Introduction to Containers

Docker and Kubernetes

NA Partner Channels- IBM Cloud

IBM Cloud Technical Evangelist Team

Agenda

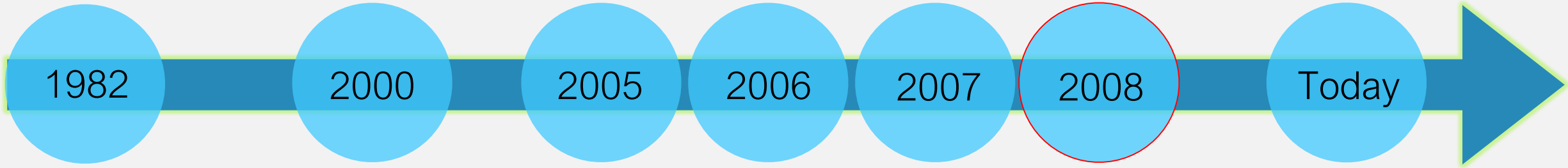
1. Containers
2. Why Containers?
3. Docker Containers
4. Container Orchestration
5. Kubernetes
6. Kubernetes in the IBM Cloud
7. Conclusion

Why Containers?

Everyone Loves Containers

- A standard way to package an application and all its dependencies so that it can be moved between environments and run without changes
- Containers work by isolating the differences between applications inside the container so that everything outside the container can be standardized

Container History Lesson



Unix/chroot
BSD

FreeBSD
jails/Solaris
zones

OpenVZ
Parallels

Cgroups/Process
Containers
IBM/Google

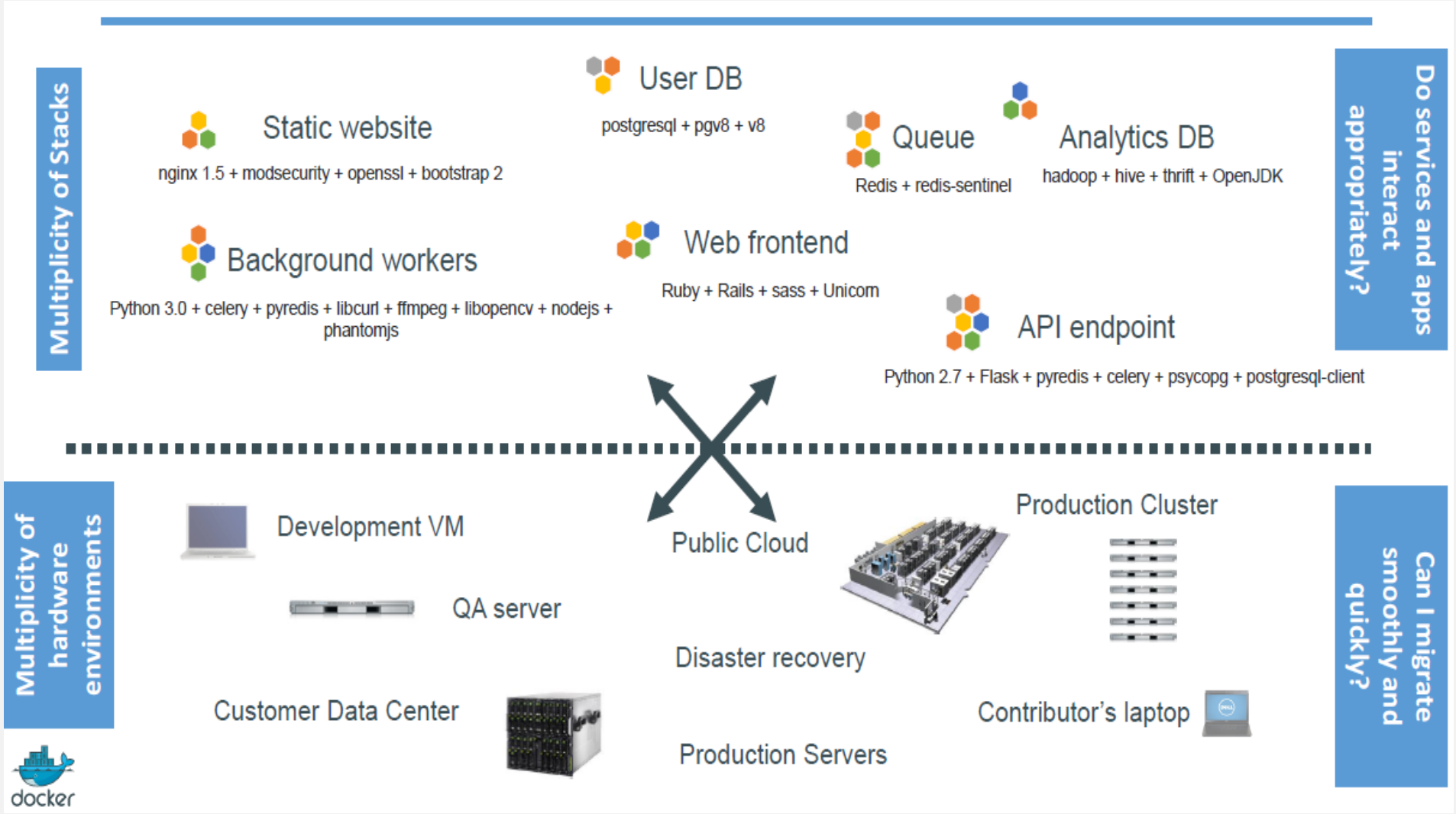
AIX Wpars
IBM

Linux Containers
(LXC)

docker

Rocket

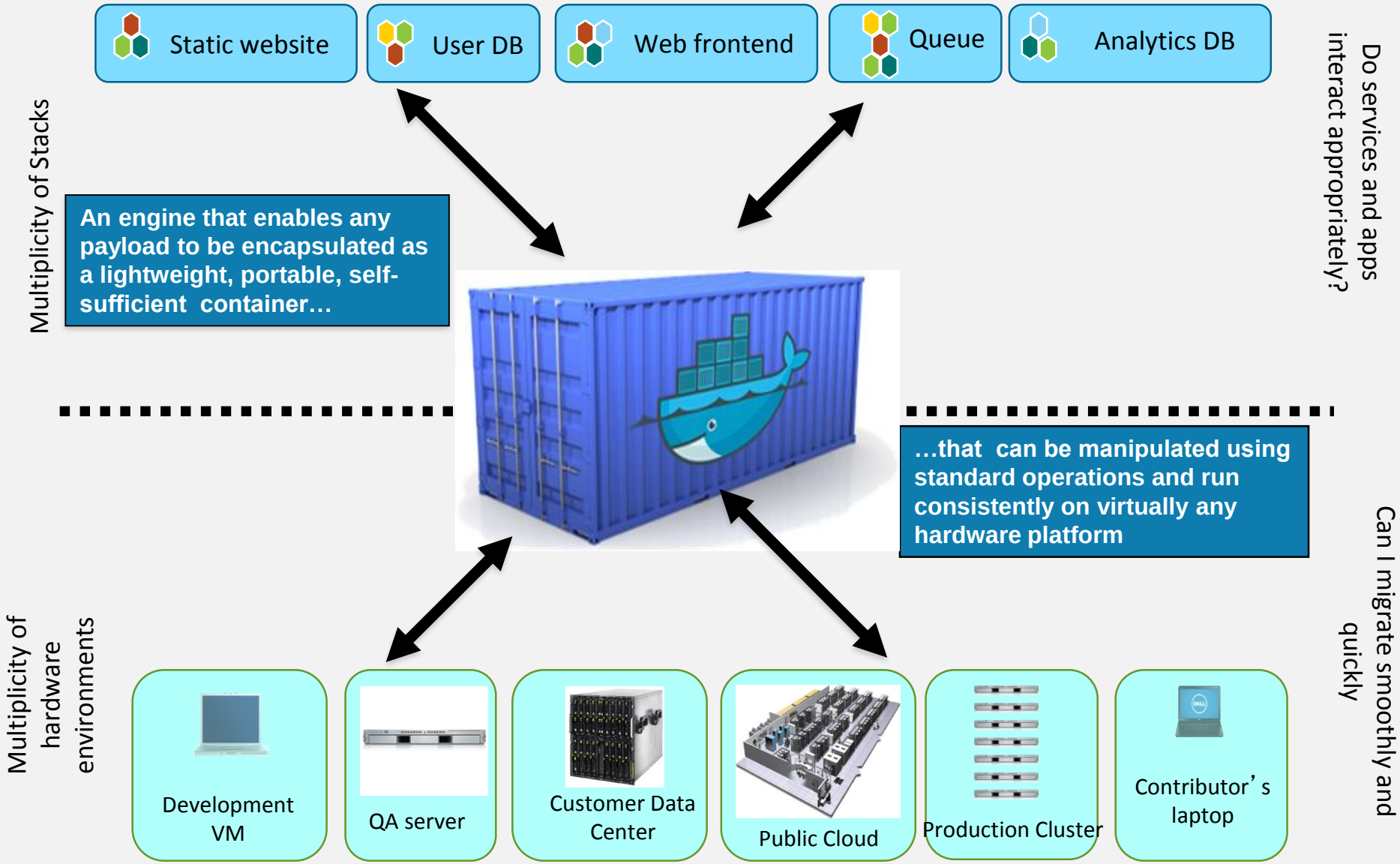
The Challenge



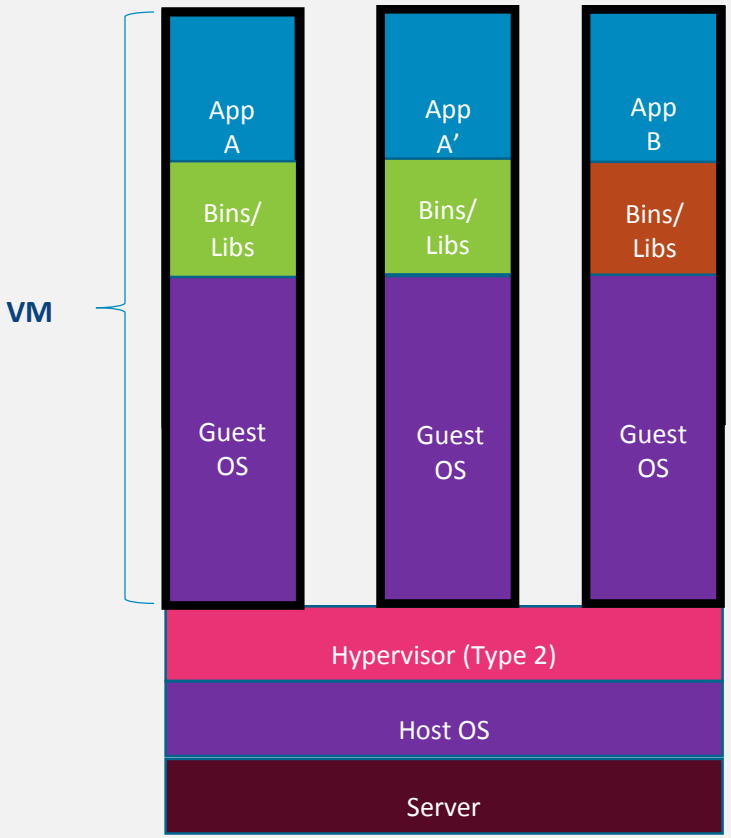
The Matrix from Hell

	Development VM	QA Server	Single Prod Server	Onsite Cluster	Public Cloud	Contributor's laptop	Customer Servers
Static website	?	?	?	?	?	?	?
Web frontend	?	?	?	?	?	?	?
Background workers	?	?	?	?	?	?	?
User DB	?	?	?	?	?	?	?
Analytics DB	?	?	?	?	?	?	?
Queue	?	?	?	?	?	?	?

A Shipping Container for Code

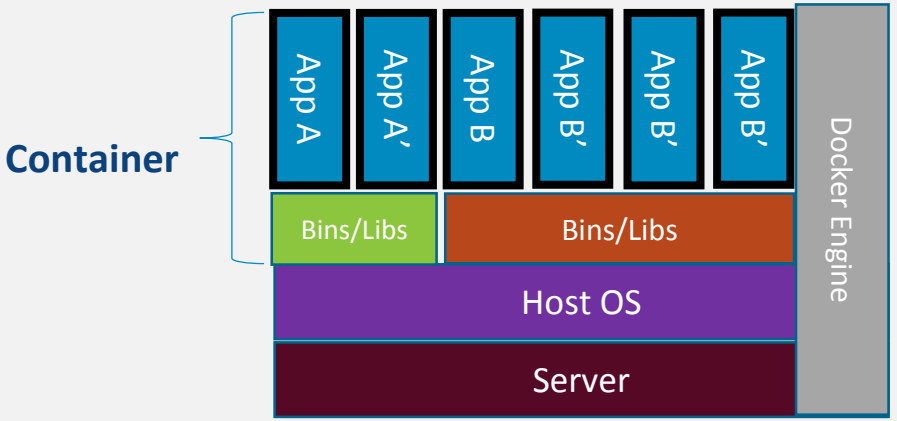


VM's vs. Containers



Containers are isolated, but share OS and, where appropriate, bins/libraries

…faster, less overhead

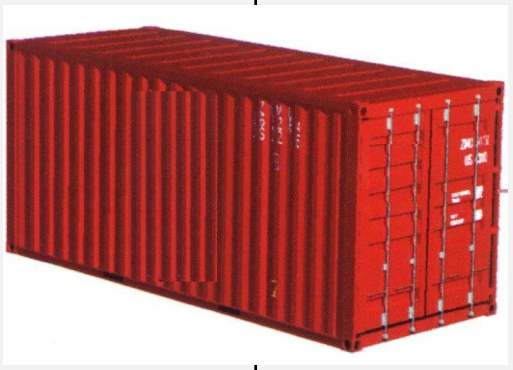


Simple Fact:

A container is ***just a process / service*** running on the host machine and ***managed by the Docker Engine***

Dev vs. Ops

Dev	Ops



- Code
- Libraries
- Configuration
- Server runtime
- OS

- Logging
- Remote access
- Network configuration
- Monitoring

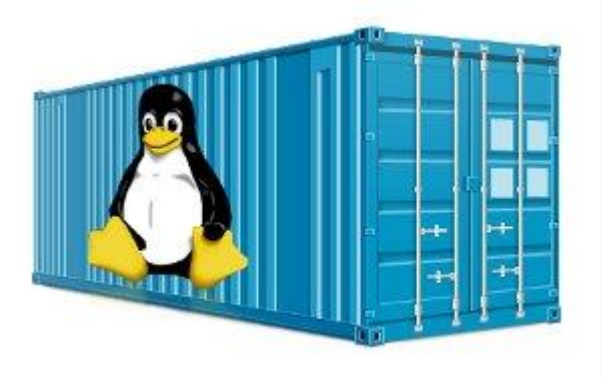
Separation of concerns

A container separates and bridges the Dev and Ops in DevOps

- Dev focuses on the application environment
- Ops focuses on the deployment environment

Container Advantages

- Containers are portable
- Containers are easy to manage
- Containers provide “just enough” isolation
- Containers use hardware more efficiently
- Containers are immutable



Docker Containers

Docker Adoption

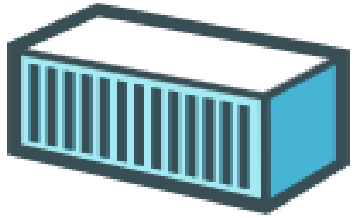
Docker enables application development **efficiency**, making deployment more **efficient**, eliminating vendor ‘lock-in’ with true **portability**

- Open software
- Open contribution
- Open design
- Open governance

Docker Mission

Docker is an **open platform** for building distributed applications for **developers** and **system administrators**

Build



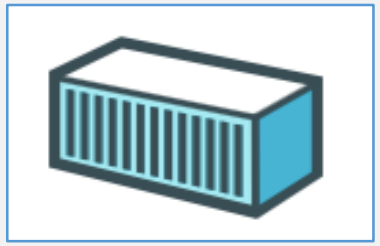
Ship

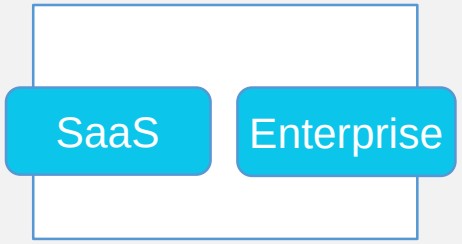
Run

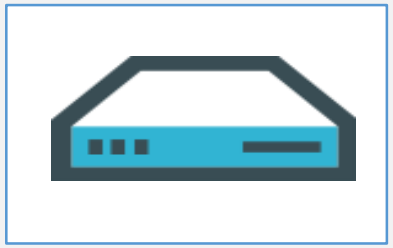
Any App

Anywhere

Docker Components







Image

- A read-only snapshot of a container stored in Docker Hub to be used as a template for building containers

Container

- The standard unit in which the application service resides or transported

Docker Hub/Registry

- Available in SaaS or Enterprise to deploy anywhere you choose
- Stores, distributes, and shares container images

Docker Engine

- A program that creates, ships, and runs application containers
- Runs on any physical and virtual machine or server locally, in private or public cloud
- Client communicates with Engine to execute commands

Containers

Everyone’s container journey starts with one container….

Containers

At first the growth is easy to handle….

Containers

Orchestration

More to Containers than just Docker

Serverless

APACHE OpenWhisk™

PaaS

CLOUD FOUNDRY

Container Orchestration

Apache MESOS™

kubernetes

Swarm/
Swarm Mode

Container Engine

OPEN CONTAINER INITIATIVE

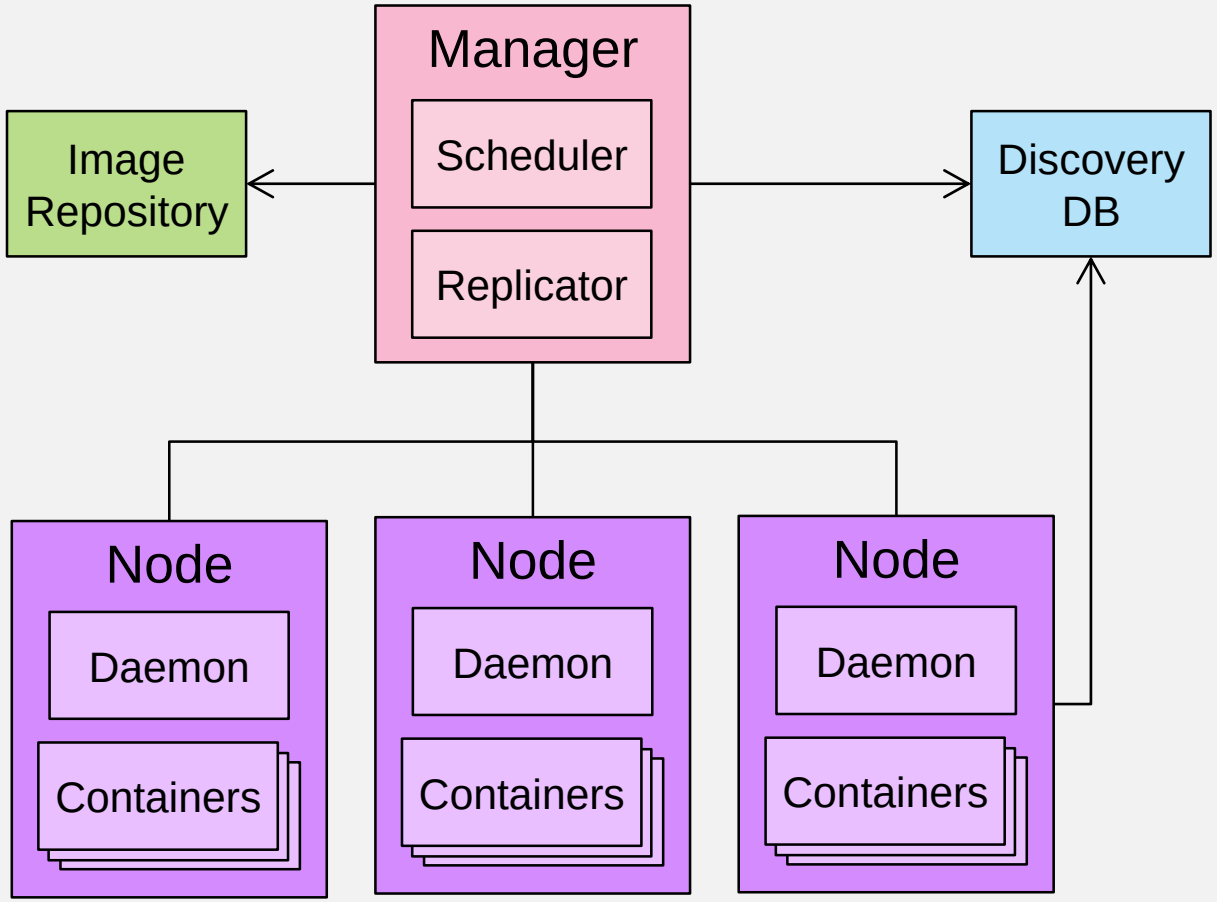
rkt

docker

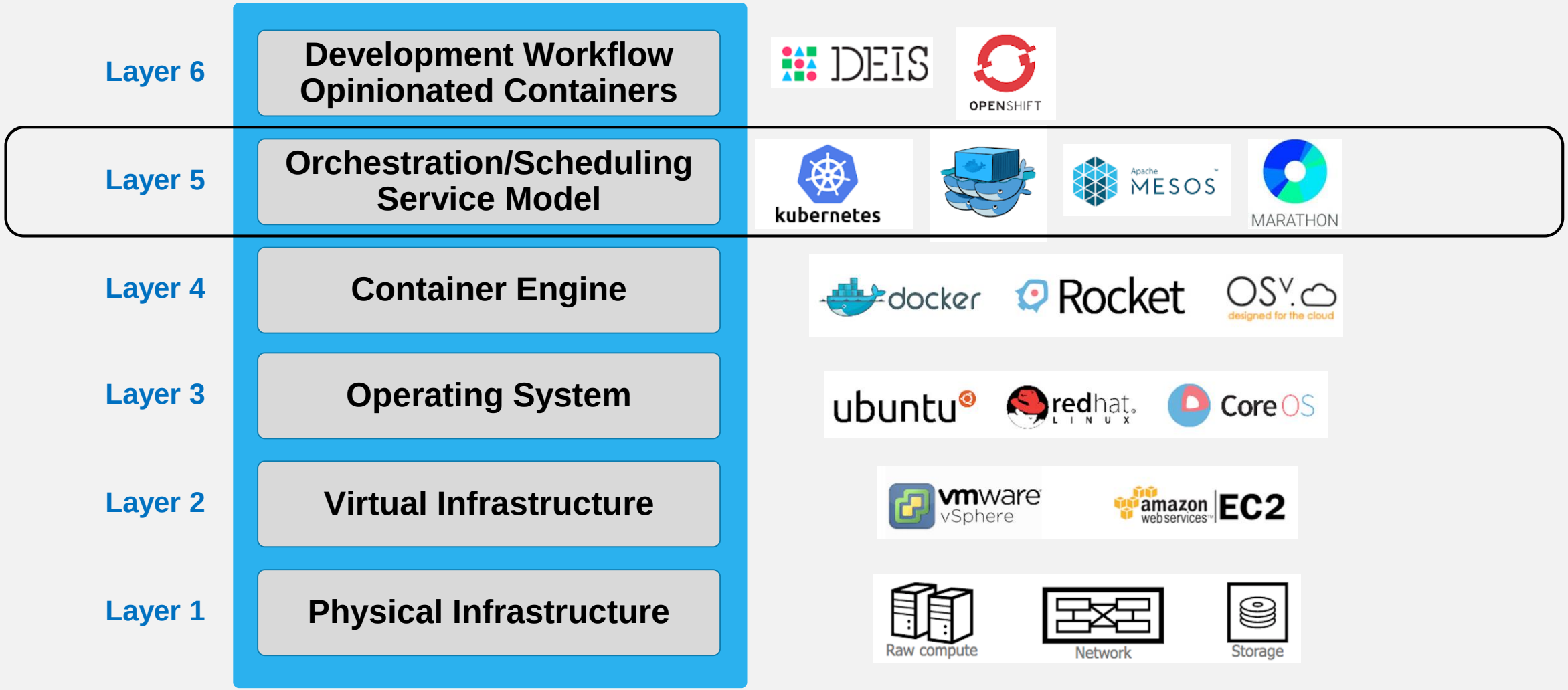
What is Container Orchestration?

- Container orchestration
  - Cluster management
  - Scheduling
  - Service discovery
  - Replication
  - Health management

Container Orchestrator



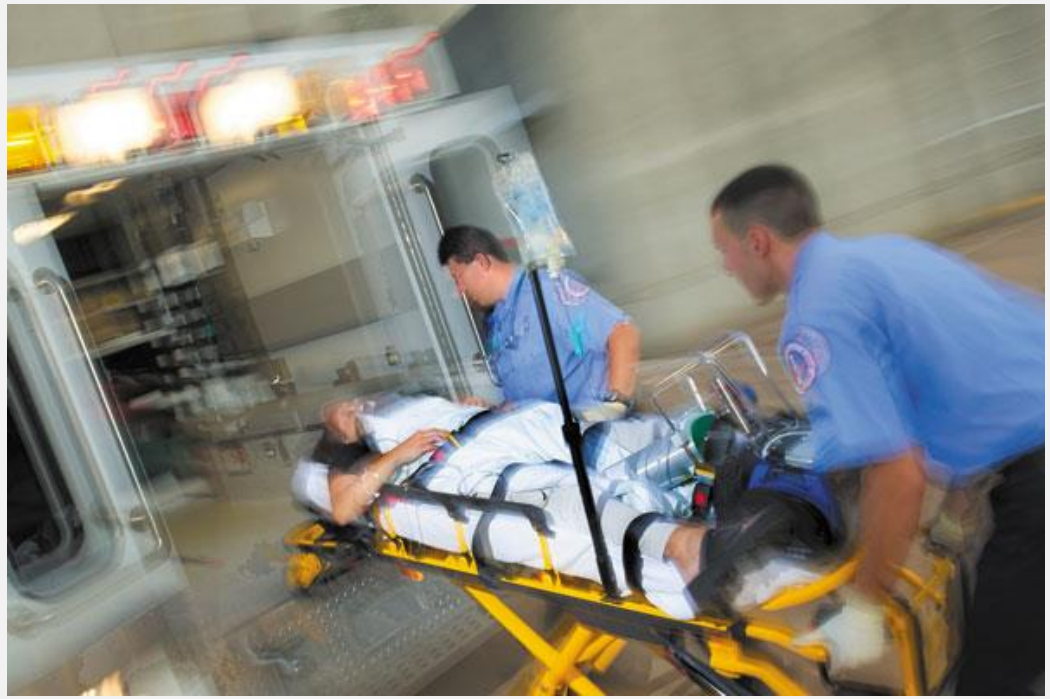
Container Ecosystem Layers



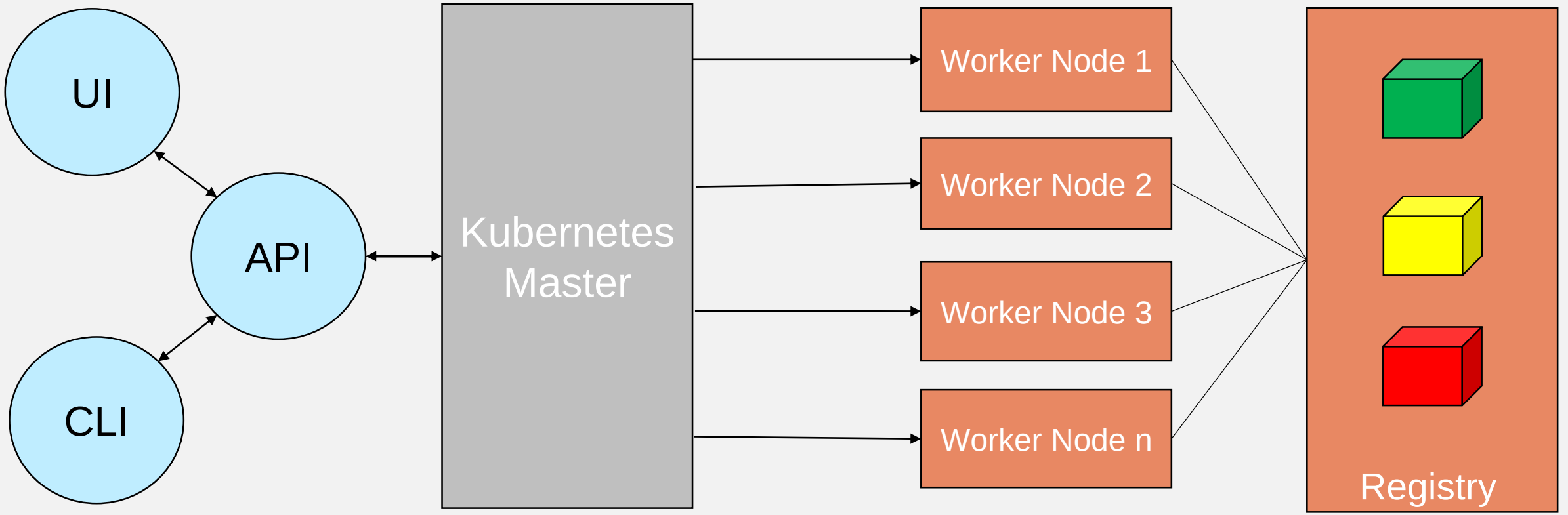
Kubernetes

What is Kubernetes?

- Container orchestrator
- Manage applications, not machines
- Designed for extensibility
- Open source project managed by the Linux Foundation



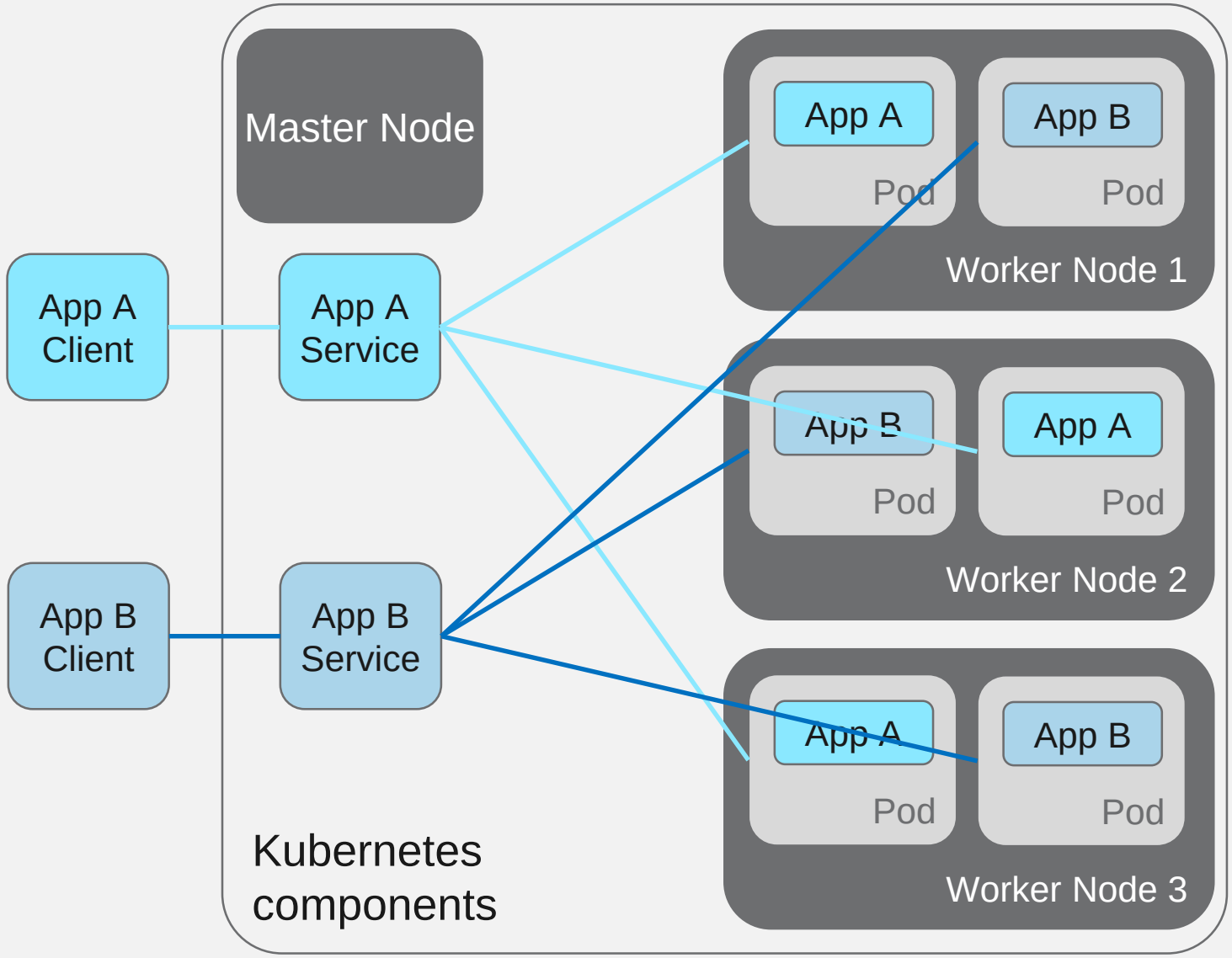
Kubernetes Architecture



- Etcd
- API Server
- Controller Manager Server
- Scheduler

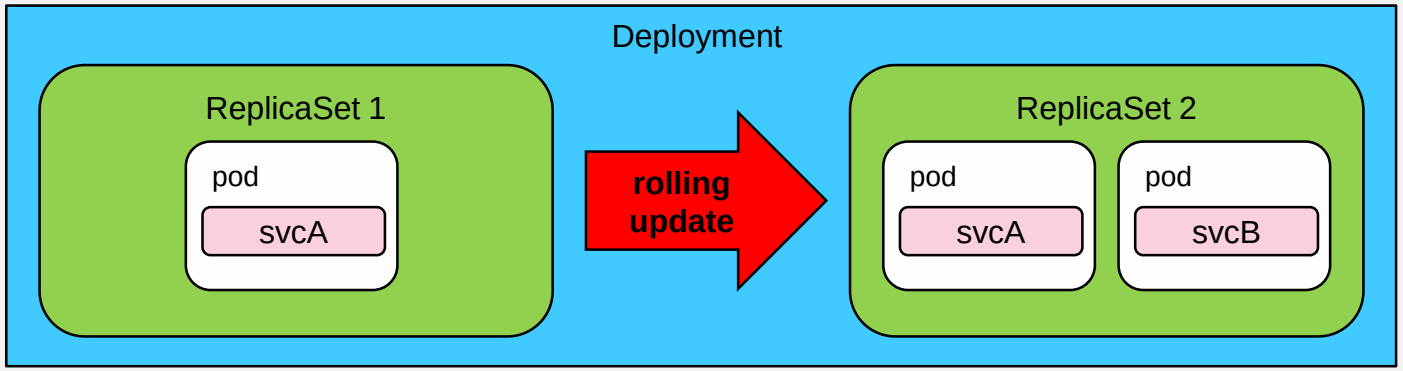
Kubernetes Architecture: Workloads

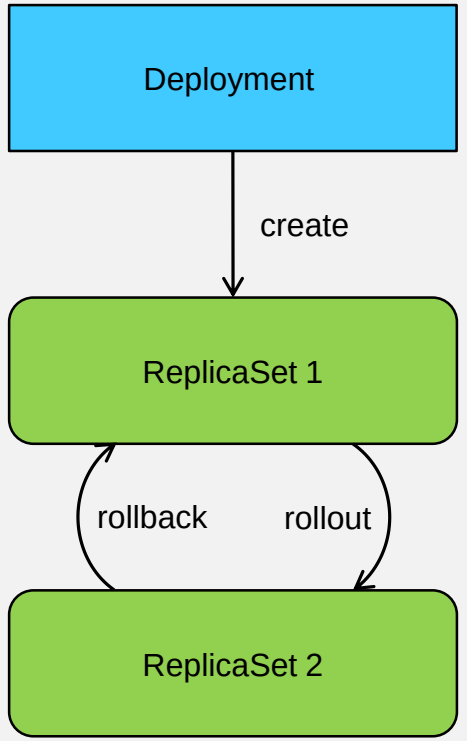
- Container
  - Packaging of an app
- Pod
  - Unit of deployment
- Service
  - Fixed endpoint for 1+ pods



Kubernetes Terminology: Deployment

- Deployment
  - A set of pods to be deployed together, such as an application
- ReplicaSet
  - Ensures that a specified number of pod replicas are running at any given time

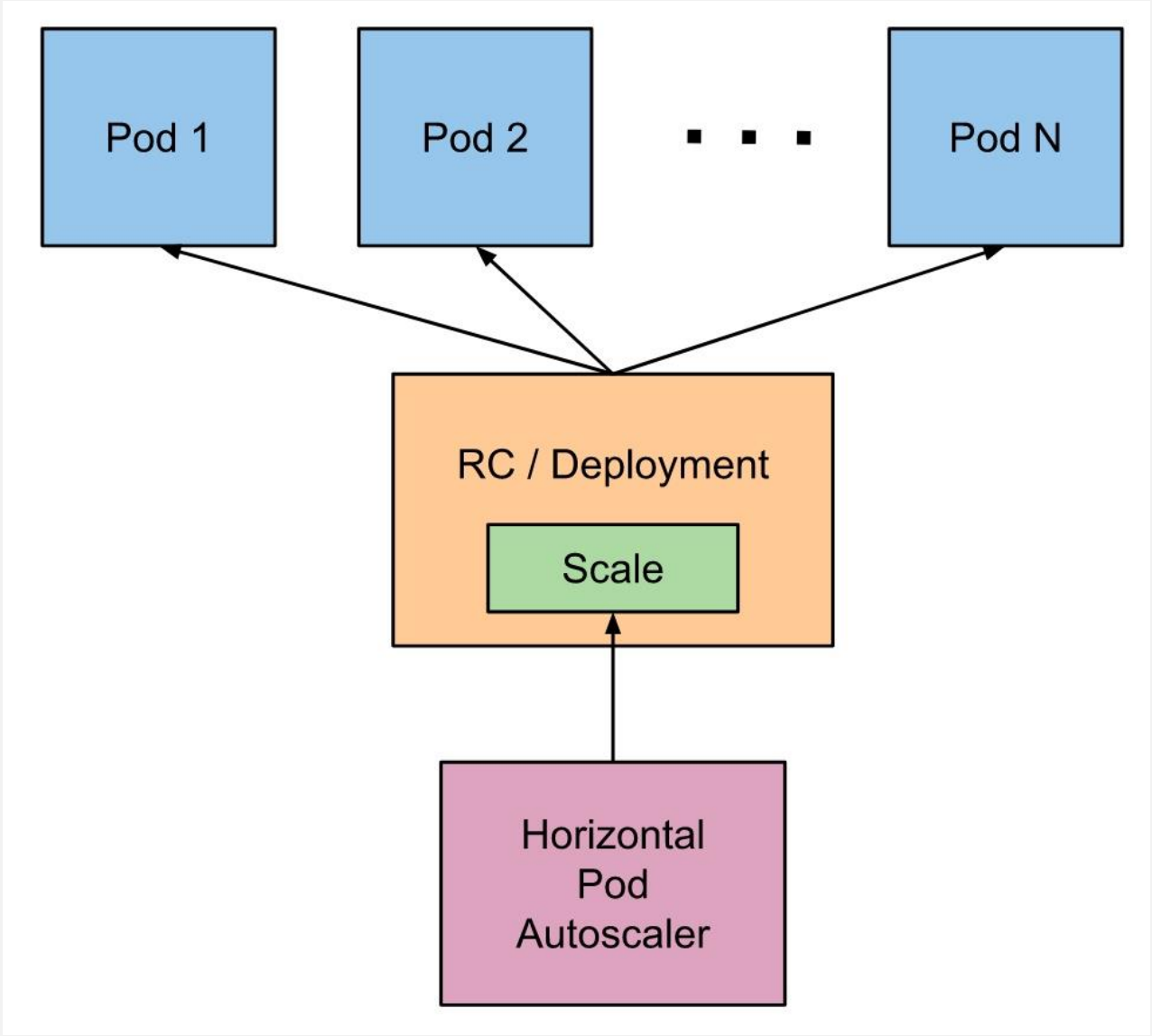




Kubernetes Terminology: Autoscaling

- Horizontal Pod Autoscaling (HPA)

```
$ kubectl autoscale deployment
<deployment-name> --cpu-percent=50
  --min=1 --max=10 deployment
"<hpa-name>" autoscaled
```



Common Kubernetes Commands

- Get the state of your cluster
  ```
  $ kubectl cluster-info
  ```
- Get all the nodes of your cluster
  ```
  $ kubectl get nodes -o wide
  ```
- Get info about the pods of your cluster
  ```
  $ kubectl get pods -o wide
  ```
- Get info about the replication controllers of your cluster
  ```
  $ kubectl get rc -o wide
  ```
- Get info about the services of your cluster
  ```
  $ kubectl get services
  ```
- Get full config info about a Service
  ```
  $ kubectl get service
  NAME_OF_SERVICE -o json
  ```
- Get the IP of a Pod
  ```
  $ kubectl get pod NAME_OF_POD -
  template={{.status.podIP}}
  ```
- Delete a Pod
  ```
  $ kubectl delete pod NAME
  ```
- Delete a Service
  ```
  $ kubectl delete service
  NAME_OF_SERVICE
  ```

Helm & Helm Chart

- Helm
  - Package manager for Kubernetes
  - Used to manage Kubernetes applications
- Helm Chart
  - Used to define, install, and upgrade complex Kubernetes applications
  - Easy to create, version, share and publish
  - Expressed in “Yet Another Markup Language” (YAML) files

Kubernetes in the IBM Cloud

Kubernetes in the IBM Cloud

TWO PRIMARY OPTIONS

IBM Cloud (Public)

- IBM Kubernetes Container Service available as a fully managed service, as well as private Docker registry
- Pods and Containers can leverage other IBM Cloud services, such as Watson AI, the Watson Data Platform, and many others
- Pods and Containers can access your services either on-prem or from other cloud providers through secure means
- Full DevOps services available to help manage application development

IBM Cloud Private

- An operational Kubernetes-focused development and production version of IBM Cloud for deployment in your on-prem or cloud environment
- Enterprise-quality management, scalability, security, and resiliency features to support your Kubernetes Cluster deployment
- Built-in access to enterprise services such as analytics, middleware, data storage, and data science
- Access and integrate to your other on-prem and/or cloud services

IBM Cloud Private Options

Community

Use Case
Create cloud-native applications in a non-production environment

Platform
- Kubernetes
- Core services (security, logging, monitoring, etc.)
- Catalog of containerized content

Freely available in Docker Hub

The Community Edition is limited to 1 Master Node, and is for non-production use.

Cloud Native

Use Case
Create cloud-native applications in a non-production environment

Platform
- Kubernetes
- Core services (security, logging, monitoring, etc.)
- Catalog of containerized content

Cloud Foundry (optional add-on)

IBM Enterprise Software
- Microservice Builder
- WebSphere Liberty
- IBM SDK for node.js
- Cloud Automation Manager

Enterprise

Use Case
- Modernize and optimize existing applications
- Open enterprise data centers

Platform
- Kubernetes
- Core services (security, logging, monitoring, etc.)
- Catalog of containerized content

Cloud Foundry (optional add-on)

IBM Enterprise Software
- Everything in Cloud Native, plus:

\+ WAS ND
\+ MQ Advanced
\+ API Connect Professional
\+ Db2 Direct Advanced (separate PN)
\+ UrbanCode Deploy (separate PN)

Conclusion

Conclusion

- Why containers?
- Docker containers
- Container orchestration
- Kubernetes
- Kubernetes in the IBM Cloud

Resources

- Docker tutorial
  - https://docs.docker.com/get-started/
- Kubernetes tutorial
  - https://kubernetes.io/docs/tutorials/kubernetes-basics/
- The Evolution of Linux Containers and Their Future
  - https://dzone.com/articles/evolution-of-linux-containers-future
- Introduction to container orchestration
  - https://www.exoscale.ch/syslog/2016/07/26/container-orch/
- TNS Research: The Present State of Container Orchestration
  - https://thenewstack.io/tns-research-present-state-container-orchestration/
- Large-scale cluster management at Google with Borg
  - https://research.google.com/pubs/pub43438.html