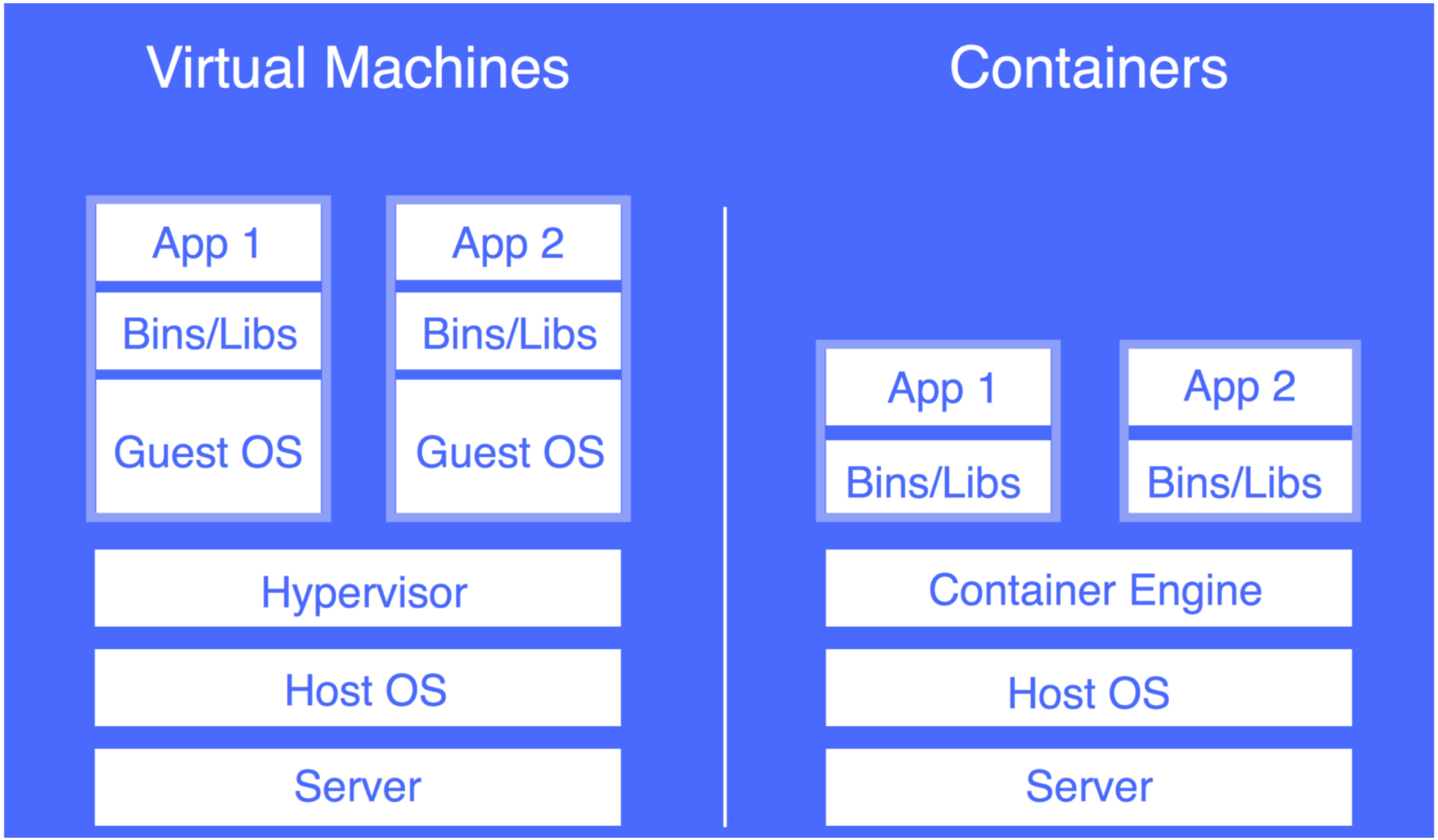
Kubernetes on
IBM Cloud

Agenda

- *Overview of IBM Cloud and Kubernetes*
- *Functionalities provided by IBM Cloud Clusters*
- *How to create and manage cluster*
- *How to deploy apps/services/pod on IBM Cloud clusters*

Overview of IBM Cloud and Kubernetes

- *The need for Container Orchestration*
- *IBM Cloud Platform and IBM Container Service*
- *Overview of Kubernetes*
- *Kubernetes Features*
- *Kubernetes Architecture*

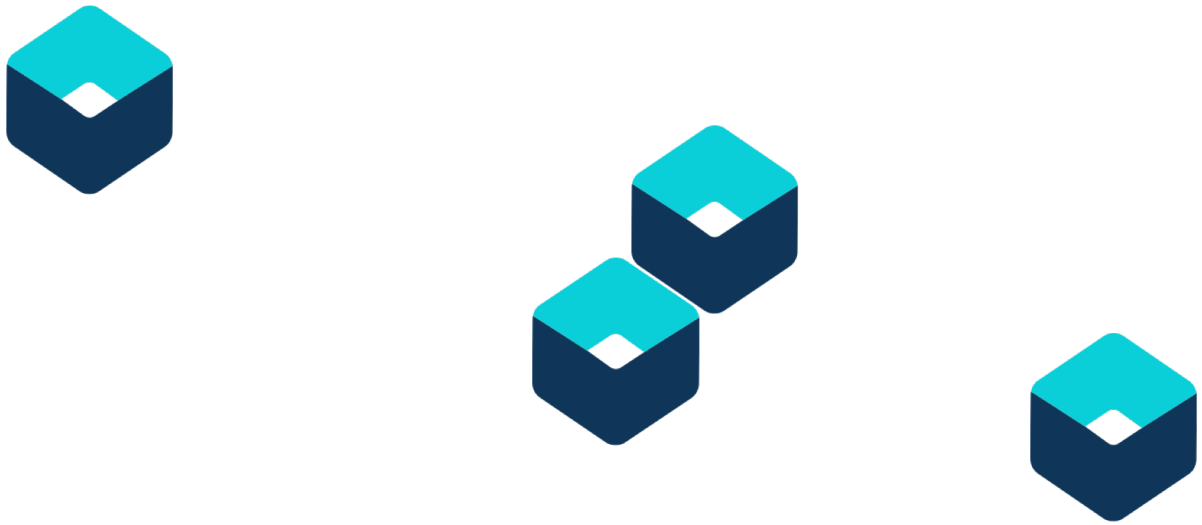

Virtual Machines
App 1
Bins/Libs
Guest OS
App 2
Bins/Libs
Guest OS
Hypervisor
Host OS
Server
Containers
App 1
Bins/Libs
App 2
Bins/Libs
Container Engine
Host OS
Server

What is a Container and Docker ?

- ***Container*** is a standard way to package an application and all its dependencies so that it can be moved between environments and **run** without changes

- ***Docker*** is a containerization tool designed to make it easier to create, deploy, and run applications by using containers
- Docker standardises container management
- Create a Docker Image and push to a repository (Docker Hub)
- Allow anyone to pull image and run

Everyone’s container journey starts with one container….



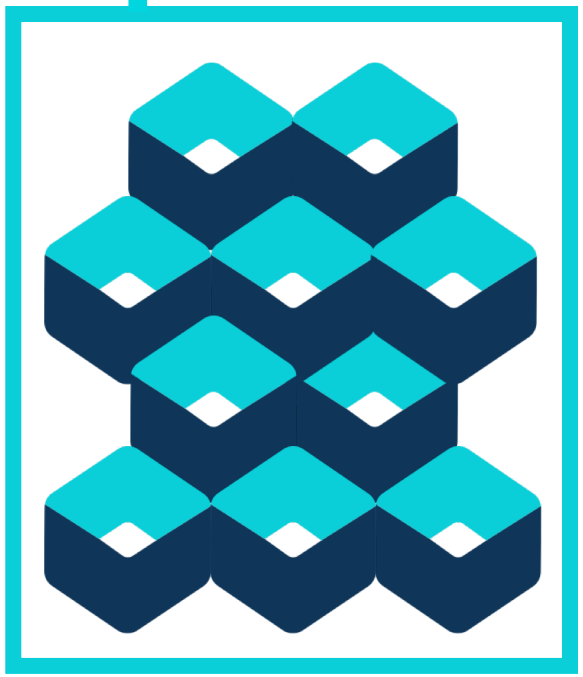
At first the growth is easy to handle….

Moving from *Container Management* to *Container Orchestration*

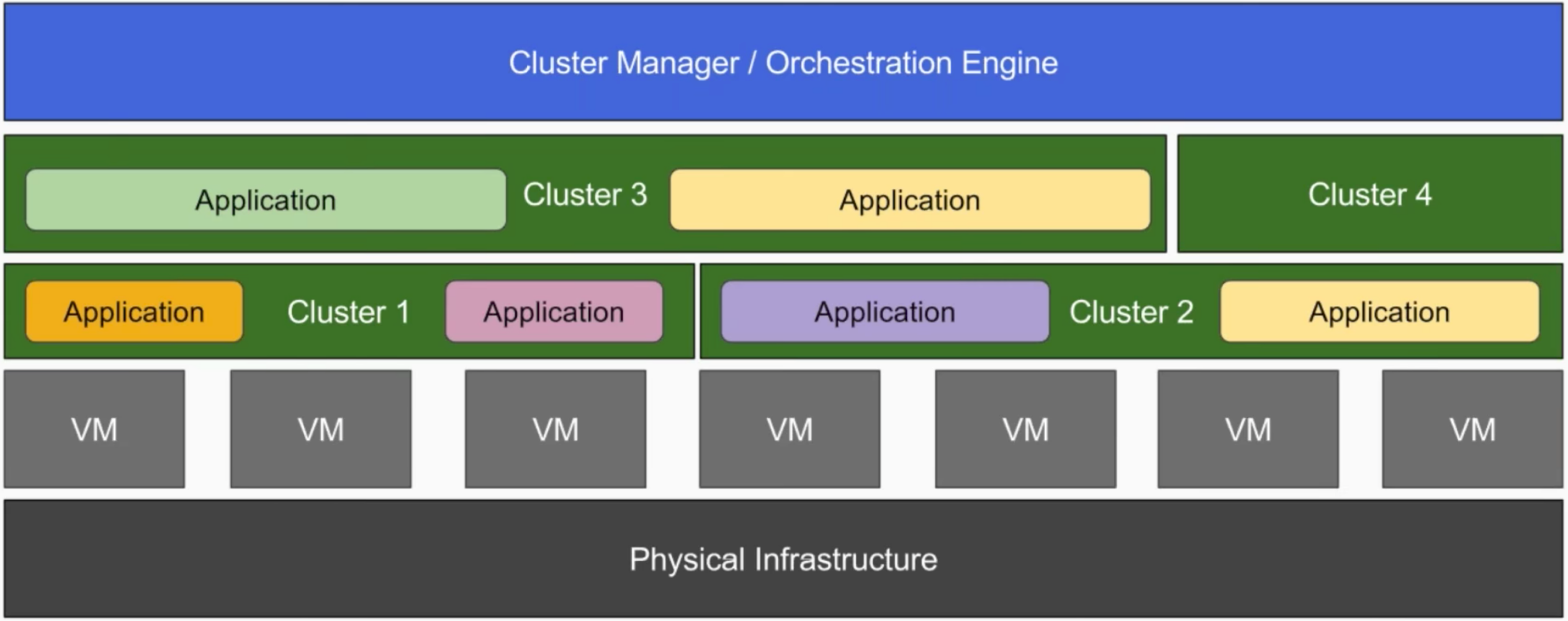
- *Docker has solved the problem of packaging, deploying and running containerized applications*
- *Docker is great for managing a few containers running on a fewer machines*
- *Production applications deal with dozens of containers running on hundreds of machines*

But soon it is overwhelming… chaos reins

Regain control with Kubernetes



The need for container orchestration



What is Kubernetes?

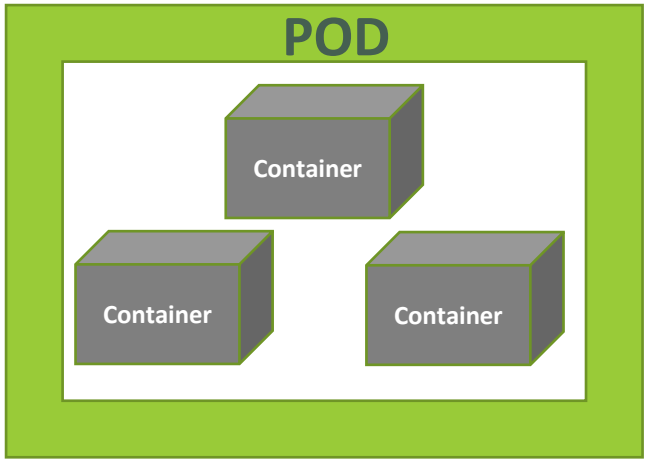
- An open-source system for automating deployment, scaling, and management of containerized applications
- An orchestration tool for scheduling app containers onto a cluster of compute machines

Concepts/Terminology

- Cluster – *A set of physical/virtual machines*
- Nodes - *Hosts that run Kubernetes*
- Pods - *Units of deployment*
- Labels - *Key-value pairs for identification*
- Services - *Collection of pods exposed as an endpoint*
- Replication Controller – *Ensures availability and scalability*
- Name Space – *Virtual Cluster*

PODS

- Pods are the smallest deployable units that are created and managed in Kubernetes
- Group of one or more containers that are always co-located, co-scheduled, and run in a shared context
- Containers in the same pod have the same hostname
- Pods can have one or more containers

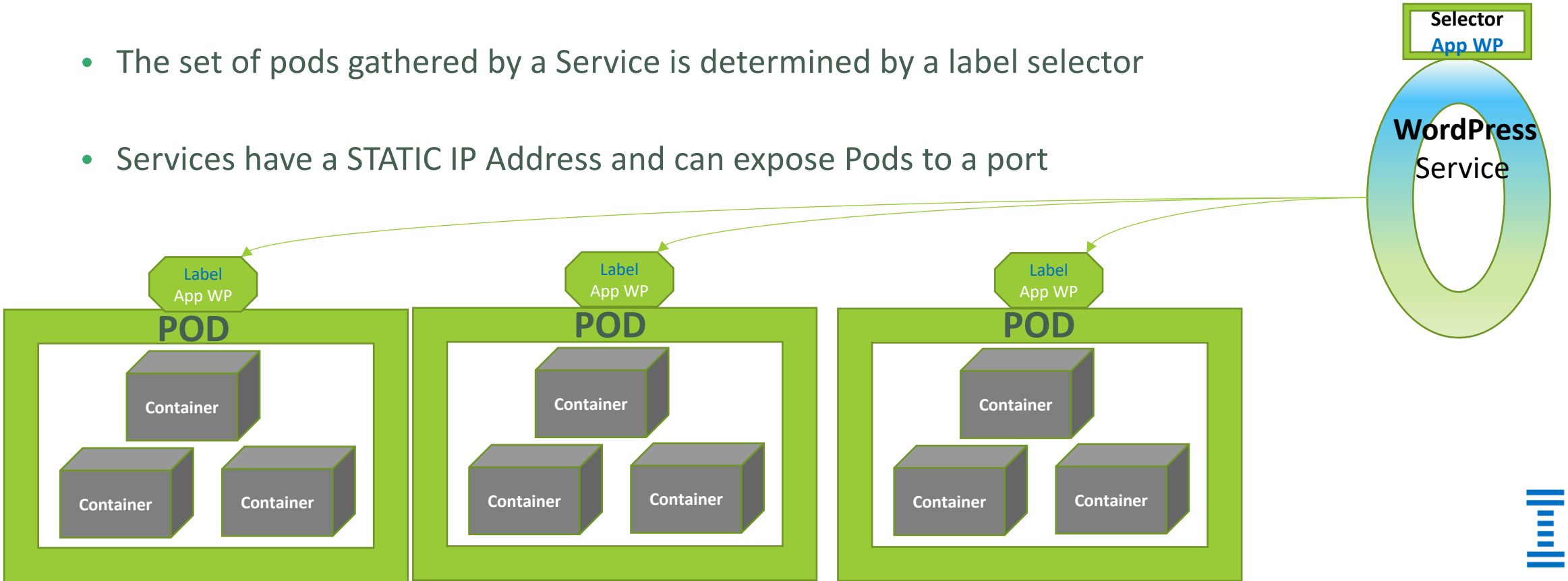


Labels/Selectors

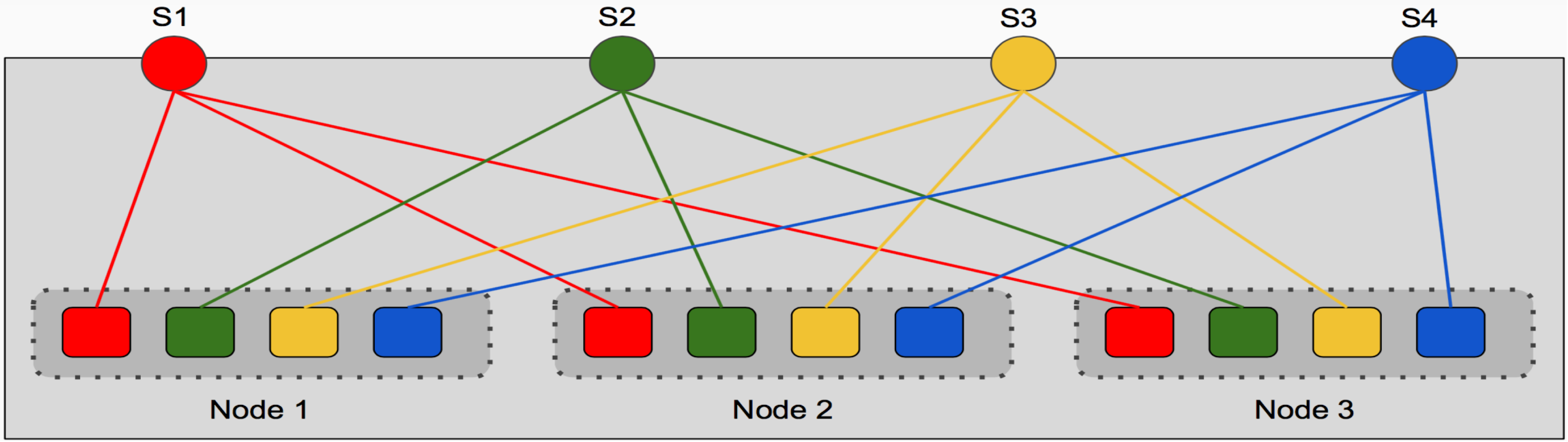
- Labels are value/key pairs assigned to objects like Pods and Services
- Labels can be attached to objects at creation time and subsequently added and modified at any time
- Basically Labels are used to identify objects
- Labels are the essential glue to associate one API object with other
  - Replication Controller -> Pods
  - Service -> Pods
  - Pods -> Nodes

Services

- An abstraction to define a logical set of Pods bound by a policy by to access them
- Service can be exposed internal or external to the cluster
- The set of pods gathered by a Service is determined by a label selector
- Services have a STATIC IP Address and can expose Pods to a port



Understanding Services



Replication Controller

- Ensures that a Pod or homogeneous set of Pods are always up and available
- Always maintains desired number of Pods
  - If there are excess Pods, they get killed
  - New pods are launched when they fail, get deleted, or terminated
- Creating a replication controller with a count of 1 ensures that a Pod is always available
- Replication Controller and Pods are associated through Labels

IBM Container Service

Intelligent Scheduling

Automated rollouts and rollbacks

Service discovery & load balancing

Secret & configuration management

Self-healing

Horizontal scaling

Design Your Own Cluster

Container Security & Isolation

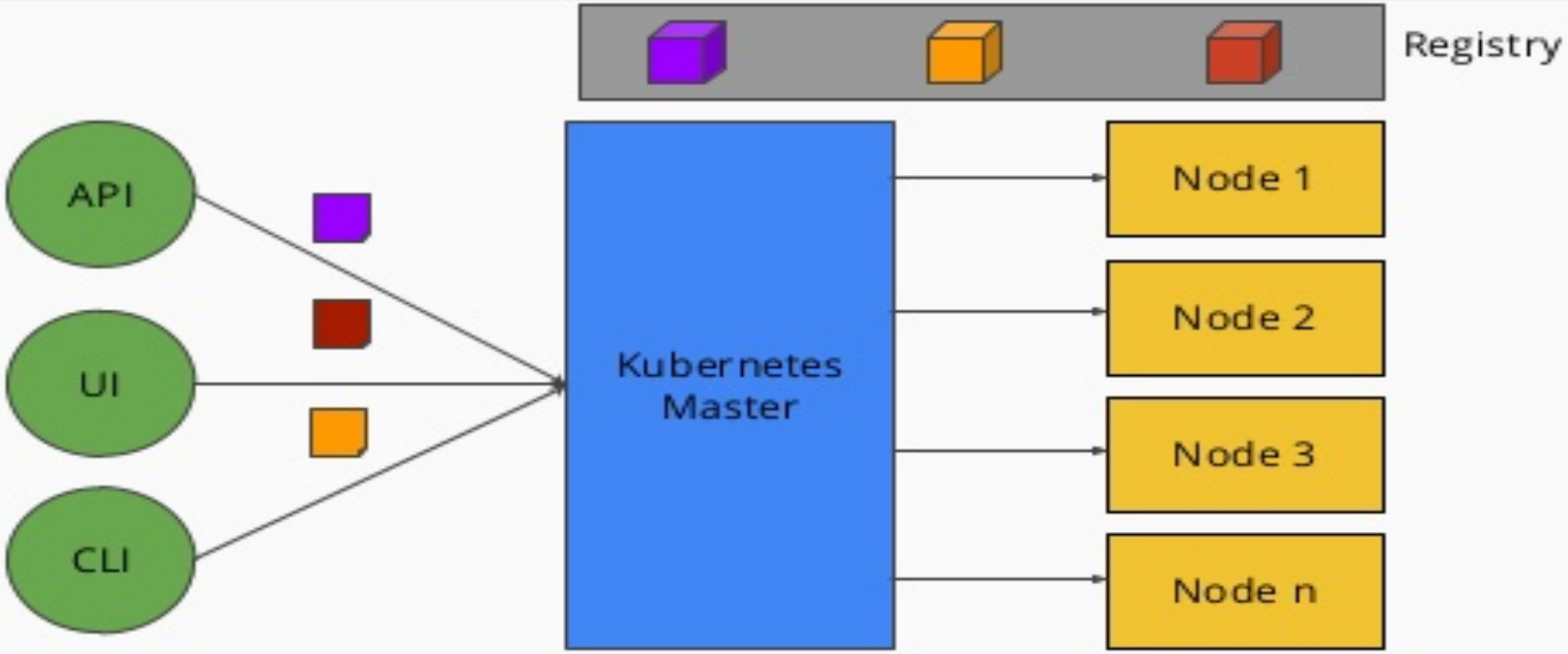
Simplified Cluster Management

Native Kubernetes Experience

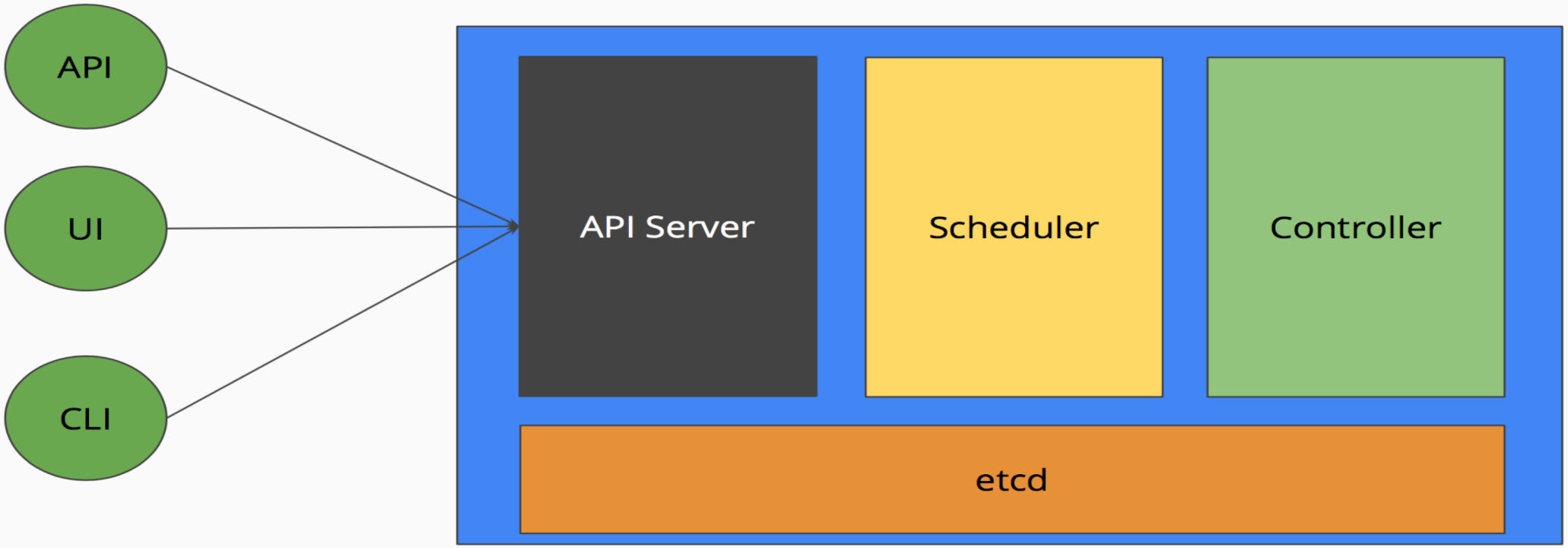
Leverages IBM Cloud & Watson

Integrated Operational Tools

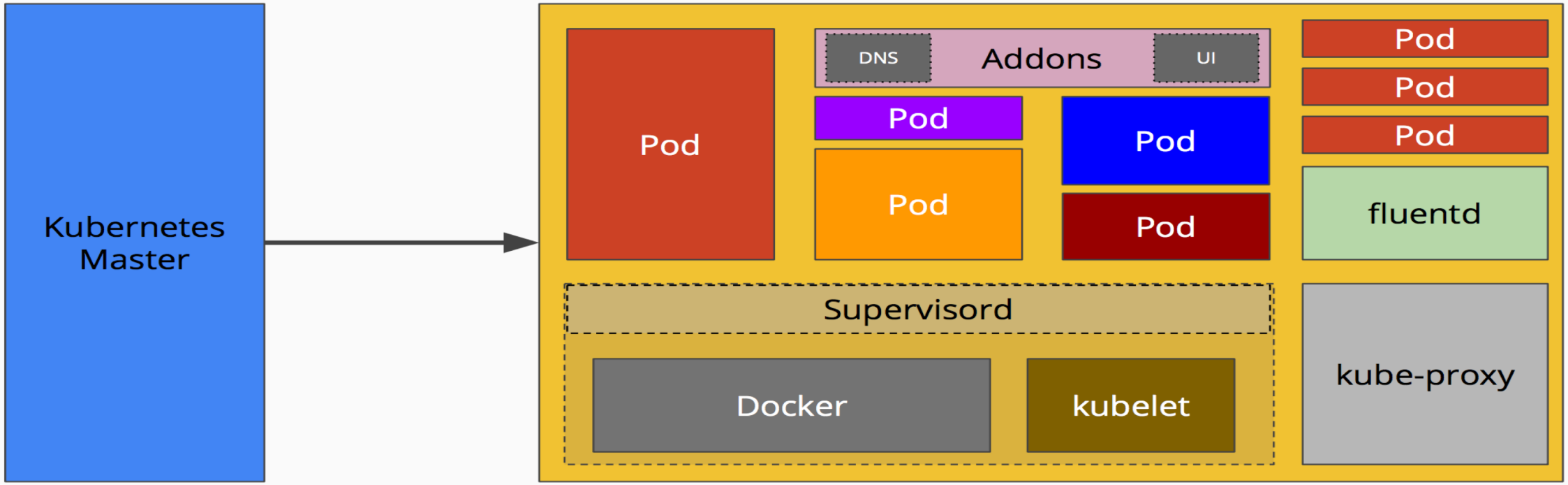
Kubernetes Architecture



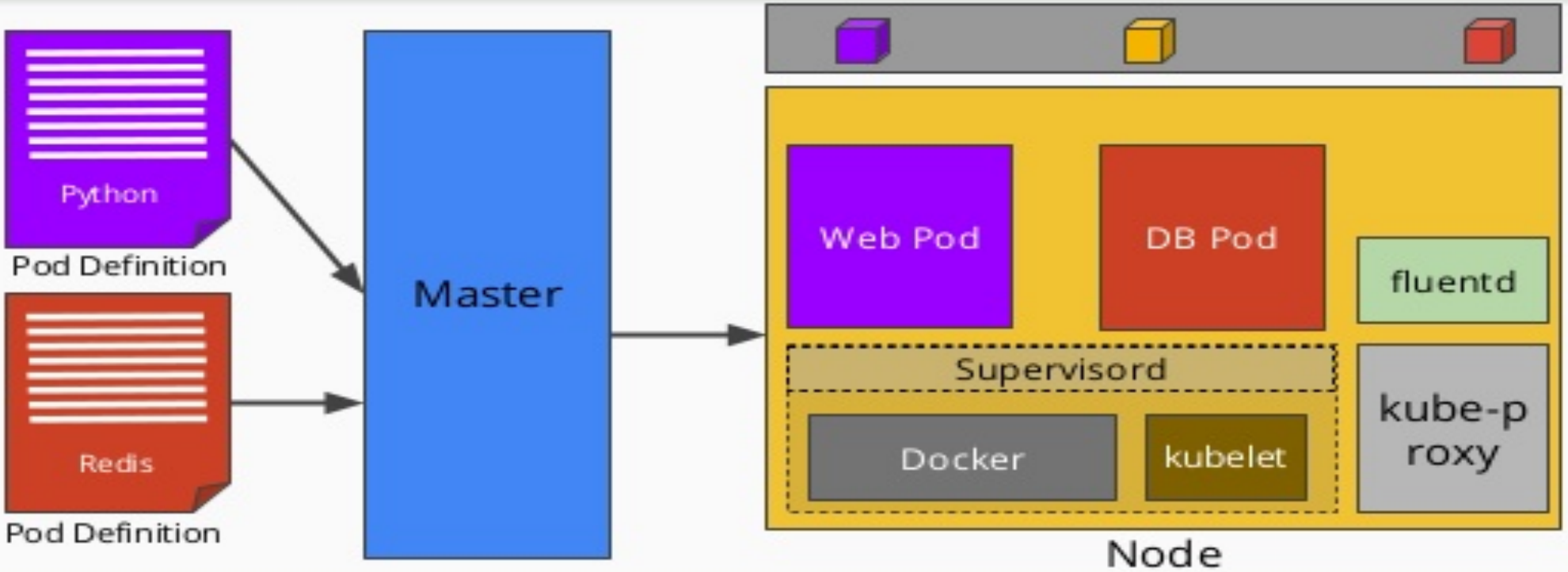
Kubernetes Master



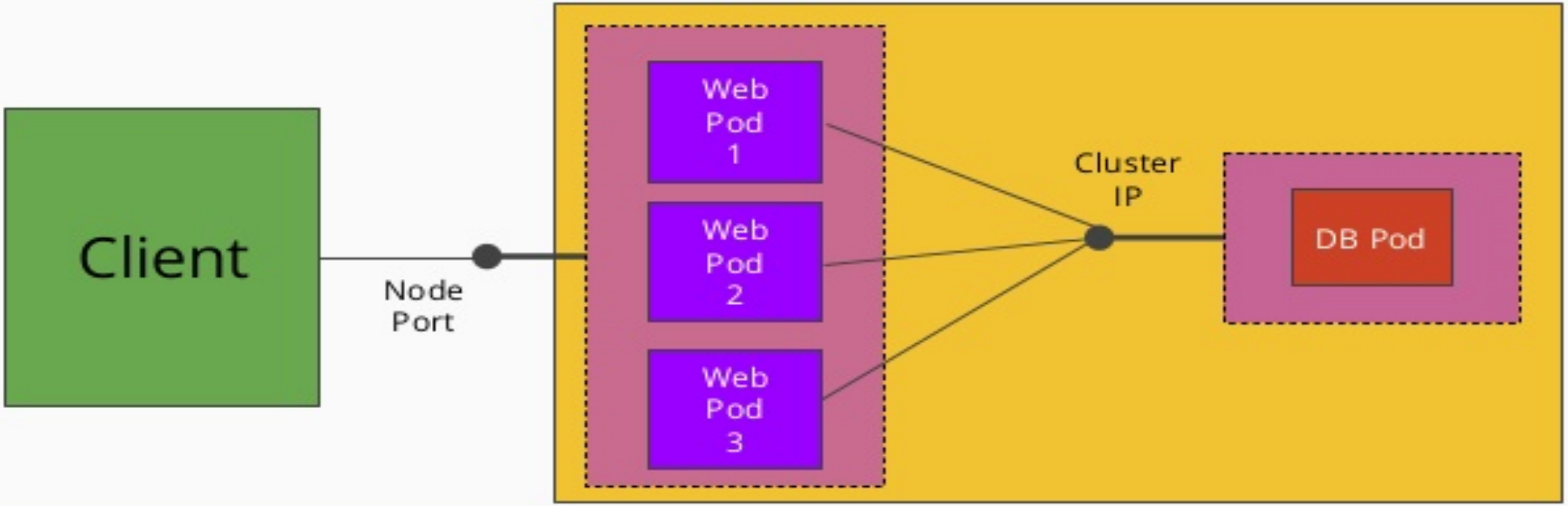
Kubernetes Node



Deploying a Pod

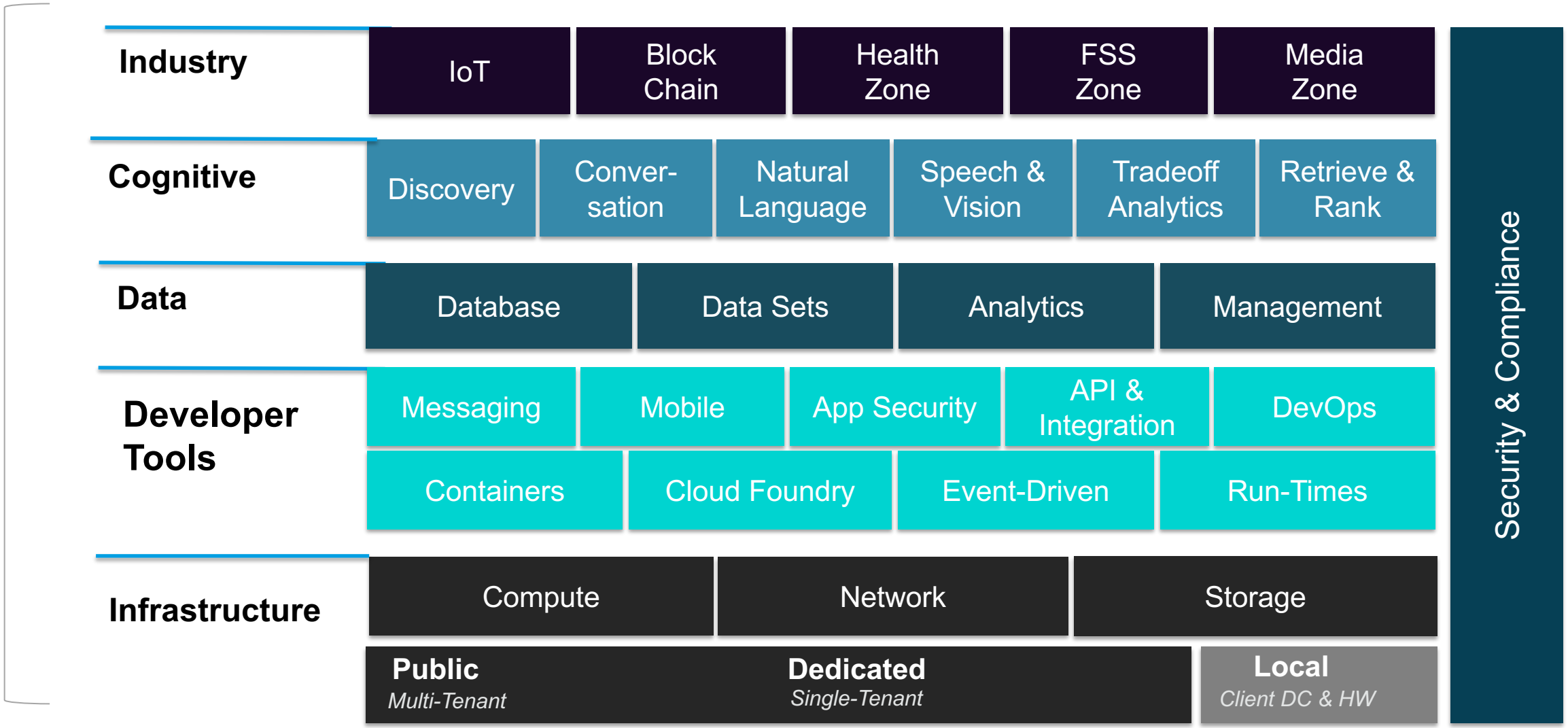


Exposing Services



IBM Cloud Platform

IBM Cloud


Industry
IoT
Block Chain
Health Zone
FSS Zone
Media Zone
Cognitive
Discovery
Conver-sation
Natural Language
Speech & Vision
Tradeoff Analytics
Retrieve & Rank
Data
Database
Data Sets
Analytics
Management
Developer Tools
Messaging
Mobile
App Security
API & Integration
DevOps
Containers
Cloud Foundry
Event-Driven
Run-Times
Infrastructure
Compute
Network
Storage
Public
Multi-Tenant
Dedicated
Single-Tenant
Local
Client DC & HW
Security & Compliance

Developer Productivity, Choice, Control, & Consistency

Speed

Portability

Performance & Control

OpenWhisk
"Serverless" / "Event Driven" Apps

Cloud Foundry
Open PaaS Environment

Container
Maximum Portability

Virtual Server or VMware
Leverage Existing Images & Tools

Bare Metal
Maximum Performance & Control

Language/ Framework

.js .java liberty .py .php .go .rb ANGULARJS express spring

IBM

What is IBM Cloud Container Service?

Advanced capabilities for building cloud-native apps, adding DevOps to existing apps, and relieving the pain around security, scale, and infrastructure management.

Go Live in Seconds
The developer can choose any language runtime or bring their own. Zero to production in one command.

APIs and Services
A catalog of IBM, third party, and open source API services allow the developer to stitch an application together in minutes.

On-Prem Integration
Build hybrid environments. Connect to on-premise assets plus other public and private clouds.

DevOps
Development, monitoring, deployment, and logging tools allow the developer to run the entire application.

Layered Security
IBM secures the platform and infrastructure and provides you with the tools to secure your apps.

Flexible Pricing
Sign up in minutes. Pay as you go and subscription models offer choice and flexibility.

IBM Cloud Catalog

All Categories

Infrastructure

Compute

Storage

Network

Security

Containers

VMware

Platform

Boilerplates

APIs

Application Services

Search

Get started by creating a Kubernetes cluster, or manage your container images in the registry.

Kubernetes Cluster

Deploy highly available apps to a cluster of compute hosts

Lite IBM

Container Registry

Store and distribute Docker images by using this managed private registry. Ma

Lite IBM

IBM **Cloud** Catalog

Catalog Support Manage

All Categories

Infrastructure

- Compute
- Storage
- Network
- Security
- Containers
- VMware

Platform

- Boilerplates
- APIs
- Application Services
- Blockchain
- Cloud Foundry Apps
- Data & Analytics
- DevOps
- Finance
- Functions
- Integrate
- Internet of Things
- Mobile
- Network
- Security
- Watson

A new generation of applications.

Internet of Things Platform

This service is the hub of all things IBM IoT, it is where you can set up and manage your

Lite IBM

Context Mapping

IBM Watson IoT Context Mapping Service brings the power to your application to

IBM

Driver Behavior

IBM Watson IoT Driver Behavior Service lets you analyze drivers' behavior from vehicle

IBM

IoT for Electronics

The IoT for Electronics service supports user and device registration and notifications.

IBM

IoT for Insurance

IBM© IoT for Insurance is an integrated IoT production instance that collects and

IBM

AT&T Flow Designer

Design, Build and Deploy IoT Solutions in Minutes

Third Party

AT&T IoT Data Plans

Launch your IoT product fast with IoT data plans

Third Party

AT&T M2X

Time Series IoT Data Service

Third Party

Car Diagnostic API

Translation service for OBD error codes.

Third Party

IQP IoT Code-Free App Development

Code-Free IoT App Creation

Third Party

Precision Location

Skyhook Precision Location

Third Party

UnificationEngine

Intelligent IoT messaging for all H2M communications.

Third Party

XpertRule Decision Automation for node-RED

Decision Author for node-RED

Third Party

IBM **Cloud** Catalog

Catalog Support Manage

All Categories

Infrastructure

- Compute
- Storage
- Network
- Security
- Containers
- VMware

Platform

- Boilerplates
- APIs
- Application Services
- Blockchain
- Cloud Foundry Apps
- Data & Analytics
- DevOps
- Finance
- Functions
- Integrate
- Internet of Things
- Mobile
- Network
- Security
- Watson

Search

Filter

Build cognitive apps that help enhance, scale, and accelerate human expertise.

Conversation

Add a natural language interface to your application to automate interactions with

Lite IBM

Discovery

Add a cognitive search and content analytics engine to applications.

Lite IBM

Document Conversion

Converts a HTML, PDF, or Microsoft Word™ document into a normalized HTML, plain

IBM Deprecated

Language Translator

Translate text from one language to another for specific domains.

Lite IBM

Natural Language Classifier

Natural Language Classifier performs natural language classification on question texts.

IBM

Natural Language Understanding

Analyze text to extract meta-data from content such as concepts, entities, emoti

Lite IBM

Personality Insights

The Watson Personality Insights derives insights from transactional and social me

Lite IBM

Retrieve and Rank

Add machine learning enhanced search capabilities to your application

IBM Deprecated

Speech to Text

Low-latency, streaming transcription

Lite IBM

Text to Speech

Synthesizes natural-sounding speech from text.

Lite IBM

Tone Analyzer

Tone Analyzer uses linguistic analysis to detect three types of tones from

Lite IBM

Visual Recognition

Find meaning in visual content! Analyze images for scenes, objects, faces, and ot

IBM

IBM **Cloud** Catalog

Catalog Support

All Categories

Infrastructure

- Compute
- Storage
- Network
- Security
- Containers
- VMware

Platform

- Boilerplates
- APIs
- Application Services
- Blockchain
- Cloud Foundry Apps
- Data & Analytics
- DevOps
- Finance
- Functions
- Integrate
- Internet of Things
- Mobile

Activity Tracker
Collect, view, search, monitor, and export logs for API access to IBM cloud platform
Lite IBM Beta

Alert Notification
Never miss critical alerts. Notify the right people immediately. Speed up response
IBM

Auto-Scaling
Automatically increase or decrease the number of application instances based on
IBM

Availability Monitoring
Around the world, around the clock availability and performance monitoring.
Lite IBM

Continuous Delivery
Build, test and deliver using DevOps best practices.
Lite IBM

Continuous Release
Manage software deployments with this enterprise-scale release management
IBM Beta

DevOps Insights
Improve agility, reliability, and security by using machine learning and analytics
IBM Beta

Event Management
Consolidated operational event and incident management.
IBM

Globalization Pipeline
Manage the translation of your cloud and mobile applications using IBM Globalizati
IBM

Key Protect
An app-independent service for protecting, managing, and generating keys.
IBM

Log Analysis
Collect, store, and analyze your application's log data.
Lite IBM

Monitoring
Collect, store, and analyze metrics from your dynamic cloud environments and micro-
IBM

Monitoring and Analytics
Gain the visibility and control you need over your application. Determine the response
IBM

Virtual Private Network (VPN)
Secured VPN connection for Containers.
IBM Deprecated

BlazeMeter
Performance Testing Platform
Third Party

Deployment of *WordPress* App

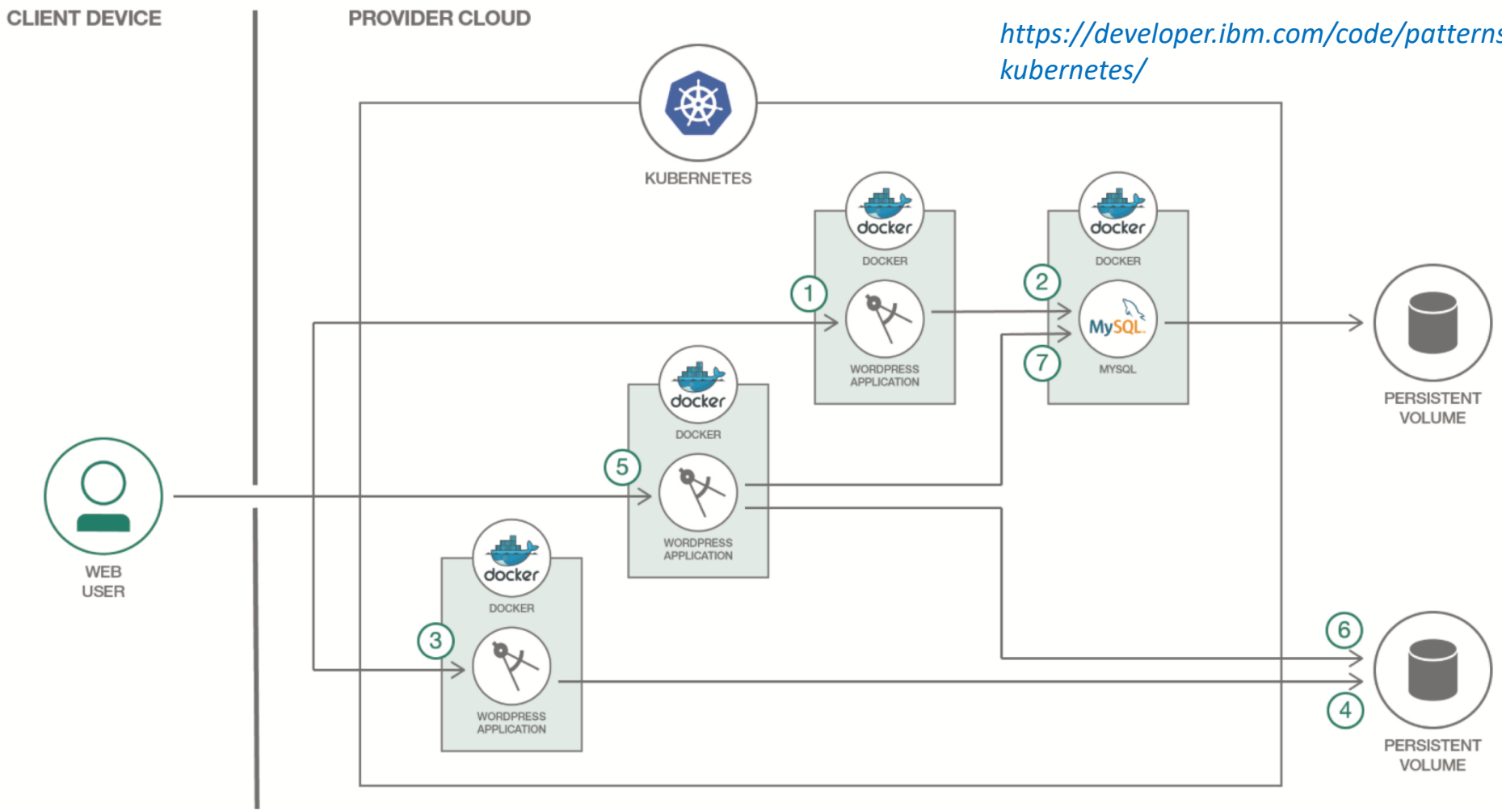
 ©2017 IBM Corporation

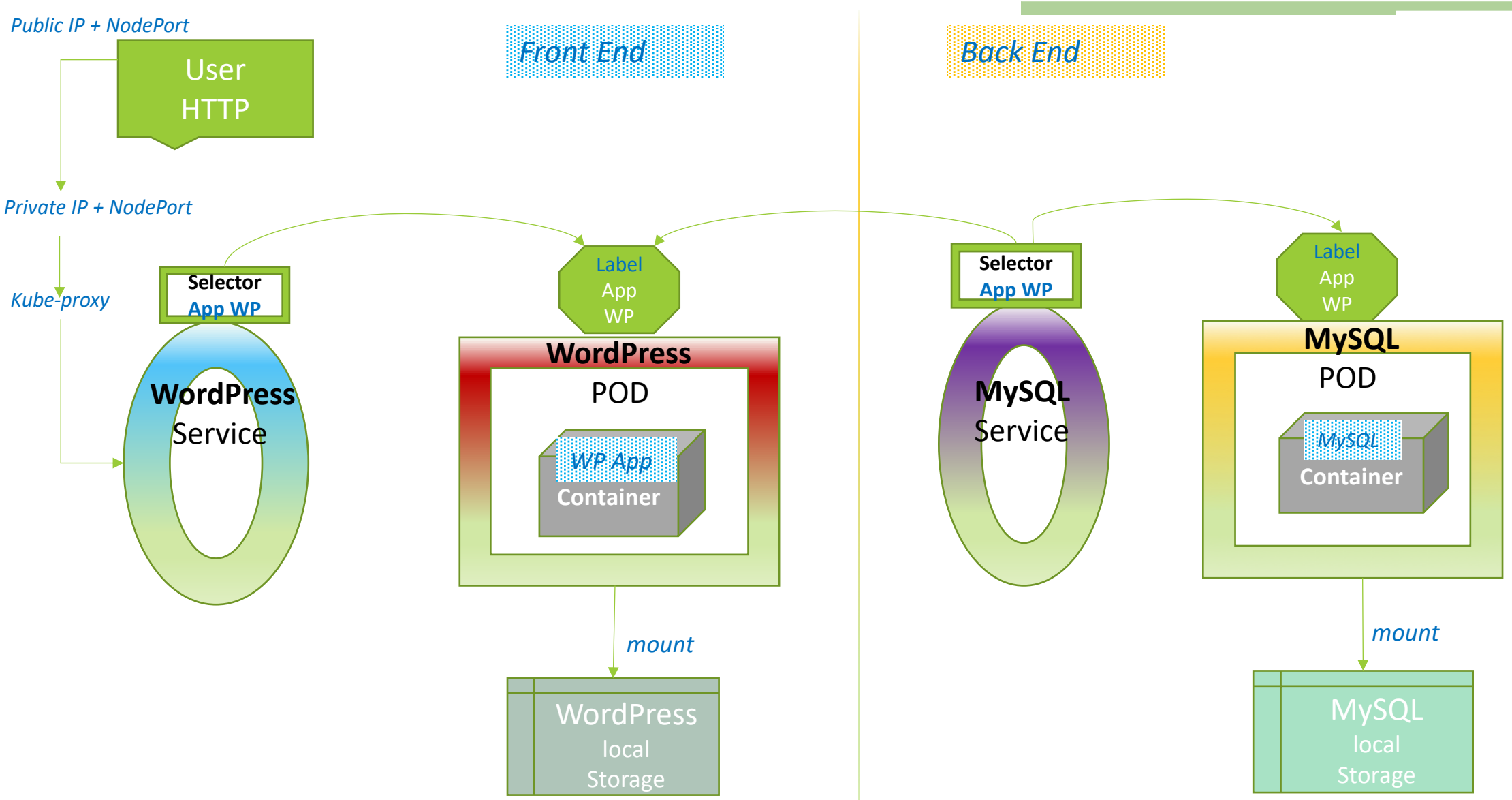
Flow

Website, blogs, tags, categories, and other data are stored in MySQL.

Themes, plugins, PDFs, videos, MP3s, etc. are stored in a persistent volume attached to the WordPress pods. Non-textual data such as PDFs, Videos, and MP3s.

https://developer.ibm.com/code/patterns/scalable-wordpress-on-kubernetes/




Public IP + NodePort
User
HTTP
Front End
Back End
Private IP + NodePort
Kube-proxy
Selector
App WP
WordPress
Service
Label
App
WP
WordPress
POD
WP App
Container
mount
WordPress
local
Storage
Selector
App WP
MySQL
Service
Label
App
WP
MySQL
POD
MySQL
Container
mount
MySQL
local
Storage

Generic Example: Tying between App → Service → POD

mysql POD

```yaml
apiVersion: v1
kind: Pod
metadata:
  name: mysql
  labels:
    name: mysql
    app: demo
spec:
  containers:
    - name: mysql
      image: mysql:latest
      ports:
        - containerPort: 3306
          protocol: TCP
      env:
        - name: "MYSQL_ROOT_PASSWORD"
          value: "password"
```

mysql Service

```yaml
apiVersion: v1
kind: Service
metadata:
  name: mysql
  labels:
    name: mysql
    app: demo
spec:
  ports:
   - port: 3306
     name: mysql
     targetPort: 3306
  selector:
     name: mysql
     app: demo
```

Web POD

```yaml
apiVersion: v1
kind: Pod
metadata:
  name: web
  labels:
    name: web
    app: demo
spec:
  containers:
    - name: redis
      image: redis
      ports:
        - containerPort: 6379
        - name: redis
          protocol: TCP
    - name: python
      image: epradeepk/py-red
      env:
        - name: "REDIS_HOST"
          value: "localhost"
      ports:
        - containerPort: 5000
          name: http
          protocol: TCP
```

Web Service

```yaml
apiVersion: v1
kind: Service
metadata:
  name: web
  labels:
    name: web
    app: demo
spec:
  selector:
      name: web
  type: NodePort
  ports:
   - port: 80
     name: http
     targetPort: 5000
     protoco: TCP
```

Thank You