Kubernetes 101

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Agenda

Recap Container Basics & Docker:

- Container architecture
- Advantages
- Docker ecosystem

Kubernetes:

- Kubernetes Basics
- Kubernetes Architecture
- Kubernetes Concepts

Hands-on Workshop

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Before we begin...

- Create an IBM Cloud Account:

  http://ibm.biz/CodeKube

- Go to cloud.ibm.com and log in
- Go to Manage -> Account -> Account Settings
- Click “Apply Code” under “Feature (Promo) Codes” and enter your promo code
- Your account type will change to “Trial” if the code was successful

- Install the IBM Cloud CLIs and login:

  http://bit.ly/ibm_cli

  $ bx login

- Provision a cluster:

  $ bx cs cluster-create --name <name-of-cluster>

WIFI: CodeNode
Password: welovecode

Recap Container Basics & Docker

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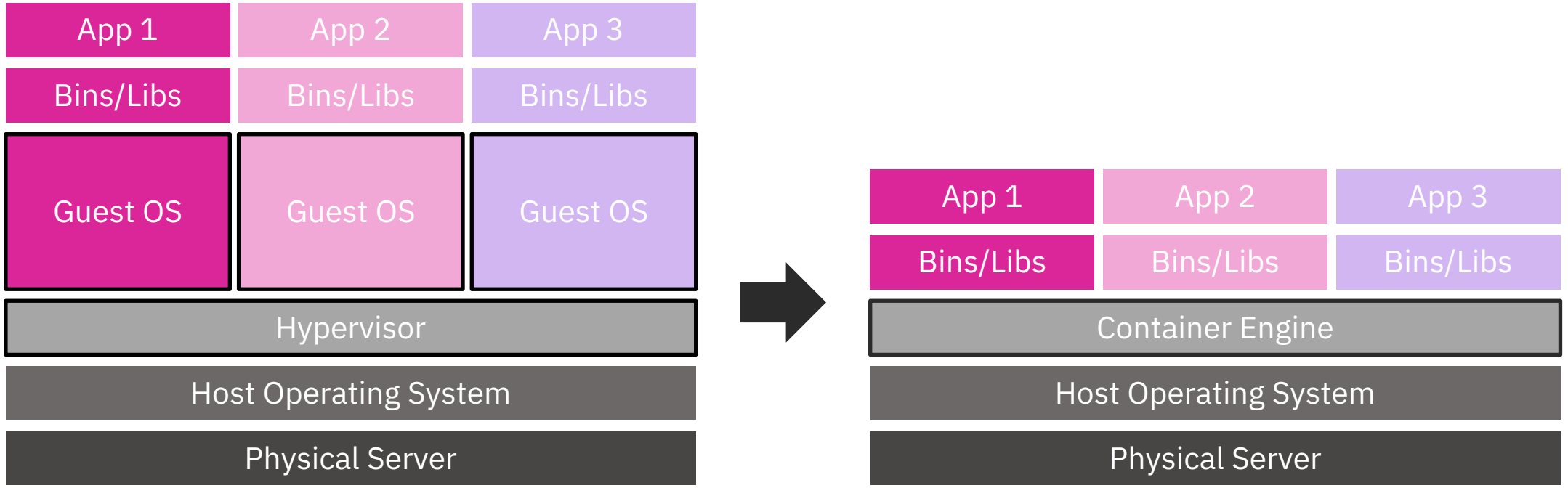
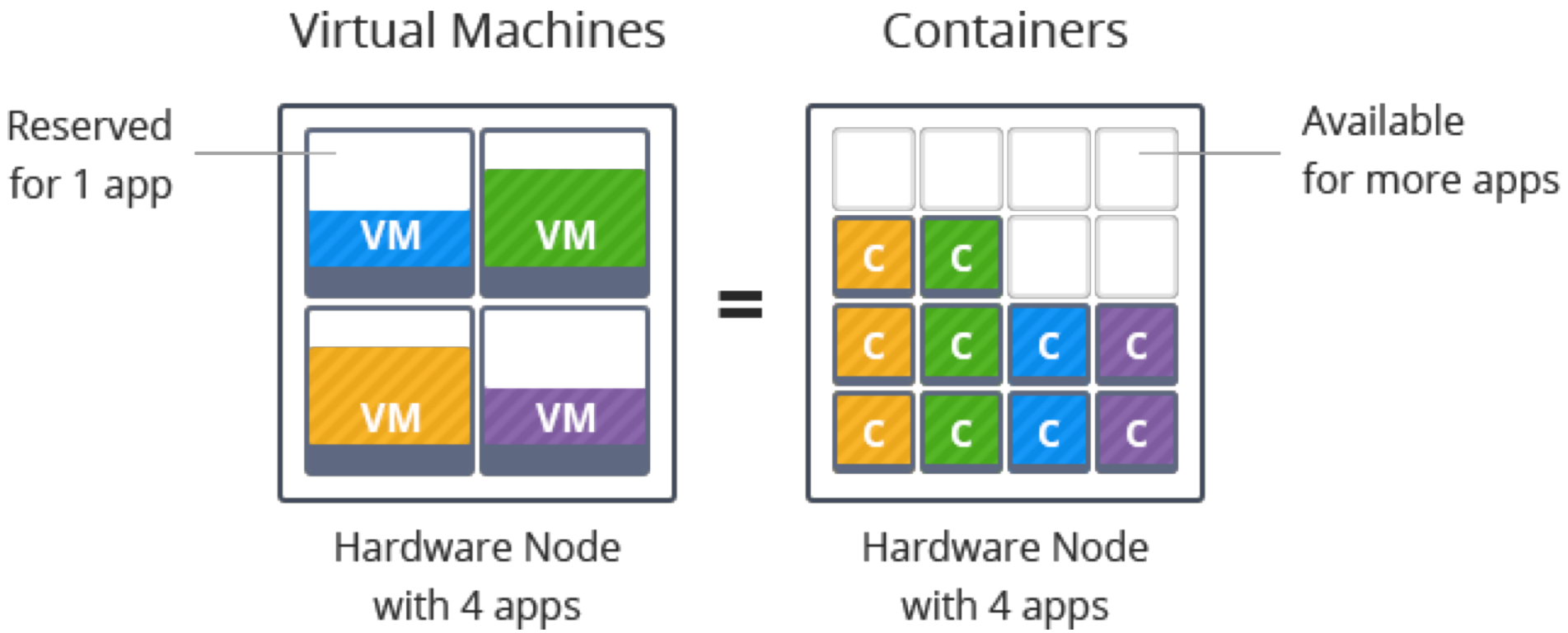
Container Basics

- A container contains!
- Virtualizing the hardware OS subsystems
- Interaction with a single OS

VMs vs. Container Virtualization



Advantages



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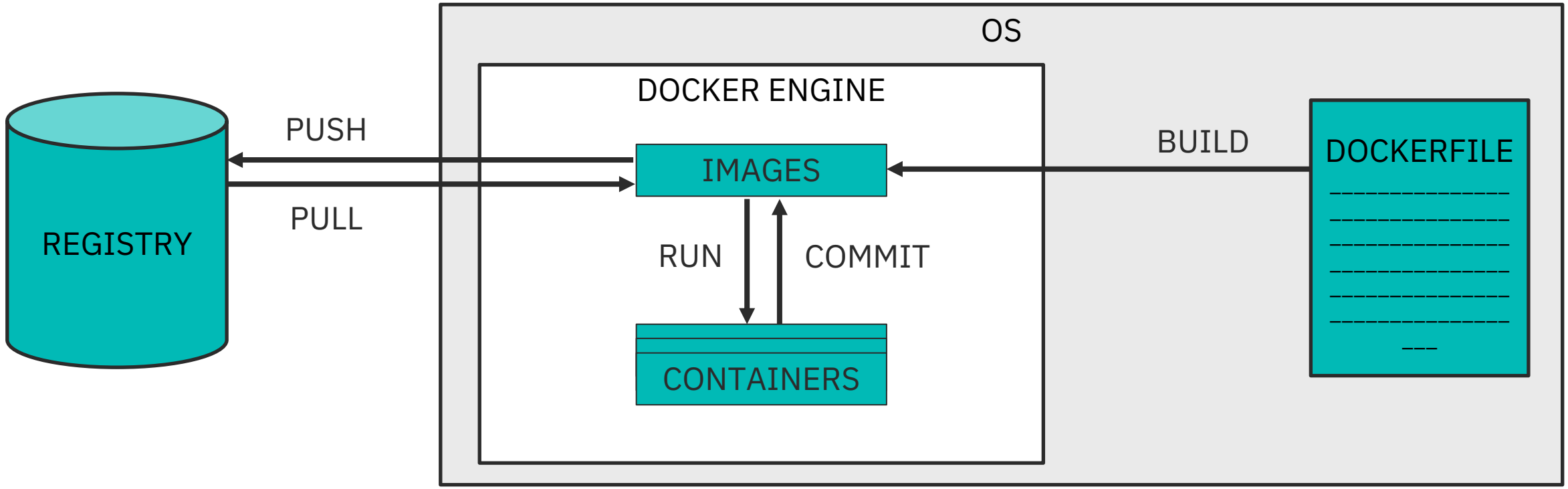
Docker Architecture



Kubernetes

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Limitations of Docker

Problem: *I have **multiple applications**, that I wish to run across **multiple servers** with **high availability**. Docker is great but its not that smart!*

- Docker is only aware of the containers running on the machine it runs on
- Horizontal scaling in Docker does not exist
- Docker does not repair applications which become unhealthy and cannot

Container Stack

Layer 6	Development Workflow	DEIS, OPENSHIFT, CLOUD FOUNDRY, DOCKER CLOUD, apprenda
Layer 5	**Orchestration/Scheduling Service Model**	kubernetes, docker, Apache MESOS, Marathon
Layer 4	Container Engine	docker, Rocket, OSv designed for the cloud
Layer 3	Operating System	ubuntu, redhat LINUX, CoreOS
Layer 2	Virtual Infrastructure	vmware vSphere, amazon web services EC2,
Layer 1	Physical Infrastructure	Raw compute, Network, Storage

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Kubernetes Capabilities

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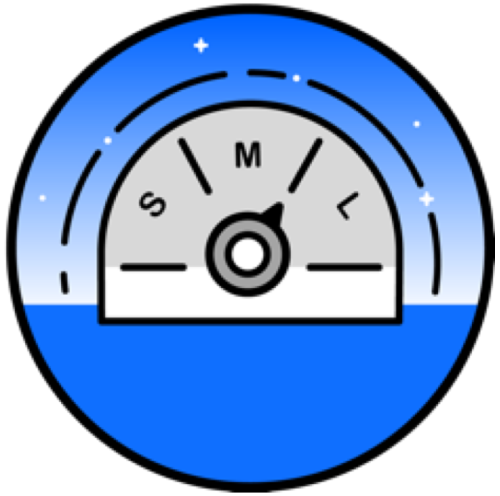
Intelligent Scheduling

- Automatically places containers based on required resources
- Supports mixed workloads to drive increased utilization

Self-healing

- Restarts containers that fail
- Replaces and reschedules containers when nodes die
- Kills containers that don't respond to your user-defined health check



Horizontal scaling

- Scale your application with a simple command
- Automatic scaling based on real-time usage

Service discovery and load balancing

- Simple discovery of services through a single DNS name
- Manage access to container applications through IP address or HTTP route.
- Automatically load balance traffic and route around failure

Automated rollouts and rollbacks

- Roll out changes to your application or its configuration, while monitoring application health to ensure things stay up
- If something goes wrong, Kubernetes will rollback the change for you

Secret and configuration management

- Safely store application credentials and secrets
- Deploy and update secrets and application configuration without rebuilding your image and without exposing secrets in your stack configuration.

Kubernetes Concepts

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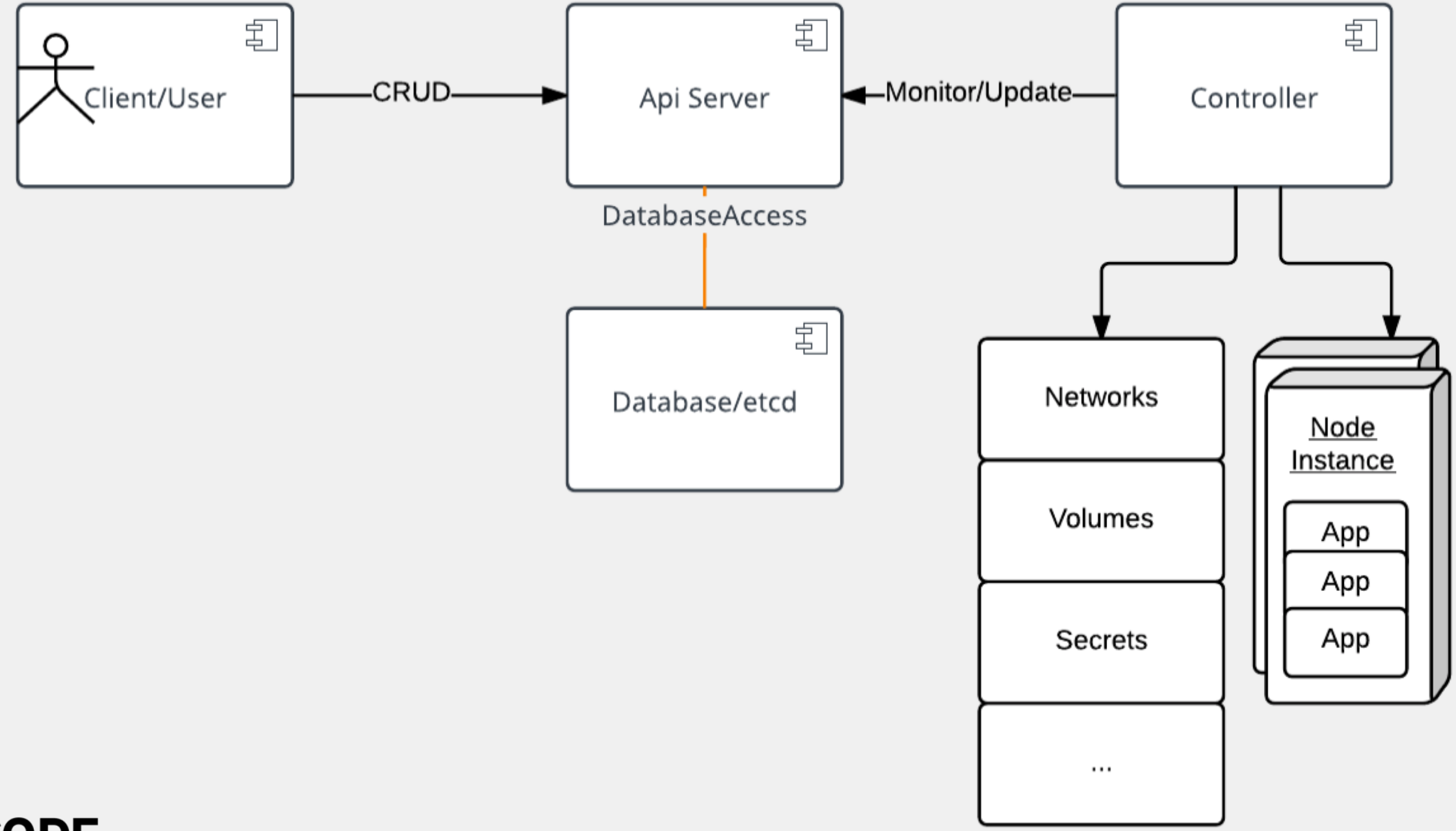
Client/User
CRUD
Api Server
Monitor/Update
Controller
DatabaseAccess
Database/etcd
Networks
Volumes
Secrets
...
Node
Instance
App
App
App

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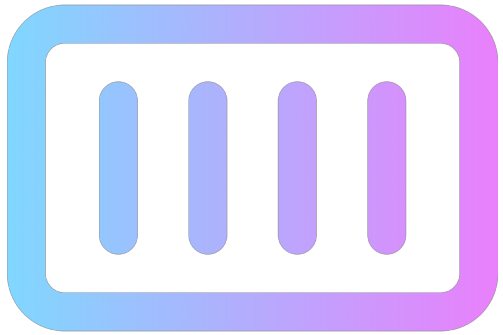
Master Node

- Controls and manages the cluster
- Kubectl (command line)
- REST API (communication with workers)
- Scheduling and replication logic

Worker Nodes

- Hosts the K8s services
- Kubelet (K8s agent that accepts commands from the master)
- Kubeproxy (network proxy service responsible for routing activities for inbound or ingress traffic)
- Runs Docker engine

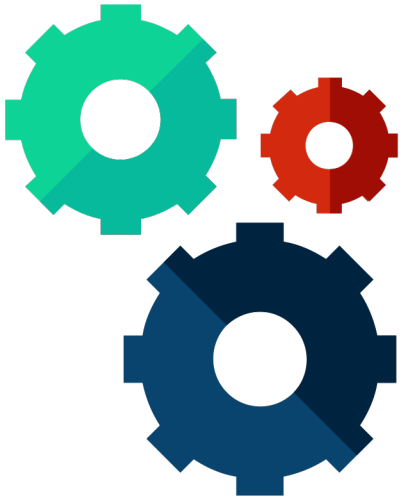


Pods

- Smallest deployment unit in K8s
- Collection of containers that run on a worker node
- Each has its own IP
- Pod shares a PID namespace, network, and hostname

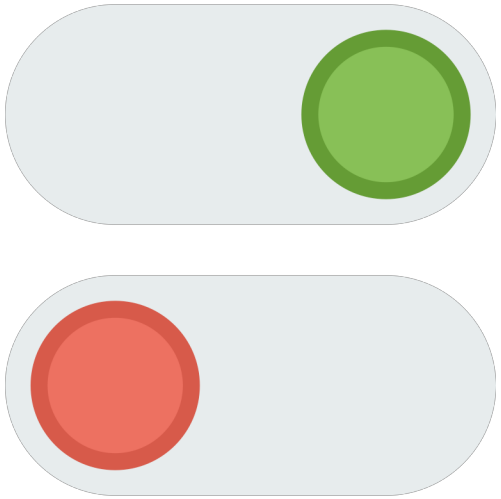
Labels

- Metadata assigned to K8s resources
- Key-value pairs for identification
- Critical to K8s as it relies on querying the cluster for resources that have certain labels



Services

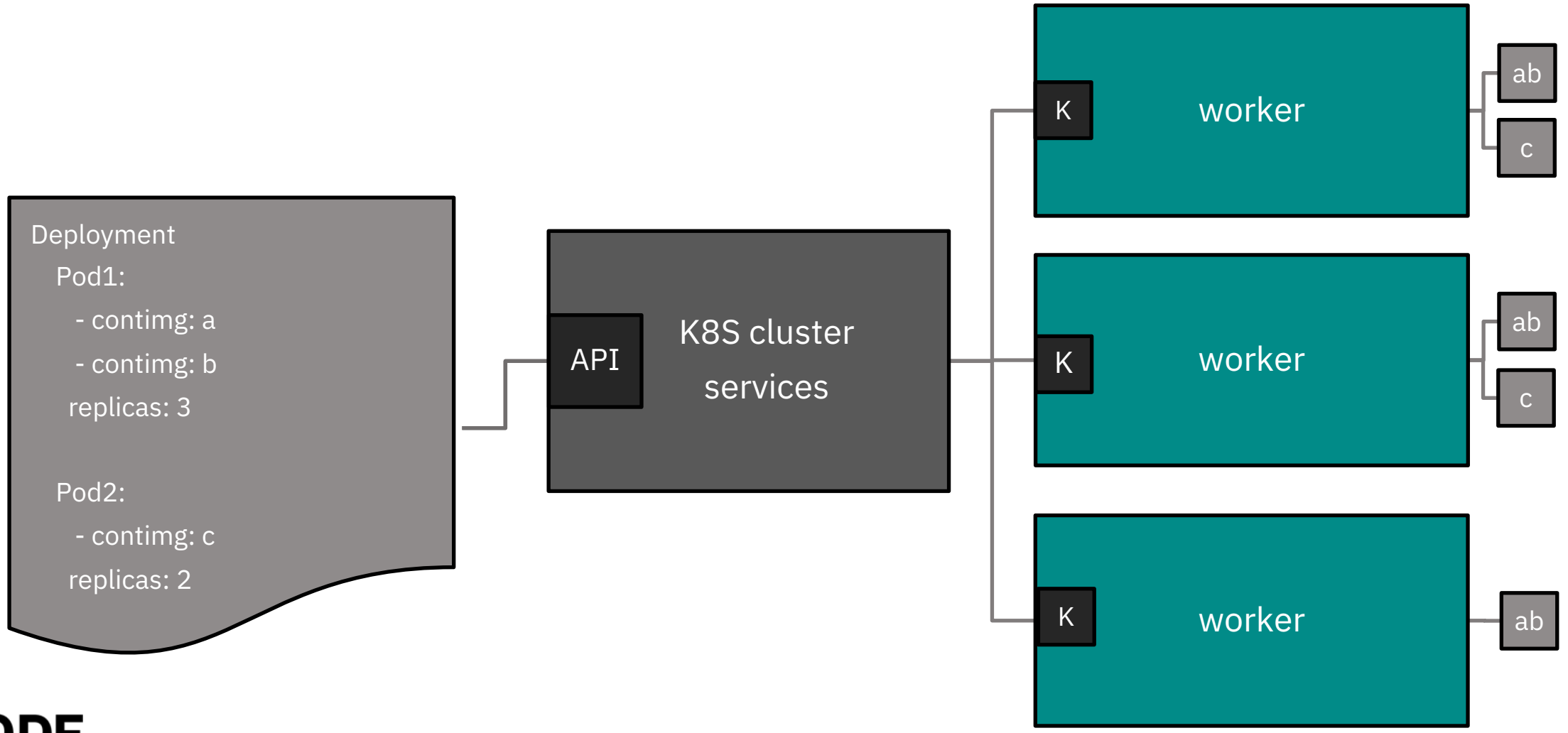
- Collections of pods exposed as an endpoint
- Information stored in the K8s cluster state and networking info propagated to all worker nodes



Replication Controllers

- Ensures availability and scalability
- Maintains the number of pods as requested by user
- Uses a template that describes specifically what each pod should contain

Kubernetes Cluster: Deployment



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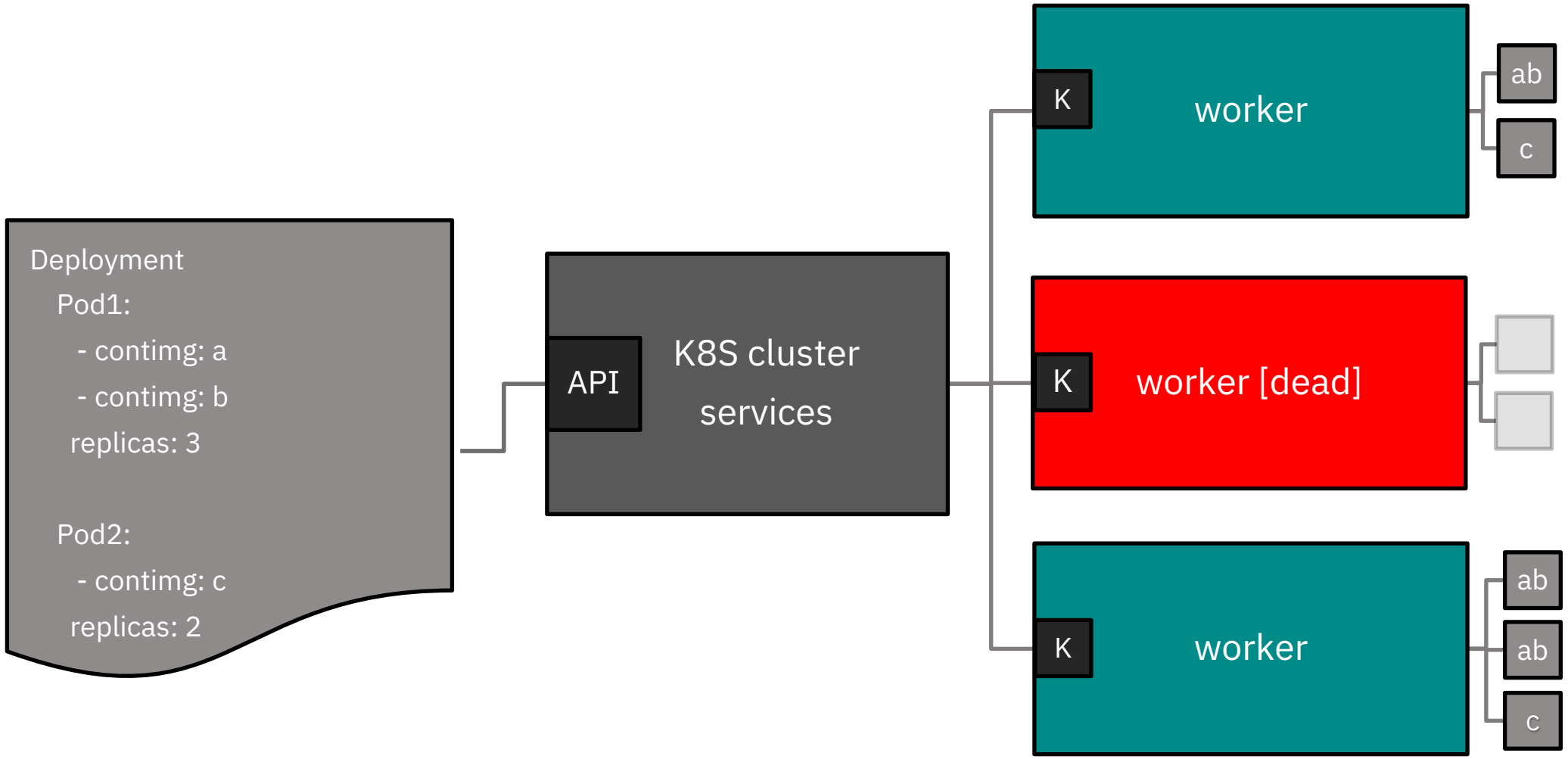
Kubernetes Cluster: Monitoring



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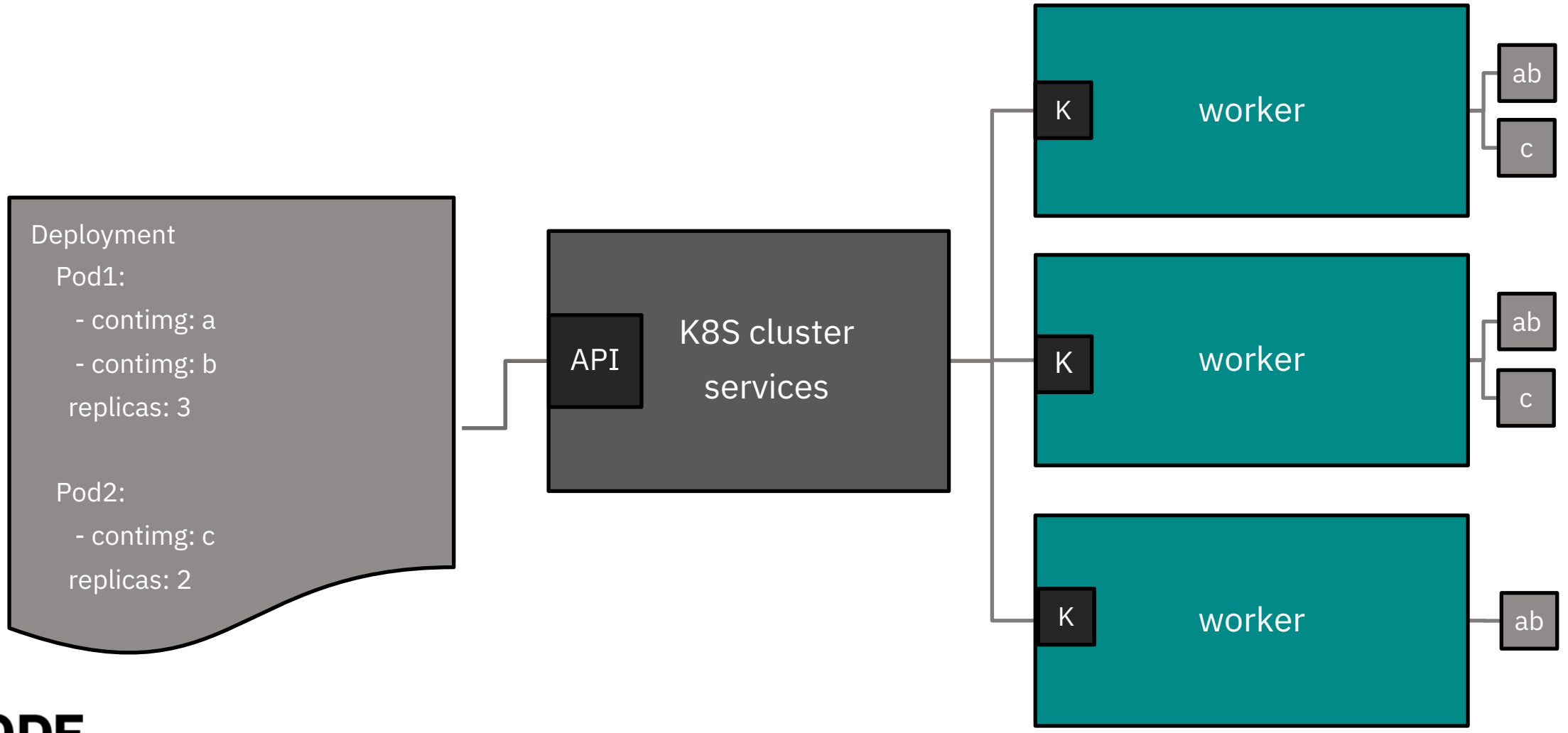
Kubernetes Cluster: Scaling



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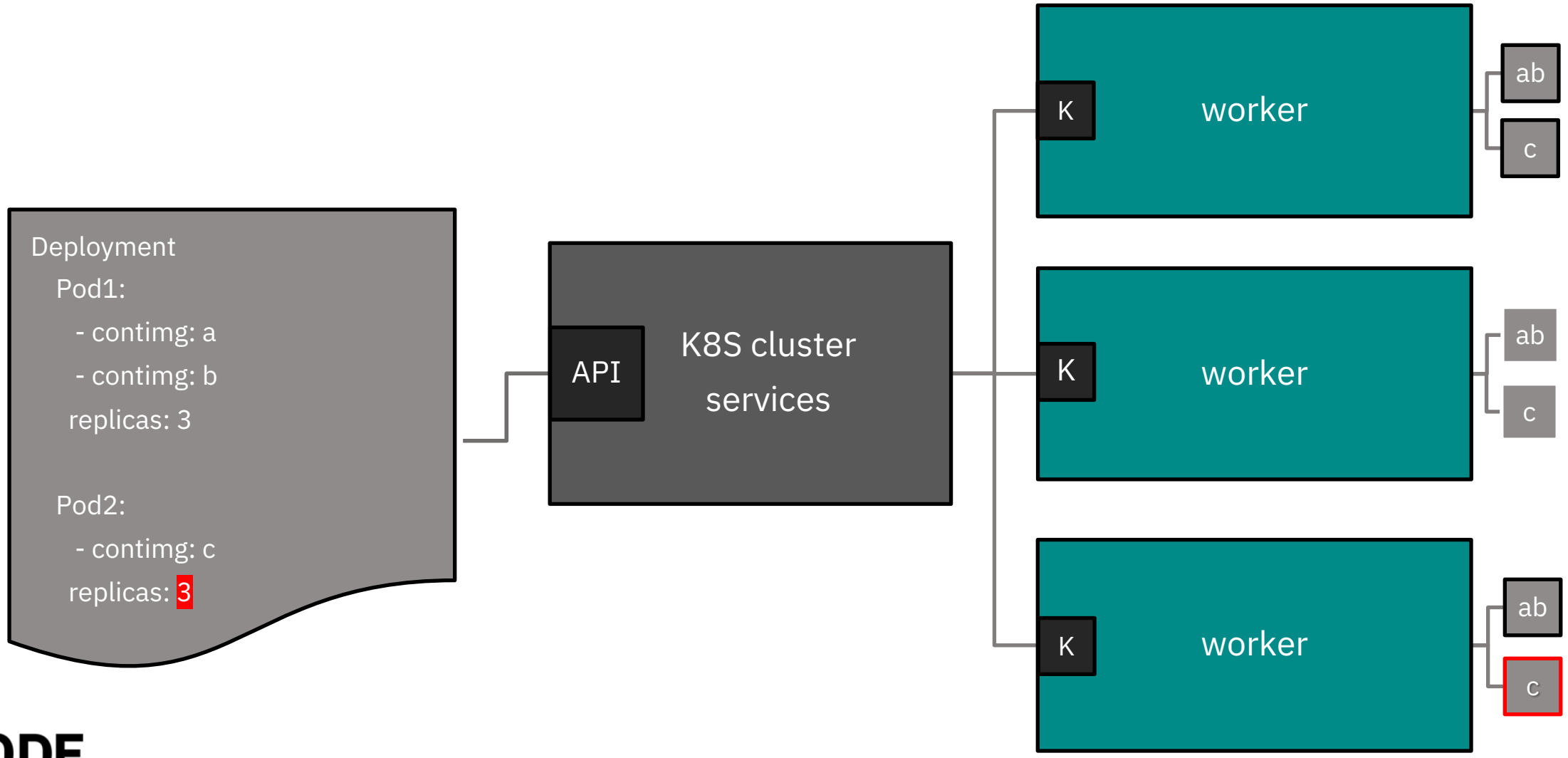
Kubernetes Cluster: Scaling



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Kubectl CLI

Create the configuration specified in *configuration.yml* file

- kubectl create –f *configuration.yml*

Show all the pods deployed in k8s in the default name space

- kubectl get pods

Show the details of the pod *pod_name*

- kubectl describe pod *pod_name*

Display the logs corresponding to the pod *pod_name* in the default name space

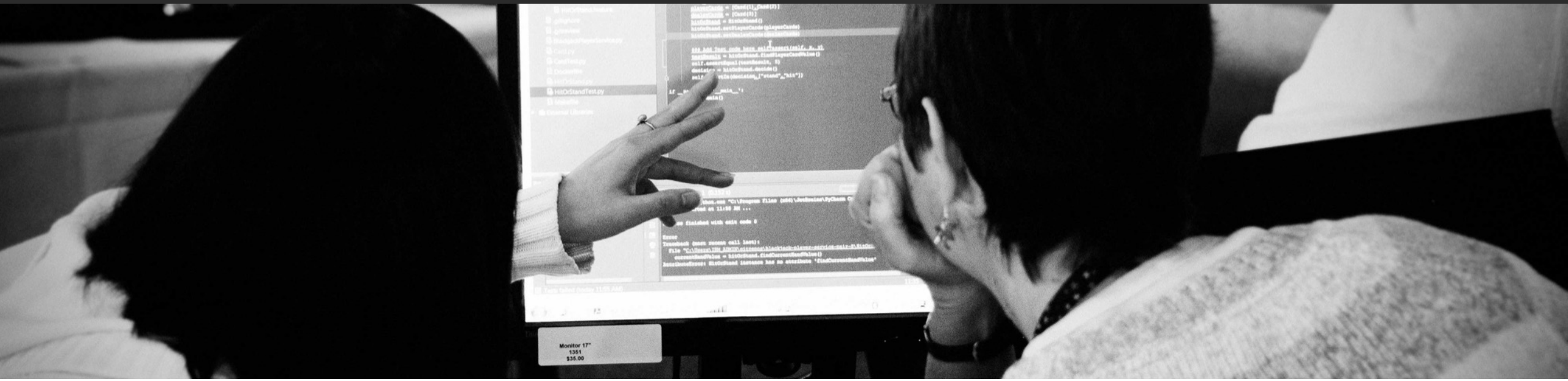
- kubectl logs *pod_name*

Enter an interactive shell inside pod *pod_name*

- kubectl exec –ti *pod_name* bash

https://kubernetes.io/docs/reference/kubectl/cheatsheet/

Workshop time!



https://github.com/IBMDeveloperUK/kube101

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