Docker and Kubernetes

Hands-on Workshop

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Agenda

Download Code and Instructions from: git@github.com:coder-lgtm/docker-k8s.git

- Introduction to Docker
- Virtualization technology concepts
- Launching a web application locally using Docker
- Introduction to Kubernetes
- Re-launching the same application in the Public Cloud using Kubernetes
- Scaling up / scaling down the website
- Q & A

What is Docker

- PaaS: Platform-as-a-Service offering - provides a platform to package software and dependencies together.

- Application containerization - is an OS-level virtualization method used to deploy and run distributed applications without launching an entire virtual machine (VM) for each app. Multiple isolated applications or services run on a single host and access the same OS kernel.

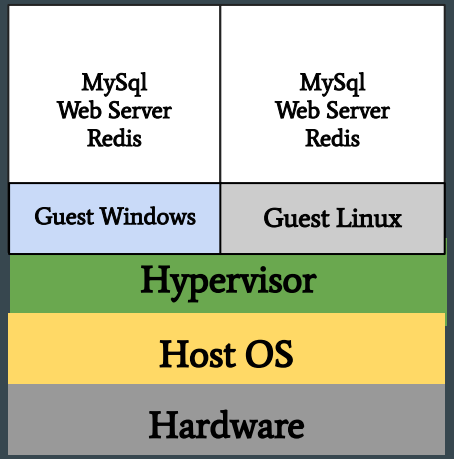
Why Docker

- **For Development**: Developers can collaborate with each other over shared software code by eliminating “runs on my machine but not yours” problem
- **For Deployments**: Helps save computing power by running multiple containers (and hence multiple software such as a web server and database) side by side on one host machine
- **For Delivery**: Enterprises use docker to ship software in agile fashion with confidence that it will work on various operating systems without issues
- **How do we share Docker Images?** One example: https://hub.docker.com/ Like Github, a public container repository provided by Docker

Docker Terminology

- **Docker Image:** Lightweight and standalone executable that forms the package, which can include code, dependencies, settings, and system tools.
- **Docker Machine:** A tool for provisioning and managing your Dockerized hosts.
- **Docker Container:** Runtime environment for the Docker Image
- **Docker Engine:** Runs on Docker hosts (e.g., Virtualbox); this is a tool provides the Docker command line interface (CLI) and Docker server-side APIs to manage the lifecycle of Docker containers

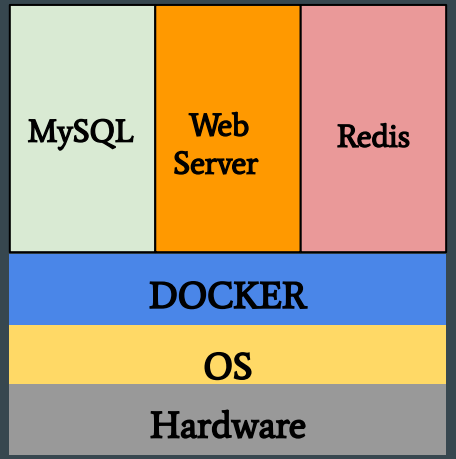
Docker vs Virtual Machines



Guest OS sits on Hypervisor, does not share resources

Minutes to launch each guest OS, size is in GBs

Virtual Machine



Docker containers. Share the same OS Layer/ Kernel

Milliseconds to launch, size is in MBs

Docker

How to work with Docker? (One of the many ways...)

- Docker works on top of Linux Kernel
- How do you make it work on MacOS? Install Docker Toolbox
- The Toolbox installs and configures: VirtualBox and Docker Machine
- The Docker Machine provisions Docker hosts with the Docker Engine
- The Docker Engine offers command line interface that allows us to build and run Docker containers on top of VirtualBox

```
> docker-machine env
export DOCKER_TLS_VERIFY="1"
export DOCKER_HOST="tcp://192.168.99.101:2376"
export DOCKER_CERT_PATH="/Users/rj/.docker/machine/machines/default"
export DOCKER_MACHINE_NAME="default"
# Run this command to configure your shell:
# eval $(docker-machine env)
```

Demo Time!

- Prerequisites: follow the README.md in the git@github.com:coder-lgtm/docker-k8s.git
  - Create a small webapp
  - Install Docker and Virtualbox
  - Validate installation

- Demo 1: Launch Python website locally
- Demo 2: Dockerize the website application

Kubernetes

- Kubernetes provides Container Orchestration
- Why Container Orchestration?
  - If you have only one instance of your app, if it goes down, you have an outage
  - What if some of the running containers crash?
  - How do you make your application robust?
    - Auto scaling?
    - Load balancing?
    - Self-healing?
- Kubernetes is one orchestration mechanism - other options include Docker Swarm and Mesos
  - Kubernetes is the most popular option and available on all public cloud platforms.

Kubernetes Terminology

- Cluster: A collection of nodes that Kubernetes uses to run instances of your application
- Node: A physical machine / host in a cluster
- Pod: A unit of execution on a node. Containers run in a pod on a node. One node can have multiple pods running on it
- kubectl: The command-line tool to run Kubernetes
- Rolling Update: Incrementally updating pod instances with code updates
- Auto Scaling: Kubernetes will automatically scale up your cluster by adding instances when the load increases and scale it down when load decreases (to save you money)

Kubernetes Architecture Overview

- Control plane host: API Server, etcd (datastore), kube-scheduler, kube-controller
- Worker node hosts: kubelet, kubeproxy, container runtime
- Command-line tool: kubectl
- Kubernetes objects (defined by YAML file)
- kind, aka resources (there are multiple, we will cover the following three)
  - Pod
  - Deployment
  - Service

Demo Time!

- Prerequisites: follow the README.md in the git@github.com:coder-lgtm/docker-k8s.git
  - Set up a GCP project
- Demo:
  - How does kubectl explore nodes / pods?
  - What processes run on the pods?
  - How do you access containers running on the pod?
  - How to scale up / scale down?
  - How to set up auto scaling?

Summary

Docker and Kubernetes offer a fundamental shift to software development with a new level of portability and velocity.

Docker is a PaaS offering that lets you build and manage the lifecycle of a “container” to simplify and accelerate software development.

Kubernetes is an orchestration tool for Docker. Production environment workloads require effective management of the containers and Kubernetes is a brilliant tool for that - it offers load management, auto-scaling, self-healing, creation, deletion, and rolling updates (new code release, geographic migration, etc.).

Thank you!

Q & A