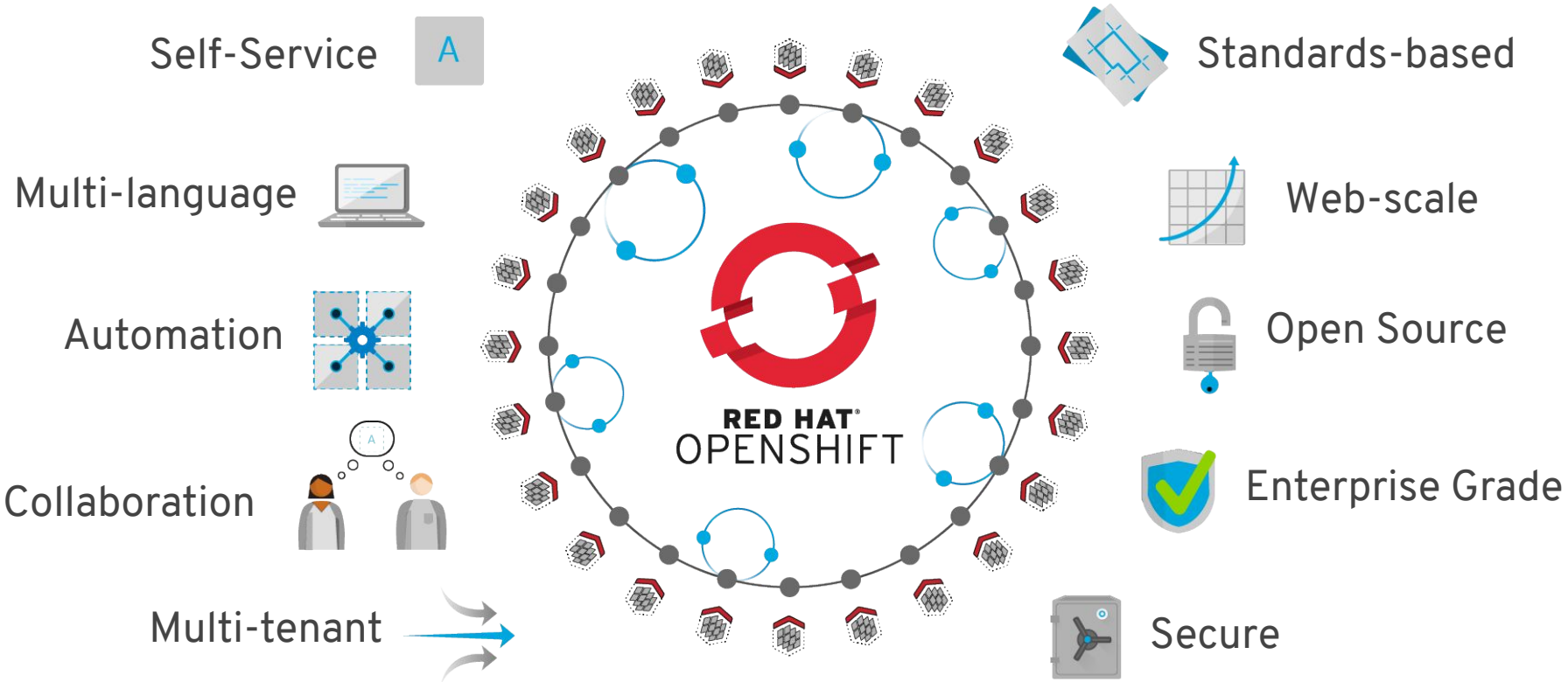
OpenShift 4.x Architecture Workshop

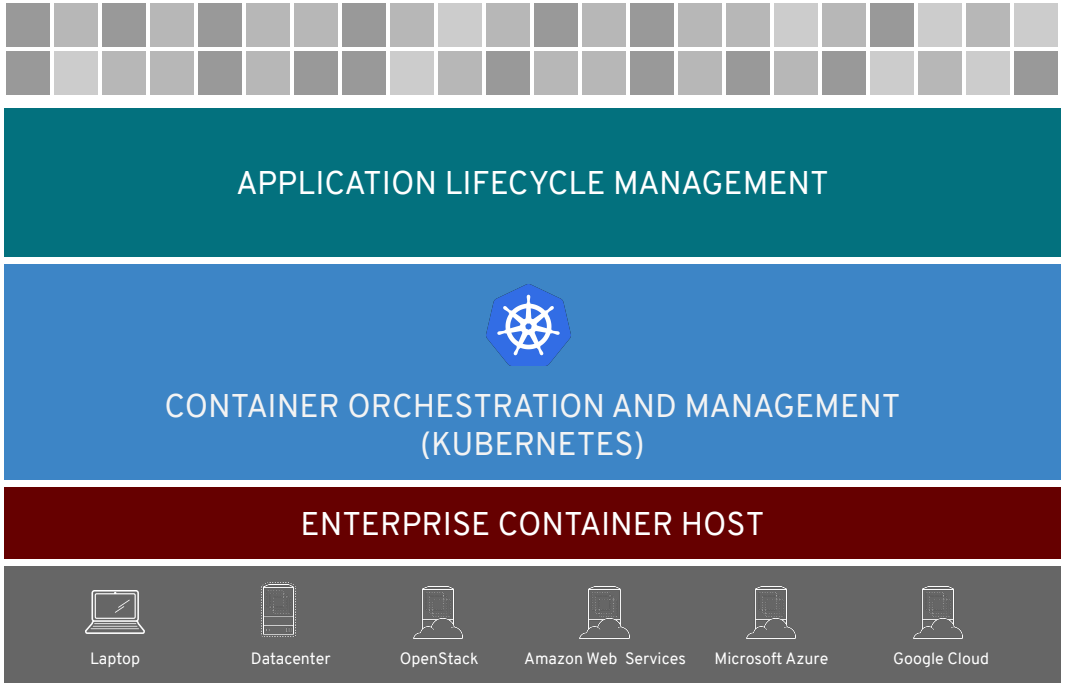
OpenShift Container Platform (OCP)
Advanced Architecture

July 2019

Red Hat


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

OPENSHIFT CONTAINER PLATFORM



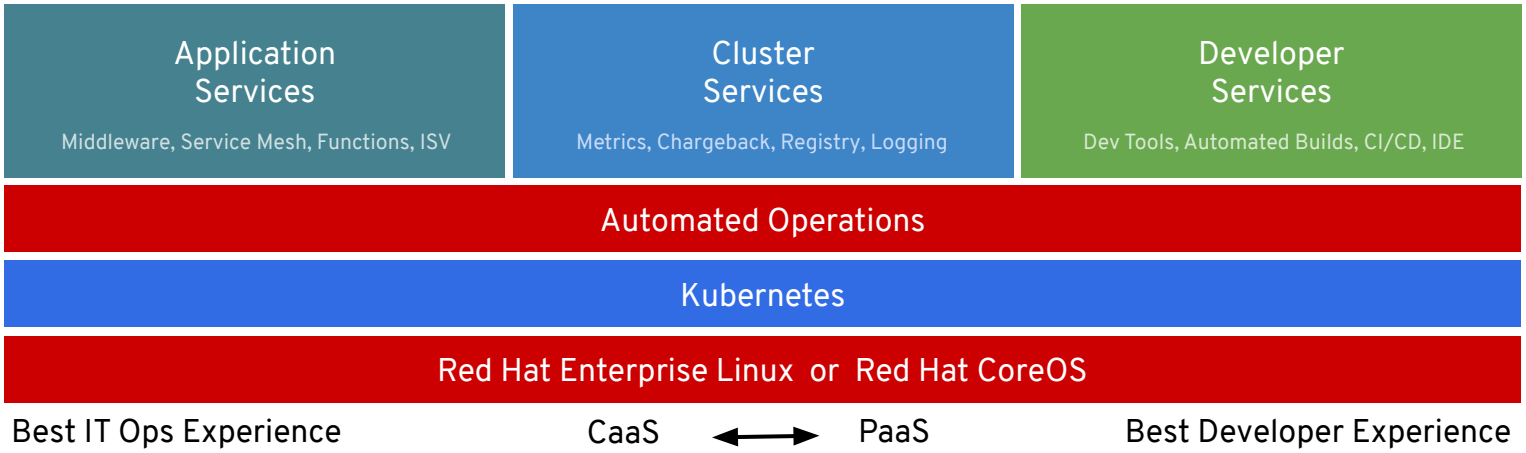
ANY
CONTAINER

RED HAT®
OPENSHIFT

ANY
INFRASTRUCTURE

Red Hat

OPENSHIFT CONTAINER PLATFORM



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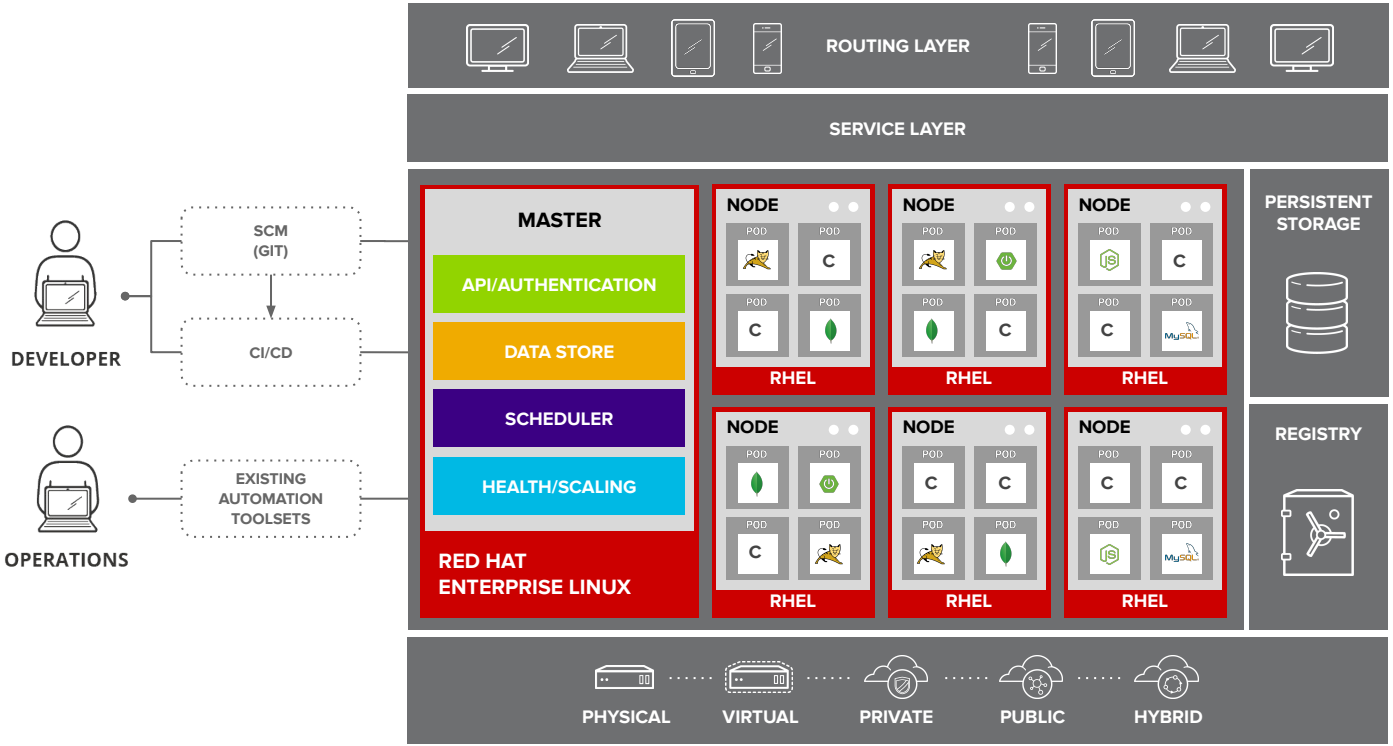
OPENSHIFT ARCHITECTURE



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Cotainer Concepts Overview

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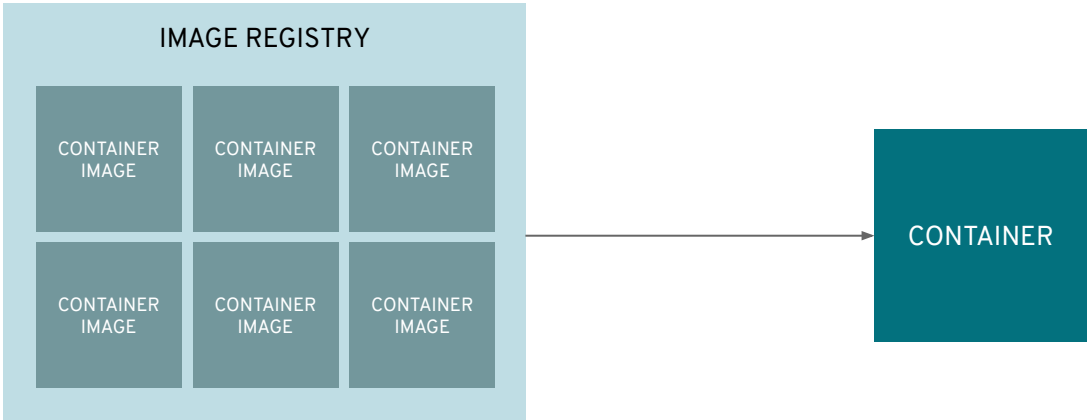
A container is the smallest compute unit

containers are created from container images

container images are stored in an image registry



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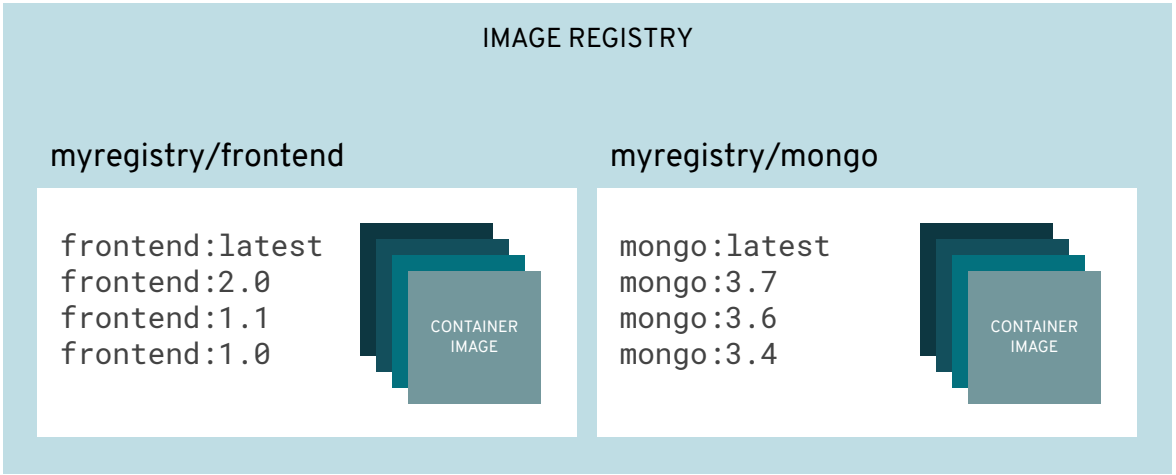
an image repository contains all versions of an image in the image registry



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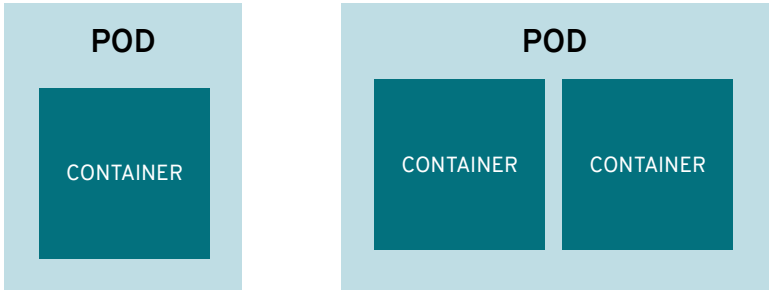
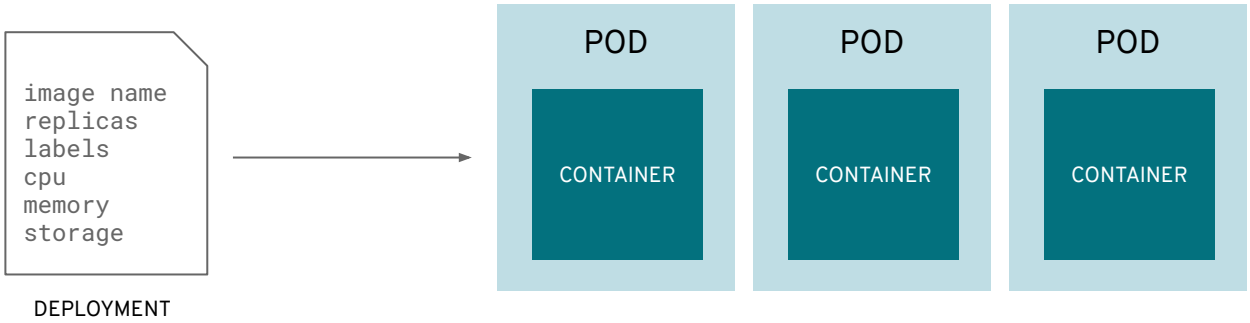
containers are wrapped in pods which are units of deployment and management



IP: 10.1.0.11

IP: 10.1.0.55

pods configuration is defined in a `deployment`



Red Hat

OpenShift Architecture

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YOUR CHOICE OF INFRASTRUCTURE

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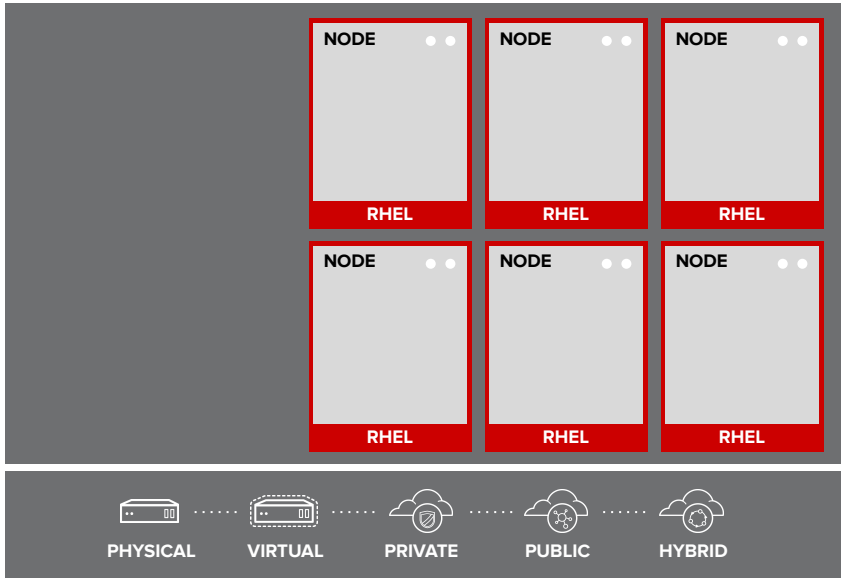
NODES RHEL INSTANCES WHERE APPS RUN



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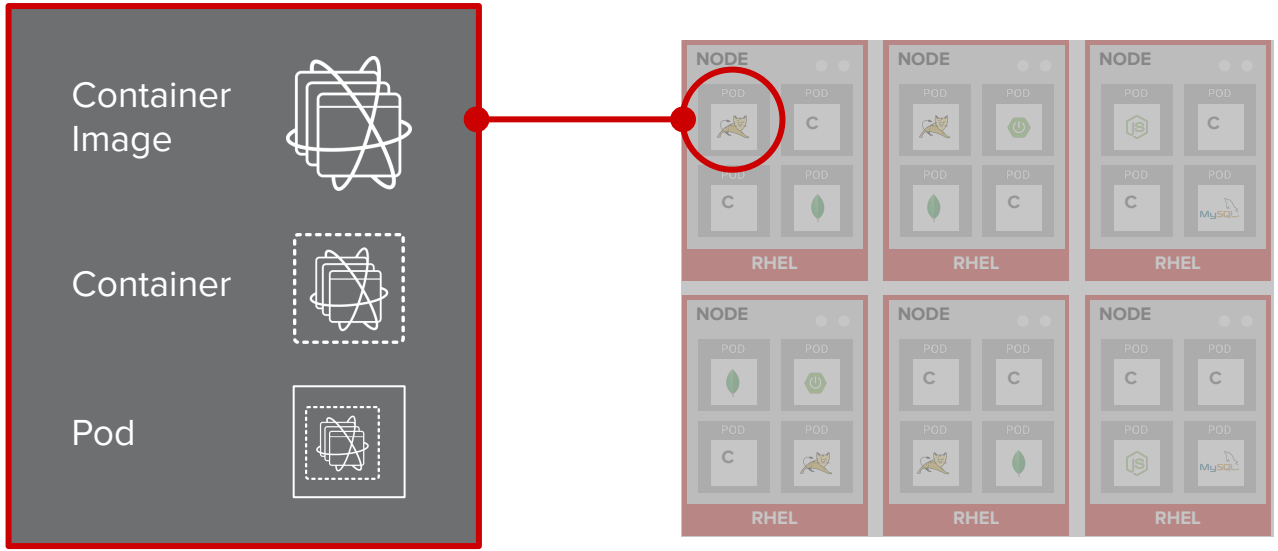
APPS RUN IN CONTAINERS



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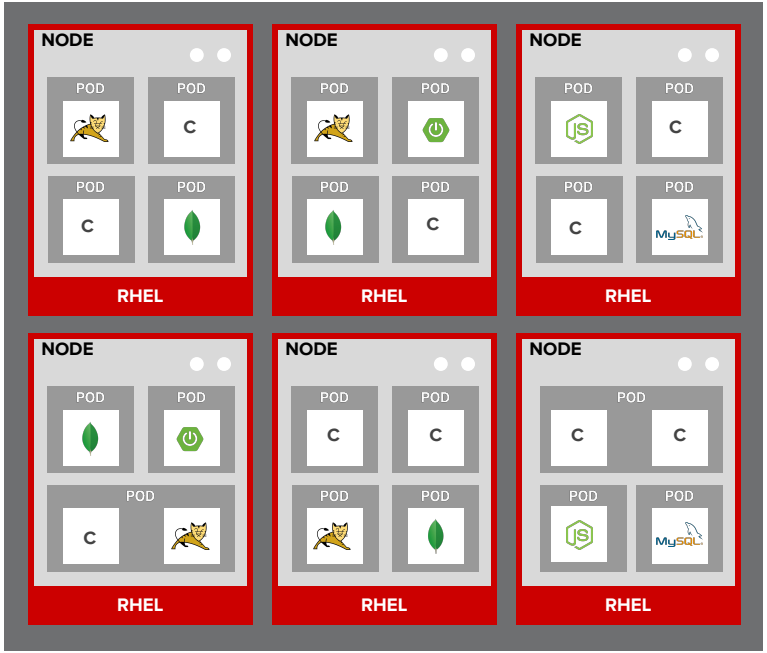
PODS ARE THE UNIT OF ORCHESTRATION



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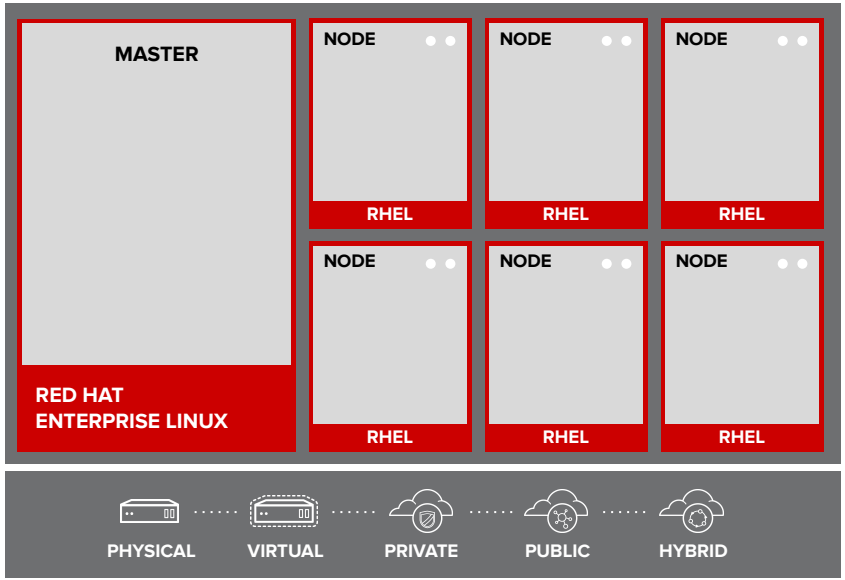
MASTERS ARE THE CONTROL PLANE



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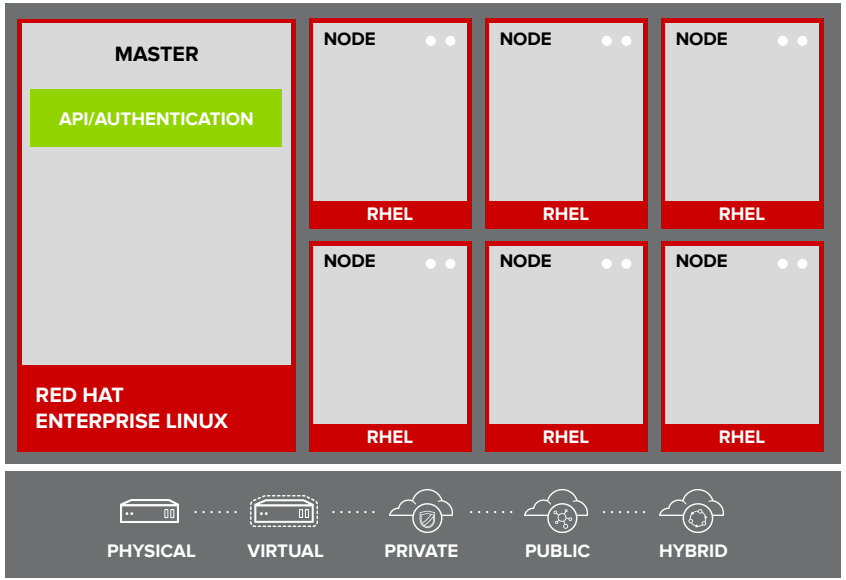
API AND AUTHENTICATION



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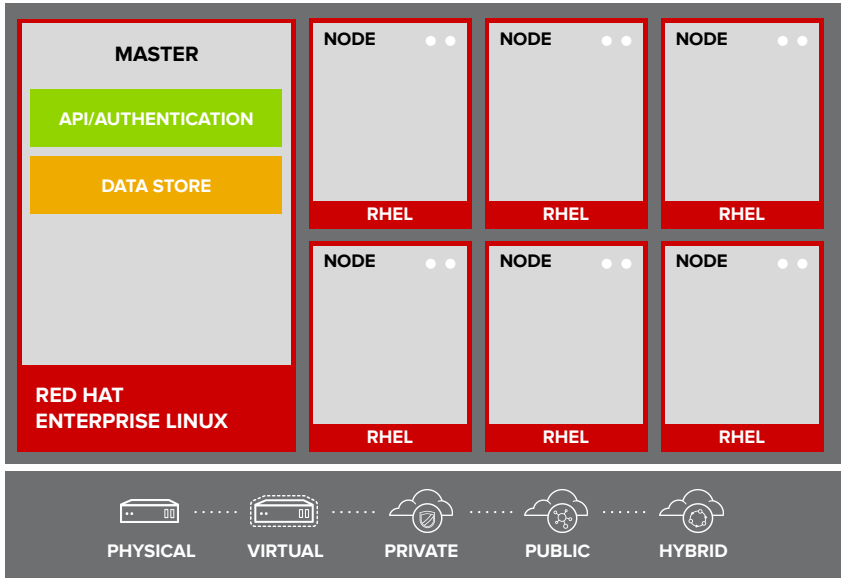
DESIRED AND CURRENT STATE



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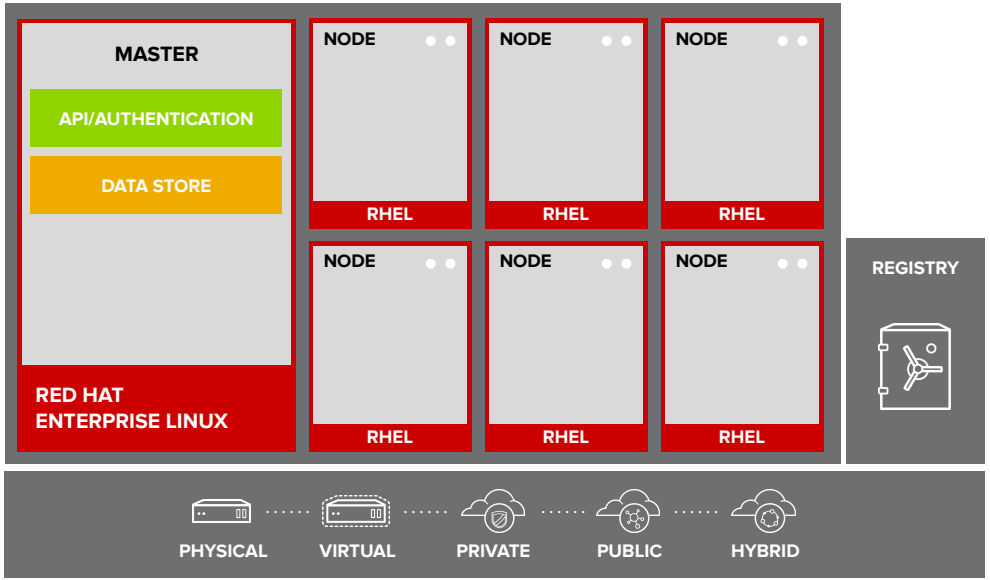
INTEGRATED CONTAINER REGISTRY



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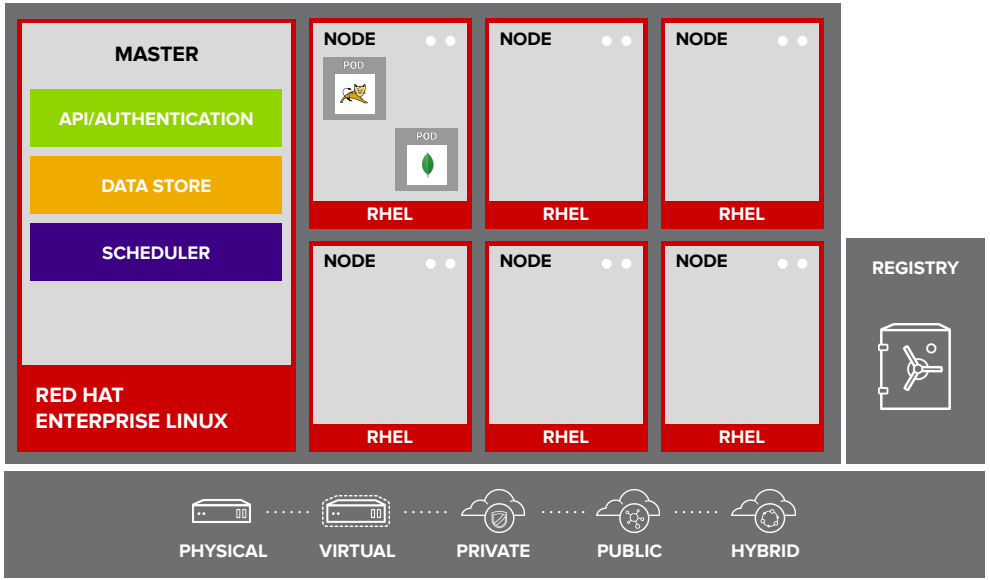
ORCHESTRATION AND SCHEDULING



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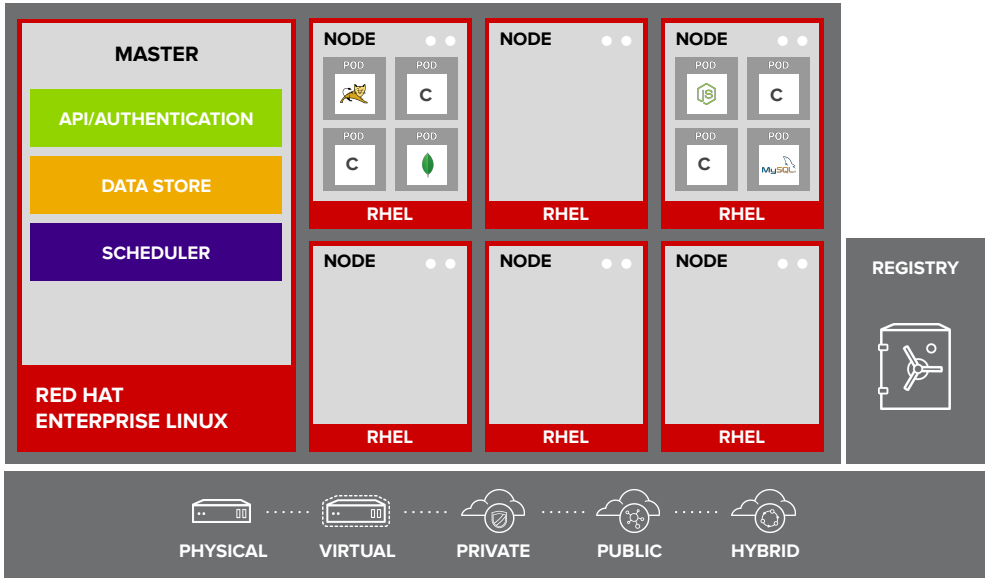
PLACEMENT BY POLICY



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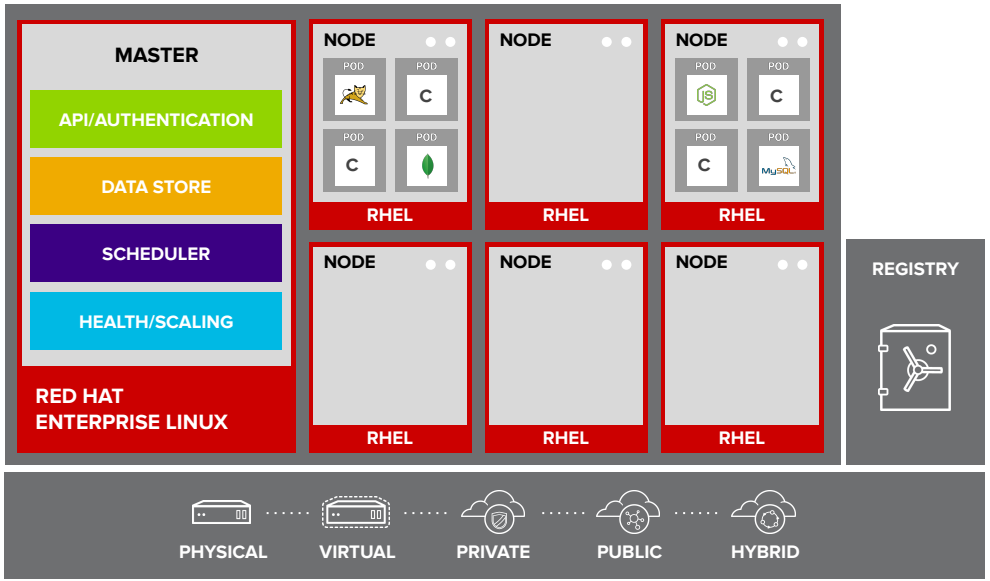
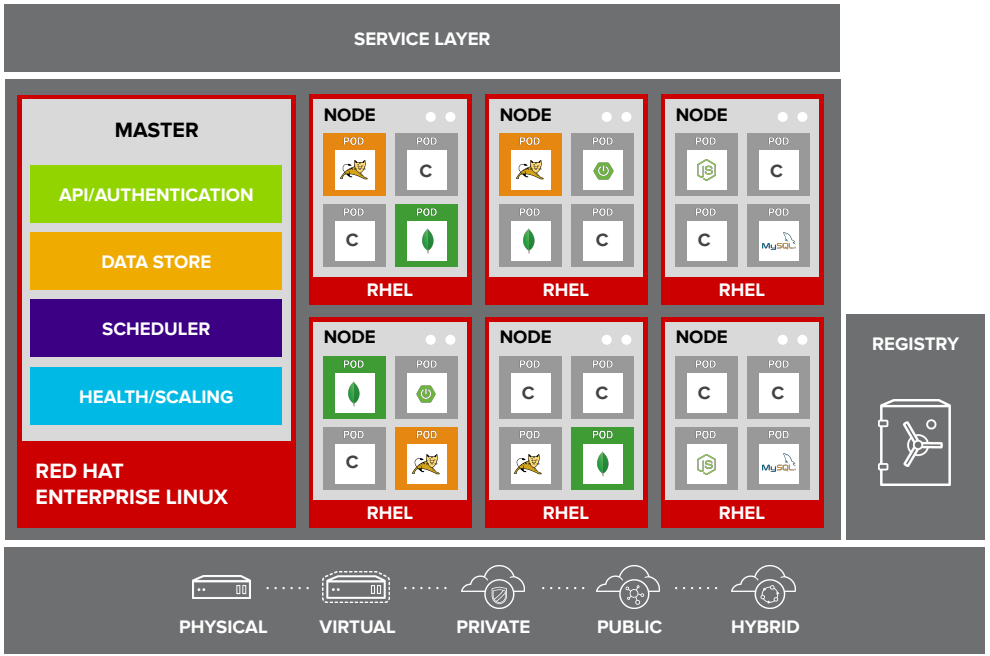
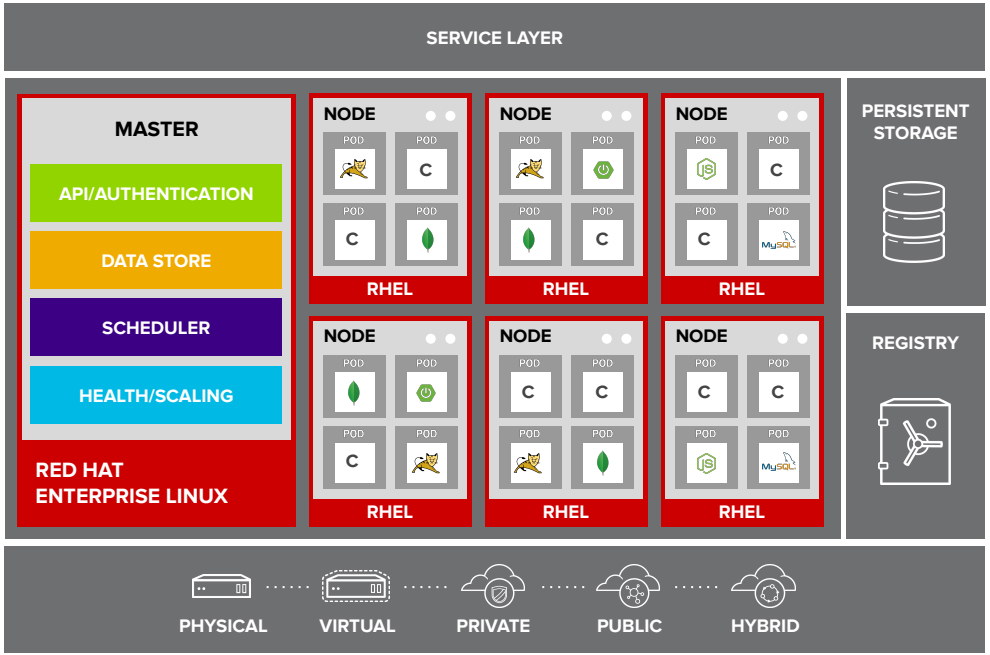
AUTOSCALING PODS



SERVICE DISCOVERY



PERSISTENT DATA IN CONTAINERS



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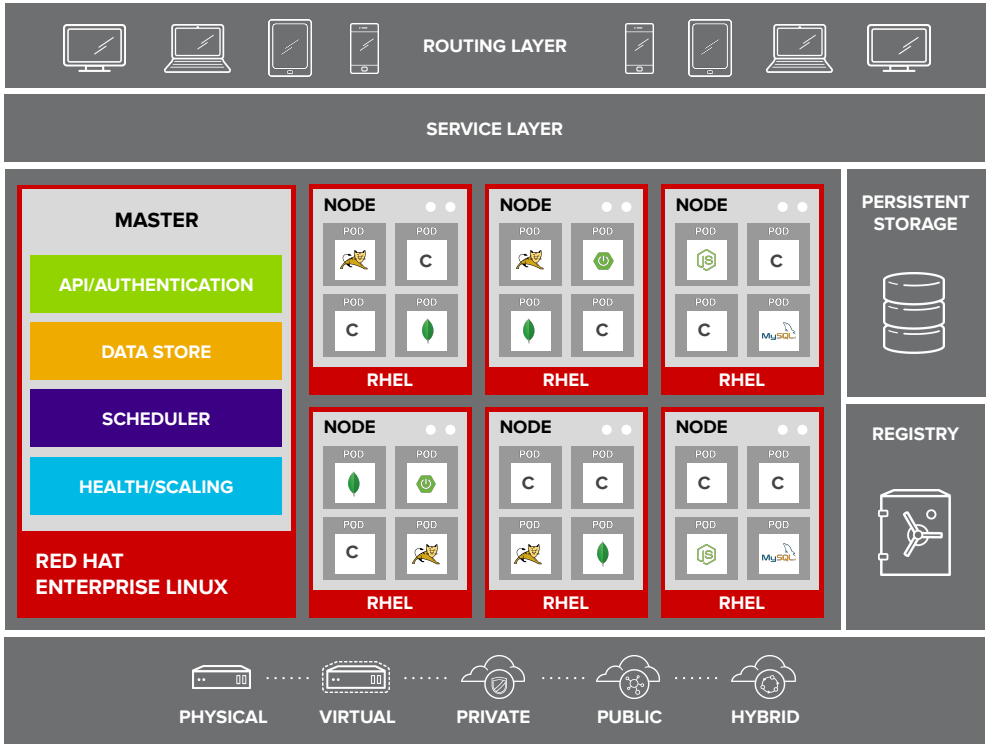
ROUTING AND LOAD-BALANCING



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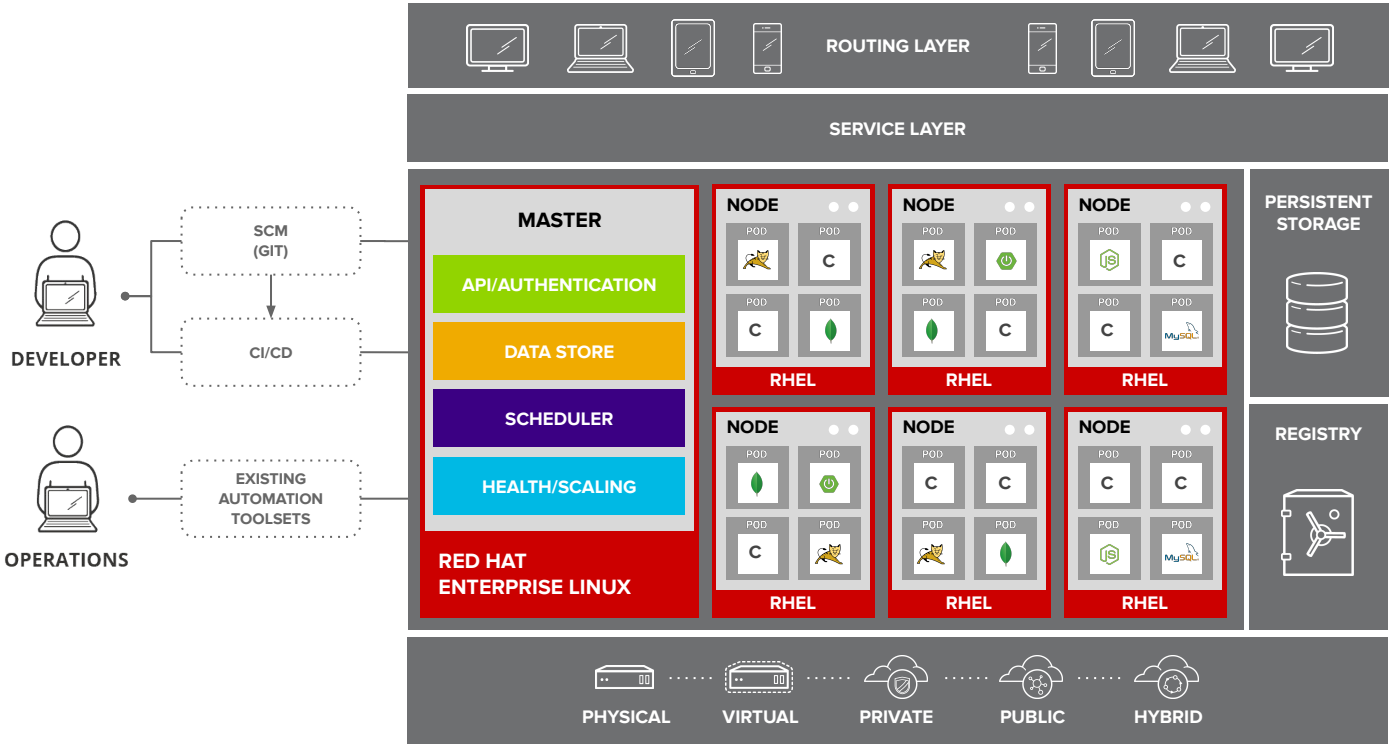
ACCESS VIA WEB, CLI, IDE AND API



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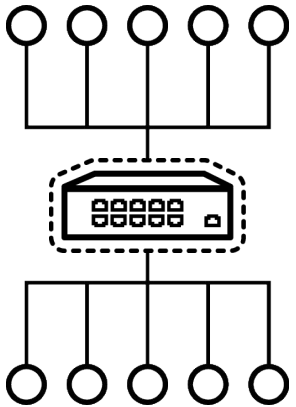
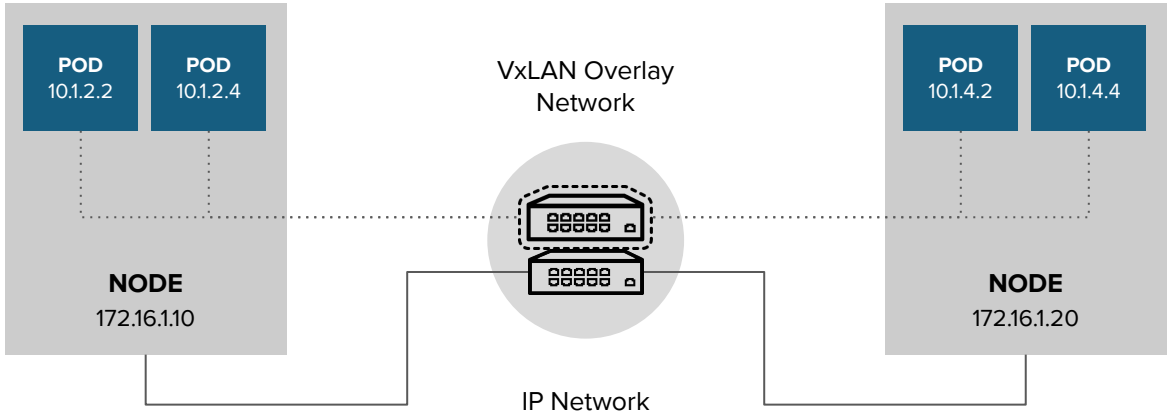
Networking

OPENSHIFT NETWORKING

- Built-in internal DNS to reach services by name
- Split DNS is supported via DNSmasq
  - Master answers DNS queries for internal services
  - Other name servers serve the rest of the queries
- Software Defined Networking (SDN) for a unified cluster network to enable pod-to-pod communication
- OpenShift follows the Kubernetes Container Networking Interface (CNI) plug-in model



OPENSHIFT NETWORKING



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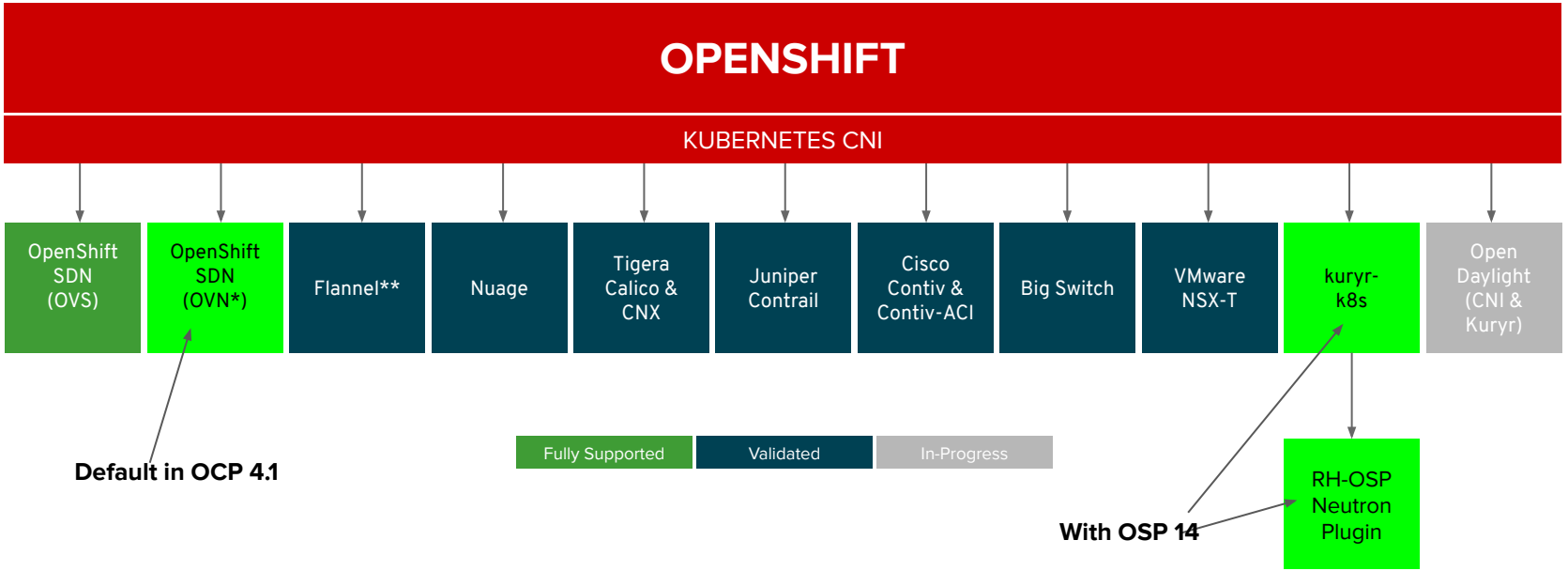
OPENSHIFT NETWORK PLUGINS



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OPENSHIFT SDN

FLAT NETWORK

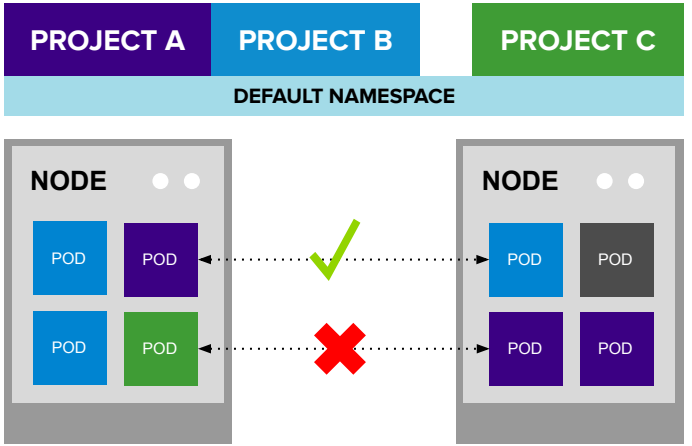
- All pods can communicate with each other across projects

MULTI-TENANT NETWORK

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

NETWORK POLICY (Default)

- Granular policy-based isolation



Multi-Tenant Network

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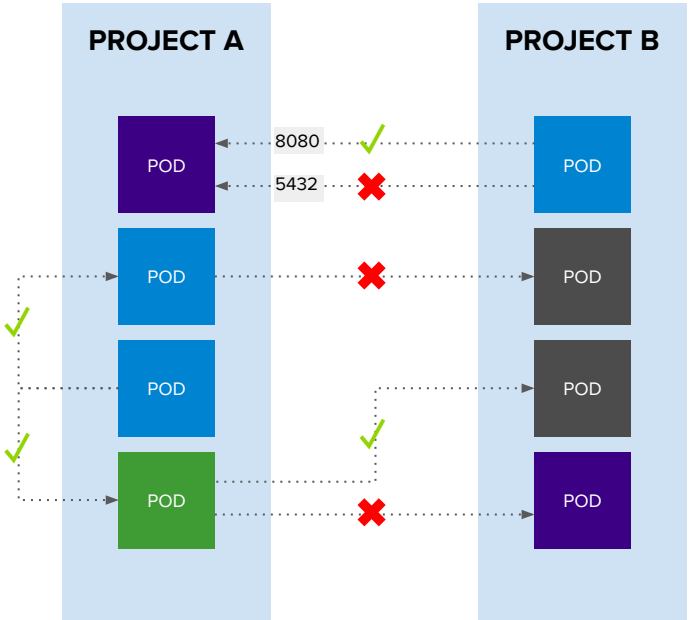
OPENSHIFT SDN - NETWORK POLICY



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
```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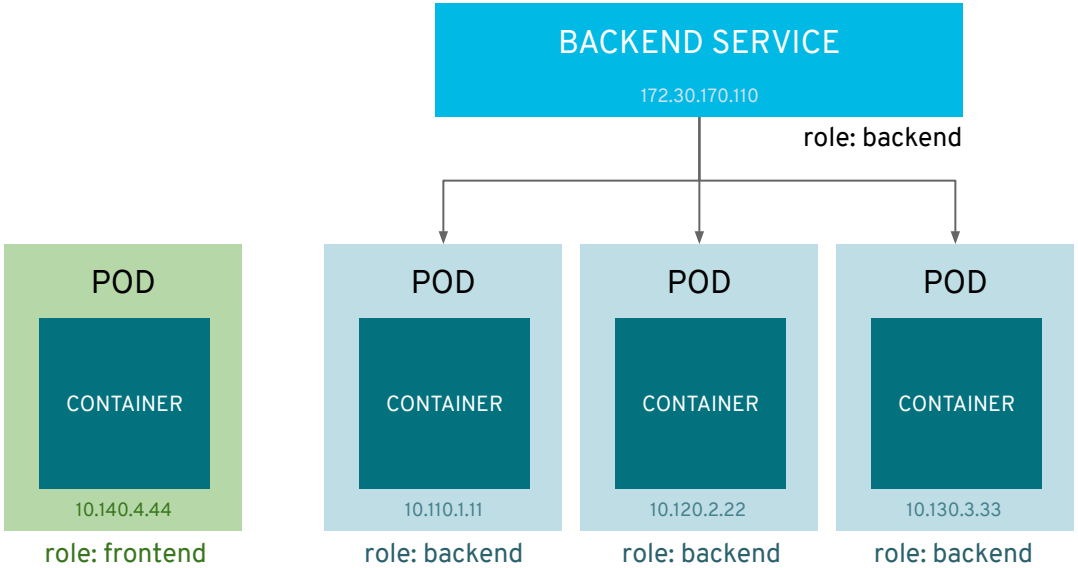
services provide internal load-balancing and service discovery across pods



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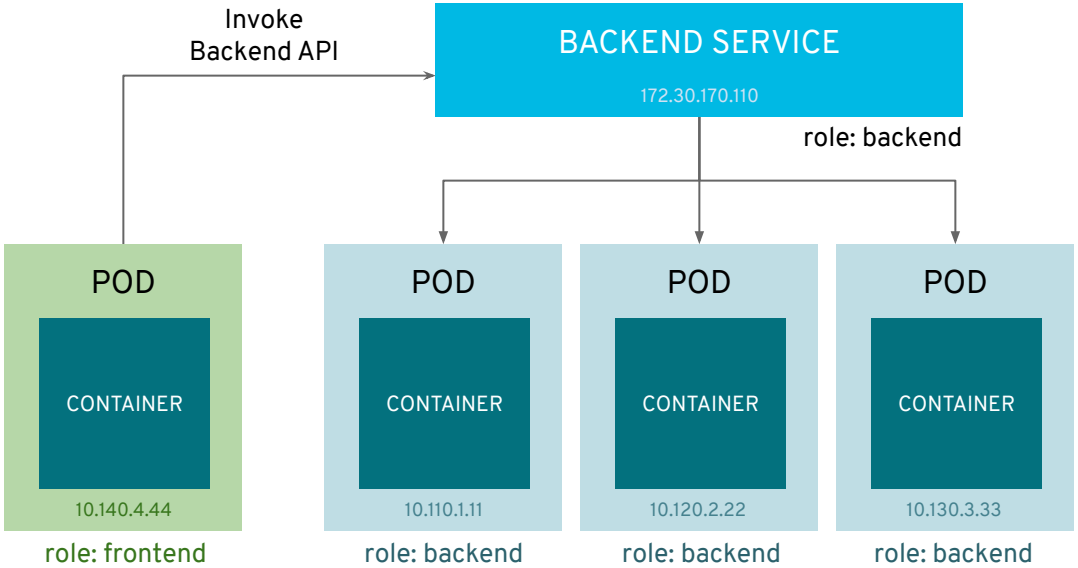
apps can talk to each other via services



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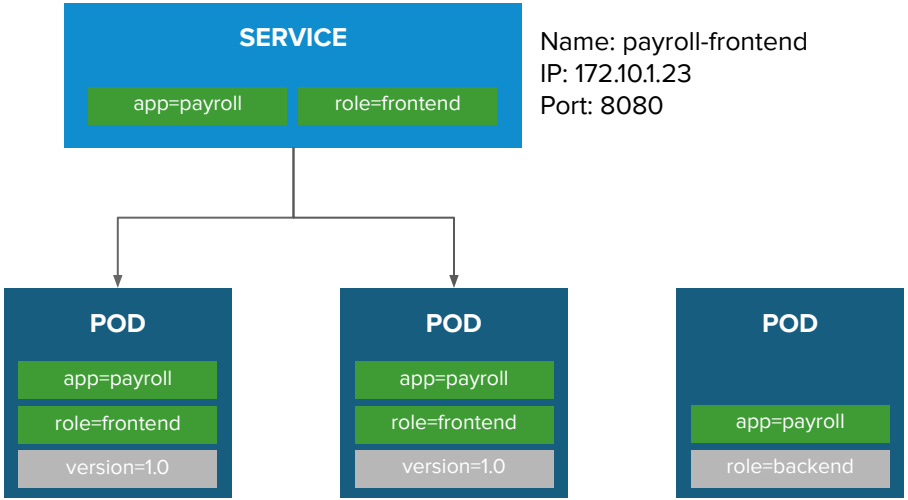
BUILT-IN SERVICE DISCOVERY
INTERNAL LOAD-BALANCING



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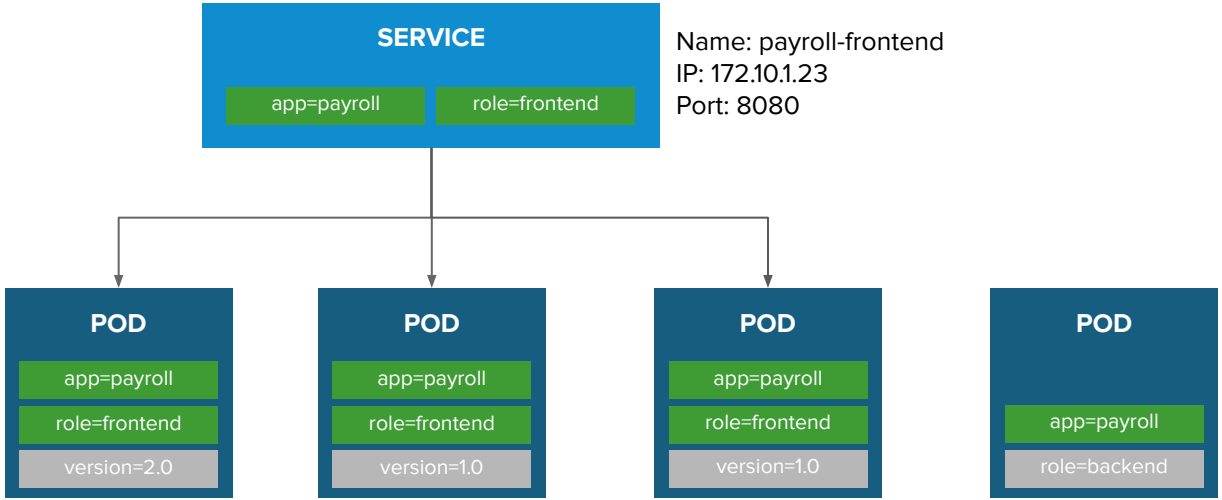
BUILT-IN SERVICE DISCOVERY
INTERNAL LOAD-BALANCING



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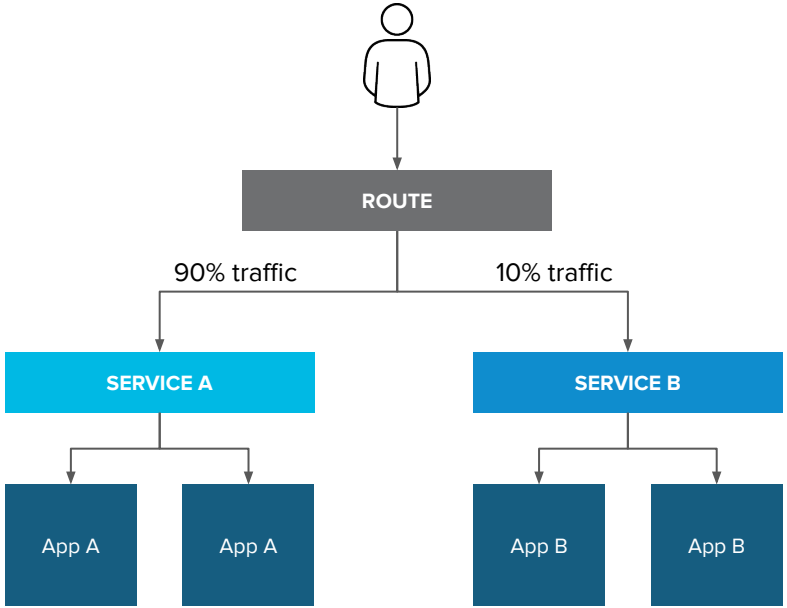
ROUTE SPLIT TRAFFIC

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



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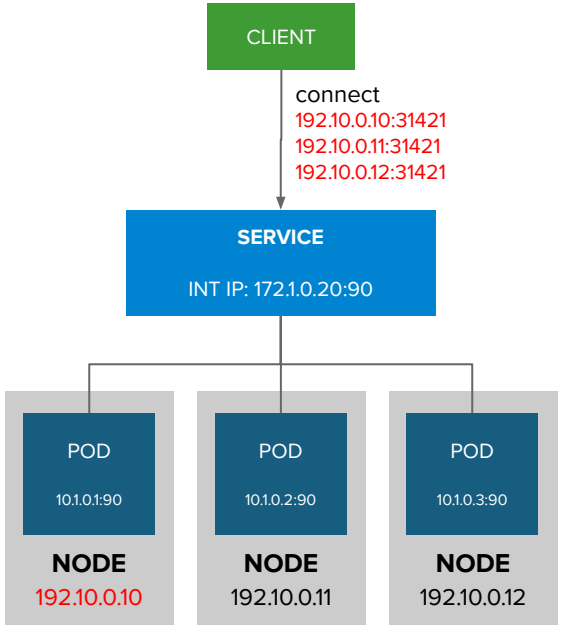
EXTERNAL TRAFFIC TO A SERVICE ON A RANDOM PORT WITH NODEPORT

- 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



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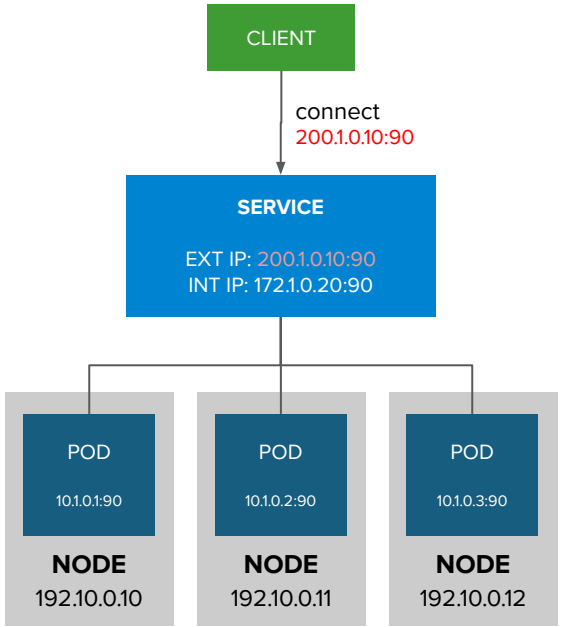
EXTERNAL TRAFFIC TO A SERVICE ON ANY PORT WITH INGRESS

- Access a service with an external IP on any TCP/UDP port, such as
  - Databases
  - Message Brokers
- Automatic IP allocation from a predefined pool using Ingress IP Self-Service
- IP failover pods provide high availability for the IP pool



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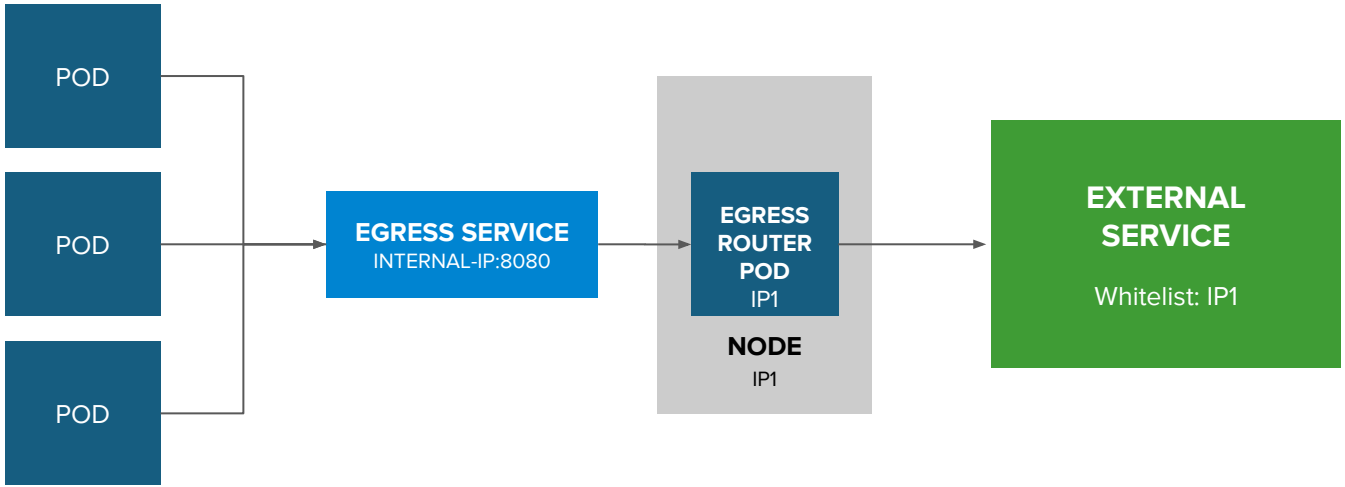
CONTROL OUTGOING TRAFFIC SOURCE IP WITH EGRESS ROUTER



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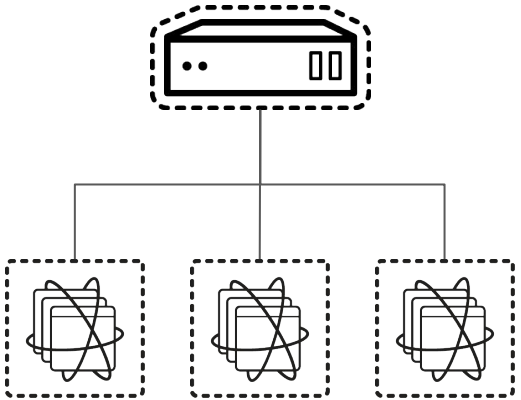
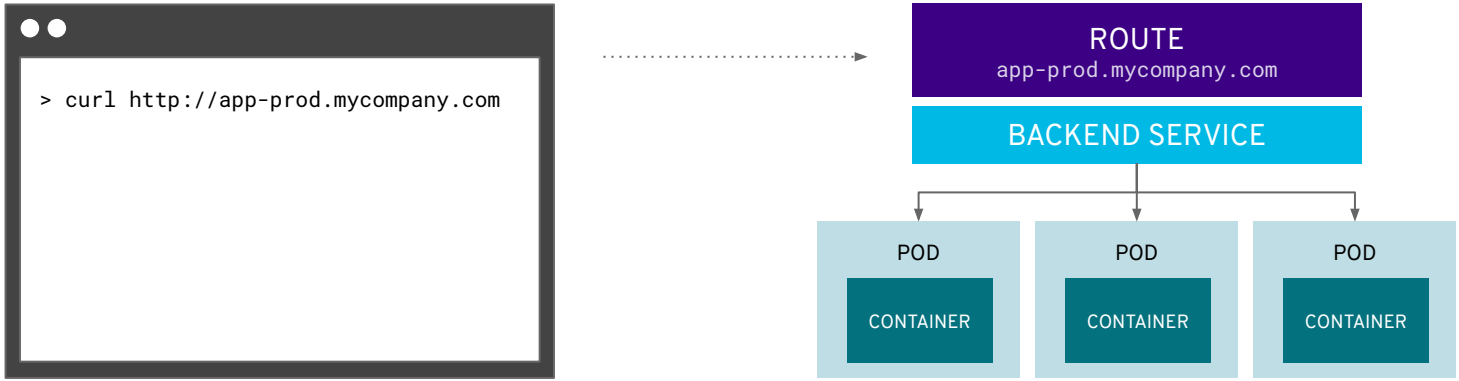
ROUTING AND EXTERNAL LOAD-BALANCING

- 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 add services to the external load-balancer and provide readable urls for the app



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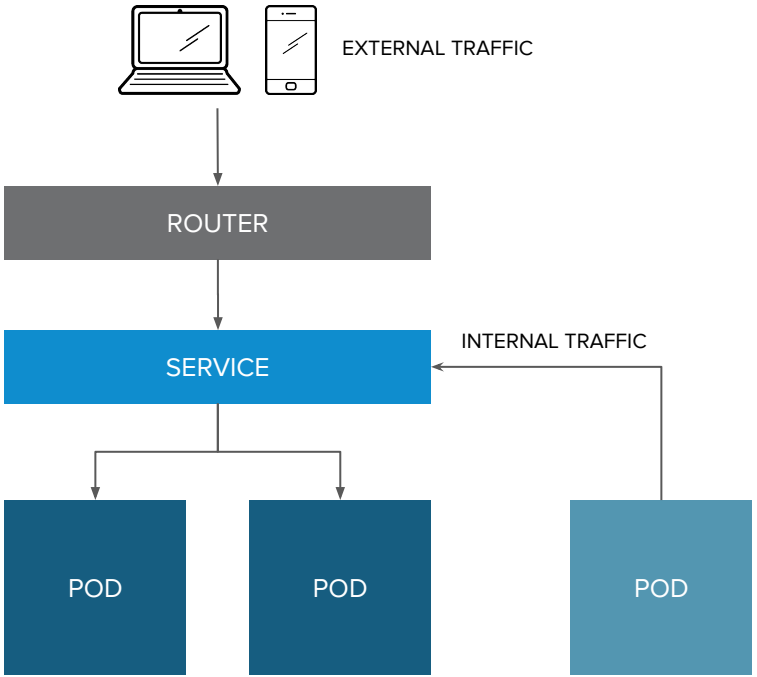
ROUTE EXPOSES SERVICES EXTERNALLY



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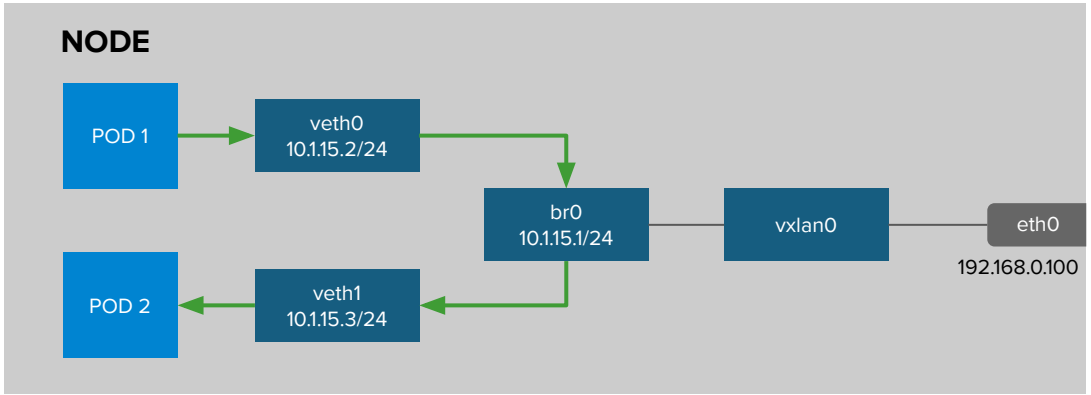
OPENSHIFT SDN - OVS PACKET FLOW

Container to Container on the Same Host



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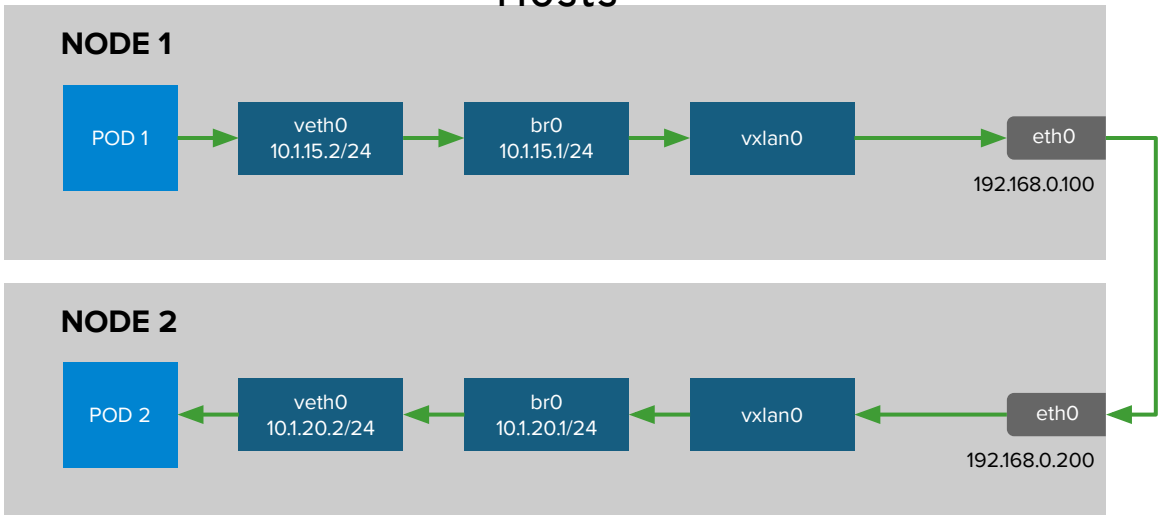
OPENSHIFT SDN - OVS PACKET FLOW

Container to Container on the Different Hosts



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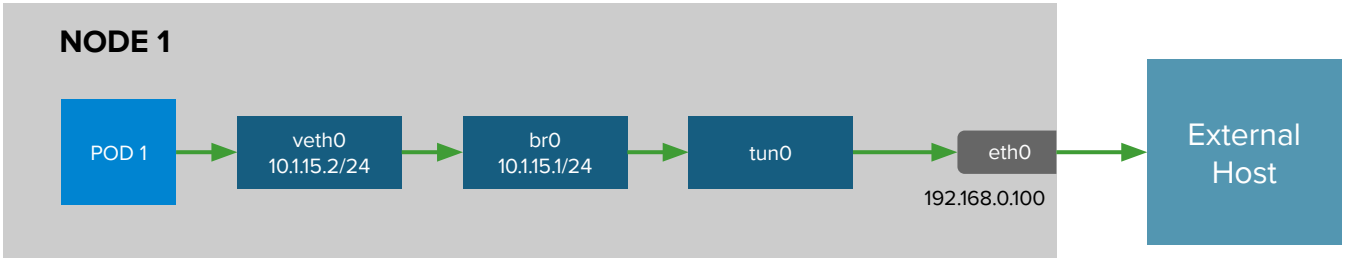
OPENSHIFT SDN - OVS PACKET FLOW

Container Connects to External Host



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OpenShift Monitoring / Clustering

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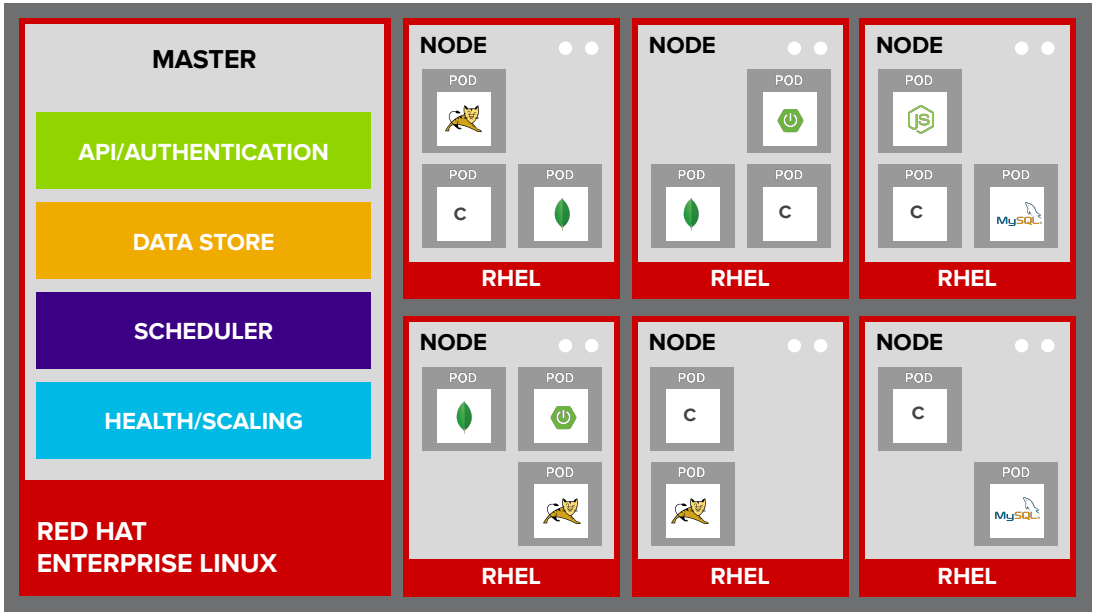
AUTO-HEALING FAILED PODS



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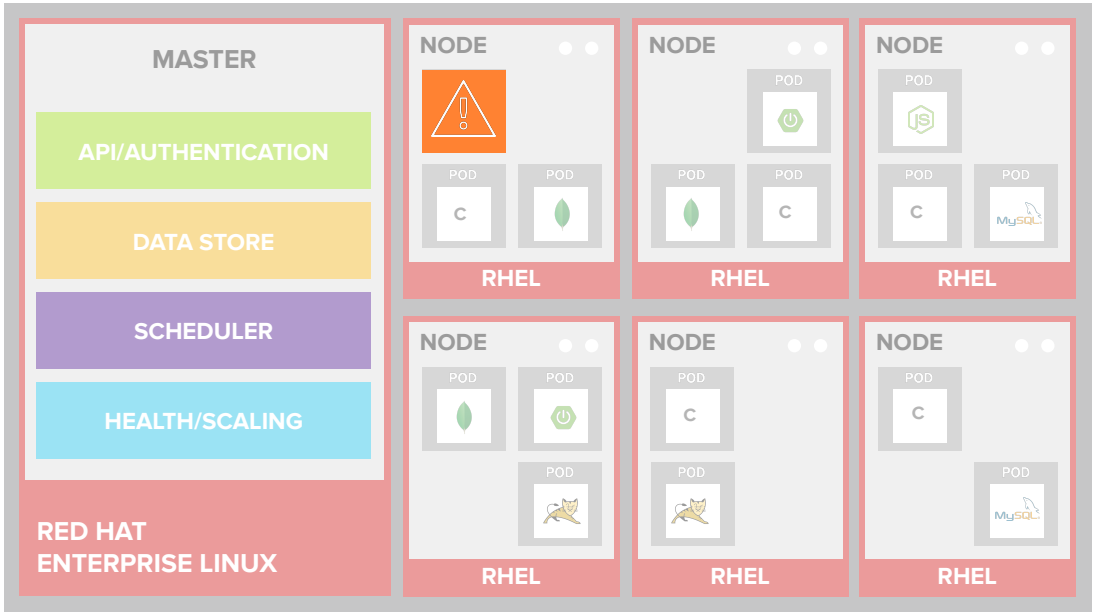
AUTO-HEALING FAILED CONTAINERS



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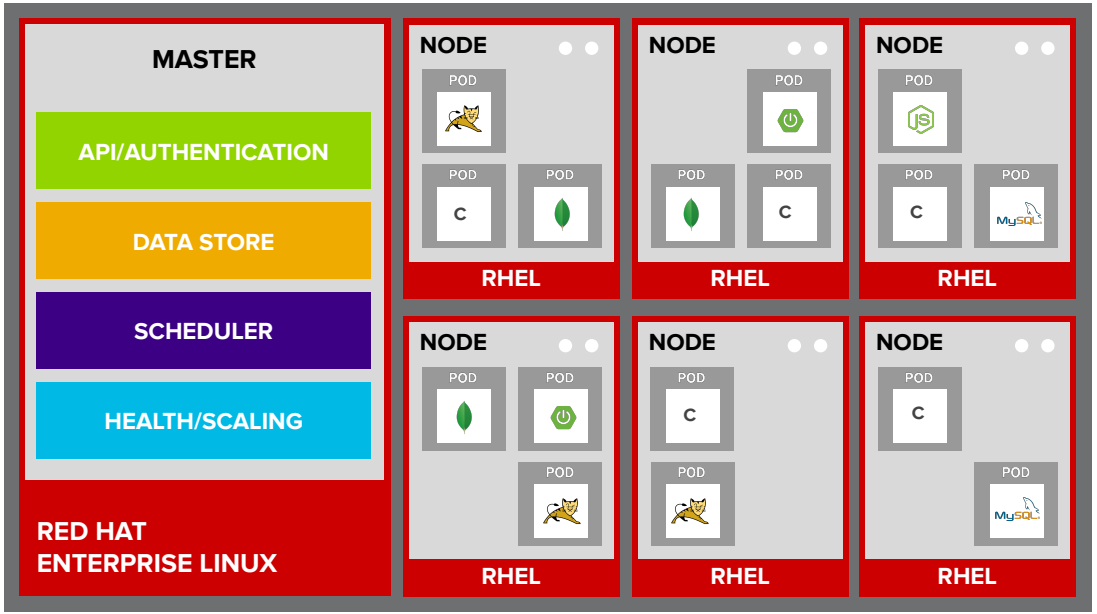
AUTO-HEALING FAILED CONTAINERS



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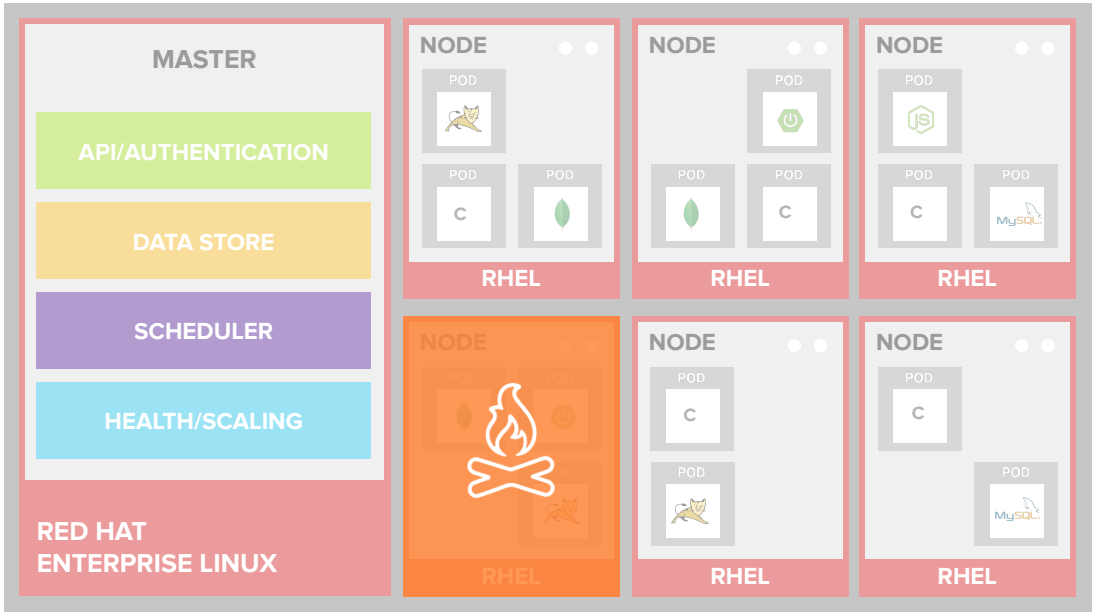
AUTO-HEALING FAILED CONTAINERS



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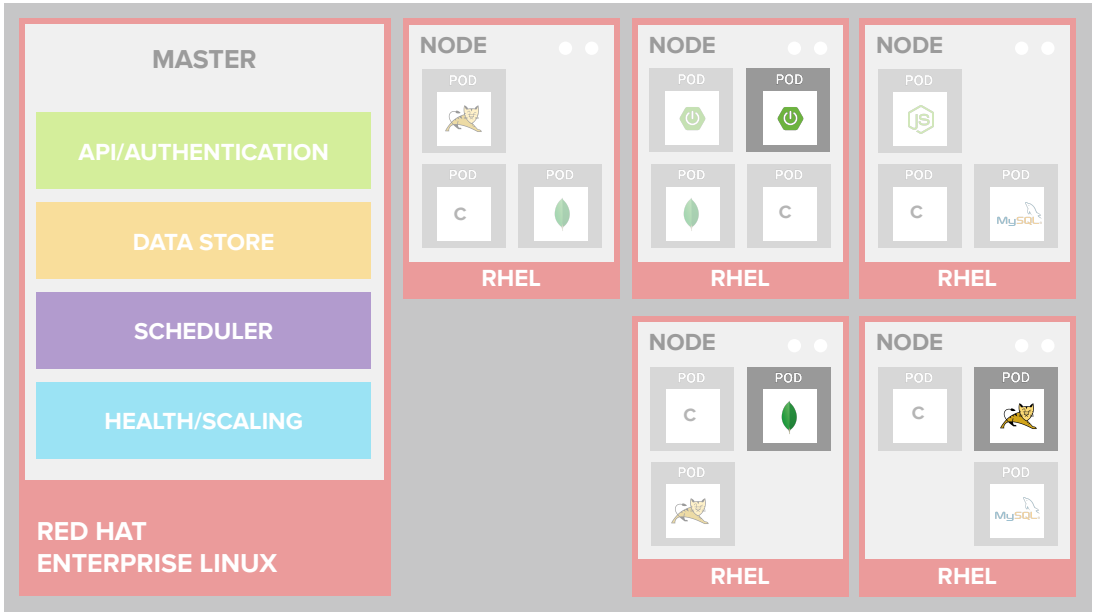
AUTO-HEALING FAILED CONTAINERS



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OpenShift persistent Storage

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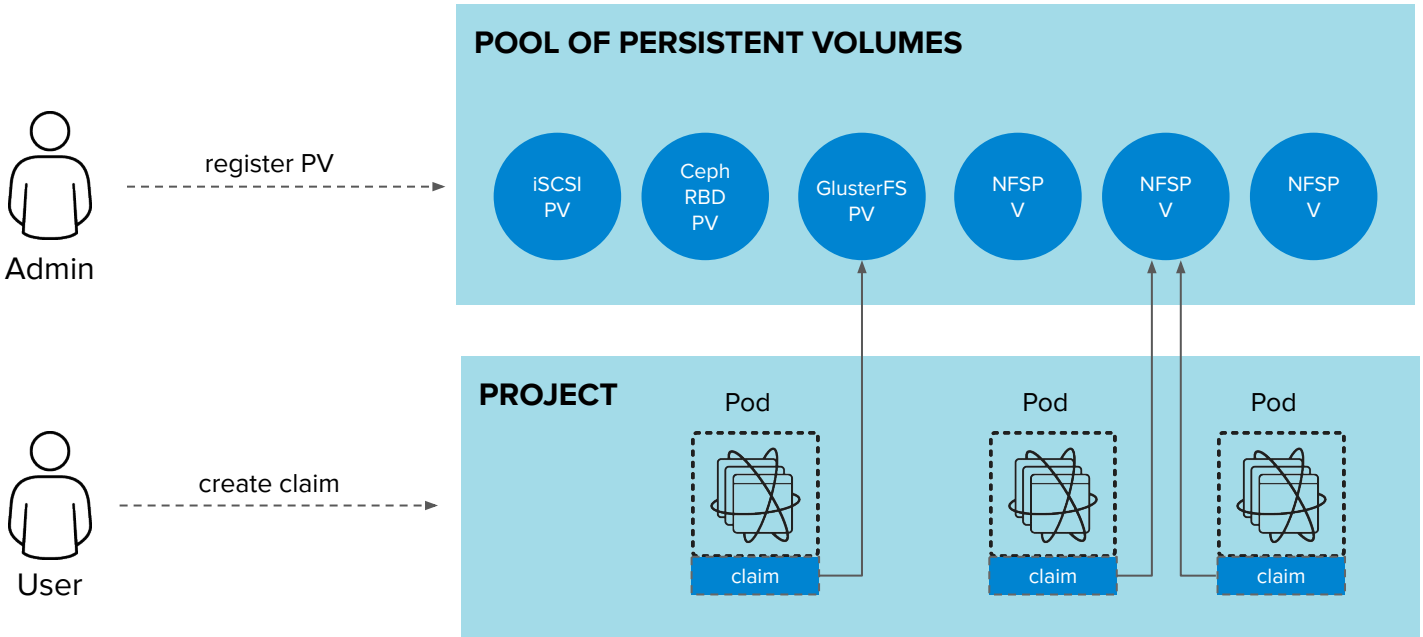
PERSISTENT STORAGE

- Persistent Volume (PV) is tied to a piece of network storage
- Provisioned by an administrator (static or dynamically)
- Allows admins to describe storage and users to request storage
- Assigned to pods based on the requested size, access mode, labels and type

NFS	OpenStack Cinder	iSCSI	Azure Disk	AWS EBS	FlexVolume
GlusterFS	Ceph RBD	Fiber Channel	Azure File	GCE Persistent Disk	VMWare vSphere VMDK
		NetApp Trident*	Container Storage Interface (CSI)**		

* Shipped and supported by NetApp via TSANet
** Tech Preview

PERSISTENT STORAGE



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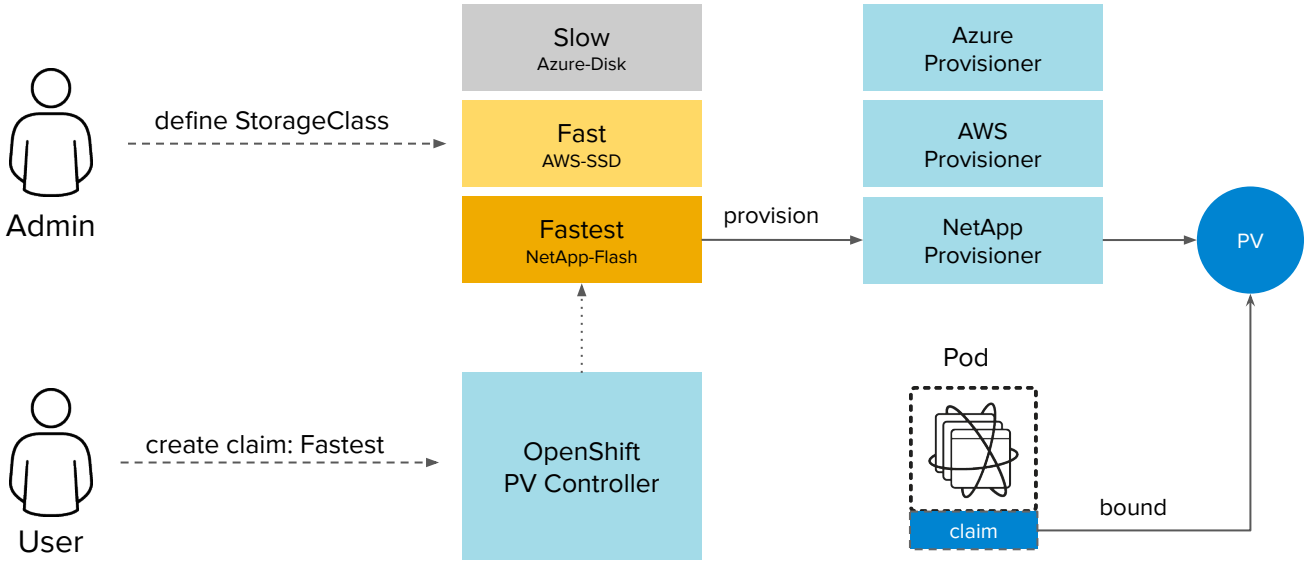
DYNAMIC VOLUME PROVISIONING



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Thank you !