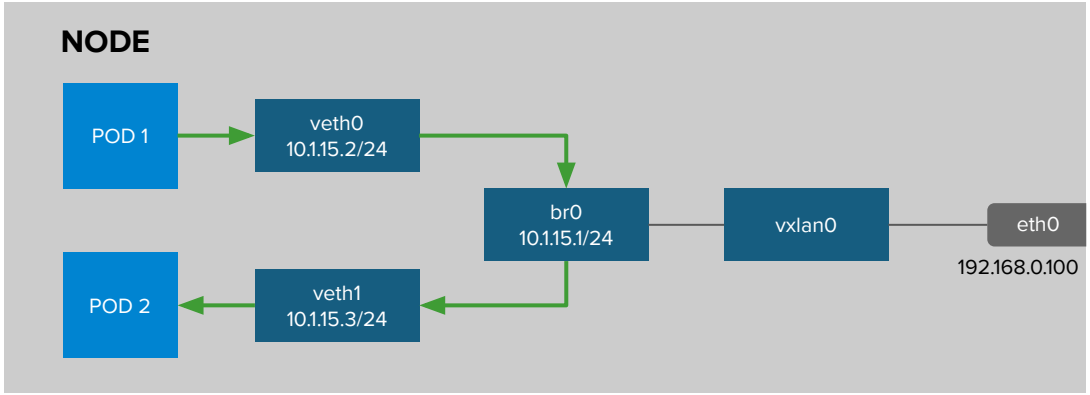
Example Policies

- Allow all traffic inside the project
- Allow traffic from green to gray
- Allow traffic to purple on 8080

```
apiVersion: extensions/v1beta1
kind: NetworkPolicy
metadata:
  name: allow-to-purple-on-8080
spec:
  podSelector:
    matchLabels:
      color: purple
  ingress:
  - ports:
    - protocol: tcp
      port: 8080
```

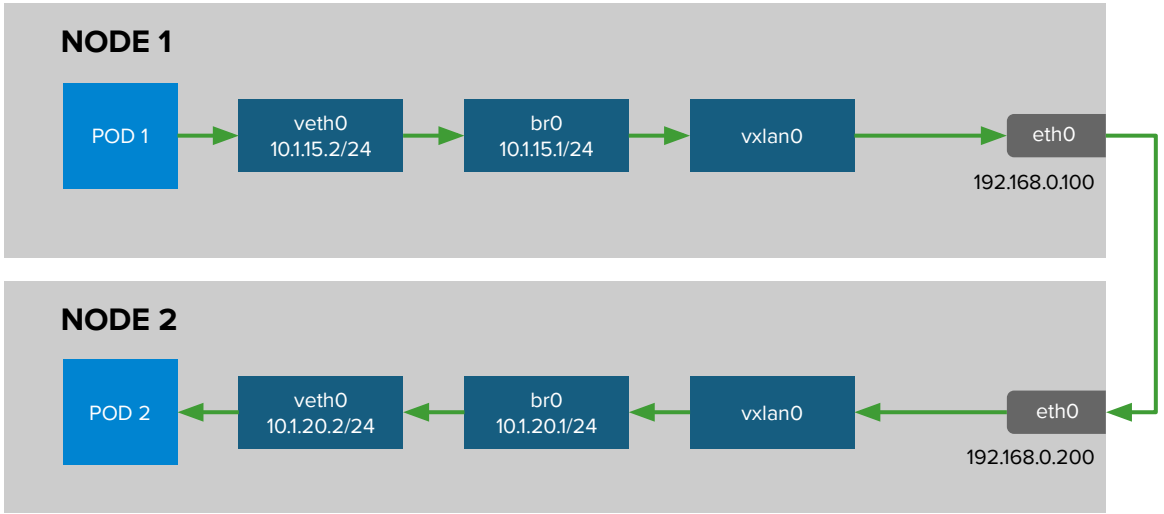
OpenShift SDN packet flows

container-container on same host



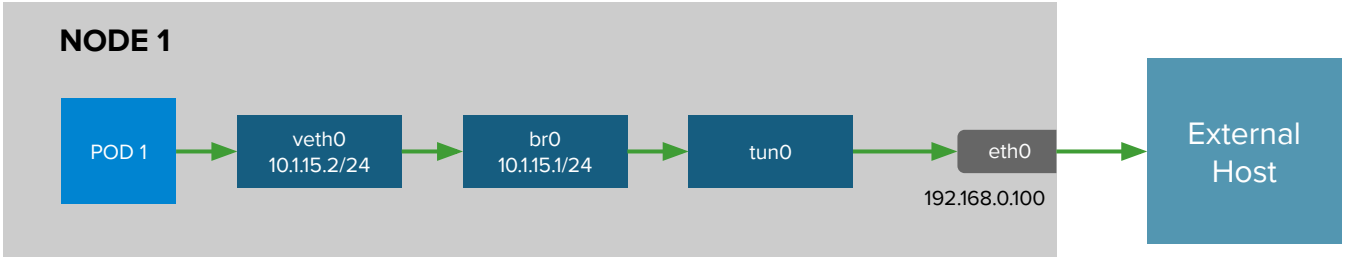
OpenShift SDN packet flows

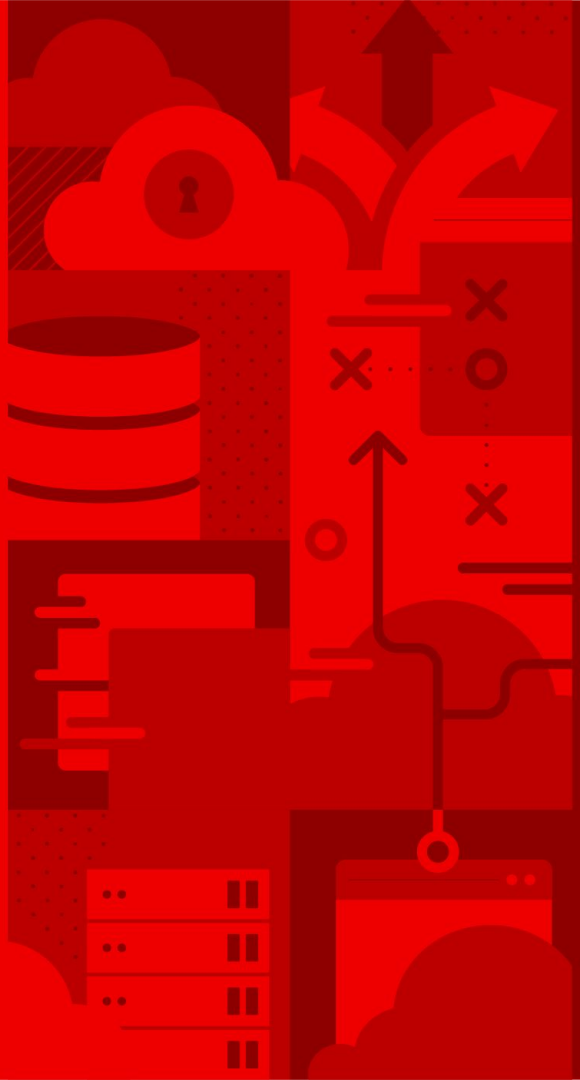
container-container across hosts



OpenShift SDN packet flows

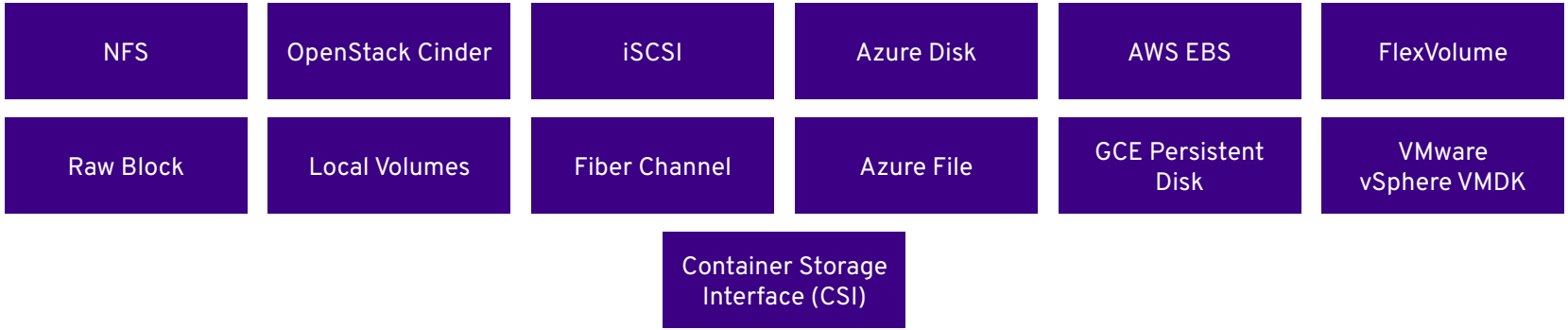
container leaving the host



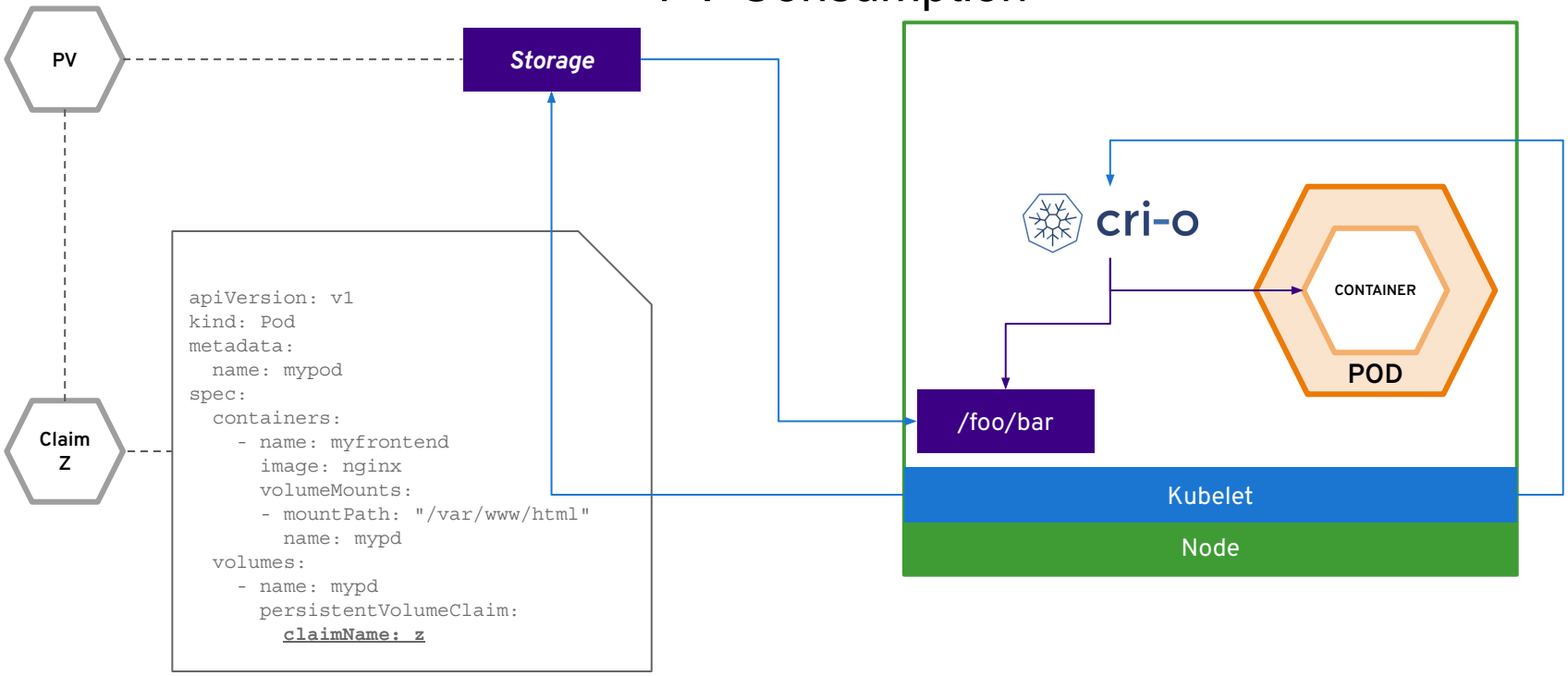


Persistent Storage

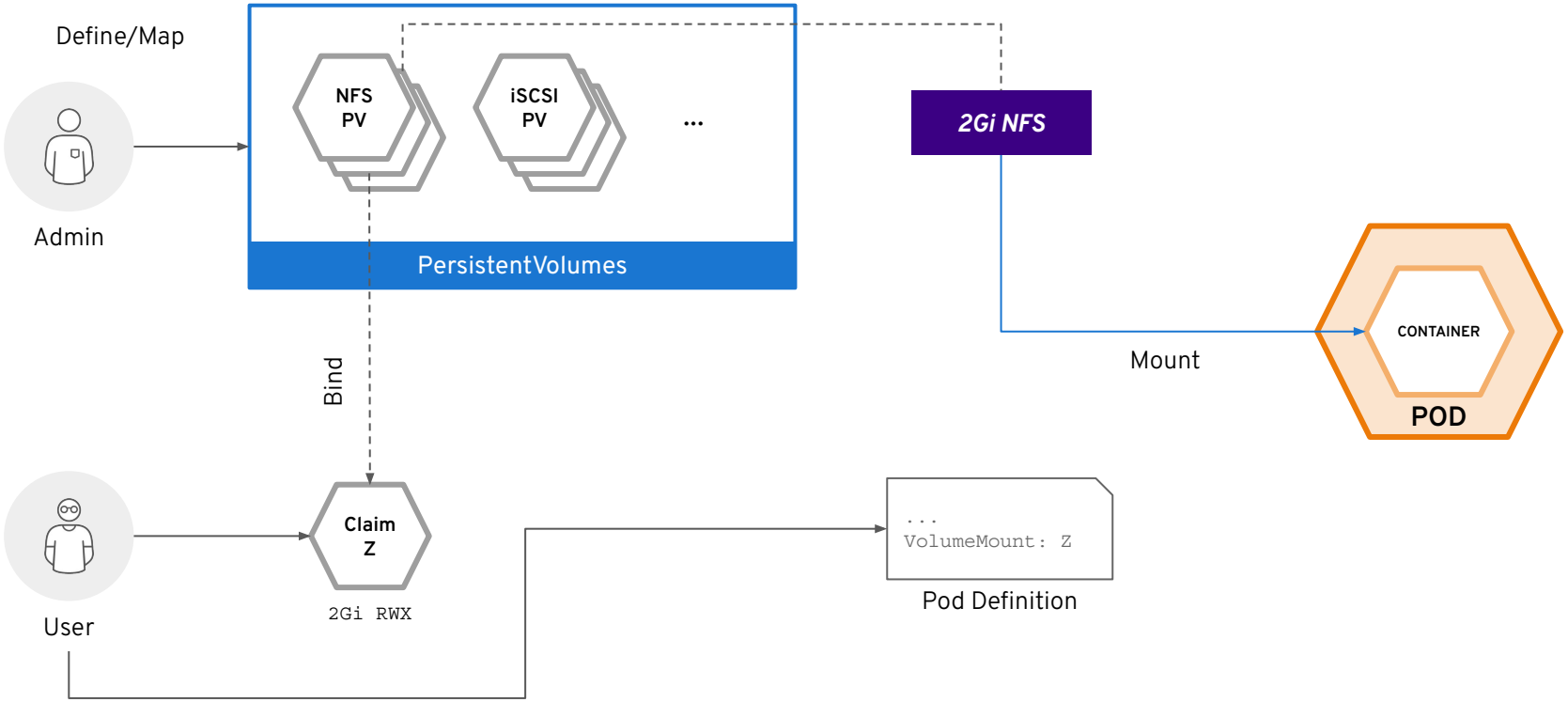
A broad spectrum of static and dynamic storage endpoints



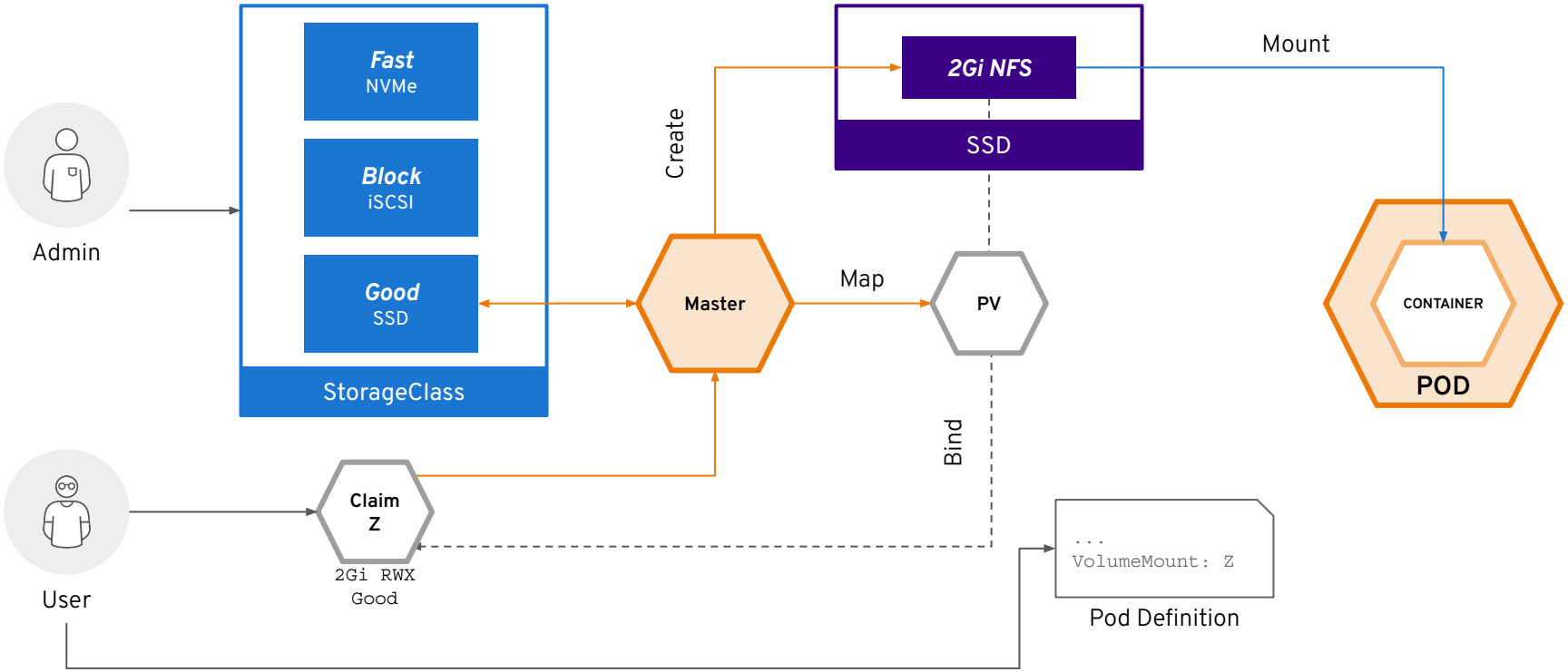
PV Consumption

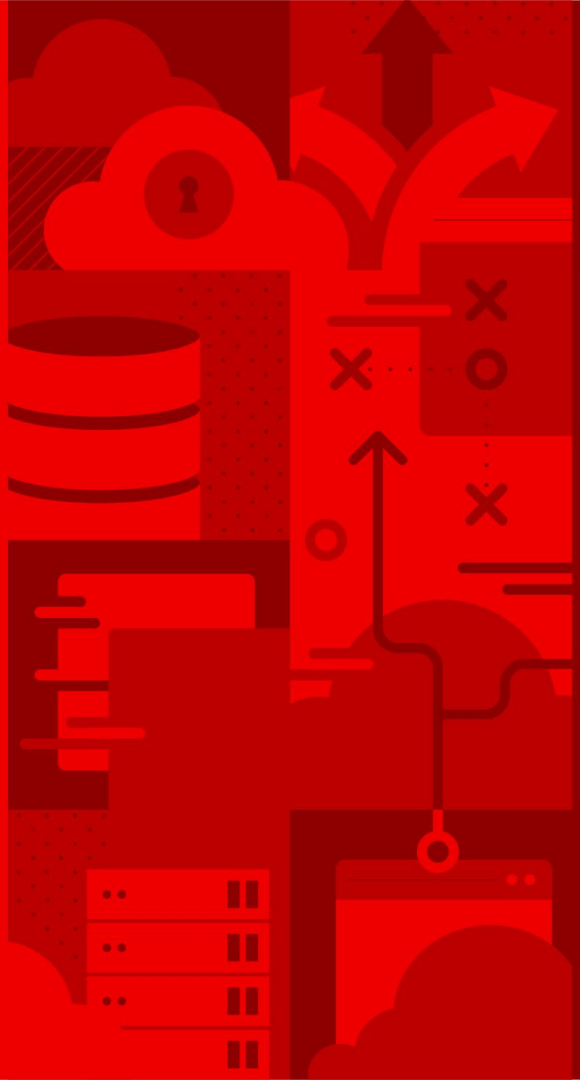


Static Storage Provisioning



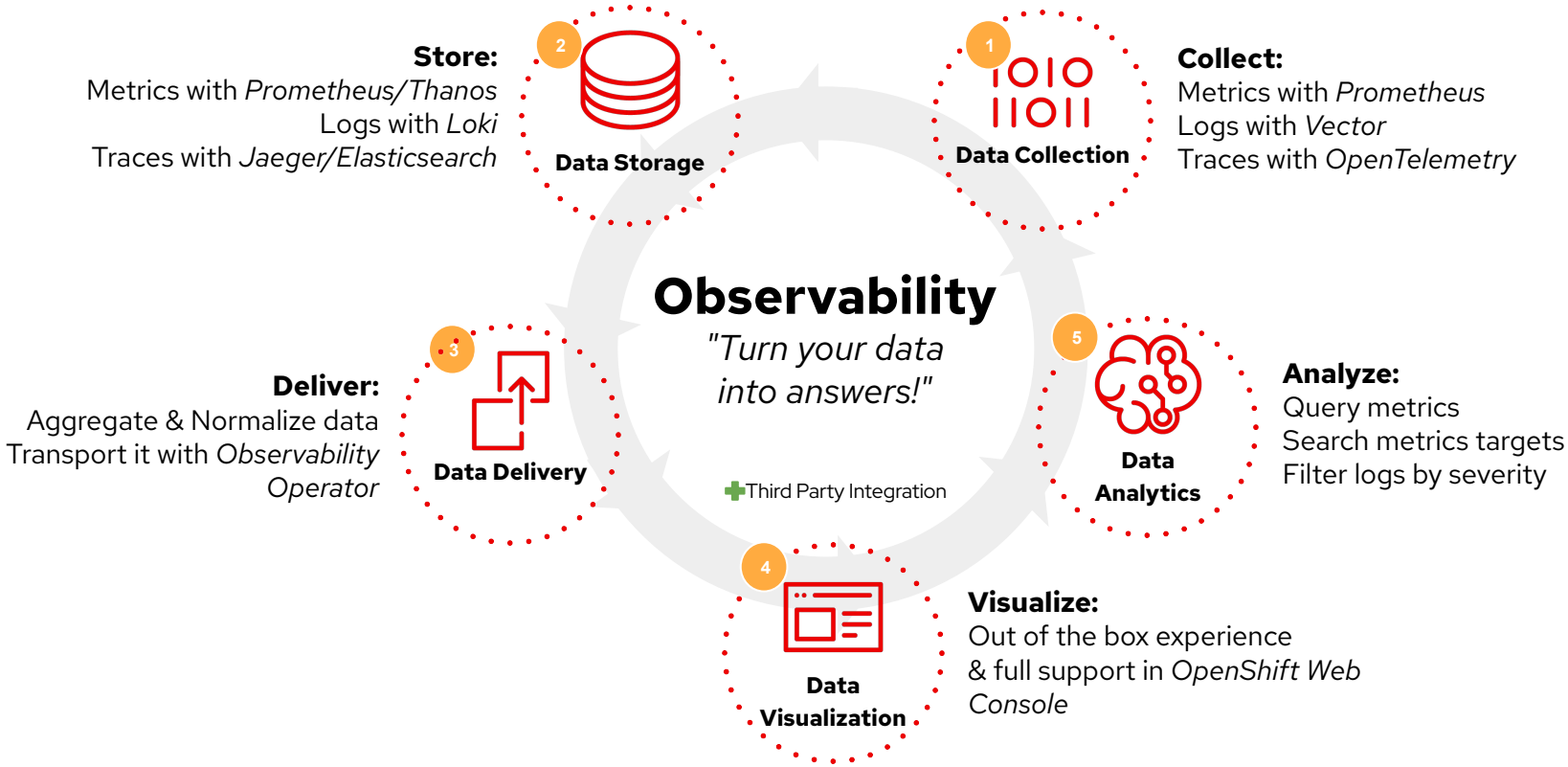
Dynamic Storage Provisioning





Observability

OpenShift Observability: Five Pillars



Store:
Metrics with *Prometheus/Thanos*
Logs with *Loki*
Traces with *Jaeger/Elasticsearch*

Collect:
Metrics with *Prometheus*
Logs with *Vector*
Traces with *OpenTelemetry*

Deliver:
Aggregate & Normalize data
Transport it with *Observability Operator*

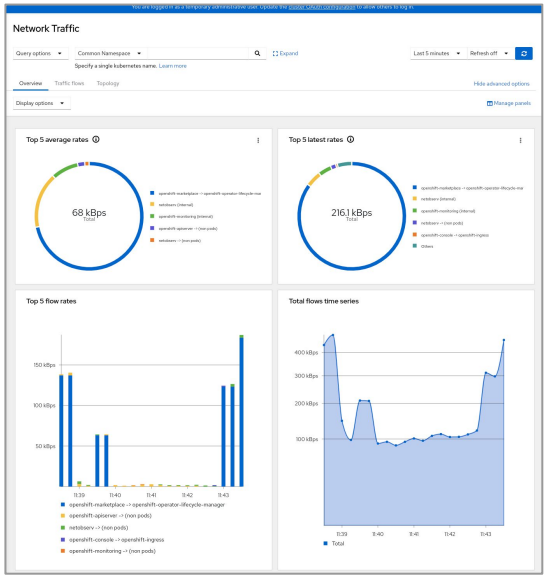
Analyze:
Query metrics
Search metrics targets
Filter logs by severity

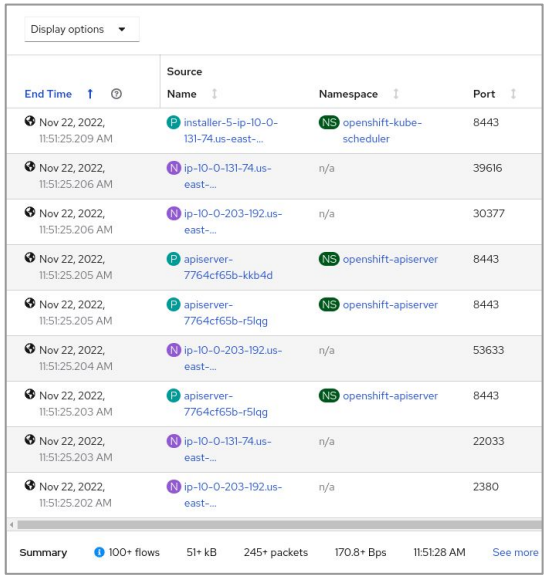
Visualize:
Out of the box experience
& full support in *OpenShift Web Console*

Network Observability

Network Observability GAs at 4.12 for all supported versions of OpenShift at 4.10 or newer

- Integrated with the larger Observability ecosystem, this optional Operator focuses on networking information for a single cluster
- Uses an **eBPF-based** agent on cluster nodes to collect metrics
- Provides observable network traffic metrics, flows, topology and tracing





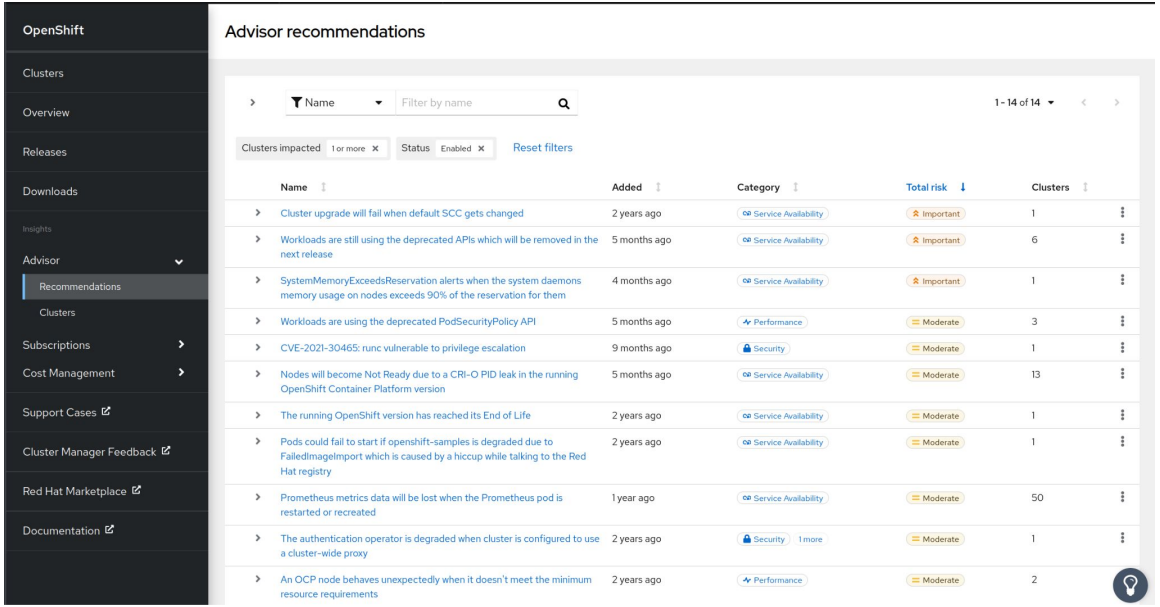
PM: Marc Curry, Deepthi Dharwar

Red Hat

Insights Advisor for OpenShift

- **Free service leveraging Red Hat experience with supporting and operating OpenShift**
- New recommendations based on analysis of Kubernetes YAML files (available for managed OpenShift only ATM)
- Alerts in OpenShift WebConsole for most critical recommendations
- **New recommendations** focused on storage performance, etcd issues etc.
- Improved internal integrations for more stable upgrades

https://console.redhat.com/openshift/advisor
https://console.redhat.com/settings/notifications/openshift

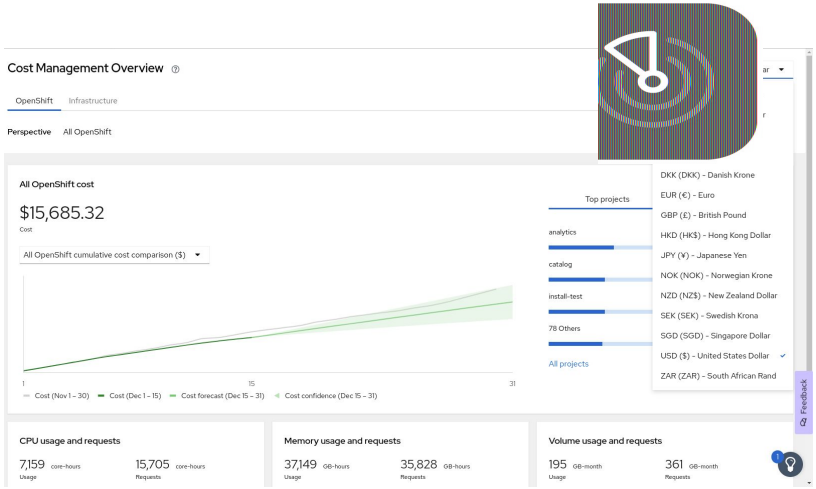


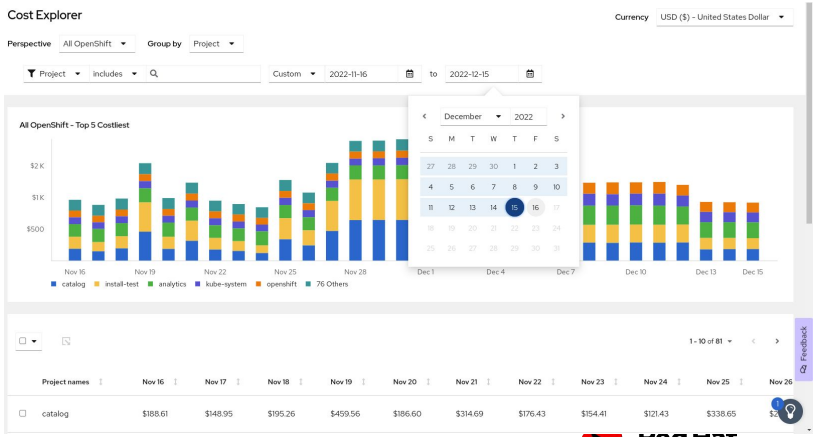
PM: Tomas Dosek

Red Hat

Insights Cost Management

- **Free service to monitor per-project and per-cluster spending**
- Currency support
- Marketplace services reported including ROSA, ARO, RHEL, ODF, 3rd parties, etc
- ROSA and ARO costs distributed to projects
- Costs now distributed according to the same resource consumption criteria in every view
- Cost of unallocated capacity accounted (both workers and platform)
- Filtering gained exclude capabilities (“negative filtering”)
- AWS costs default to amortized when Savings Plans are involved
- Previous month report and custom date picker in Cost Explorer
- Performance improvements for OCP clusters running on GCP
- Integration with console.redhat.com notifications





https://console.redhat.com/openshift/cost-management
https://console.redhat.com/settings/applications/cost-management
https://console.redhat.com/settings/notifications/openshift

PM: Pau Garcia Quiles

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