

# WORKSHOP ADVANCED DOCKER



สอนการ deploy Dockers ด้วย Kubernetes  
จากประสบการณ์ใช้งานจริงบน Production ของ  
application ระดับประเทศ



วิทยากร : คุณ PRAPARN LUNGPOONLARP  
INFRASTRUCTURE ENGINEER, NETWORK ENGINEER,  
SYSTEM ENGINEER



kubernetes



# Outline Day 1

- Container concept (Recap)
- Introduction to Kubernetes
- System Architecture
- Fundamental of Kubernetes
  - Pods, Container and Services
  - Daemon Sets and Replication Controller (RC)
  - Deployment/Replica-Set (RS) and Rolling update
  - Resource Management and Horizontal Pods Autoscaling (HPA)
  - Map and Secret
  - Jobs and Cron Jobs
  - Debug Log and Monitoring



# Outline Day 2

- Fundamental of Kubernetes
  - ConfigMap Secret
  - Job and CronJob
  - Log and Monitoring
- Ingress Networking
- Kubernetes in real world
  - Cluster Setup for Bare Metal
  - Orchestrator Assignment
    - nodeSelector
    - Interlude
    - Affinity
    - Taints/Tolerations
- Stateful application deployment
  - Consideration and Awareness
  - Persistent Volumes
  - StatefulSets



# Pre-require

- Windows 10 (64 bit) / Mac OSX (64 Bit) with memory 8 GB
- Intermediate understand for docker/compose and container concept
- Google Cloud Account (Free for 300\$) or other Cloud / Bare Metal / Play with K8S
- LINE Account
- Basic understand for network/load balance concept
- Tool for editor (atom etc)
- Tool for shell (putty / terminal etc)
- Tool for transfer file (winscp / scp)
- Internet for download / upload image



# LabSheet

- <https://tinyurl.com/y8yazrxy>

LabSheet

ไฟล์ แก้ไข ดู แทรก รูปแบบ ข้อมูล เครื่องมือ ส่วนเสริม ความช่วยเหลือ แก้ไขล่าสุด 1 นาทีที่ผ่านมา

Group No

	A	B	C	D	E	F	G	H	I	J
1	Group No	No	Machine Name	Private IP Address	Public IP Address	Role	Username	ssh connect string		Remark
2	1	1	Training_AdvanceDockerwithK8S_StudentG1_1	10.0.1.109	13.229.92.115	Master	ubuntu	ssh -i "docker_lab" ubuntu@ 13.229.92.115		
3		2	Training_AdvanceDockerwithK8S_StudentG1_2	10.0.1.139	13.250.11.169	Worker1	ubuntu	ssh -i "docker_lab" ubuntu@ 13.250.11.169		
4		3	Training_AdvanceDockerwithK8S_StudentG1_3	10.0.1.47	52.221.249.56	Worker2	ubuntu	ssh -i "docker_lab" ubuntu@ 52.221.249.56		
5	2	4	Training_AdvanceDockerwithK8S_StudentG2_1	10.0.1.50	13.229.215.190	Master	ubuntu	ssh -i "docker_lab" ubuntu@ 13.229.215.190		
6		5	Training_AdvanceDockerwithK8S_StudentG2_2	10.0.1.196	13.229.72.95	Worker1	ubuntu	ssh -i "docker_lab" ubuntu@ 13.229.72.95		
7		6	Training_AdvanceDockerwithK8S_StudentG2_3	10.0.1.77	13.229.251.109	Worker2	ubuntu	ssh -i "docker_lab" ubuntu@ 13.229.251.109		
8	3	7	Training_AdvanceDockerwithK8S_StudentG3_1	10.0.1.174	54.169.75.239	Master	ubuntu	ssh -i "docker_lab" ubuntu@ 54.169.75.239		
9		8	Training_AdvanceDockerwithK8S_StudentG3_2	10.0.1.252	13.229.247.143	Worker1	ubuntu	ssh -i "docker_lab" ubuntu@ 13.229.247.143		
10		9	Training_AdvanceDockerwithK8S_StudentG3_3	10.0.1.75	13.229.65.47	Worker2	ubuntu	ssh -i "docker_lab" ubuntu@ 13.229.65.47		
11	4	10	Training_AdvanceDockerwithK8S_StudentG4_1	10.0.1.85	13.229.206.76	Master	ubuntu	ssh -i "docker_lab" ubuntu@ 13.229.206.76		
12		11	Training_AdvanceDockerwithK8S_StudentG4_2	10.0.1.208	13.229.70.154	Worker1	ubuntu	ssh -i "docker_lab" ubuntu@ 13.229.70.154		
13		12	Training_AdvanceDockerwithK8S_StudentG4_3	10.0.1.86	3.0.147.248	Worker2	ubuntu	ssh -i "docker_lab" ubuntu@ 3.0.147.248		
14	5	13	Training_AdvanceDockerwithK8S_StudentG5_1	10.0.1.234	3.0.146.98	Master	ubuntu	ssh -i "docker_lab" ubuntu@ 3.0.146.98		
15		14	Training_AdvanceDockerwithK8S_StudentG5_2	10.0.1.209	54.255.172.4	Worker1	ubuntu	ssh -i "docker_lab" ubuntu@ 54.255.172.4		
16		15	Training_AdvanceDockerwithK8S_StudentG5_3	10.0.1.207	54.255.136.224	Worker2	ubuntu	ssh -i "docker_lab" ubuntu@ 54.255.136.224		
17	6	16	Training_AdvanceDockerwithK8S_StudentG6_1	10.0.1.134	54.169.204.141	Master	ubuntu	ssh -i "docker_lab" ubuntu@ 54.169.204.141		
18		17	Training_AdvanceDockerwithK8S_StudentG6_2	10.0.1.62	3.0.183.181	Worker1	ubuntu	ssh -i "docker_lab" ubuntu@ 3.0.183.181		
19		18	Training_AdvanceDockerwithK8S_StudentG6_3	10.0.1.95	18.136.199.90	Worker2	ubuntu	ssh -i "docker_lab" ubuntu@ 18.136.199.90		
20	7	19	Training_AdvanceDockerwithK8S_StudentG7_1	10.0.1.202	3.0.176.230	Master	ubuntu	ssh -i "docker_lab" ubuntu@ 3.0.176.230		
21		20	Training_AdvanceDockerwithK8S_StudentG7_2	10.0.1.41	3.0.94.126	Worker1	ubuntu	ssh -i "docker_lab" ubuntu@ 3.0.94.126		
22		21	Training_AdvanceDockerwithK8S_StudentG7_3	10.0.1.81	3.0.54.130	Worker2	ubuntu	ssh -i "docker_lab" ubuntu@ 3.0.54.130		
23	8	22	Training_AdvanceDockerwithK8S_StudentG8_1	10.0.1.65	3.0.98.215	Master	ubuntu	ssh -i "docker_lab" ubuntu@ 3.0.98.215		
24		23	Training_AdvanceDockerwithK8S_StudentG8_2	10.0.1.93	18.136.210.250	Worker1	ubuntu	ssh -i "docker_lab" ubuntu@ 18.136.210.250		
25		24	Training_AdvanceDockerwithK8S_StudentG8_3	10.0.1.146	54.254.214.135	Worker2	ubuntu	ssh -i "docker_lab" ubuntu@ 54.254.214.135		
26	9	25	Training_AdvanceDockerwithK8S_StudentG9_1	10.0.1.154	54.255.138.111	Master	ubuntu	ssh -i "docker_lab" ubuntu@ 54.255.138.111		
27		26	Training_AdvanceDockerwithK8S_StudentG9_2	10.0.1.223	3.0.92.216	Worker1	ubuntu	ssh -i "docker_lab" ubuntu@ 3.0.92.216		
28		27	Training_AdvanceDockerwithK8S_StudentG9_3	10.0.1.224	3.0.17.138	Worker2	ubuntu	ssh -i "docker_lab" ubuntu@ 3.0.17.138		
29	10	28	Training_AdvanceDockerwithK8S_StudentG10_1	10.0.1.55	13.250.38.8	Master	ubuntu	ssh -i "docker_lab" ubuntu@ 13.250.38.8		
30		29	Training_AdvanceDockerwithK8S_StudentG10_2	10.0.1.149	52.221.184.17	Worker1	ubuntu	ssh -i "docker_lab" ubuntu@ 52.221.184.17		
31		30	Training_AdvanceDockerwithK8S_StudentG10_3	10.0.1.17	3.0.50.103	Worker2	ubuntu	ssh -i "docker_lab" ubuntu@ 3.0.50.103		

Present by: Praparn L. (eva10409@gmail.com)



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# Lab Resource

- Repository for lab

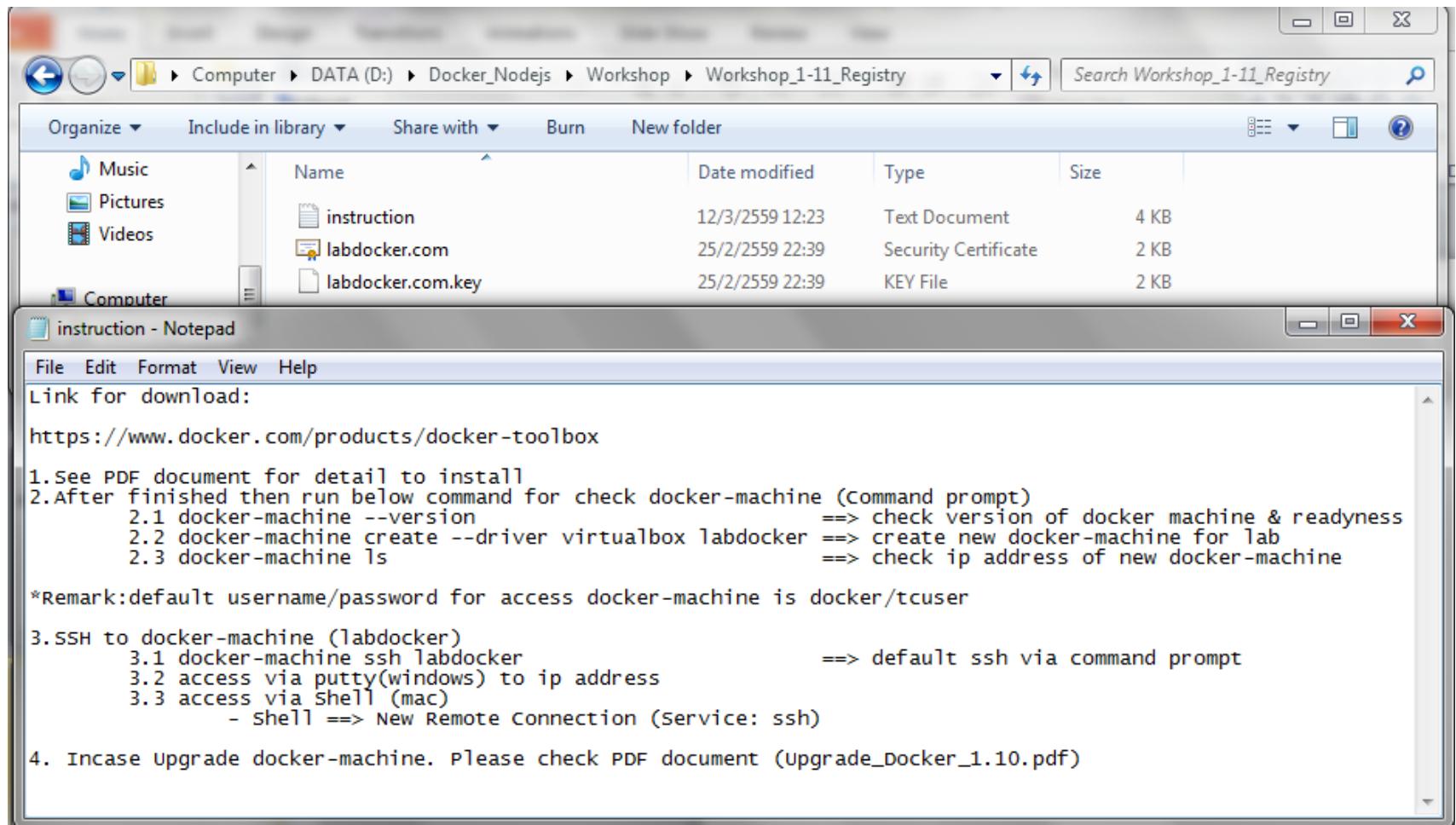
The screenshot shows a search results page for 'labdocker' on a platform that uses a Docker icon in its interface. The search bar at the top contains 'labdocker'. Below the search bar, there is a dropdown menu set to 'All'. The results list three public repositories:

Repository	Type	Stars	Pulls	Details
labdocker/alpineweb	public	0	31	<a href="#">DETAILS</a>
labdocker/nginx	public	0	16	<a href="#">DETAILS</a>
labdocker/alpine	public	0	7	<a href="#">DETAILS</a>



# Lab Resource

- Software in lab



# Lab Resource

- Download on Google Drive
  - <http://tinyurl.com/yxoe8aj6>
- Download on GitHub
  - Git clone [https://github.com/praparn/kubernetes\\_201904](https://github.com/praparn/kubernetes_201904)

No description, website, or topics provided.

Branch: master ▾ New pull request

File	Created	Last Commit
praparn 2017110214055	2017/11/02 14:05:55	2017/11/02 14:05:55
WorkShop_1.1_Install_Kubernetes	2017/11/02 14:05:55	2017/11/02 14:05:55
WorkShop_1.2_Pods_Service_Deployment	2017/11/02 14:05:55	2017/11/02 14:05:55
WorkShop_1.3_Replication_Controller	2017/11/02 14:05:55	2017/11/02 14:05:55
WorkShop_1.4_Deployment	2017/11/02 14:05:55	2017/11/02 14:05:55
WorkShop_1.5_Volume	2017/11/02 14:05:55	2017/11/02 14:05:55
WorkShop_1.6_Liveness_Readiness_Probe	2017/11/02 14:05:55	2017/11/02 14:05:55
WorkShop_1.7_Resource_Management_and_HPA	2017/11/02 14:05:55	2017/11/02 14:05:55
WorkShop_2.1_ConfigMap_Secret	2017/11/02 14:05:55	2017/11/02 14:05:55
WorkShop_2.3_Log_and_Monitoring	2017/11/02 14:05:55	2017/11/02 14:05:55
WorkShop_2.4_Ingress_Network	2017/11/02 14:05:55	2017/11/02 14:05:55
WorkShop_2.5_Kubernetes_RealWorld	2017/11/02 14:05:55	2017/11/02 14:05:55
WorkShop_2.6_Orchestrator_Assignment	2017/11/08235628	2 days ago
WorkShop_2.7_Persistent_Storage	2017/11/10	23 hours ago
Workshop_2.2_Job_CronJob	2017/11/02 14:05:55	an hour ago
.DS_Store	2017/11/0003943	22 hours ago
Kubernetes_Training_master.pdf	2017/11/0003943	22 hours ago
Untitled-1	2017/11/02 14:05:55	an hour ago



# Workshop 1.1: Install Kubernetes



Kubernetes: Production Workload Orchestration



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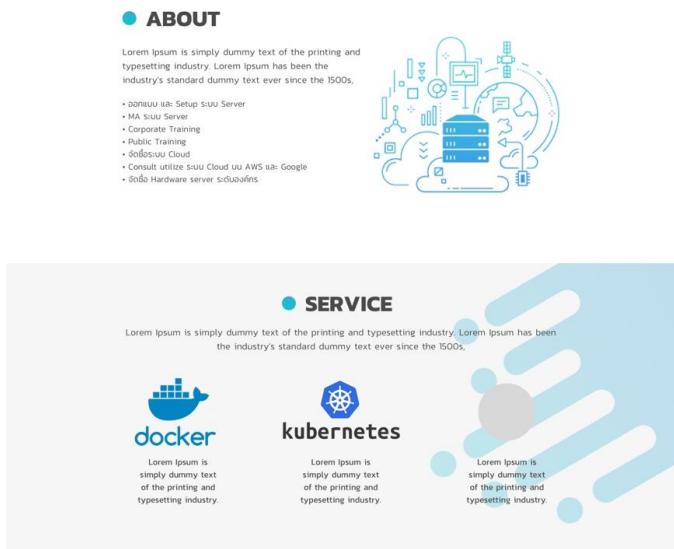
# Workshop 1.1: Install Kubernetes

- LAB Sheet
- <https://tinyurl.com/y84sh9zv>

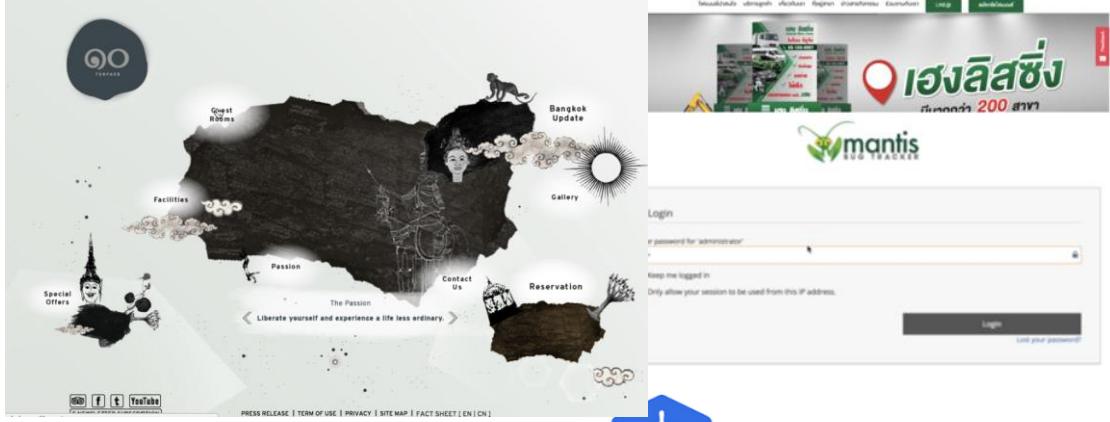
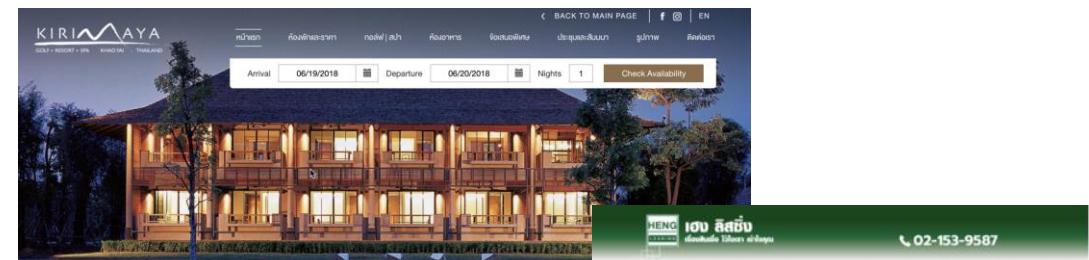
Table No	Group No	No	Public IP Address	Private IP Address	Role
1	1	1	54.169.12.33	10.0.1.25	Master
		2	54.255.243.139	10.0.1.102	Worker
		3	52.221.203.26	10.0.1.254	Worker
	2	1	13.250.121.106	10.0.1.100	Master
		2	54.255.243.173	10.0.1.202	Worker
		3	52.221.232.245	10.0.1.12	Worker
	3	1	54.169.39.94	10.0.1.169	Master
		2	13.229.72.232	10.0.1.107	Worker
		3	13.250.109.203	10.0.1.135	Worker
2	4	1	13.250.103.188	10.0.1.110	Master
		2	13.229.128.105	10.0.1.199	Worker
		3	54.169.134.39	10.0.1.162	Worker
	5	1	54.255.145.5	10.0.1.32	Master
		2	54.254.218.192	10.0.1.59	Worker
		3	52.221.216.253	10.0.1.166	Worker
3	6	1	13.250.112.82	10.0.1.45	Master
		2	54.254.166.86	10.0.1.50	Worker
		3	52.221.181.188	10.0.1.218	Worker
	7	1	52.221.208.50	10.0.1.182	Master
		2	52.77.249.187	10.0.1.4	Worker
		3	13.250.104.158	10.0.1.173	Worker
4	8	1	54.169.32.99	10.0.1.222	Master
		2	52.221.191.74	10.0.1.147	Worker
		3	13.229.80.170	10.0.1.167	Worker



# Who are we ? (Opcellent)



A screenshot of an event listing on a platform like Meetup. It shows logos for HENG LEASING, GDG Chiang Mai, and ARTISAN DIGITAL. The event is titled "Advanced Docker and Kubernetes 101" and is presented by Praparn Lungpoonlap. It's scheduled for Saturday, 12 May 2018, from 6pm to 9pm at Punspace Tha Pae Gate. A note says "FREE FOOD AND BEER! - BUT PLEASE BRING YOUR OWN LAPTOP :)"



Present by: Praparn L. (eva10409@gmail.com)



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# Kubernetes 1.13.X



Documentation Blog Partners Community Case Studies English ^ v1.13 ^

## Kubernetes 1.13 Release Notes

### Security Content

- CVE-2018-1002105, a critical security issue in the Kubernetes API Server, is resolved in v1.13.0 (and in [v1.10.11](#), [v1.11.5](#), and [v1.12.3](#)). We recommend all clusters running previous versions update to one of these releases immediately. See issue [#71411](#) for details.

### Urgent Upgrade Notes

(No, really, you MUST do this before you upgrade)

Before upgrading to Kubernetes 1.13, you must keep the following in mind:

- kube-apiserver
  - The deprecated `etcd2` storage backend has been removed. Before upgrading a kube-apiserver using `--storage-backend=etcd2`, etcd v2 data must be migrated to the v3 storage backend, and kube-apiserver invocations changed to use `--storage-backend=etcd3`. Please consult the installation procedure used to set up etcd for specific migration instructions. Backups prior to upgrade are always a good practice, but since the etcd2 to etcd3 migration is not reversible, an etcd backup prior to migration is essential.
  - The deprecated `--etcd-quorum-read` flag has been removed. Quorum reads are now always enabled when fetching data from etcd. Remove the `--etcd-quorum-read` flag from kube-apiserver invocations before upgrading.
- kube-controller-manager
  - The deprecated `--insecure-experimental-approve-all-kubelet-csrs-for-group` flag has been removed.
- kubelet
  - The deprecated `--google-json-key` flag has been removed. Remove the `--google-json-key` flag from kubelet invocations before upgrading. ([#69354](#), [@yujuhong](#))
  - DaemonSet pods now make use of scheduling features that require kubelets to be at 1.11 or above. Ensure all kubelets in the cluster are at 1.11 or above before upgrading kube-controller-manager to 1.13.
  - The schema for the alpha `CSINodeInfo` CRD has been split into `spec` and `status` fields, and new fields `status.available` and `status.volumePluginMechanism` added. Clusters using the previous alpha schema must delete and recreate the CRD using the new schema. ([#70515](#), [@davidz627](#))

Ref: <https://kubernetes.io/docs/setup/release/notes/>



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# Kubernetes 1.13.X



[Documentation](#) [Blog](#) [Partners](#) [Community](#) [Case Studies](#) [English ^](#) [v1.13 ^](#)

## SIG Cloud Provider

For v1.13, SIG Cloud Provider has been focused on stabilizing the common APIs and interfaces consumed by cloud providers today. This involved auditing the cloud provider APIs for anything that should be deprecated as well as adding changes where necessary. In addition, SIG Cloud Provider has begun exploratory work around having a “cloud provider” e2e test suite which can be used to test common cloud provider functionalities with resources such as nodes and load balancers.

We are also continuing our long running effort to extract all the existing cloud providers that live in k8s.io/kubernetes into their own respective repos. Along with this migration, we are slowly transitioning users to use the cloud-controller-manager for any cloud provider features instead of the kube-controller-manager.

## SIG Cluster Lifecycle

For 1.13 SIG Cluster Lifecycle is pleased to announce the long awaited promotion of kubeadm to stable GA, and the promotion of kubeadm’s configuration API to `v1beta1`. In this release the SIG again focused on further improving the user experience on cluster creation and also fixing a number of bugs and other assorted improvements.

Some notable changes in kubeadm since Kubernetes 1.12:

- kubeadm’s configuration API is now `v1beta1`. The new configuration format provides improvements in - image repository management, addons configuration, and other areas. We encourage `v1alpha3` users to migrate to this configuration API using `kubeadm config migrate`, as `v1alpha3` will be removed in 1.14. The documentation for `v1beta1` can be found here: <https://godoc.org/k8s.io/kubernetes/cmd/kubeadm/app/apis/kubeadm/v1beta1>
- kubeadm has graduated `kubeadm alpha phase` commands to `kubeadm init phase`. This means that the phases of creating a control-plane node are now tightly integrated as part of the `init` command. Alpha features, not yet ready for GA are still kept under `kubeadm alpha` and we appreciate feedback on them.
- `kubeadm init` and `kubeadm init phase` now have a `--image-repository` flag, improving support for environments with limited access to official kubernetes repository.
- The DynamicKubeletConfig and SelfHosting functionality was moved outside of `kubeadm init` and feature gates and is now exposed under `kubeadm alpha`.
- Kubeadm init phase certs now support the `--csr-only` option, simplifying custom CA creation.
- `kubeadm join --experimental-control-plane` now automatically adds a new etcd member for `local etcd` mode, further simplifying required tasks for HA clusters setup.
- Improvements were made to `kubeadm reset` related to cleaning etcd and notifying the user about the state of iptables.
- kubeadm commands now print warnings if input YAML documents contain unknown or duplicate fields.
- kubeadm now properly recognizes Docker 18.09.0 and newer, but still treats 18.06 as the default supported version.
- kubeadm now automatically sets the `--pod-infra-container-image` flag when starting the kubelet.



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# Kubernetes 1.13.X

## Docker Enterprise Edition 2.1

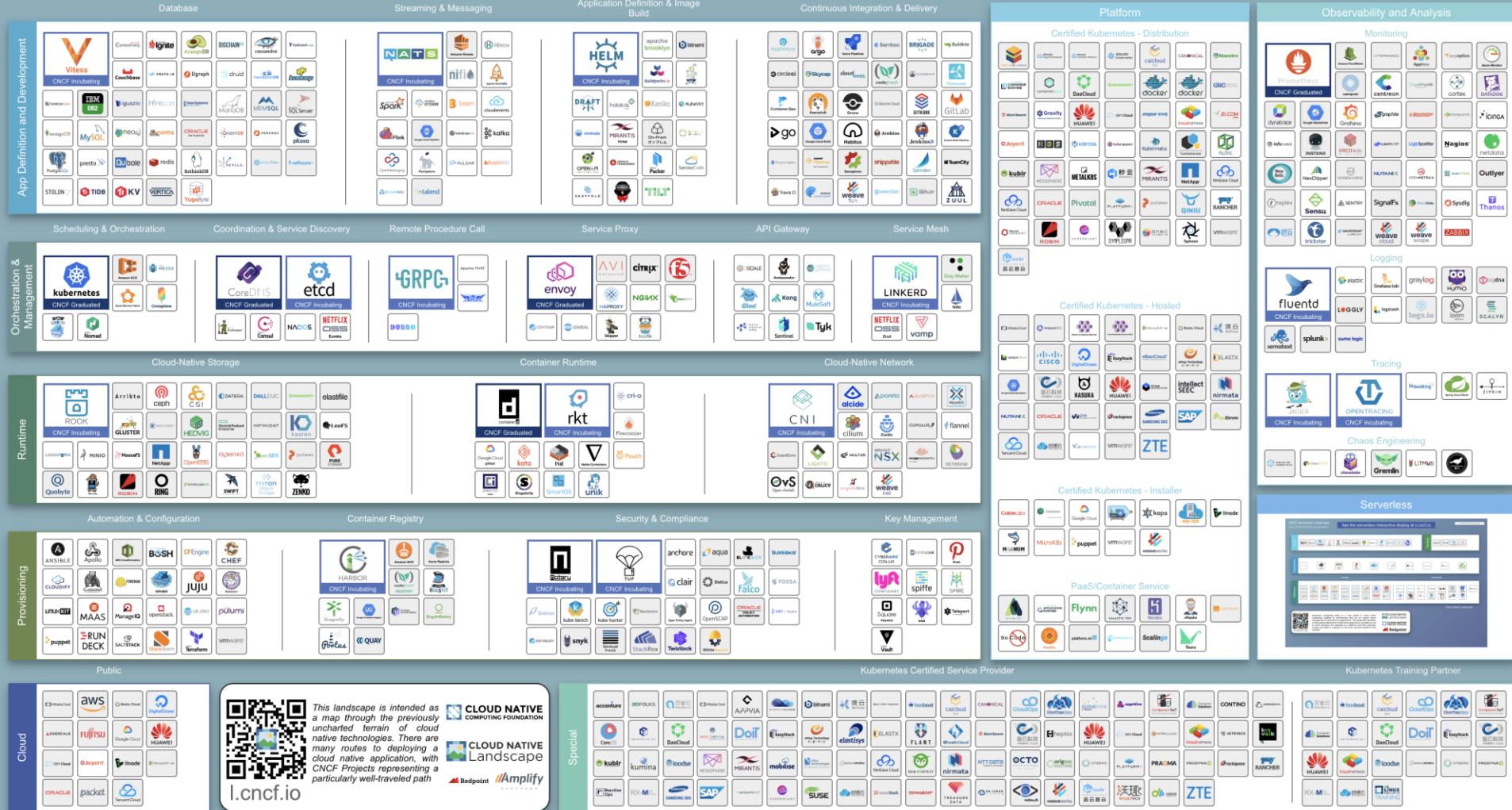
OS Distribution (x86_64)	Enterprise Engine	UCP	DTR	Storage Driver	Orchestration	DTR Storage Backend
RHEL 7.4 <sup>1</sup>	18.09.x	3.1.x	2.6.x	overlay2, devicemapper	Swarm mode, Kubernetes	NFSv4, NFSv3, Amazon S3, S3 Compliant Alternatives, Azure Storage (Blob), Google Cloud Storage, OpenStack Swift, Local Filesystem
RHEL 7.5 <sup>1</sup>	18.09.x	3.1.x	2.6.x	overlay2	Swarm mode, Kubernetes	NFSv4, NFSv3, Amazon S3, S3 Compliant Alternatives, Azure Storage (Blob), Google Cloud Storage, OpenStack Swift, Local Filesystem
RHEL 7.6 <sup>1</sup>	18.09.x	3.1.x starting with 3.1.3	2.6.x starting with 2.6.2	overlay2	Swarm mode, Kubernetes	NFSv4, NFSv3, Amazon S3, S3 Compliant Alternatives, Azure Storage (Blob), Google Cloud Storage, OpenStack Swift, Local Filesystem
SLES 12 SP2 <sup>1</sup>	18.09.x	3.1.x	2.6.x	overlay2, btrfs	Swarm mode, Kubernetes	NFSv4, NFSv3, Amazon S3, S3 Compliant Alternatives, Azure Storage (Blob), Google Cloud Storage, OpenStack Swift, Local Filesystem
SLES 12 SP3 <sup>1</sup>	18.09.x	3.1.x	2.6.x	overlay2,btrfs	Swarm mode, Kubernetes	NFSv4, NFSv3, Amazon S3, S3 Compliant Alternatives, Azure Storage (Blob), Google Cloud Storage, OpenStack Swift, Local Filesystem
SLES 15	18.09.x starting with 18.09.3	3.1.x	2.6.x	overlay2,btrfs	Swarm mode, Kubernetes	NFSv4, NFSv3, Amazon S3, S3 Compliant Alternatives, Azure Storage (Blob), Google Cloud Storage, OpenStack Swift, Local Filesystem
Ubuntu 16.04 <sup>1</sup>	18.09.x	3.1.x	2.6.x	overlay2, aufs	Swarm mode, Kubernetes	NFSv4, NFSv3, Amazon S3, S3 Compliant Alternatives, Azure Storage (Blob), Google Cloud Storage, OpenStack Swift, Local Filesystem
Ubuntu 18.04 <sup>1</sup>	18.09.x	3.1.x	2.6.x	overlay2,aufs	Swarm mode, Kubernetes	NFSv4, NFSv3, Amazon S3, S3 Compliant Alternatives, Azure Storage (Blob), Google Cloud Storage, OpenStack Swift, Local Filesystem
CentOS 7.5 <sup>1</sup>	18.09.x	3.1.x	2.6.x	overlay2, devicemapper	Swarm mode, Kubernetes	NFSv4, NFSv3, Amazon S3, S3 Compliant Alternatives, Azure Storage (Blob), Google Cloud Storage, OpenStack Swift, Local Filesystem
Oracle Linux 7.6 <sup>4</sup>	18.09.x	3.1.x	2.6.x	overlay2, devicemapper <sup>2</sup>	Swarm mode, Kubernetes	NFSv3, Amazon S3, S3 Compliant Alternatives, Azure Storage (Blob), Google Cloud Storage, OpenStack Swift, Local Filesystem
Windows Server 2016	18.09.x	3.1.x <sup>2</sup>	n/a <sup>3</sup>	windowsfilter	Swarm mode	NFSv4, NFSv3, Amazon S3, S3 Compliant Alternatives, Azure Storage (Blob), Google Cloud Storage, OpenStack Swift, Local Filesystem
Windows Server, version 1709	18.09.x	3.1.x <sup>2</sup>	n/a <sup>3</sup>	windowsfilter	Swarm mode	NFSv4, NFSv3, Amazon S3, S3 Compliant Alternatives, Azure Storage (Blob), Google Cloud Storage, OpenStack Swift, Local Filesystem
Windows Server, version 1803	18.09.x	3.1.x <sup>2</sup>	n/a <sup>3</sup>	windowsfilter	Swarm mode	NFSv4, NFSv3, Amazon S3, S3 Compliant Alternatives, Azure Storage (Blob), Google Cloud Storage, OpenStack Swift, Local Filesystem
Windows Server, version 2019	18.09.x	3.1.x starting with 3.1.3 <sup>2</sup>	n/a <sup>3</sup>	windowsfilter	Swarm mode	NFSv4, NFSv3, Amazon S3, S3 Compliant Alternatives, Azure Storage (Blob), Google Cloud Storage, OpenStack Swift, Local Filesystem

Ref: <https://success.docker.com/article/compatibility-matrix?fbclid=IwAR3a0ry4k7zz4ZbqzF4FuHtP5DNj-IhpiR-wc4yj4H6KLUVic3WcJqW7bek>



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# Landscape of the world now



Ref: <https://landscape.cncf.io/>

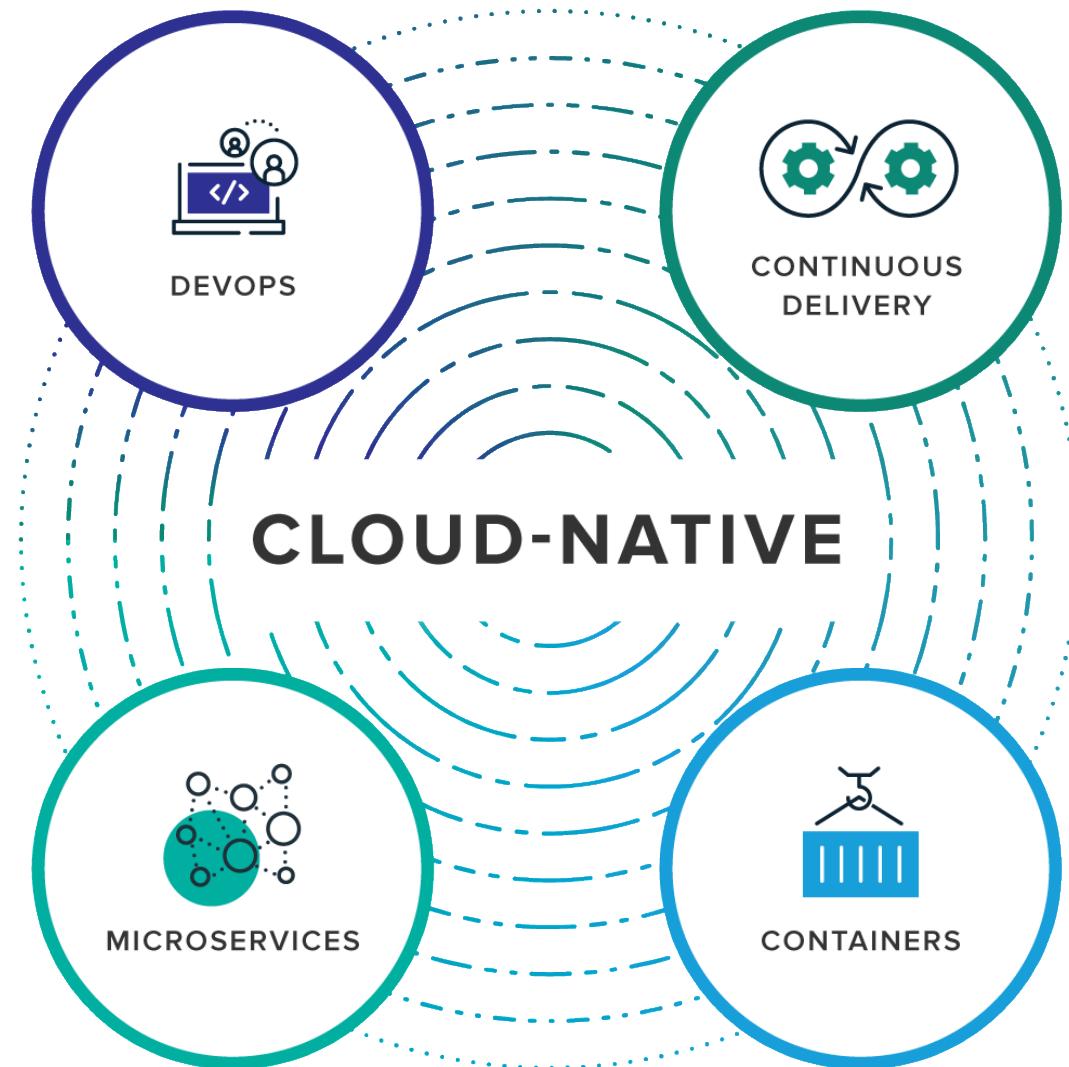
# Kubernetes: Production Workload Orchestration



# kubernetes

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# Landscape of the world now



# Landscape of the world now

## Docker with Swarm and Kubernetes

1 →

The best enterprise container security and management

3 →

Native Kubernetes integration provides full ecosystem compatibility



2 ←

The best container development workflow

4 ←

Industry-standard container runtime

Kubernetes: Production Workload Orchestration



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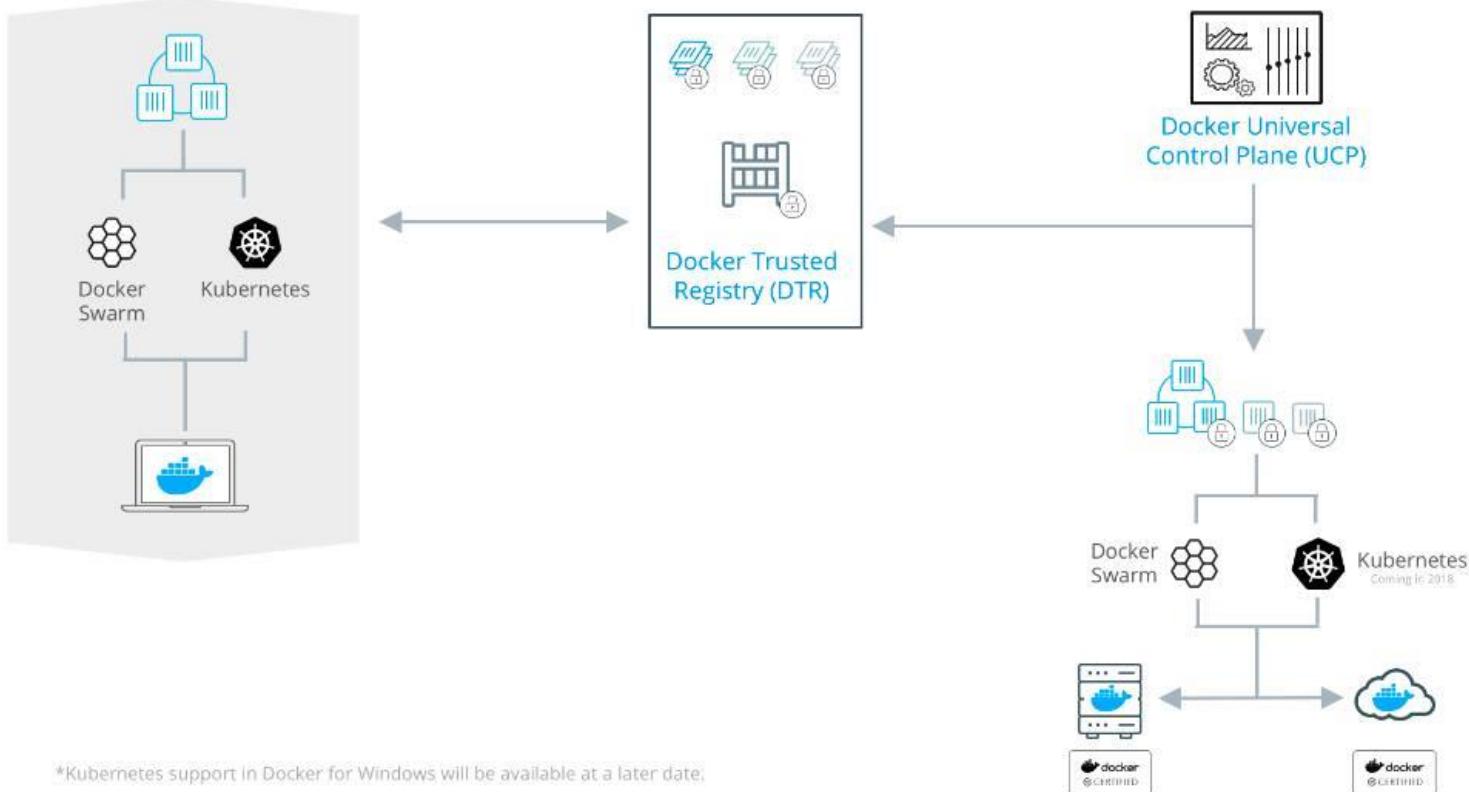
# Landscape of the world now

Docker for Mac  
Docker for Windows\*

Build Test Ship

Docker  
Enterprise Edition

Secure Deploy Manage



Kubernetes: Production Workload Orchestration



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# Landscape of the world now

2018  
Docker  
Usage  
Report.

## Orchestrators for Docker containers

**Key assessment:** First place goes to Kubernetes, followed by Kubernetes and then Kubernetes.

Sysdig [ServiceVision™](#) automatically identifies orchestrators in use, correlating logical infrastructure objects with container metrics. This awareness tells us what orchestrators are deployed by customers. In the 2018 study [Kubernetes](#) retained the hold on the lead position. No real surprise there as the past year has seen the market evolve and Kubernetes embraced seemingly across the board.

For example, Microsoft uses Kubernetes for its [Azure Kubernetes Service \(AKS\)](#), as does IBM with its [Cloud Container Service](#) and [Cloud Private](#) offering. Even Docker and Mesosphere have added support and functionality for Kubernetes.

This means clear lines of demarcation no longer exist as they did in previous years.

For instance, Mesosphere is able to deploy and manage "Kubernetes-as-a-service" in a DC/OS environment. Multiple Kubernetes clusters may be deployed under a single Mesosphere cluster. We did not identify where customers use both orchestrators, but will in the future.

Docker Swarm climbed into the second slot in this year's study, surpassing Mesos-based tools. Given Docker has embraced Kubernetes, we didn't expect this. Possible drivers include:

1. Swarm's barrier to entry is incredibly low. While it may not have all the features of Kubernetes, as more people start with containers this may be the first stop in orchestration.

2. Docker Enterprise Edition, featuring the Universal Control Plane (UCP) has simplified many operational aspects of getting started with Swarm. Since Docker's Kubernetes tie-in came late in 2017, any change in adoption in our customer base from Swarm to Kubernetes might be still forthcoming.



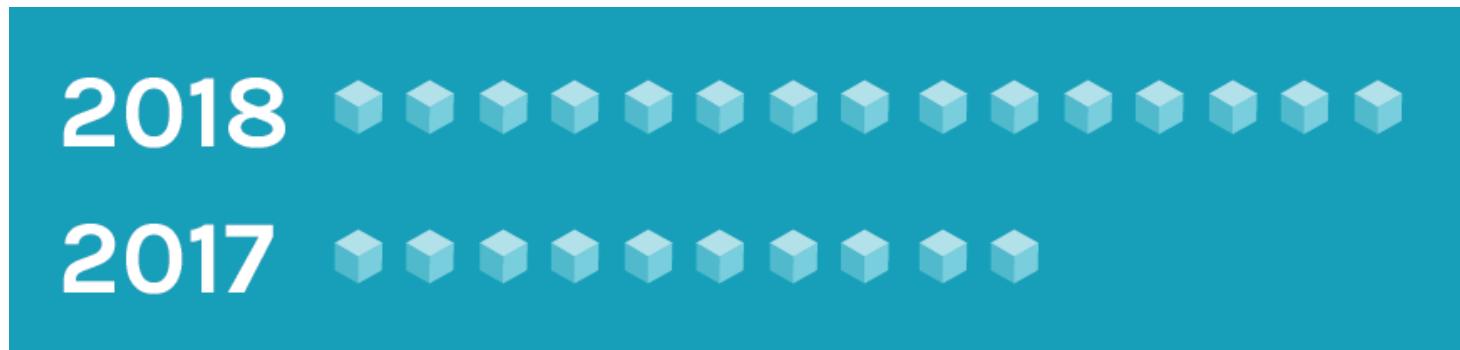
Figure 8. Kubernetes and Swarm grow orchestrator share, Mesos shrinks.

# Ultimate goals is application

- Most application component on container



- Median container density per host rises 50% (Per year)



# Ultimate goals is application

- Max container housing per single host is 154 containers !!! (2017: 95) (Docker Native)

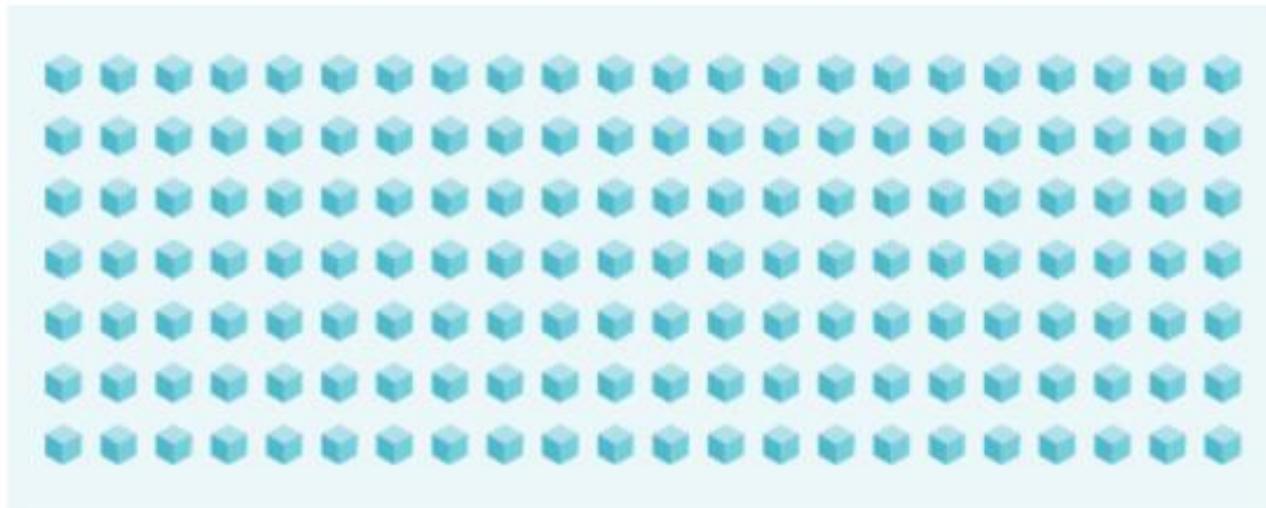
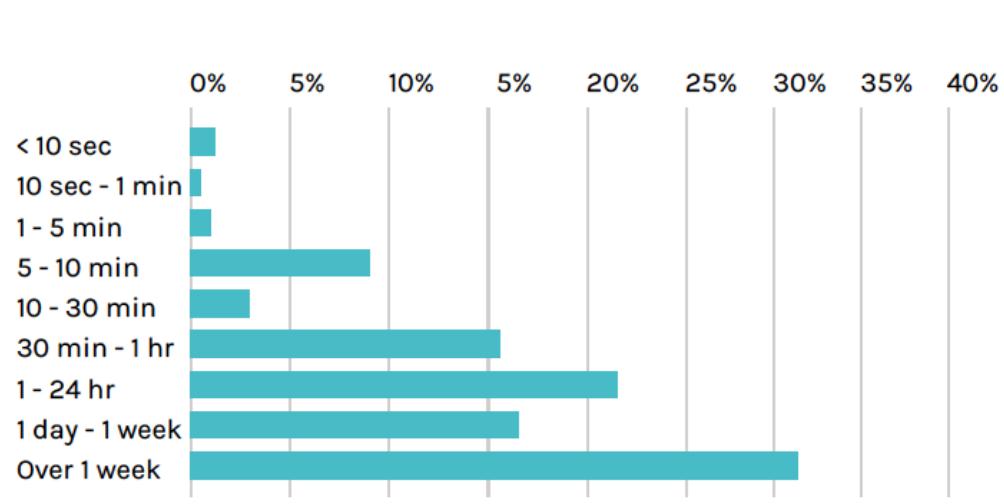
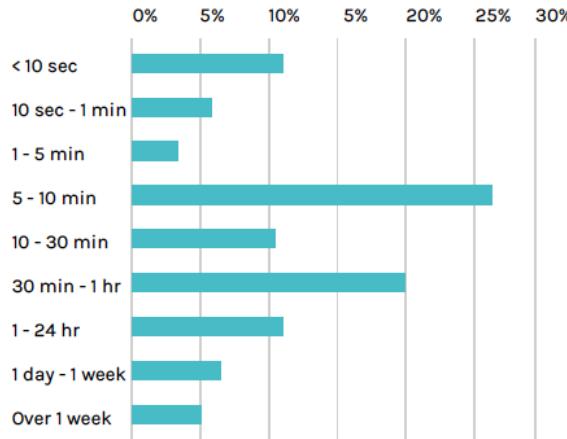


Figure 3. Max density observed: 154 containers

# Ultimate goals is application

- Lifespan of containers and service (95% less than a week)
- (Container Run Time) (Image Live Time)

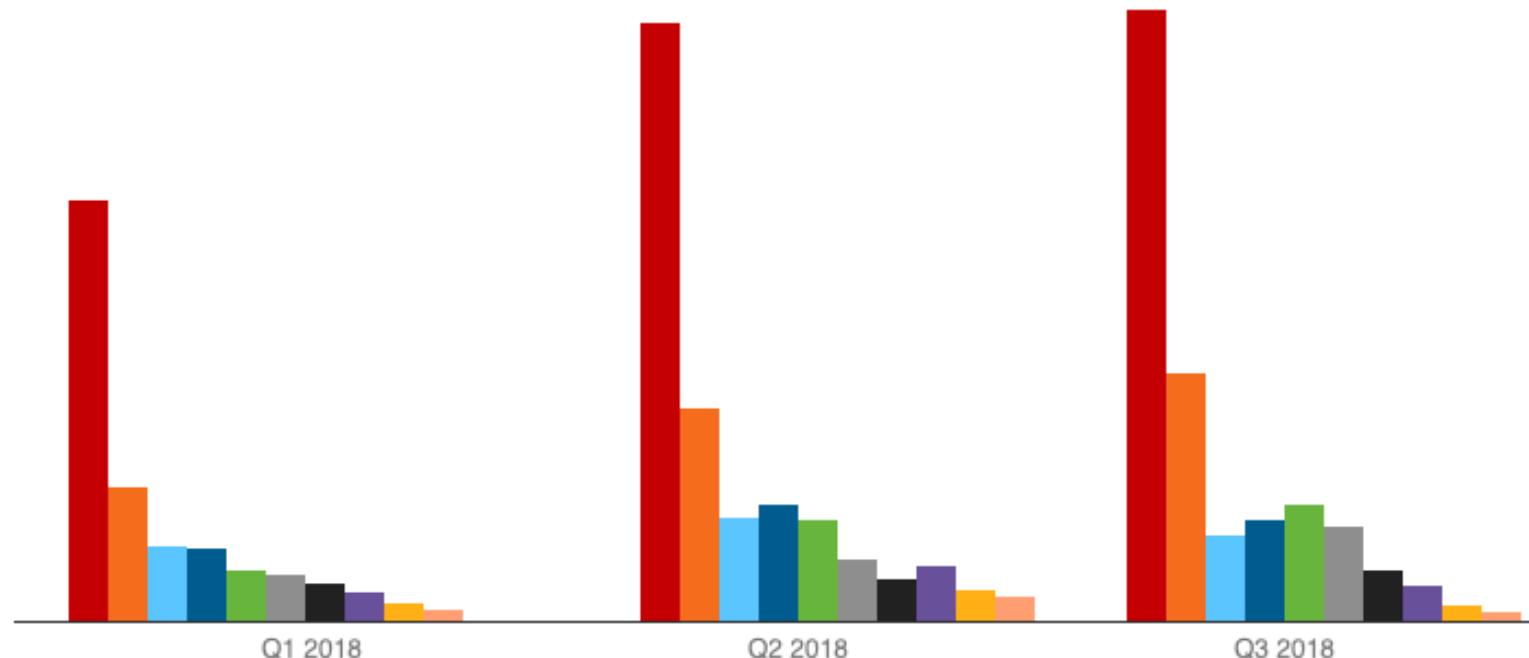


# Landscape of the world now

## The Top Tech Skills of 2018

Recruiters and hiring managers want developers skilled in Kubernetes and Terraform, but upstart skills like Kotlin are also in high demand.

■ Kubernetes ■ Terraform ■ TensorFlow ■ Blockchain ■ Kotlin ■ Automation Anywhere ■ GraphQL  
■ Ethereum ■ Keras ■ Cryptocurrencies



All data gathered via the Dice jobs database

Source: [Dice](#)

Kubernetes: Production Workload Orchestration



kubernetes  
by Google

# Landscape of the world now

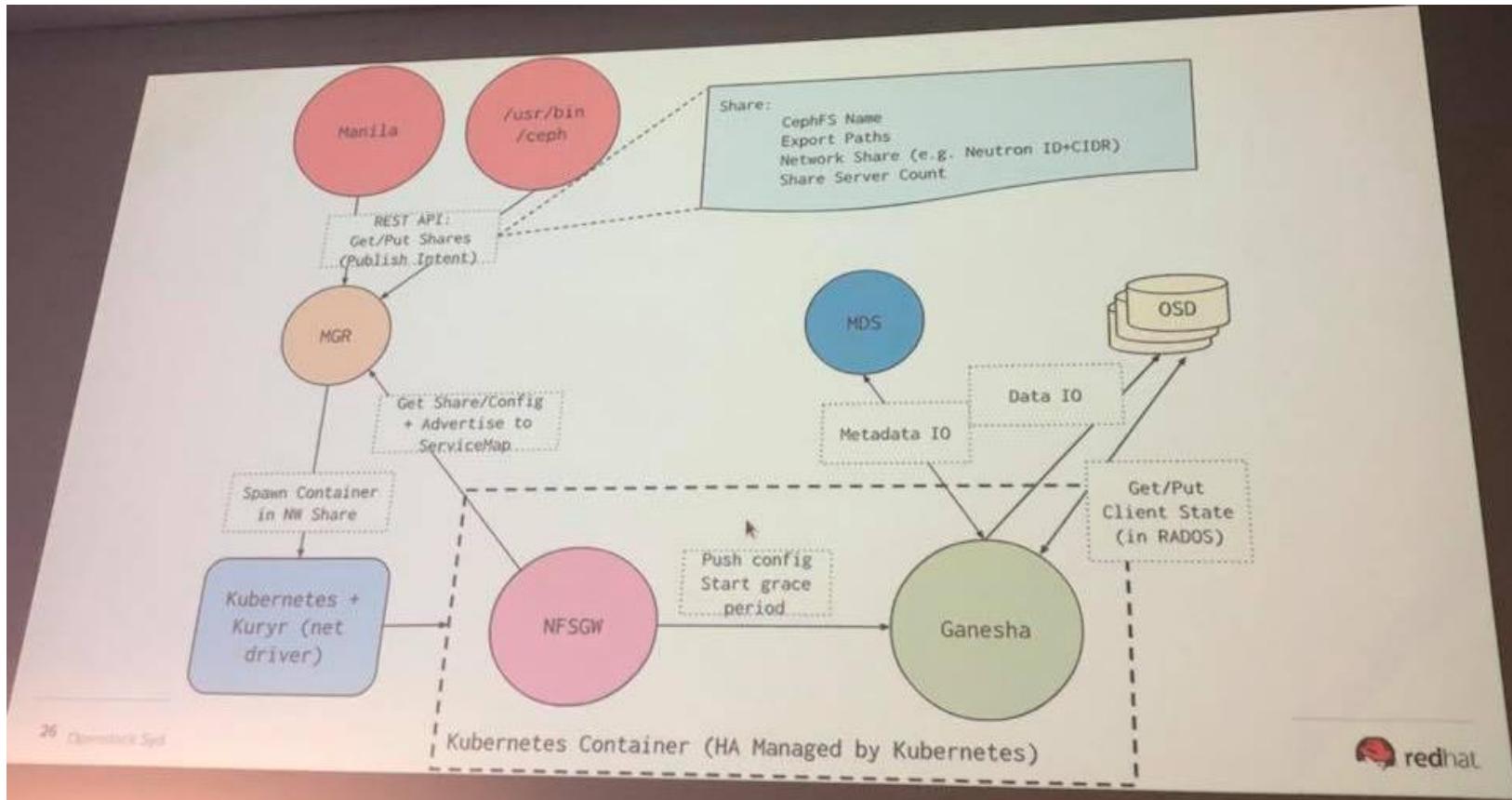
Cloud computing, ecommerce tech skill searches growing fast

## Year-over-year growth

Rank	Skill	Job search growth	Rank	Skill	Job search growth
1	Kubernetes	173%	11	Azure	53%
2	Magento	116%	12	Spanish	46%
3	Verilog	89%	13	Django	45%
4	Golang	81%	14	PHP	45%
5	Ansible	72%	15	Blockchain	44%
6	Autocad	71%	16	A+	44%
7	Laravel	66%	17	Siebel	43%
8	React	61%	18	Chinese	38%
9	Node.js	57%	19	CCNA	32%
10	C	54%	20	HTML	30%



# Landscape of the world now

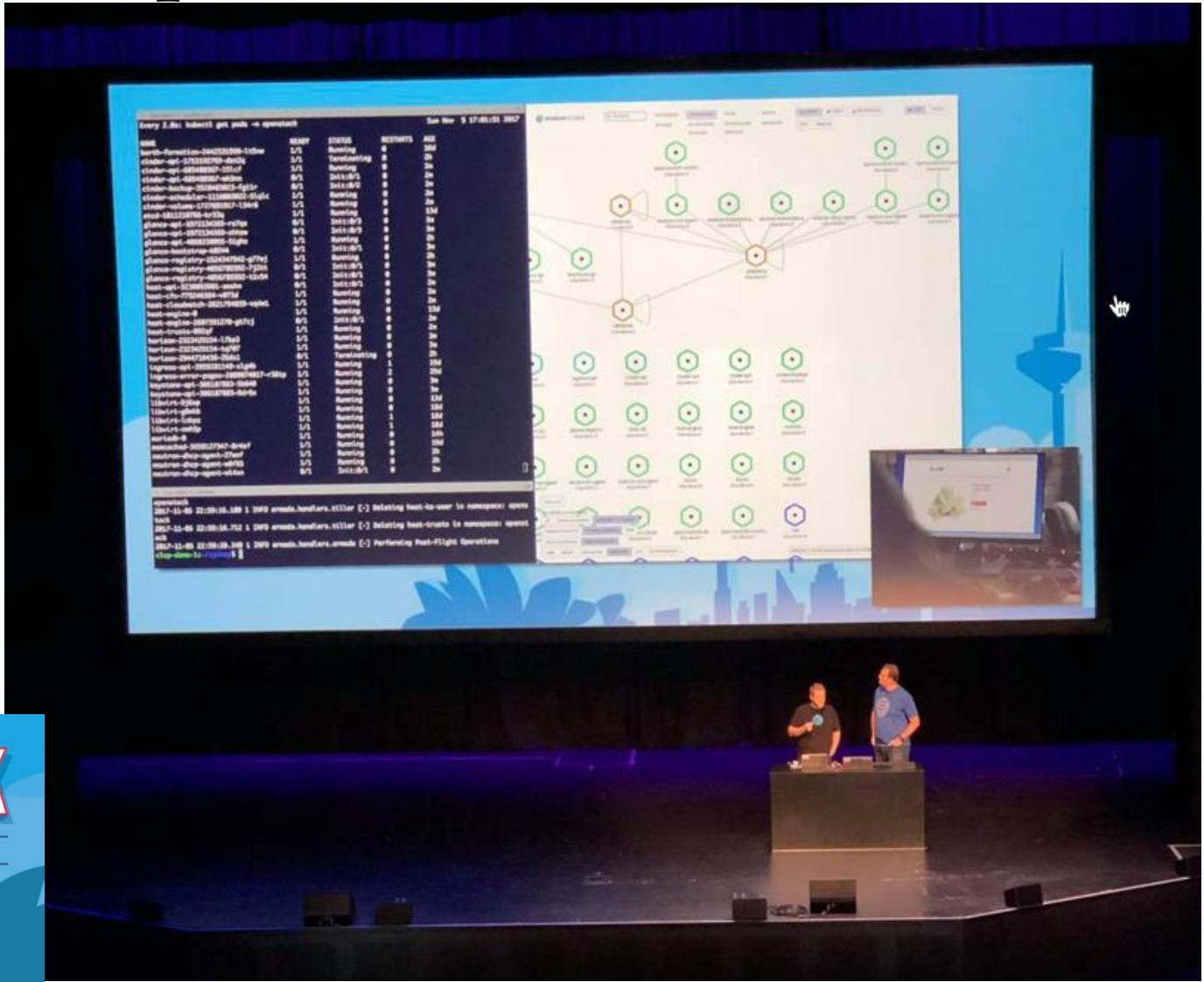


Kubernetes: Production Workload Orchestration



kubernetes  
by Google

# Landscape of the world now



Kubernetes: Production Workload Orchestration



kubernetes  
by Google

# Landscape of the world now



The banner features the Red Hat logo at the top left. To its right are five navigation links: Technologies, Services & support, Success stories, and About Red Hat. Below these is a "PRESS RELEASE" button. The main title, "Red Hat Improves IT Flexibility and Reduces Complexity with Linux Containers in Latest Version of Production-Ready OpenStack Platform", is displayed prominently in white text on a blue background. A subtext below it reads: "Red Hat OpenStack Platform 12 introduces containerized services and improves overall platform security". The background of the banner shows a blurred image of a road at night with streetlights.



SYDNEY – OpenStack Summit Sydney 2017 – November 6, 2017 – Red Hat, Inc. (NYSE: RHT), the world's leading provider of open-source solutions, today announced Red Hat OpenStack Platform 12, the latest version of Red Hat's massively scalable and agile cloud Infrastructure-as-a-Service (IaaS). Based on the OpenStack "Pike" release, Red Hat OpenStack Platform 12 introduces containerized services, improving flexibility while decreasing complexity for faster application development. Red Hat OpenStack Platform 12 delivers many new enhancements, including upgraded DCI (distributed continuous integration) and improved security to help maintain data compliance and manage risk.

**“To achieve the benefits offered by digital transformation, enterprises need to update their infrastructure to better support the next-generation of applications that take**

Kubernetes: Production Workload Orchestration



**kubernetes**  
by Google

# Landscape of the world now



Zippyzippys Chantaban

July 21 at 4:30 AM ·

...



- เตือนฟรี
- เตือนตั้งแต่บาทแรก
- เตือนกันที เมื่อมีความเคลื่อนไหวบัญชี



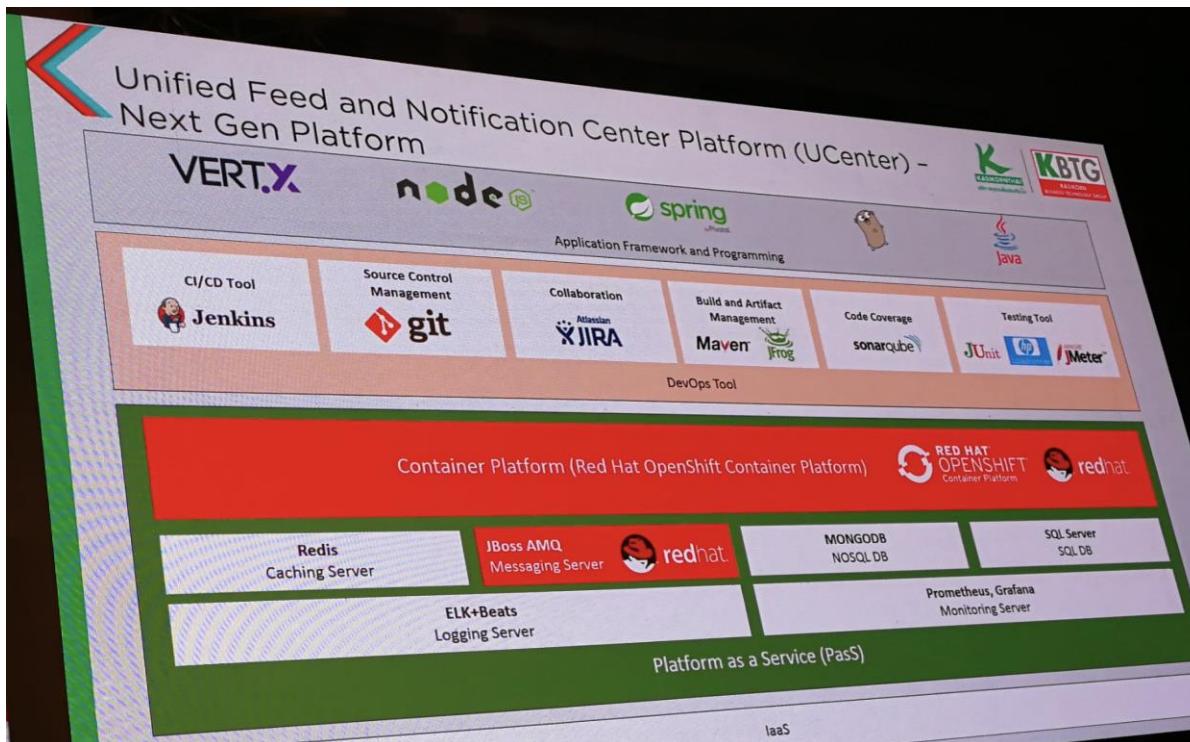
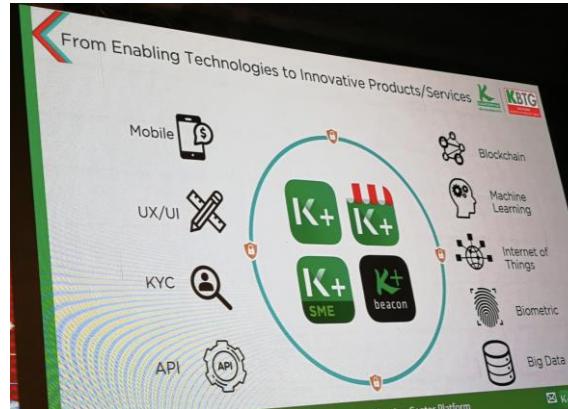
kubernetes  
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# Landscape of the world now



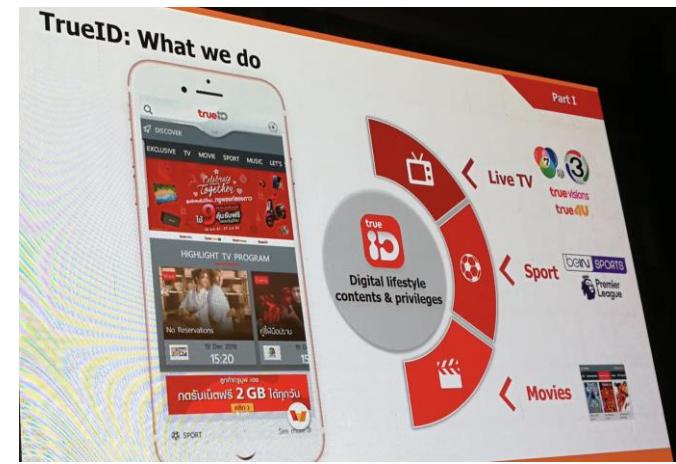
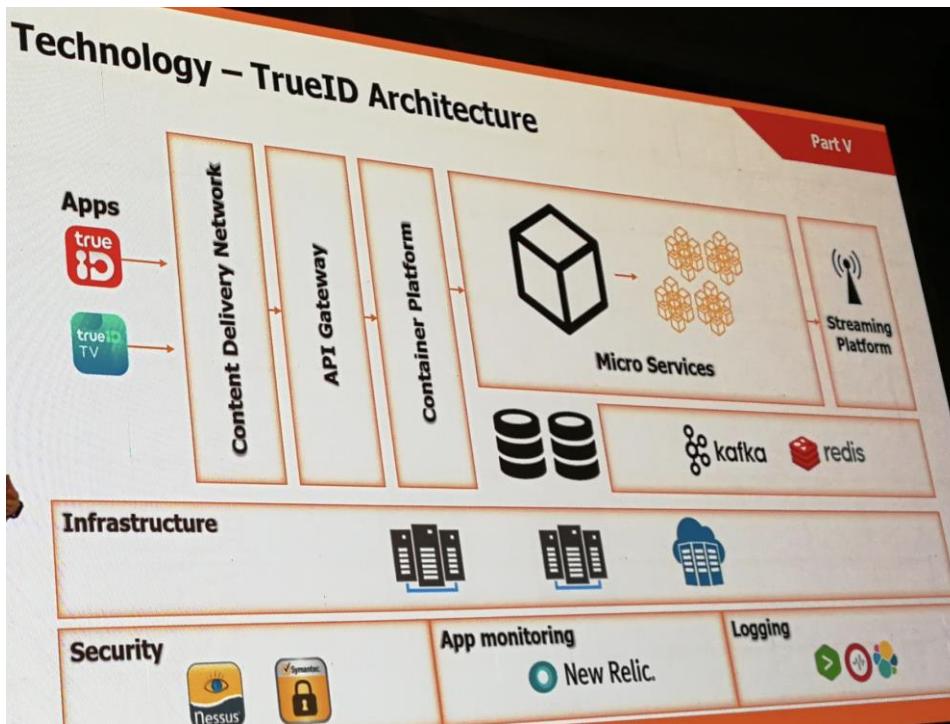
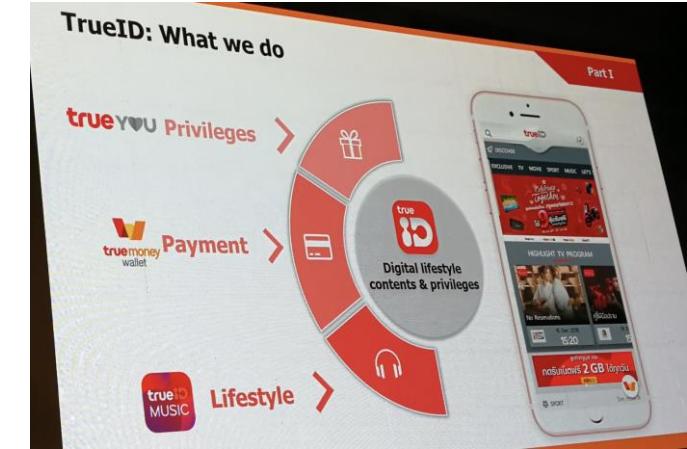
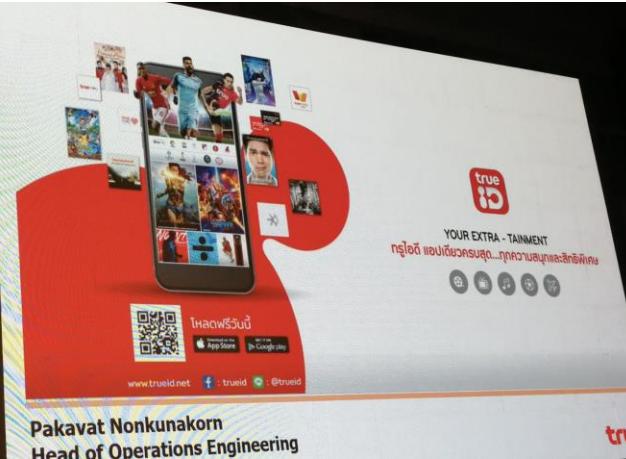
kubernetes  
by Google

# Landscape of the world now



kubernetes  
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# Landscape of the world now



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# Container Principle

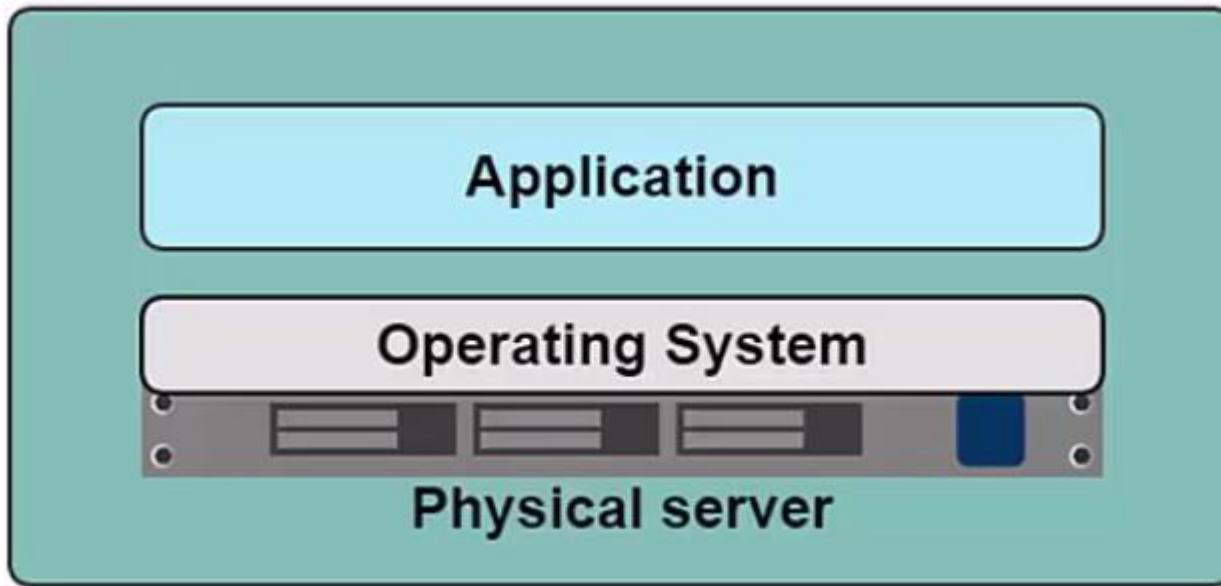


Kubernetes: Production Workload Orchestration



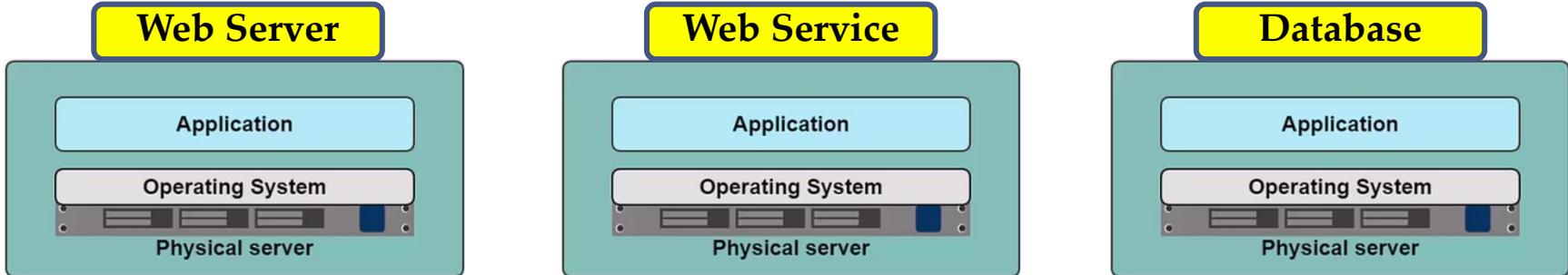
**kubernetes**  
by Google

# Container Principle



# Existing Technology

- Production Environment (Best design)
- Day 1: Application 1: Implement



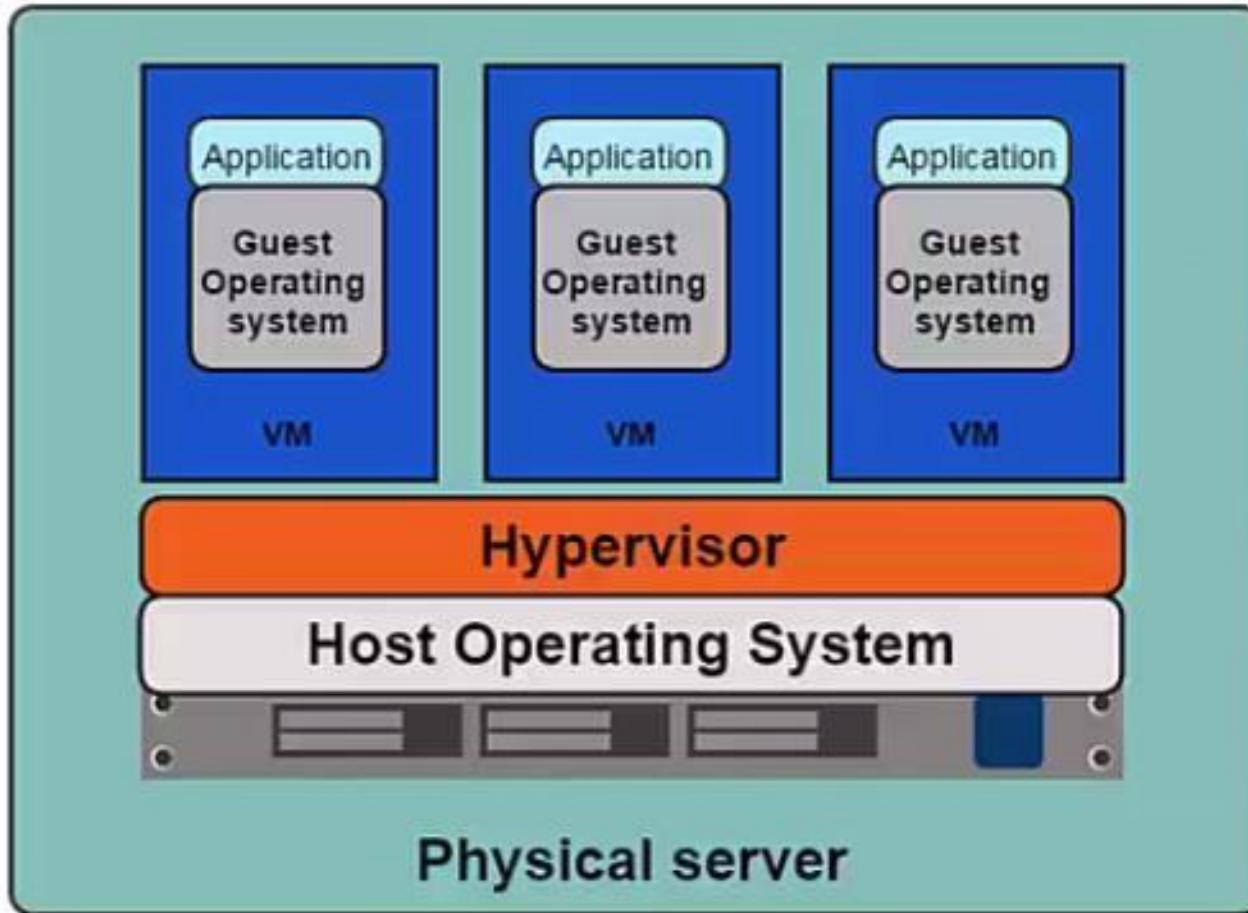
- Apache 2.20 Web Server
- PHP 5.5 Engine
- Laravel 4.1 Framework

- IIS 8
- .Net Framework 3.5

- MariaDB 5.1

- Day 2: Application 2: Need to implement
  - Need PHP 7.0 ?
  - MariaDB 10.1.14 (Need search feature on 10.1)
- Problem ?
  - Possible to upgrade PHP to 7.0 ? / How to test existing application ?
  - What effect to MariaDB upgrade ?

# Container Principle



# Container Principle

- Production Environment
- Day 1: Application 1: Implement



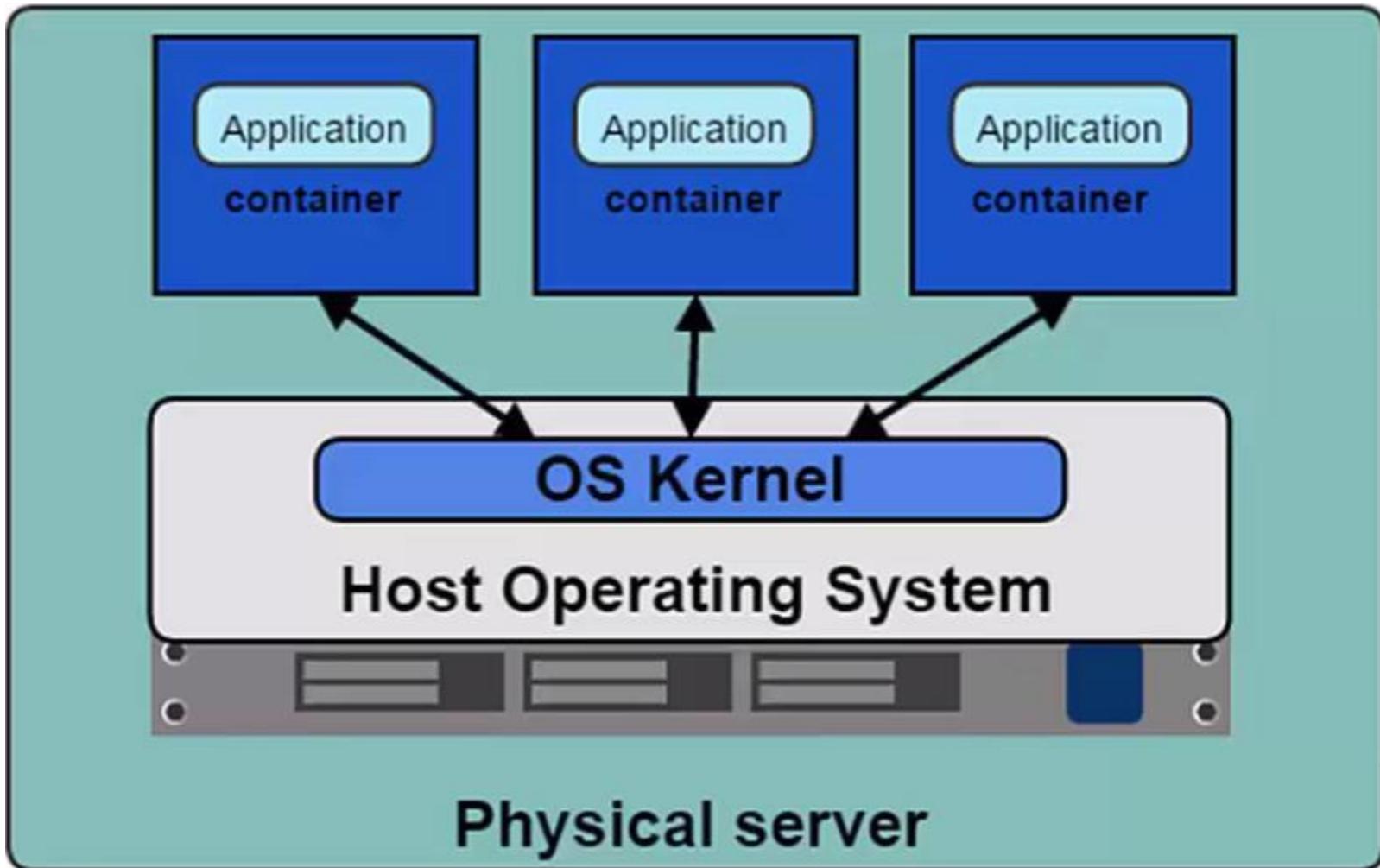
- Apache 2.20 Web Server
- PHP 5.5 Engine
- Laravel 4.1 Framework

- IIS 8
- .Net FrameWork 3.5

- MariaDB 5.1

- Day 2: Application 2: Need to implement
  - Need PHP 7.0 ?
  - MariaDB 10.1.14 (Need search feature on 10.1)
- So... The problem still exist.

# Container Principle



# Container Principle

Mechanism	Operating system	License	Available since/between	Features									
				File system isolation	Copy on Write	Disk quotas	I/O rate limiting	Memory limits	CPU quotas	Network isolation	Nested virtualization	Partition checkpointing and live migration	Root privilege isolation
chroot	most UNIX-like operating systems	varies by operating system	1982	Partial <sup>[3]</sup>	No	No	No	No	No	No	Yes	No	No
Docker Linux-VServer (security context)	Linux <sup>[7]</sup>	Apache License 2.0	2013	Yes	Yes	Not directly	Not directly	Yes	Yes	Yes	Yes	No	No
		GNU GPLv2	2001	Yes	Yes	Yes	Yes <sup>[8]</sup>	Yes	Yes	Partial <sup>[9]</sup>	?	No	Partial <sup>[9]</sup>
lxc LXC	Linux	Apache License 2.0	2013	Yes	Yes	Yes	Yes <sup>[9]</sup>	Yes	Yes	Partial <sup>[9]</sup>	?	No	Partial <sup>[9]</sup>
		GNU GPLv2	2008	Yes <sup>[10]</sup>	Yes	Partial <sup>[11]</sup>	Partial <sup>[11]</sup>	Yes	Yes	Yes	Yes	No	Yes <sup>[10]</sup>
LXD	Linux	Apache License 2.0	2015	Yes	Yes	Partial (see LXC)	Partial (see LXC)	Yes	Yes	Yes	Yes	Partial <sup>[12]</sup>	Yes
OpenVZ	Linux	GNU GPLv2	2005	Yes	No	Yes	Yes <sup>[13]</sup>	Yes	Yes	Yes <sup>[13]</sup>	Partial <sup>[13]</sup>	Yes	Yes <sup>[13]</sup>
Virtuozzo	Linux, Windows	Proprietary	2000 <sup>[14]</sup>	Yes	Yes	Yes	Yes <sup>[14]</sup>	Yes	Yes	Yes <sup>[14]</sup>	Partial <sup>[14]</sup>	Yes	Yes
Solaris Containers (Zones)	illumos (OpenSolaris), Solaris	CDDL, Proprietary	2004	Yes	Yes (ZFS)	Yes	Partial <sup>[15]</sup>	Yes	Yes	Yes <sup>[16][17][18]</sup>	Partial <sup>[15]</sup>	Partial <sup>[16][17]</sup>	Yes <sup>[15]</sup>
FreeBSD jail	FreeBSD	BSD License	2000 <sup>[20]</sup>	Yes	Yes (ZFS)	Yes <sup>[19]</sup>	No	Yes <sup>[21]</sup>	Yes	Yes <sup>[22]</sup>	Yes	No	Yes <sup>[23]</sup>
sysjail	OpenBSD, NetBSD	BSD License	2006–2009 (As of March 3, 2009, it is no longer supported)	Yes	No	No	No	No	No	Yes	No	No	?
WPARs	AIX	Proprietary	2007	Yes	No	Yes	Yes	Yes	Yes	Yes <sup>[24]</sup>	No	Yes <sup>[25]</sup>	?
HP-UX Containers (SRP) <sup>[9]</sup>	HPUX	Proprietary	2007	Yes	No	Partial <sup>[16]</sup>	Yes	Yes	Yes	Yes	?	Yes	?
iCore Virtual Accounts	Windows XP	Proprietary/Freeware	2008	Yes	No	Yes	No	No	No	No	?	No	?
Sandboxie Spoon	Windows	Proprietary/Shareware	2004	Yes	Yes	Partial	No	No	No	Partial	No	No	Yes
		Proprietary	2012	Yes	Yes	No	No	No	No	Yes	No	No	Yes
VMware ThinApp	Windows	Proprietary	2008	Yes	Yes	No	No	No	No	Yes	No	No	Yes

Reference: [https://en.wikipedia.org/wiki/Operating-system-level\\_virtualization](https://en.wikipedia.org/wiki/Operating-system-level_virtualization)



# Container Principle



Docker Enterprise Edition (EE) and Community Edition (CE)

## Enterprise Edition (EE)

- CaaS enabled platform subscription (integrated container orchestration, management and security)
- Enterprise class support
- Quarterly releases, supported for one year each with backported patches and hotfixes.
- Certified Infrastructure, Plugins, Containers

## Community Edition (CE)

- Free Docker platform for "do it yourself" dev and ops
- Monthly Edge release with latest features for developers
- Quarterly release with maintenance for ops

## Lifecycle

Squaring the circle: Faster releases and better stability



## Docker EE Availability

### From Docker



### OEM: Direct L2 / L2 Support Included



### Cloud Marketplaces



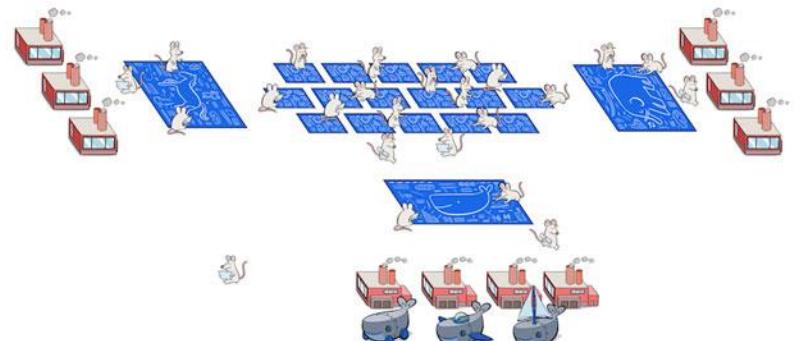
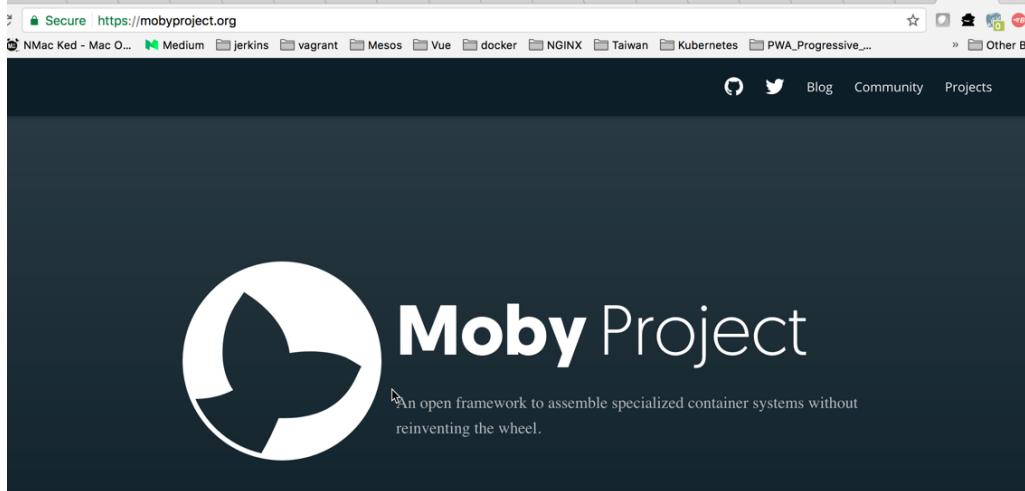
Ref: <https://blog.docker.com/2017/03/docker-online-meetup-recap-docker-enterprise-edition-ee-community-edition-ce/>

Kubernetes: Production Workload Orchestration



kubernetes  
by Google

# Container Principle



Kubernetes: Production Workload Orchestration



kubernetes  
by Google

# Container Principle

The screenshot shows the official website for rkt. At the top left is the rkt logo, which is a stylized 'r' inside a hexagon. Below it is the tagline "A security-minded, standards-based container engine". There are three main navigation links: "Overview" (highlighted in blue), "Documentation" (in grey), and "GitHub Project" (in light blue). The "Overview" section contains text about rkt's purpose and features, along with a sidebar for "THE LATEST ON RKT" and a "MORE INFORMATION" section with a "Download" link.

## Overview

rkt is an application container engine developed for modern production cloud-native environments. It features a pod-native approach, a pluggable execution environment, and a well-defined surface area that makes it ideal for integration with other systems.

The core execution unit of rkt is the *pod*, a collection of one or more applications executing in a shared context (rkt's pods are synonymous with [the concept in the Kubernetes orchestration system](#)). rkt allows users to apply different configurations (like isolation parameters) at both pod-level and at the more granular per-application level. rkt's architecture means that each pod executes directly in the classic Unix process model (i.e. there is no central daemon), in a self-contained, isolated environment. rkt implements a modern, open, standard container format, the App Container (appc) spec, but can also execute other container images, like those created with Docker.

Since its introduction by CoreOS in December 2014, the rkt project has greatly matured and is widely used in production environments.



CoreOS teams with Intel to make  
Rocket containers more secure

Kubernetes: Production Workload Orchestration



kubernetes  
by Google

# Introduction to Kubernetes



Kubernetes: Production Workload Orchestration



**kubernetes**  
by Google

# Workshop Day1: Unit 1



# Workshop Day1: Unit 1

- Alternate Solution:

The screenshot shows two main parts of the PWK interface. On the left is a session dashboard with a blue hexagonal logo containing a white steering wheel icon. The title "Play with Kubernetes" is displayed, along with a subtext: "A simple, interactive and fun playground to learn Kuberentes". Below this is a "Login" button. On the right is a terminal window with a black background and white text. The terminal shows a session timer at 03:59:50, a "CLOSE SESSION" button, and a list of instances. One instance, "node1" with IP 192.168.0.18, is selected. A "DELETE" button is visible. The terminal window also contains a warning message about using personal credentials in a sandbox environment, instructions for bootstrap, and a command-line session starting with "[node1 /]\$".

Secure | https://labs.play-with-k8s.com/p/b9moh1tduh0g00e4uge0#b9moh1td\_b9moh35duh0g00e4ugeg

03:59:50

CLOSE SESSION

Instances

+ ADD NEW INSTANCE

192.168.0.18  
node1

DELETE

b9moh1td\_b9moh35duh0g00e4ugeg

IP  
192.168.0.18

Memory  
0.77% (30.64MiB / 3.906GiB)

GPU  
0.19%

WARNING!!!!

This is a sandbox environment. Using personal credentials is HIGHLY! discouraged. Any consequences of doing so, are completely the user's responsibilites.

You can bootstrap a cluster as follows:

1. Initializes cluster master node:  
kubeadm init --apiserver-advertise-address \$(hostname -i)
2. Initialize cluster networking:  
kubectl apply -n kube-system -f \  
"https://cloud.weave.works/k8s/net?k8s-version=\$(kubectl version | base64 | tr -d '\n')"
3. (Optional) Create an nginx deployment:  
kubectl apply -f https://k8s.io/docs/user-guide//nginx-app.yaml

The PWK team.

[node1 /]\$



# Workshop Day1: Unit 1

- Alternate Solution:

The screenshot shows the Katacoda Kubernetes Playground interface. At the top, there's a navigation bar with links like Apps, NMac Ked - Mac OS..., Medium, Jenkins, vagrant, Mesos, Vue, docker, NGINX, Taiwan, Kubernetes, PWA\_Progressive\_W..., MYSQL\_Cluster, and GeneralKB. Below the bar, the Katacoda logo is displayed.

**Kubernetes Playground**

**Launch Cluster**

`launch.sh`

This will create a two node Kubernetes cluster using WeaveNet for networking.

**Health Check**

`kubectl cluster-info`

Interested in writing your own Kubernetes scenarios and demos? Visit [www.katacoda.com/teach](http://www.katacoda.com/teach)

**SUMMARY**

**Terminal Host 1**  
Your Interactive Bash Terminal.

```
master $ launch.sh
Waiting for Kubernetes to start...
Kubernetes started
master $ kubectl get nodes
NAME      STATUS    ROLES      AGE       VERSION
master    Ready     master    23m      v1.8.0
node01   Ready     <none>   23m      v1.8.5
master $
```

**Terminal Host 2**  
Your Interactive Bash Terminal.

```
node01 $ launch.sh
launch.sh: command not found
node01 $
```



# Introduction to Kubernetes

- Check kubernetes version

```
kubectl get nodes -o yaml
```

```
[praparn-MacBook-Pro:~ praparn$ kubectl get nodes -o yaml
apiVersion: v1
items:
- apiVersion: v1
  kind: Node
  metadata:
    annotations:
      node.alpha.kubernetes.io/ttl: "0"
      volumes.kubernetes.io/controller-managed-attach-detach: "true"
    creationTimestamp: 2017-06-24T09:03:07Z
    labels:
      beta.kubernetes.io/arch: amd64
      beta.kubernetes.io/os: linux
      kubernetes.io/hostname: minikube
    name: minikube
    namespace: ""
    resourceVersion: "15676"
    selfLink: /api/v1/nodes/minikube
    uid: f03de16d-58bb-11e7-aae1-080027559511
  spec:
    externalID: minikube
          nodeInfo:
            architecture: amd64
            bootID: cdf78a28-072d-4707-8c1d-dbaa0b95fff7
            containerRuntimeVersion: docker://1.11.1
            kernelVersion: 4.9.13
            kubeProxyVersion: v1.6.0
            kubeletVersion: v1.6.0
            machineID: ef85c4ce9a23440e83266debd5cc9856
            operatingSystem: linux
            osImage: Buildroot 2017.02
            systemUUID: 801D91BA-D487-47D2-9C5D-C12F278B49C5
    kind: List
    metadata: {}
    resourceVersion: ""
    selfLink: "
```



# Introduction to Kubernetes



About ▾ Projects ▾ Certification ▾ People ▾ Community ▾ Newsroom ▾

JOIN NOW



## What is CNCF?

CNCF is an open source software foundation dedicated to making cloud native computing universal and sustainable. Cloud native computing uses an open source software stack to deploy applications as microservices, packaging each part into its own container, and dynamically orchestrating those containers to optimize resource utilization. Cloud native technologies enable software developers to build great products faster.

JOIN



## Projects

We host and nurture components of cloud native software stacks, including Kubernetes, Prometheus and Envoy. Kubernetes and other CNCF projects are some of the **highest velocity projects** in the history of open source. We are regularly adding new projects to better support a full stack cloud native environment.



Kubernetes: Production Workload Orchestration



kubernetes  
by Google

# Introduction to Kubernetes

- What is Orchestration (Computing)?
  - Align business request with Application/Data/Infrastructure
  - Centralize management for:
    - Resource Pool
    - Automated Workflow
    - Provisioning
    - Scale Up/Down
    - Monitoring
    - Billing
    - etc



Ref: [https://en.wikipedia.org/wiki/Orchestration\\_\(computing\)](https://en.wikipedia.org/wiki/Orchestration_(computing))

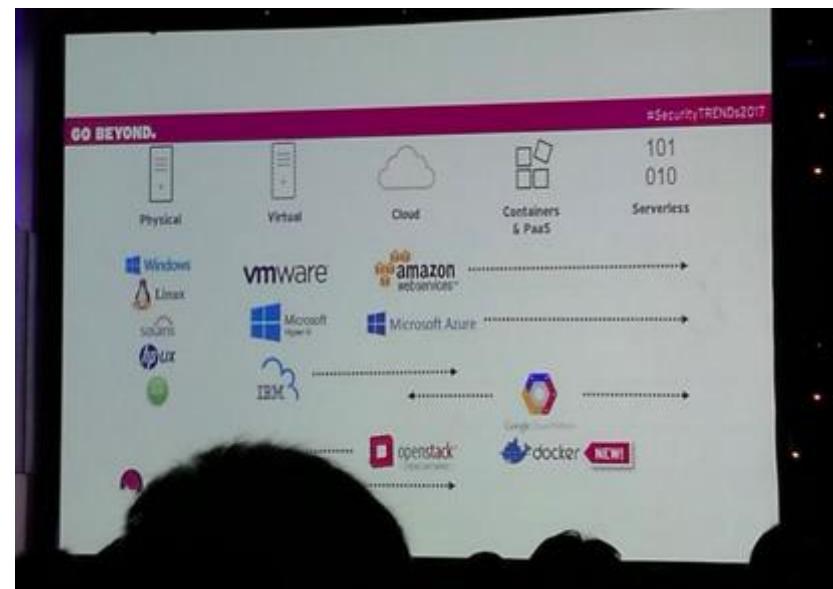
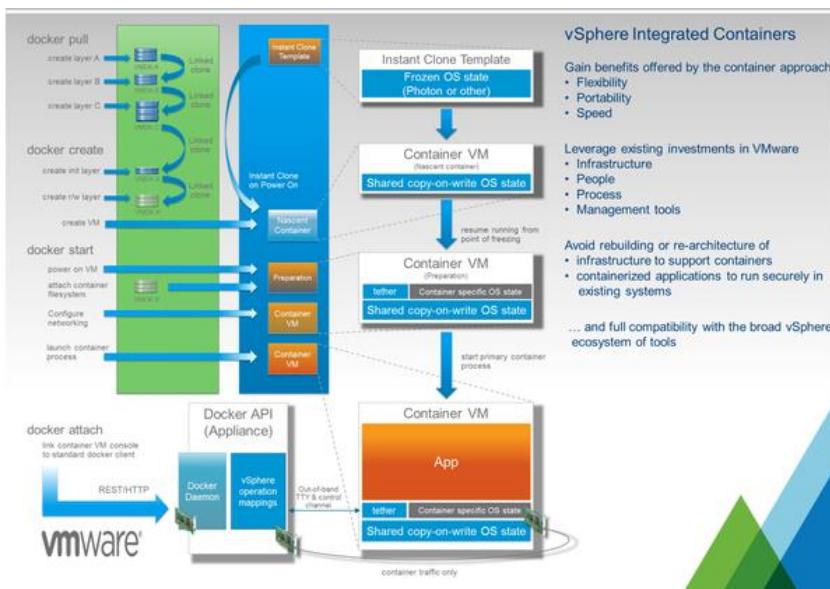
Kubernetes: Production Workload Orchestration



**kubernetes**  
by Google

# Introduction to Kubernetes

- But why Container Orchestration ?
  - Container Platform is next generation that partner/beat existing virtualize technology
    - Easy to build-ship-run on dev and production
    - Zero Configure
    - Suitable for Microservice architecture
    - Good for application, Good for business (Win/Win !!!)



# Introduction to Kubernetes

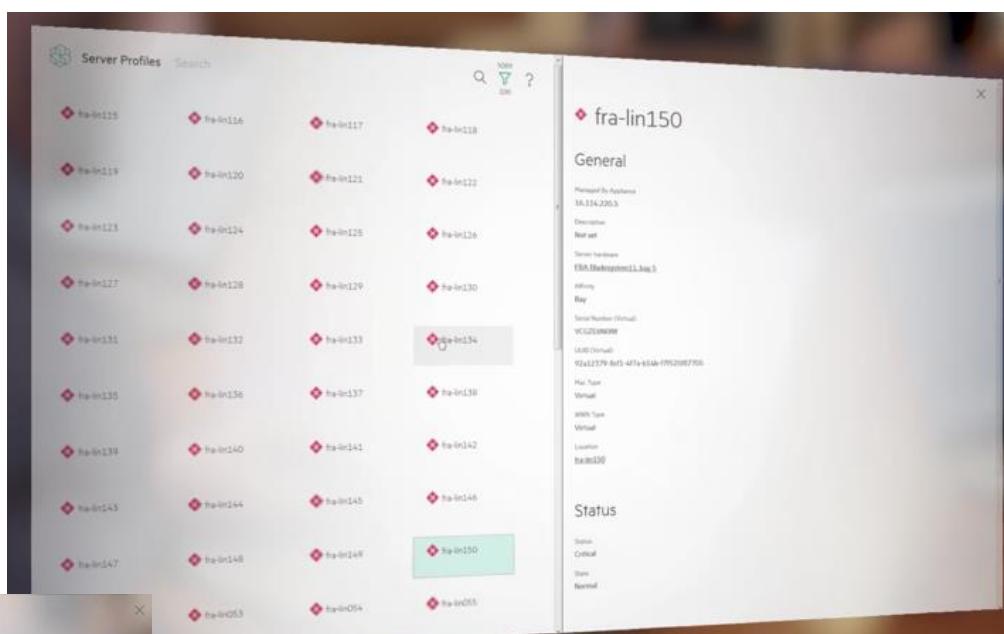
## How HPE Synergy works

Explore the Engine of the Idea Economy

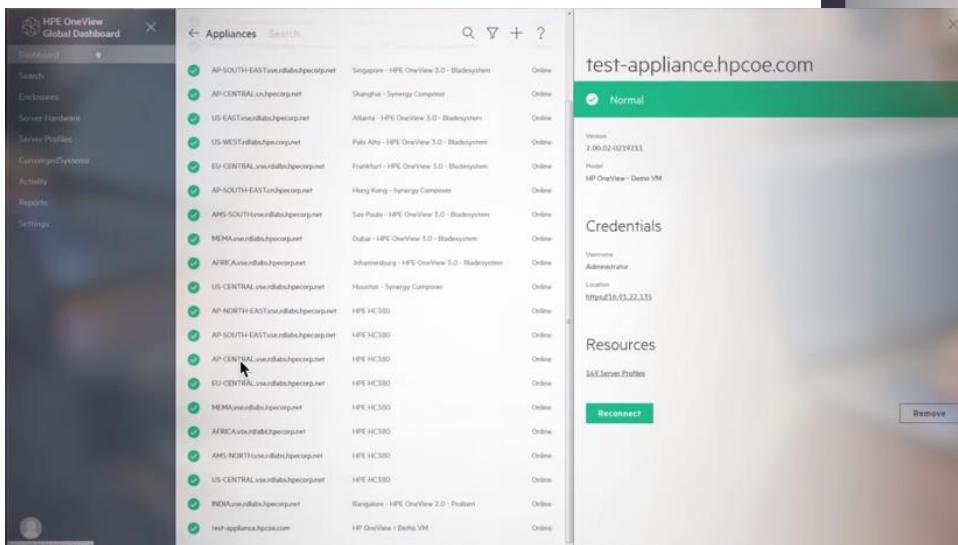
Imagine infrastructure so intelligent, it can adapt to every workload and deliver services at lightning speed.



Introduction to HPE Synergy   Composable Infrastructure   Software-defined Intelligence   Pooling and Provisioning   Simple Scalability   Open Integration



The screenshot shows the HPE OneView Global Dashboard. On the left, there's a navigation bar with links like Appliances, Search, and a plus sign for adding new resources. The main pane displays a grid of server profiles, each represented by a small icon and a name like 'fra-lin115' through 'fra-lin150'. To the right of the grid, a detailed view is open for 'fra-lin150'. This view includes sections for General (Hardware by Appliance, Description, Server hardware, Affinity, Bay, Serial Number (Virtual), UUID (Virtual), Mac Type, Virtual, and Location), Status (Status: Critical, State: Normal), and a Log tab which shows 'fra-lin150.log.3'.



The screenshot shows the HPE OneView Global Dashboard. The left sidebar lists categories such as Appliances, Enclosures, Server Hardware, Server Profiles, Converged Systems, Activity, Reports, and Settings. The main pane shows a list of appliances, each with a green checkmark and a link to its details. A specific appliance, 'test-appliance.hpcoc.com', is selected and shown in a detailed view. This view includes sections for General (Version: 2.00.02-0219211, Model: HPE OneView - Demo VM), Credentials (Username: Administrator, Location: https://10.93.22.335), and Resources (148 Server Profiles). There are 'Reconnect' and 'Remove' buttons at the bottom of the resource section.

## Your infrastructure as code

Gain efficiency and control with HPE Synergy, a powerful software-defined solution that lets you manage your infrastructure as code, deploying IT resources quickly and for any workload. Through a single interface, you can compose fluid pools of physical and virtual compute, storage, and fabric resources into any configuration for any application. With HPE Synergy, IT goes beyond the role of internal service broker to offer new applications that elevate and enhance the business.

Kubernetes: Production Workload Orchestration



kubernetes  
by Google

# Introduction to Kubernetes

- But why we need Container Orchestration ?
  - Production environment is cluster system
  - Microservice maintain connect was required
  - Application state-full will run on stateless architecture
  - Application scale up/Down was required
  - Many native command/shell for maintain container in production environment
  - etc



# Introduction to Kubernetes

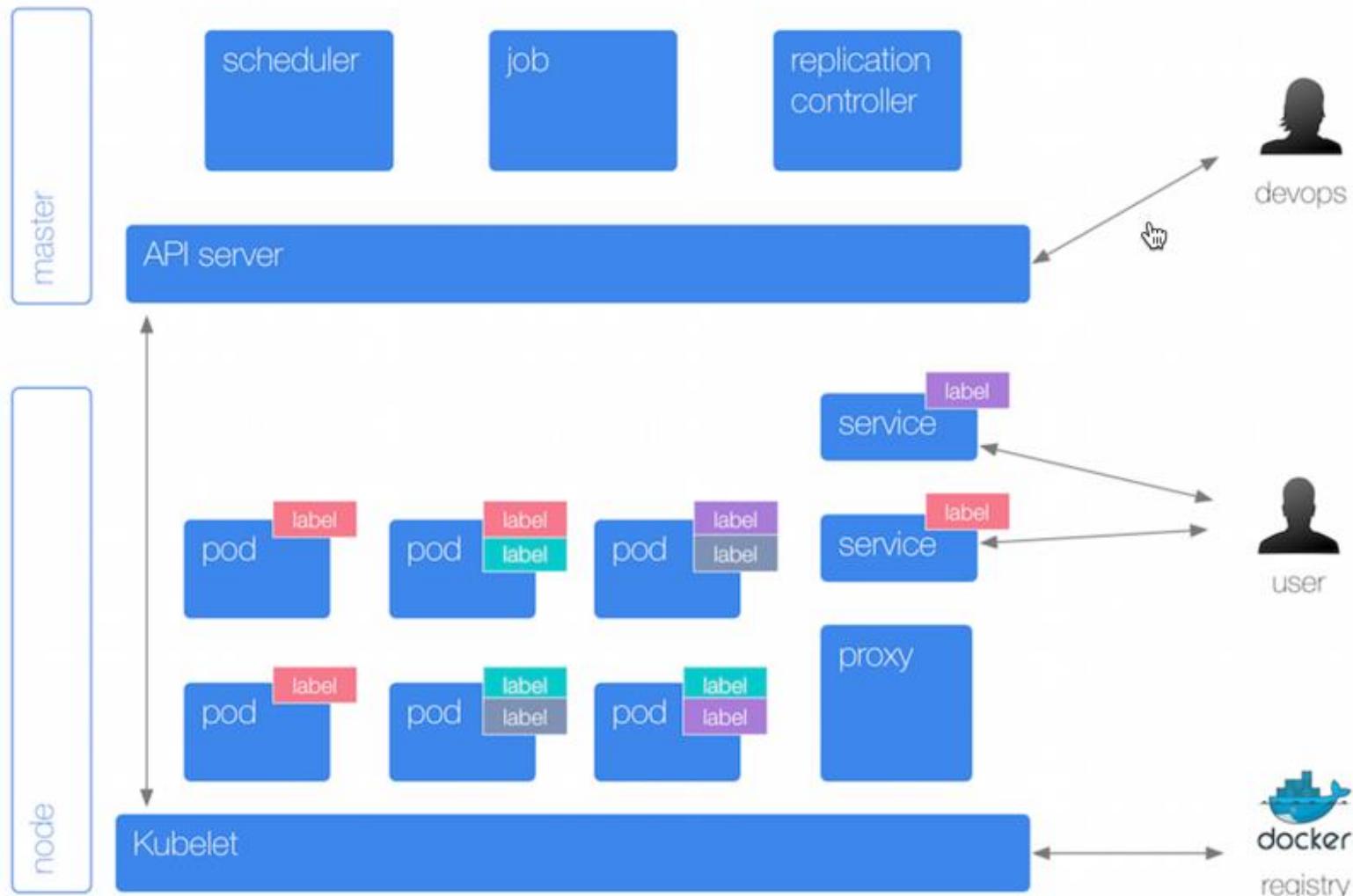


Kubernetes: Production Workload Orchestration



**kubernetes**  
by Google

# Introduction to Kubernetes



# Introduction to Kubernetes

- Key Feature
  - Automatic binpacking
  - Horizontal Pod Autoscaling (HPA)
  - Automated rollouts and rollbacks
  - Storage orchestration
  - Self-healing
  - Service discovery and load balancing
  - Secret and configuration management
  - Batch execution



# Introduction to Kubernetes

- Automatic binpacking
  - CPU/Memory's utilization can define on Pods (Smallest Unit of Kubernetes)
  - Schedule will select the node by ensure all resource is enough for running Pods as required
  - If reach memory limit
    - Current Pods will be terminate (Kill)
    - If restart flag was set. Kubenetes will try to restart Pods on other node
  - If reach cpu limit
    - Schedule will not kill Pods and waiting for it back to normal state
  - Check available node resource by command: kubectl describe node

Non-terminated Pods: (3 in total)					
Namespace	Name	CPU Requests	CPU Limits	Memory Requests	Memory Limits
kube-system	kube-addon-manager-minikube	5m (0%)	0 (0%)	50Mi (2%)	0 (0%)
kube-system	kube-dns-268032401-mx7s3	260m (13%)	0 (0%)	110Mi (5%)	170Mi (8%)
kube-system	kubernetes-dashboard-hdhrz	0 (0%)	0 (0%)	0 (0%)	0 (0%)

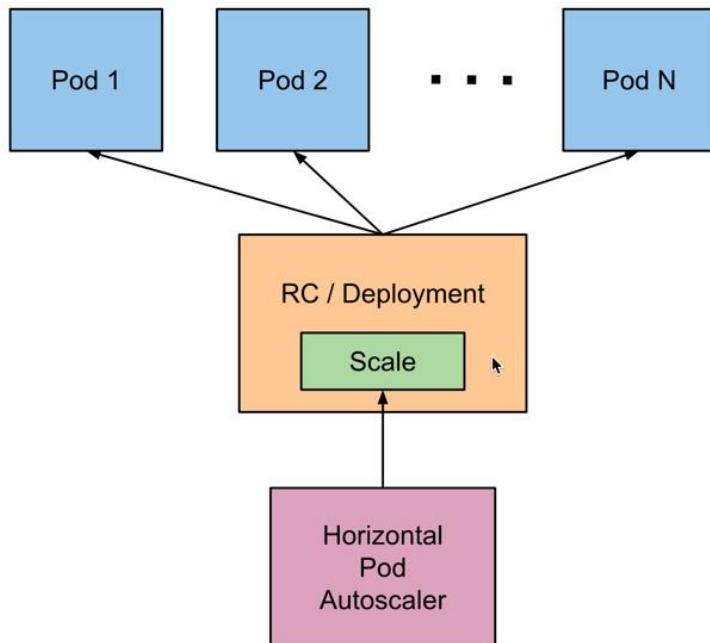
  

Allocated resources:					
(Total limits may be over 100 percent, i.e., overcommitted.)					
CPU Requests	CPU Limits	Memory Requests	Memory Limits		
265m (13%)	0 (0%)	160Mi (8%)	170Mi (8%)		
Events:	<none>				



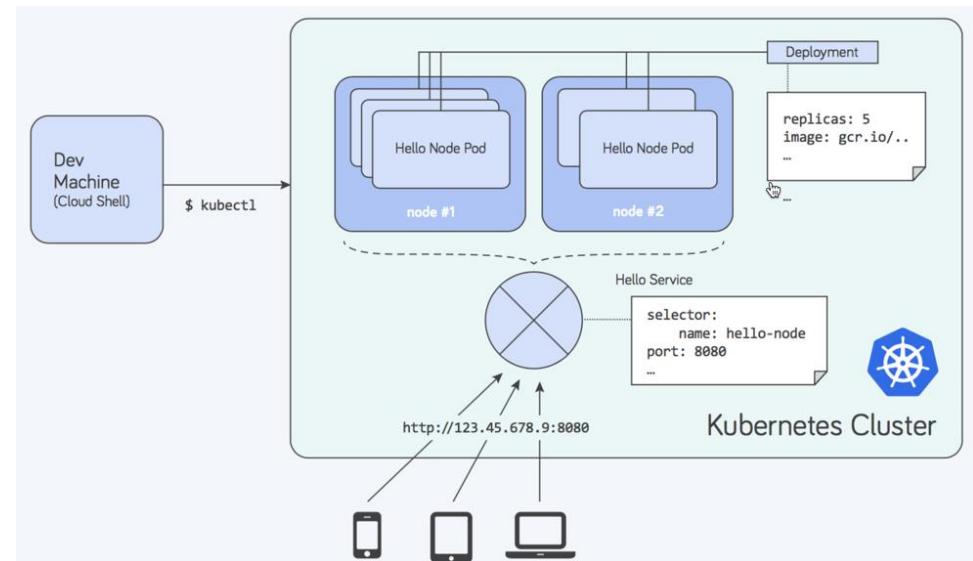
# Introduction to Kubernetes

- Horizon Pods Autoscaling (hpa/vpa (experimental))
  - Talk with RC (Replication Controller) for complete task
  - Automatic scaling Pods's number base cpu's utilization
  - Support multiple criteria (metric) for scale (Alpha feature)
  - Support customize criteria (metric) for scale (Alpha feature)
  - Looping check resource's utilization every 30 seconds (default)



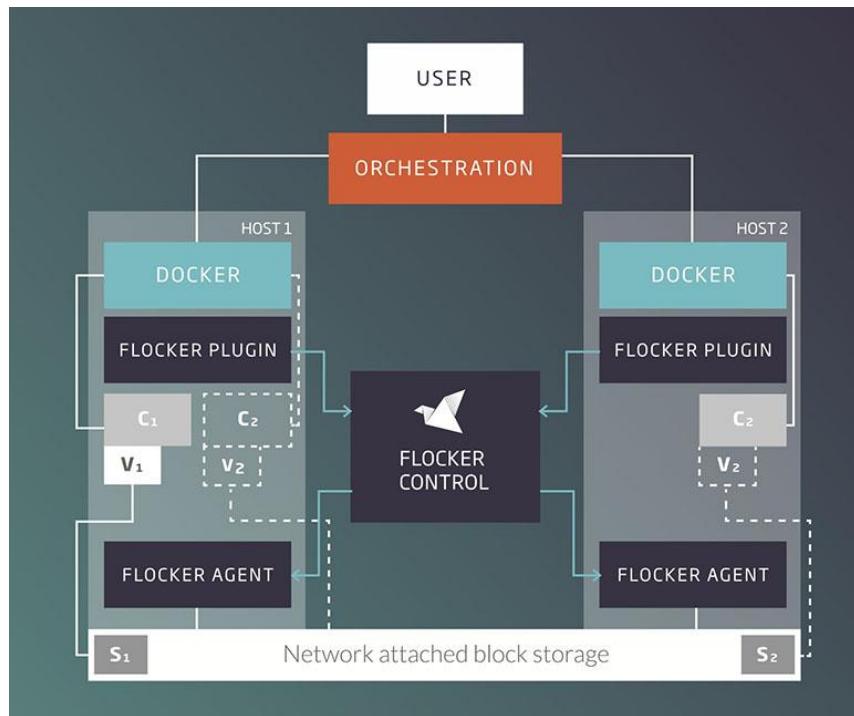
# Introduction to Kubernetes

- Automated Rollout and Rollbacks
  - Update will base on Pod's template
  - Rollout existing deployment with all remain replicas number as desired
  - If rollout is success. New version will be provision until success
  - Rollback will possible with single command
  - Rollout process can pause/resume as need



# Introduction to Kubernetes

- Storage Orchestrator
  - Support several storage type:
    - Local Storage
    - Network Storage (NFS, iScsi, Gluster, Ceph, Cinder, Flocker)
    - Cloud Storage (AWS, GCE, Azure Disk etc)



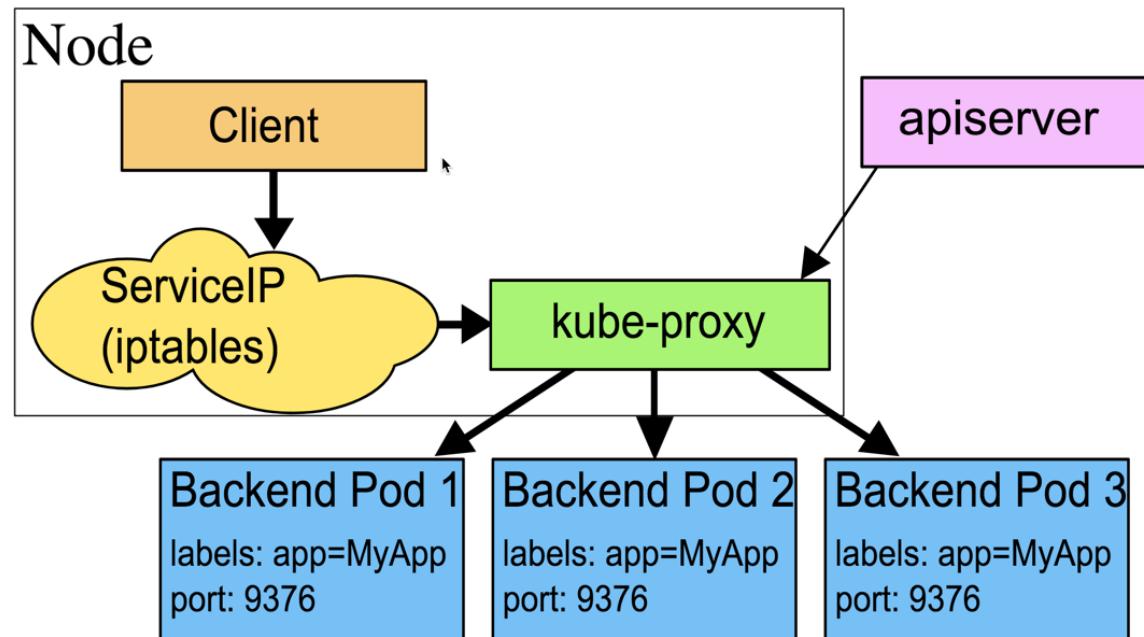
# Introduction to Kubernetes

- Self-healing
  - Replication Controller (RC) will maintain unit of Pods as design (not to much (kill) and not to few (create))
  - Full-fill Pods on every failure case with automatic by system



# Introduction to Kubernetes

- Service Discovery and Load Balancing
  - Service will act like “connector” for client need to connect with Pods
  - Discovery will use for service to look “Pods” by environment variable or dns service
  - Support load balancing between multiple Pods (replica)



# Introduction to Kubernetes

- Secret and Configuration Management
  - Kubernetes can keep confidential data (such as username/password) for running application on encrypt format.
  - Can reference on Pods instead plan text configuration.

```
$ kubectl get secrets
NAME          TYPE        DATA  AGE
db-user-pass  Opaque      2     51s

$ kubectl describe secrets/db-user-pass
Name:         db-user-pass
Namespace:    default
Labels:       <none>
Annotations: <none>

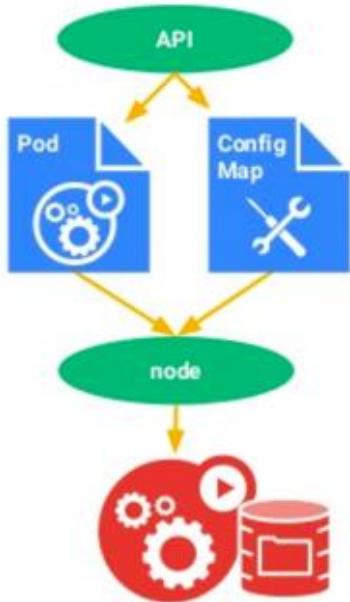
Type:         Opaque

Data
=====
password.txt: 12 bytes
username.txt: 5 bytes
```



# Introduction to Kubernetes

- Secret and Configuration Management
  - Sometime we have a many configuration that need to specify on each application, But it should be change every time need.
  - Idea is create configuration file (ConfigMap) for define all configuration that reference on Pods instead



## ConfigMap

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: dragon-config
  labels:
    environment: non-prod
data:
  dragon.how.much: very
  dragon.type: fast
```

```
apiVersion: v1
kind: Pod
metadata:
  name: dragon-pod
spec:
  containers:
    - name: dragon-container
      image: dragon-image
      env:
        - name: DRAGON_LEVEL
          valueFrom:
            configMapKeyRef:
              name: dragon-config
              key: dragon.how.much
        - name: DRAGON_TYPE
          valueFrom:
            configMapKeyRef:
              name: dragon-config
              key: dragon.type
```



# Introduction to Kubernetes

- Batch Execution
  - A job will response some kind of batch execute by create special Pods (Terminate when batch complete)
  - Normally kubernetes will use job for maintain many background process for cluster system such as Replication Controller (RC) will submit job for start new Pods when existing is fail or delete.
  - Type of Job
    - Non-parallel jobs
    - Parallel jobs with fix-completion
    - Parallel jobs with work queue



# System Architecture

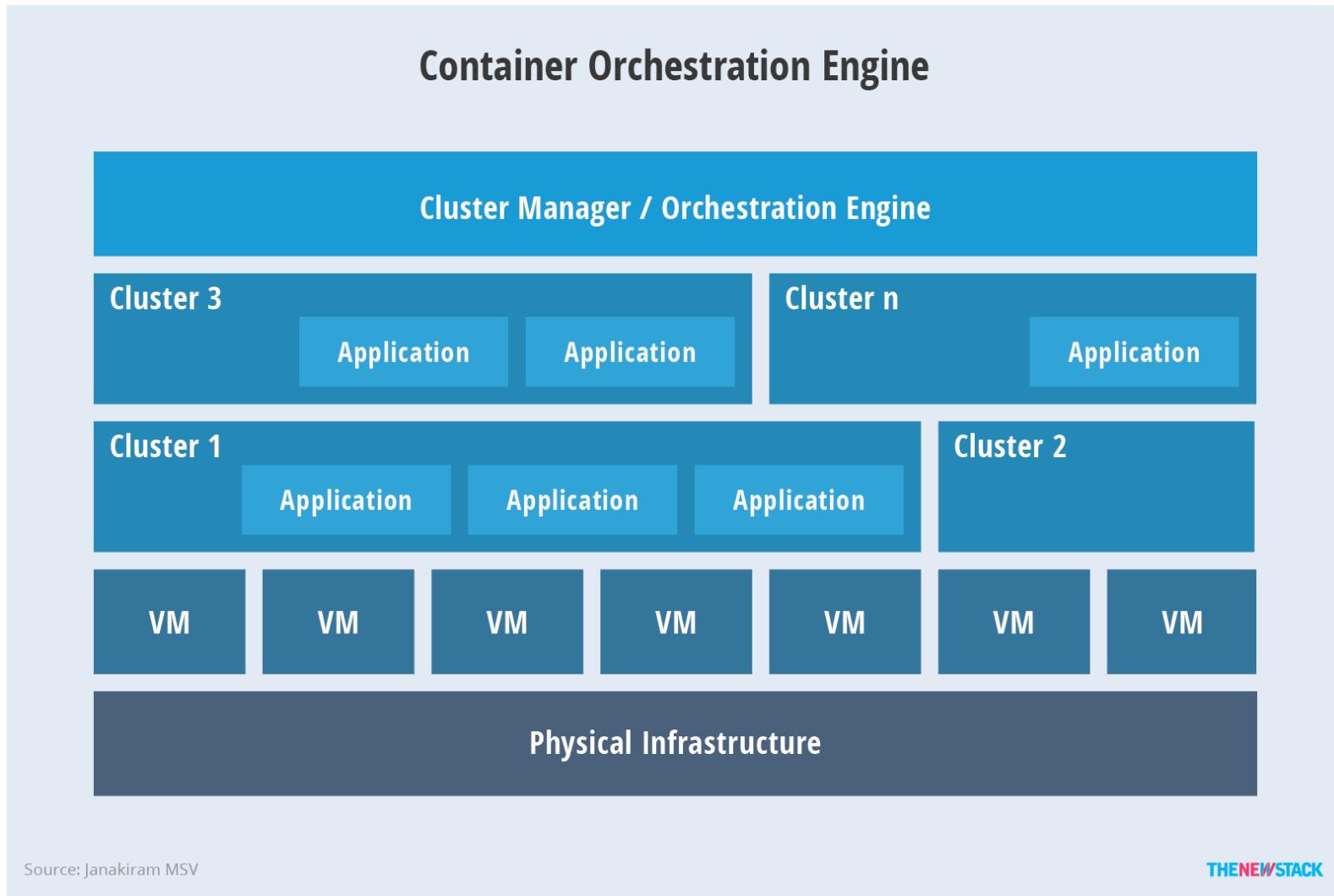


Kubernetes: Production Workload Orchestration



**kubernetes**  
by Google

# System Architecture



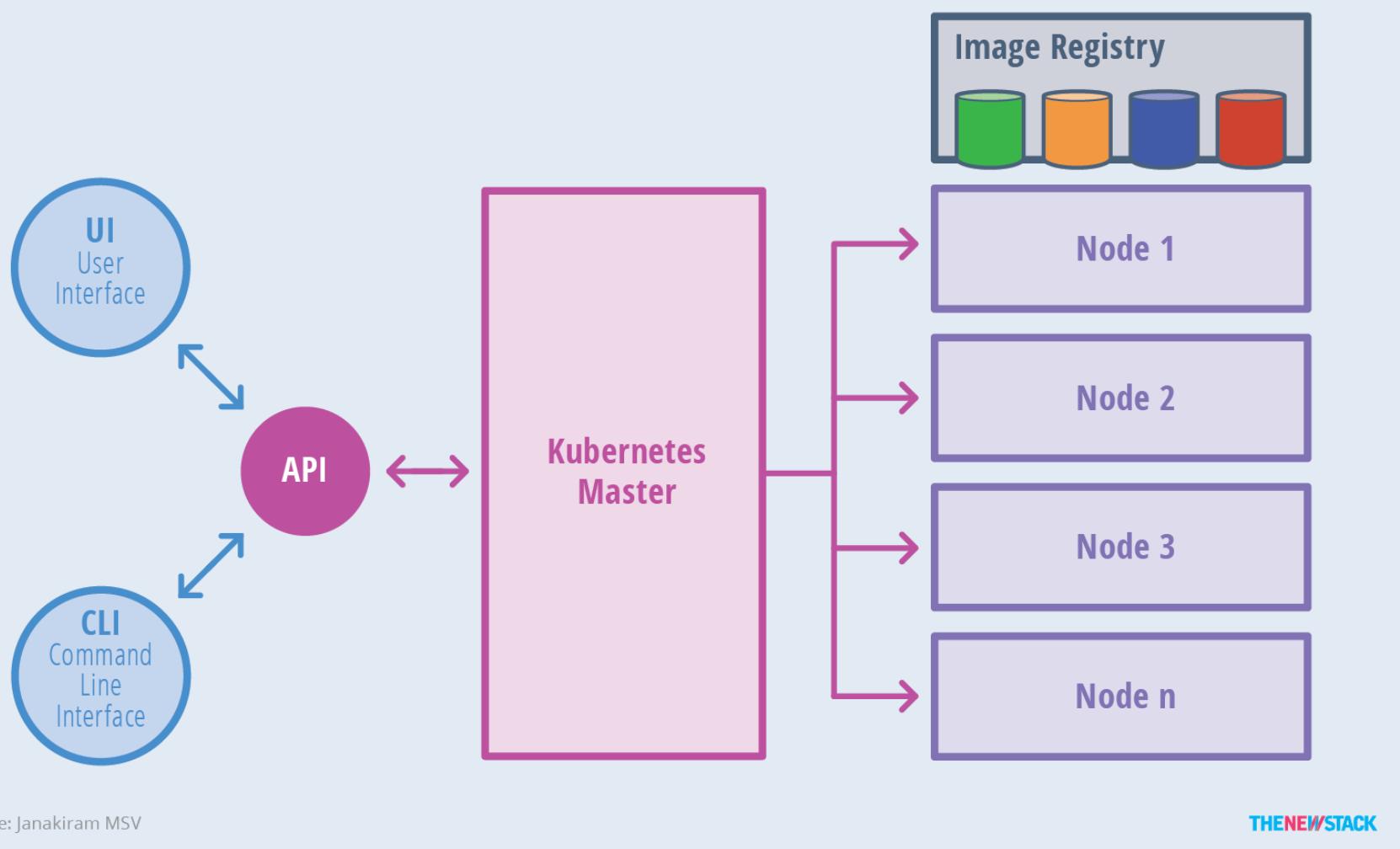
Ref: [https://cdn.thenewstack.io/media/2016/11/Chart\\_02\\_Kubernetes-Architecture.png](https://cdn.thenewstack.io/media/2016/11/Chart_02_Kubernetes-Architecture.png)

Kubernetes: Production Workload Orchestration



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# System Architecture



Source: Janakiram MSV

THE NEW STACK

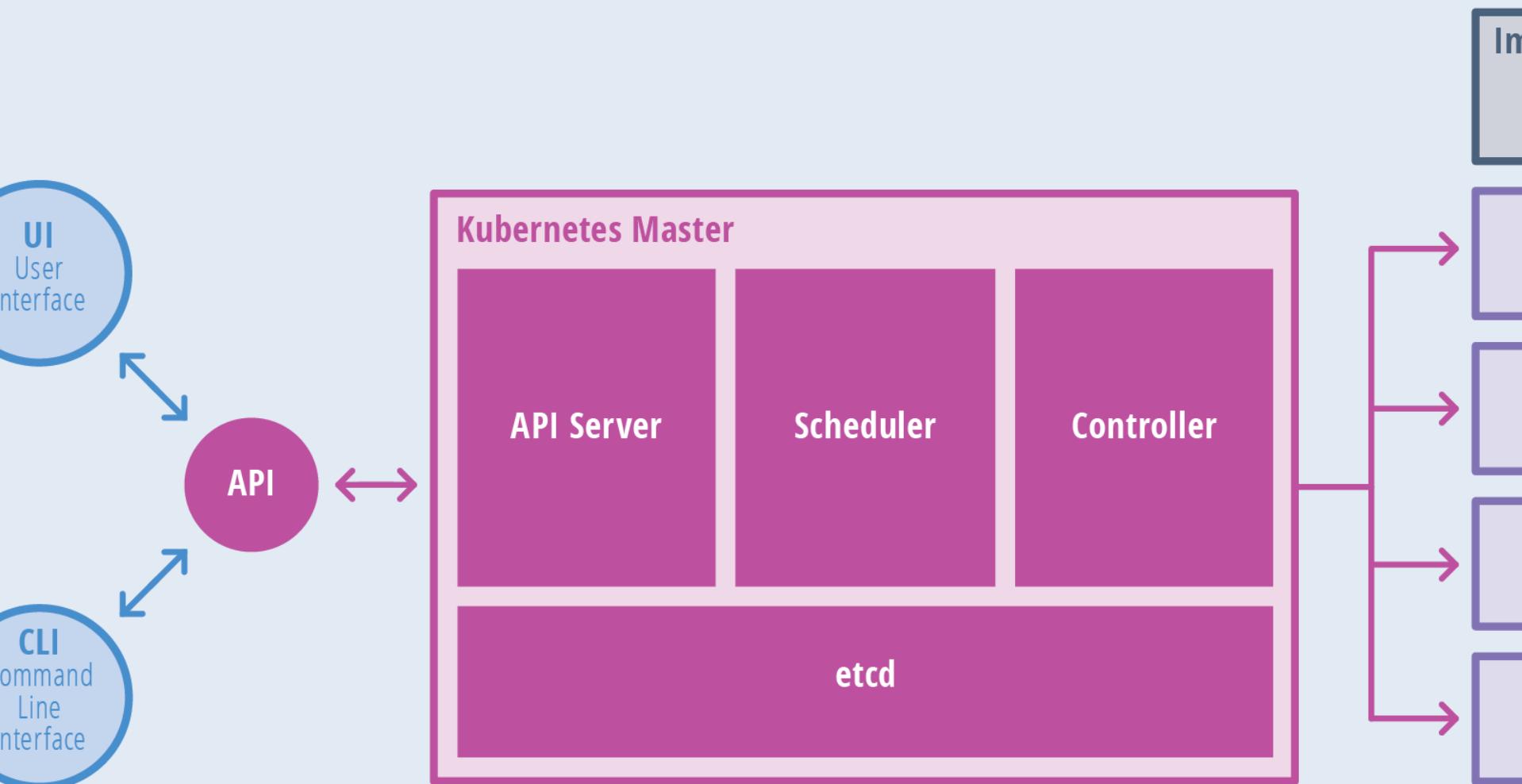
Ref: [https://cdn.thenewstack.io/media/2016/11/Chart\\_02\\_Kubernetes-Architecture.png](https://cdn.thenewstack.io/media/2016/11/Chart_02_Kubernetes-Architecture.png)

Kubernetes: Production Workload Orchestration



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# System Architecture



Source: Janakiram MSV

THE NEW STACK

Ref: [https://cdn.thenewstack.io/media/2016/11/Chart\\_02\\_Kubernetes-Architecture.png](https://cdn.thenewstack.io/media/2016/11/Chart_02_Kubernetes-Architecture.png)

Kubernetes: Production Workload Orchestration



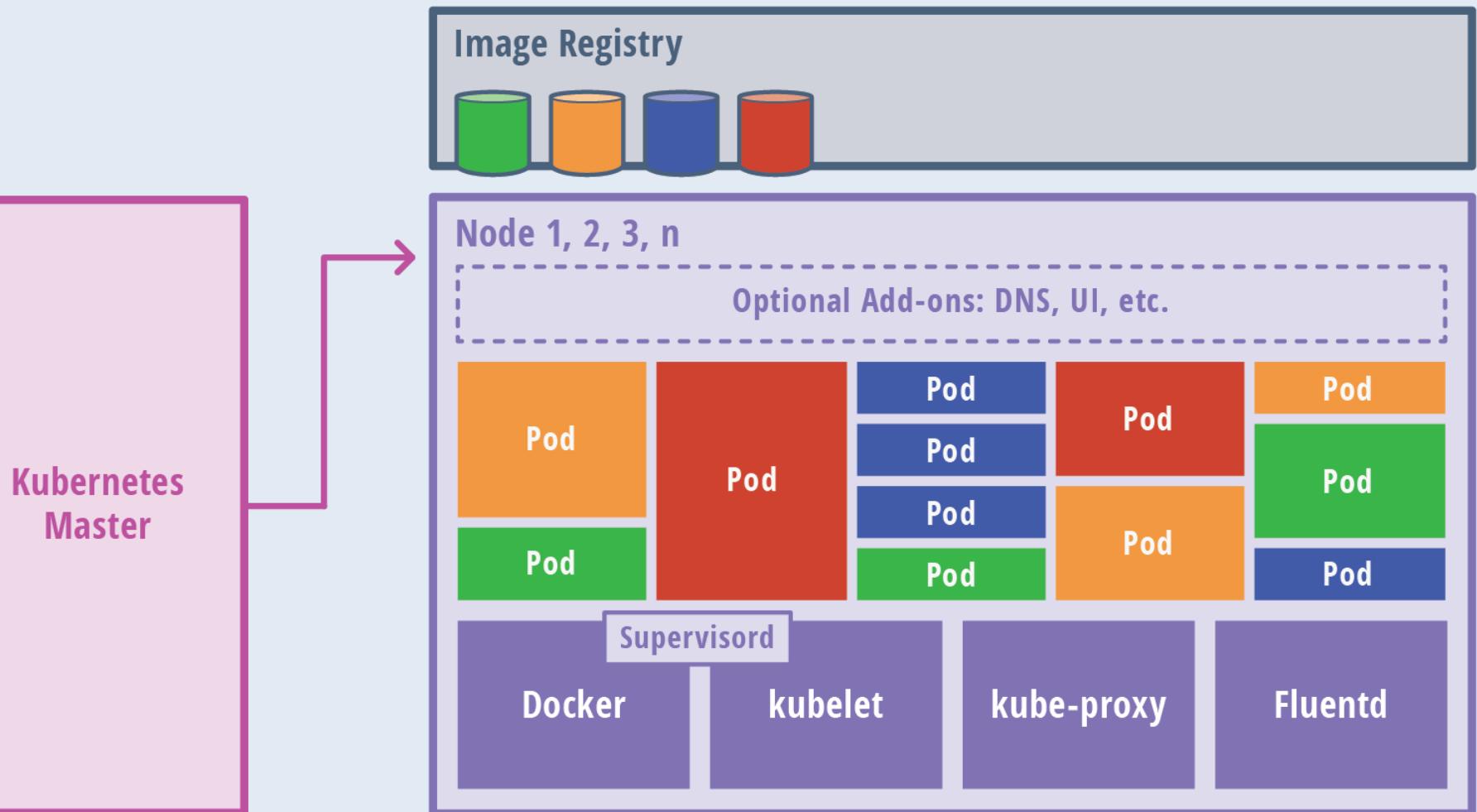
kubernetes  
by Google

# System Architecture

- Kubernetes Master
  - API Server: Interface for all UI to command that interact with kubernetes cluster
  - Scheduler (Job Dispatcher): Schedule all nodes's resource and dispatching Pods to nodes with match criteria
    - CPU ?
    - Memory ?
    - Affinity / Constraing ?
  - Controller and Replication Controller (RC) : Control/Coordinate all nodes for maintain server as configure on cluster system
  - Etcd (Open-source): Key-value database for keep state of nodes/Pods/Container
  - Secret: Encrypt confidential data
  - HPA (Horizon Pods Auto scaling): Scale pods with CPU criteria (major)
  - Event: Keep log and event on cluster
  - NameSpace: Limit resource quota via define namespace (cpu, memory, pods etc)



# System Architecture



Source: Janakiram MSV

THE NEW STACK

Ref: [https://cdn.thenewstack.io/media/2016/11/Chart\\_02\\_Kubernetes-Architecture.png](https://cdn.thenewstack.io/media/2016/11/Chart_02_Kubernetes-Architecture.png)

Kubernetes: Production Workload Orchestration



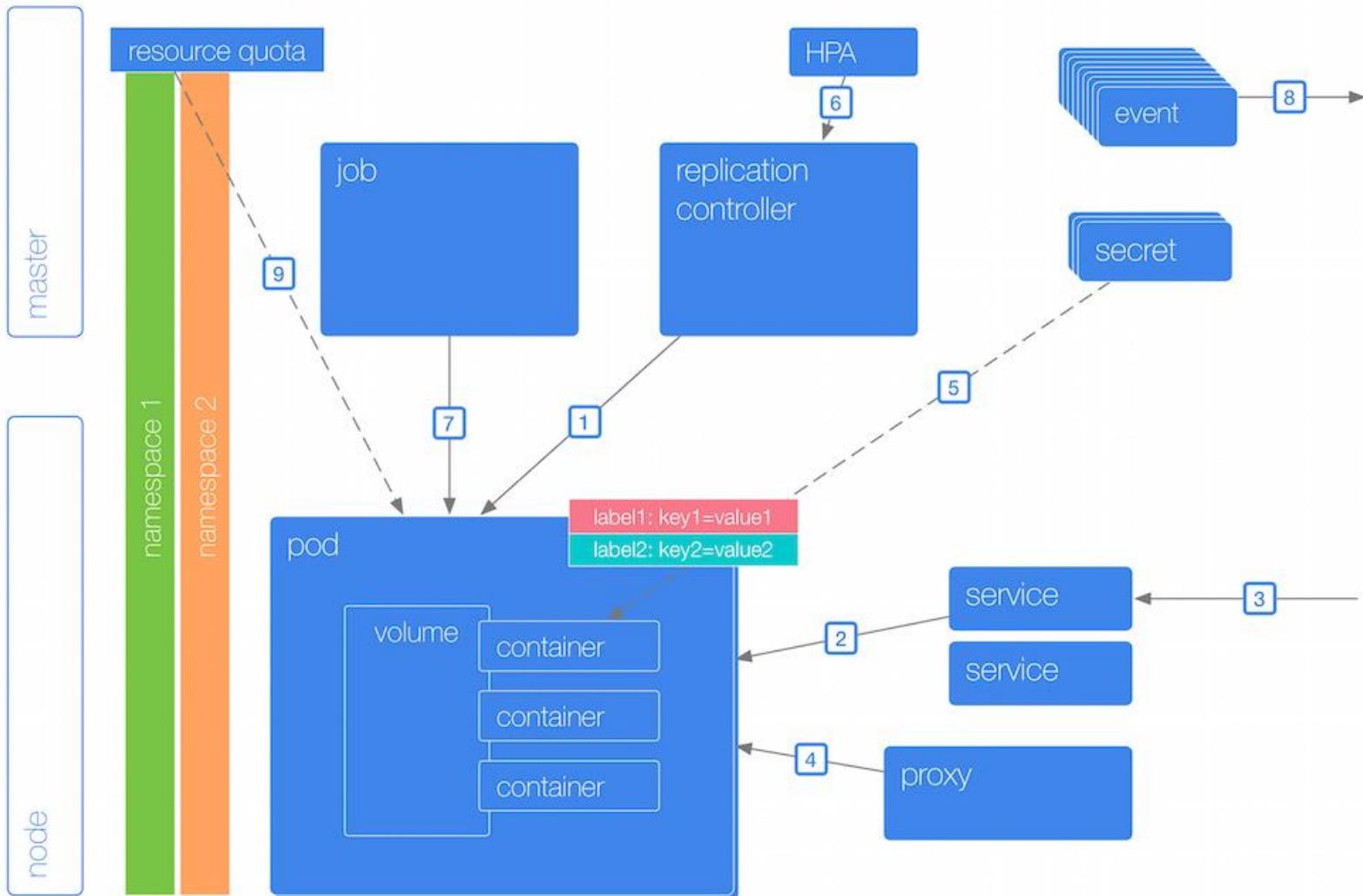
**kubernetes**  
by Google

# System Architecture

- Kubernetes Node
  - Pods: Pods is smallest deployable units of computing that can be created and manage in kubernetes (Pods != Container).
  - Docker: Docker engine for run container. Kubernetes support both docker and rkt (rocker)
  - Kubelet: Agent on node to talk with kubernetes master and send status/health of node
  - Supervisord (Docker+Kubelet): Process monitoring
  - Fluentd: Daemon for collect logs sent to kubernetes master
  - Kube-Proxy: Manage all network interface on node (Core network component)



# System Architecture



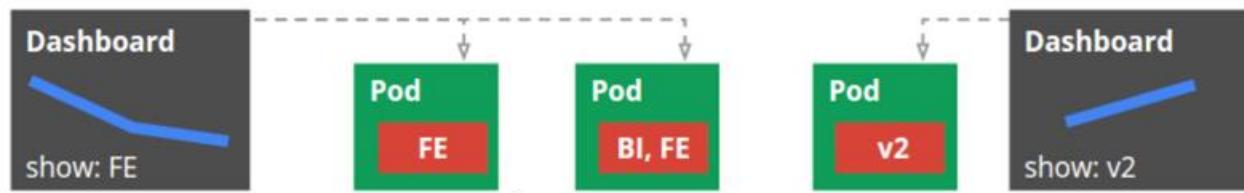
Ref: <http://k8s.info/cs.html>

Kubernetes: Production Workload Orchestration



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# System Architecture



```
"labels": {  
  "key1" : "value1",  
  "key2" : "value2"  
}
```

```
"release" : "stable", "release" : "canary"
```

```
"environment" : "dev", "environment" : "qa", "environment" : "production"
```

```
"tier" : "frontend", "tier" : "backend", "tier" : "cache"
```

```
"partition" : "customerA", "partition" : "customerB"
```

```
"track" : "daily", "track" : "weekly"
```

# System Architecture

## GETTING STARTED

run

expose

## APP MANAGEMENT

annotate

autoscale

convert

create

delete

edit

get

label

patch

replace

rolling-update

rollout

scale

set

## DECLARATIVE APP MANAGEMENT

apply

## WORKING WITH APPS

## GETTING STARTED

This section contains the most basic commands for getting a workload running on your cluster.

- `run` will start running 1 or more instances of a container image on your cluster.
- `expose` will load balance traffic across the running instances, and can create a HA proxy for accessing the containers from outside the cluster.

Once your workloads are running, you can use the commands in the [WORKING WITH APPS](#) section to inspect them.



### run

Create and run a particular image, possibly replicated.

Creates a deployment or job to manage the created container(s).

### Usage

```
$ run NAME --image=image [--env="key=value"] [--port=port] [--replicas=replicas] [--dry-run=bool] [--overrides=inline-json] [--command] -- [COMMAND] [args...]
```

### Flags

Start a single instance of nginx.

```
kubectl run nginx --image=nginx
```

Start a single instance of hazelcast and let the container expose port 5701 .

```
kubectl run hazelcast --image=hazelcast --port=5701
```

Ref: <https://kubernetes.io/docs/user-guide/kubectl/v1.7/>

Kubernetes: Production Workload Orchestration



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# System Architecture

Topic	K8S	Docker/Swarm
Architecture	Open-system (Base on cluster manager "Borg" for support complex workload)	<b>Swarm:</b> Proprietary of Docker product, "Easy to use", "Extend capability of Docker in cluster"
Operation command	Almost operate by "YAML" file (Declarative Command)	Almost operate by "command" (Imperative Command)
Unit of Work	Pods (Pods >= Container)	Container
How to Identify Work	"Label operation"	<b>Docker:</b> By container name <b>Swarm:</b> By service/stack name
Level of workload management	Service Level: (Simple) Replication Level: (Auto healing) Deployment Level: (Auto healing + Roll Update)	<b>Docker:</b> N/A <b>Swarm:</b> Service Level (Snag with service/stack)
Auto scaling	HPA (Horizontal Pods Scaling) base on CPU	No
Health check	Liveness & Readiness (Multi option to check application health)	Service health only



# System Architecture

The screenshot shows the top portion of a blog post from the Kubernetes website. At the top left is the Kubernetes logo. To its right is a navigation bar with links for Documentation, Blog (which is underlined), Partners, and Community. Below the navigation bar, the title "Kubernetes Blog" is centered. The main content area starts with the date "Wednesday, June 27, 2018".

Wednesday, June 27, 2018

## Kubernetes 1.11: In-Cluster Load Balancing and CoreDNS Plugin Graduate to General Availability

Author: Kubernetes 1.11 Release Team

We're pleased to announce the delivery of Kubernetes 1.11, our second release of 2018!

Today's release continues to advance maturity, scalability, and flexibility of Kubernetes, marking significant progress on features that the team has been hard at work on over the last year. This newest version graduates key features in networking, opens up two major features from SIG-API Machinery and SIG-Node for beta testing, and continues to enhance storage features that have been a focal point of the past two releases. The features in this release make it increasingly possible to plug any infrastructure, cloud or on-premise, into the Kubernetes system.

Notable additions in this release include two highly-anticipated features graduating to general availability: IPVS-based In-Cluster Load Balancing and CoreDNS as a cluster DNS add-on option, which means increased scalability and flexibility for production applications.

Let's dive into the key features of this release:

### IPVS-Based In-Cluster Service Load Balancing Graduates to General Availability

In this release, [IPVS-based in-cluster service load balancing](#) has moved to stable. IPVS (IP Virtual Server) provides high-performance in-kernel load balancing, with a simpler programming interface than iptables. This change delivers better network throughput, better programming latency, and higher scalability limits for the cluster-wide distributed load-balancer that comprises the Kubernetes Service model. IPVS is not yet the default but clusters can begin to use it for production traffic.

### CoreDNS Promoted to General Availability

[CoreDNS](#) is now available as a [cluster DNS add-on option](#), and is the default when using kubeadm. CoreDNS is a flexible, extensible authoritative DNS server and directly integrates with the Kubernetes API. CoreDNS has fewer moving parts than the previous DNS server, since it's a single executable and a single process, and supports flexible use cases by creating custom DNS entries. It's also written in Go making it memory-safe. You can learn more about CoreDNS [here](#).

### Dynamic Kubelet Configuration Moves to Beta

This feature makes it possible for new Kubelet configurations to be rolled out in a live cluster. Currently, Kubelets are configured via command-line flags, which makes it difficult to update Kubelet configurations in a running cluster. With this beta feature, [users can configure Kubelets in a live cluster](#) via the API server.

### Custom Resource Definitions Can Now Define Multiple Versions

Custom Resource Definitions are no longer restricted to defining a single version of the custom resource, a restriction versions of the resource can be defined. In the future, this will be expanded to support some automatic conversions; for changes, e.g. v1beta1 to v1, and to create a migration path for resources which do have changes.

Custom Resource Definitions now also support "[status](#)" and "[scale](#)" [subresources](#), which integrate with monitoring and run cloud-native applications in production using Custom Resource Definitions.

### Known Issues

- IPVS based kube-proxy doesn't support graceful close connections for terminating pod. This issue will be fixed in a future release. ([#57841](#), [@jsravn](#))
- kube-proxy needs to be configured to override hostname in some environments. ([#857](#), [@detiber](#))
- There's a known issue where the Vertical Pod Autoscaler will radically change implementation in 1.12, so users of VPA (alpha) in 1.11 are warned that they will not be able to automatically migrate their VPA configs from 1.11 to 1.12.

<https://kubernetes.io/docs/reference/workloads-18-19/>

Kubernetes: Production Workload Orchestration



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# Fundamental of Kubernetes



Kubernetes: Production Workload Orchestration



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# Pods, Container and Services



Kubernetes: Production Workload Orchestration



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# Pods, Container and Services

- Pods vs Container
  - Docker's view point:
    - 1 Container: 1 Application, 1 Component of Microservice
    - So for micro service we need multi container
      - Cache component
      - Web component
      - Database component
      - Etc
  - KuberneTEST's view point:
    - 1 Pods = 1 Container
    - 1 Pods = N Container (Container on the same context, Work closely)
    - So we can have 1 Pods for container more than 1 container



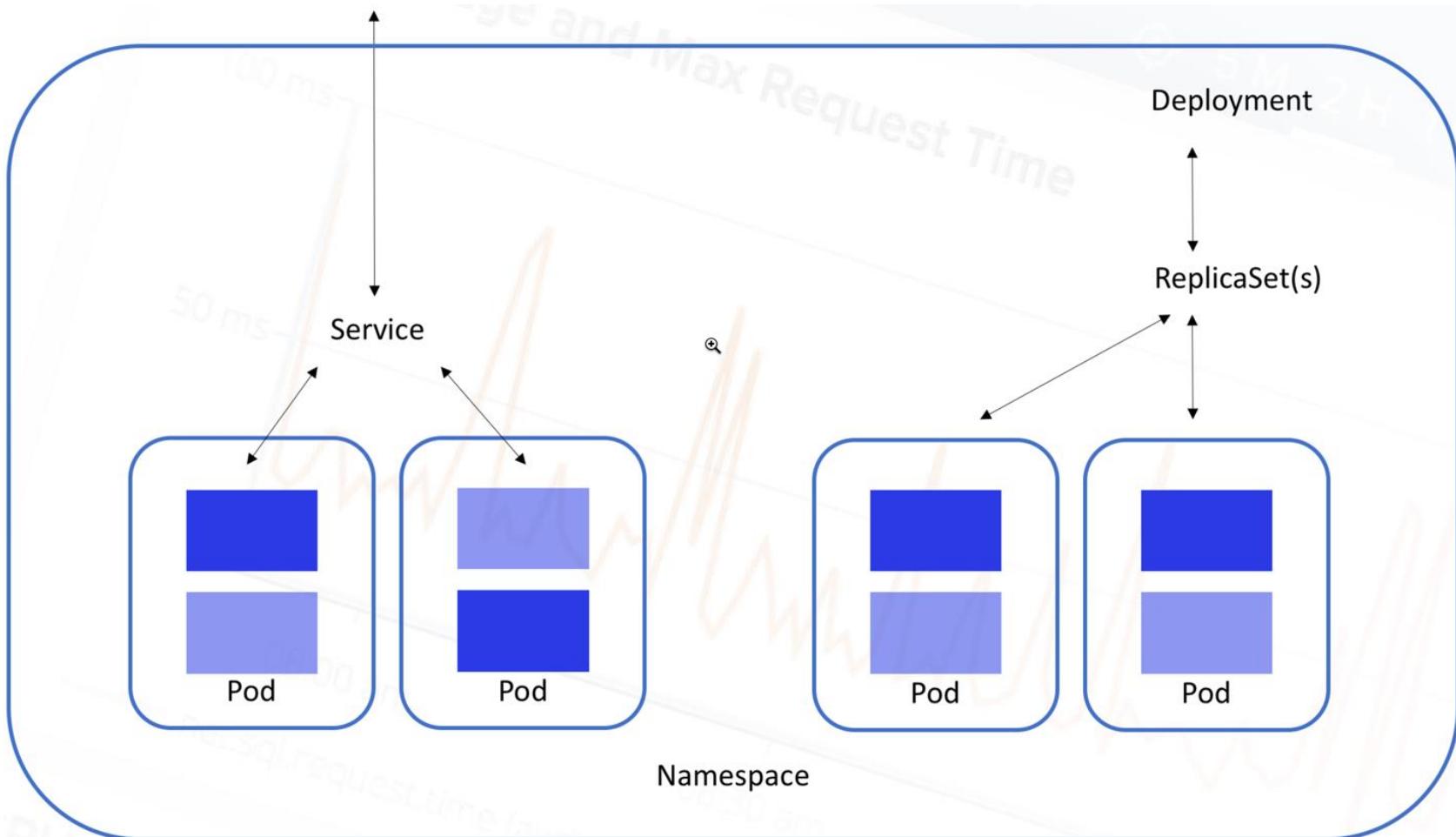
# Pods, Container and Services

- Pods vs Container
  - All container on same Pods will share:
    - Process ID (PID)
    - Network access (Communicate to each other via “localhost”)
    - Internal Process Command (IPC)
    - Unix Time-Sharing (UTS)
    - Hostname
    - IP Address/Ports
  - Use Case for Multiple Pods:
    - Apache (1 Container) +Tomcat (1 Container)
    - Apache(1 Container) + PHP (1 Container)
    - Nginx (Cache: 1 Container) + Apache/PHP (1 Container)
    - Web Server (1 Container) + Data Volume(Cache: 1 Container)
  - Pods will can create replicas of 1000+ set on cluster system



# Pods, Container and Services

- Container/ Pods / Service / Deployment/ RS



# Pods, Container and Services

- Way to deploy object in kubernetes by kubectl

Management technique	Operates on	Recommended environment	Supported writers	Learning curve
Imperative commands	Live objects	Development projects	1+	Lowest
Imperative object configuration	Individual files	Production projects	1	Moderate
Declarative object configuration	Directories of files	Production projects	1+	Highest

- Imperative commands:
  - Ex: kubectl <action> <type/name> <option>
  - Ex: kubectl run webtest --image labdocker/nginx:latest
- Imperative object configuration
  - Ex: kubectl <action> -f <YAML file>
  - Ex: kubectl create -f nginx.yml
  - Ex: kubectl replace -f nginx\_update.yml
- Declarative object configuration
  - Ex: kubectl apply -f <directory>

```
apiVersion: "v1"
kind: Pod
metadata:
  name: webtest
  labels:
    name: web
    owner: Praparn_L
    version: "1.0"
    module: WebServer
    environment: development
spec:
  containers:
    - name: webtest
      image: labdocker/cluster:webservicelite
      ports:
        - containerPort: 5000
          protocol: TCP
```



# Pods, Container and Services

- Imperative commands:

- “kubectl run” (Pods + Deployment+ RC (Replicas))

```
        kubectl run –image=<image name> <option>
```

- Option:

- --env="key=value"
- --port=port
- --replicas=<number of Pods replicas>
- --overrides=<json>
- --labels=<label>
- Etc

- Example:

```
[praparns-MacBook-Pro:~ praparn$ kubectl run webtest --image=labdocker/cluster:webservicelite --port=5000  
deployment "webtest" created
```

- **DEPRECATED !!!**

# Pods, Container and Services

- Imperative commands:

- kubectl expose (Service)

```
        kubectl expose deployment <name> <option>
```

- Option:

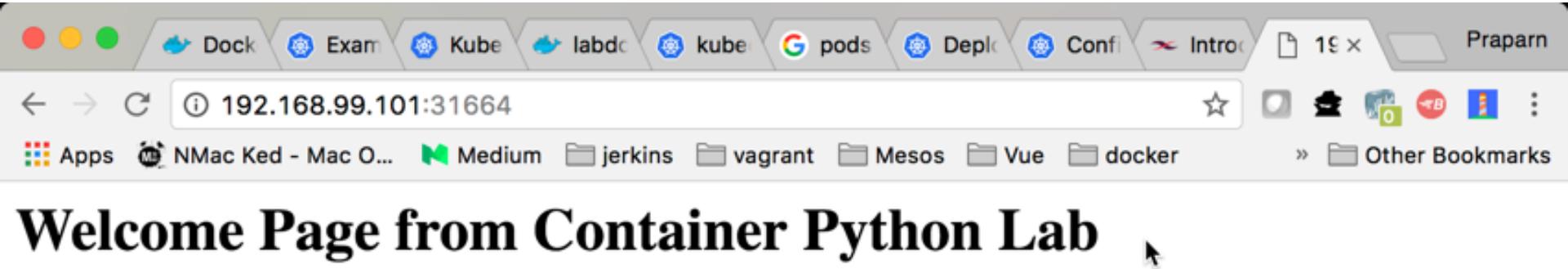
- --name=name
- --port=port for service
- --target-port=port of deployment set
- --type=<NodePort/ClusterIP/LoadBalance>
- --protocol=<TCP/UAT etc>
- Etc

```
[praparns-MacBook-Pro:~ praparn$ kubectl expose deployment webtest --target-port=5000 --type=NodePort
service "webtest" exposed
[praparns-MacBook-Pro:~ praparn$ kubectl get svc webtest
NAME      CLUSTER-IP    EXTERNAL-IP    PORT(S)          AGE
webtest   10.0.0.96    <nodes>        5000:31664/TCP  8s
```



# Pods, Container and Services

- Imperative commands:



# Pods, Container and Services

- Imperative object configuration

```
kubectl create -f <Filename>
```

- Create Pods (YAML)

```
apiVersion: "v1"
kind: Pod
metadata:
  name: webtest
  labels:
    name: web
    owner: Praparn_L
    version: "1.0"
    module: WebServer
    environment: development
spec:
  containers:
    - name: webtest
      image: labdocker/cluster:webservicelite
      ports:
        - containerPort: 5000
          protocol: TCP
```

- Create Service (YAML)

```
apiVersion: v1
kind: Service
metadata:
  name: webtest
  labels:
    name: web
    owner: Praparn_L
    version: "1.0"
    module: WebServer
    environment: development
spec:
  selector:
    name: web
    owner: Praparn_L
    version: "1.0"
    module: WebServer
    environment: development
  type: NodePort
  ports:
    - port: 5000
      name: http
      targetPort: 5000
      protocol: TCP
```



# Pods, Container and Services



JSON Formatter | My Ip | Search | Recent Links | Sample | More ▾ | Sign in | (?)

## YAML Converter

Save & Share

**YAML Input**

```
apiVersion: "v1"
kind: Pod
metadata:
  name: webtest
  labels:
    name: web
    owner: Praparn_L
    version: "1.0"
    module: WebServer
    environment: development
spec:
  containers:
    - name: webtest
      image: labdocker/cluster:webservicelite
      ports:
        - containerPort: 5000
          protocol: TCP
  nodeSelector:
    kubernetes.io/hostname: kubernetes-1
```

sample

**Load Url**

**Browse**

**YAML TO JSON**

**YAML TO XML**

**YAML TO CSV**

**Validate**

Seen this ad multiple times Not interested in this ad

**Download**

**Result : YAML TO JSON**

```
{
  "apiVersion": "v1",
  "kind": "Pod",
  "metadata": {
    "name": "webtest",
    "labels": {
      "name": "web",
      "owner": "Praparn_L",
      "version": "1.0",
      "module": "WebServer",
      "environment": "development"
    }
  },
  "spec": {
    "containers": [
      {
        "name": "webtest",
        "image": "labdocker/cluster:webservicelite",
        "ports": [
          {
            "containerPort": 5000,
            "protocol": "TCP"
          }
        ]
      }
    ],
    "nodeSelector": {
      "kubernetes.io/hostname": "kubernetes-1"
    }
}
```



# Pods, Container and Services

- Imperative object configuration

```
kubectl create -f <Filename>
```

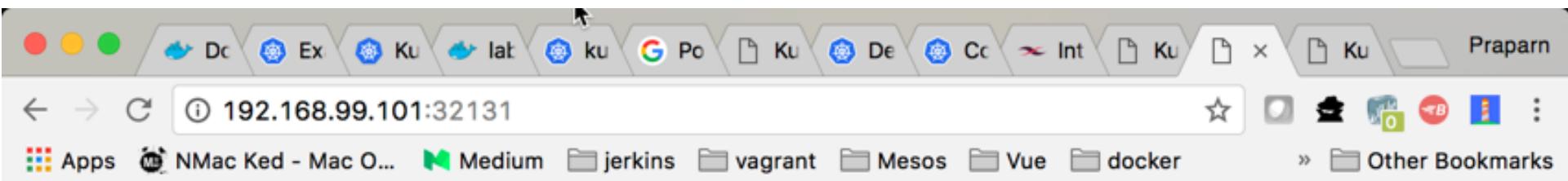
```
praparns-MacBook-Pro:WorkShop_1.2_Pods_Service_Deployment praparn$ ls -lh
total 24
-rw-r--r--@ 1 praparn  staff  550B Jul  2 09:29 instruction.txt
-rw-r--r--@ 1 praparn  staff  321B Jul  2 12:52 webtest_pod.yml
-rw-r--r--@ 1 praparn  staff  393B Jul  2 12:52 webtest_svc.yml
praparns-MacBook-Pro:WorkShop_1.2_Pods_Service_Deployment praparn$ kubectl create -f webtest_pod.yml
pod "webtest" created
praparns-MacBook-Pro:WorkShop_1.2_Pods_Service_Deployment praparn$ kubectl get pods
NAME      READY     STATUS    RESTARTS   AGE
webtest   1/1      Running   0          4m
praparns-MacBook-Pro:WorkShop_1.2_Pods_Service_Deployment praparn$ kubectl create -f webtest_svc.yml
service "webtest" created
praparns-MacBook-Pro:WorkShop_1.2_Pods_Service_Deployment praparn$ kubectl get svc
NAME      CLUSTER-IP    EXTERNAL-IP   PORT(S)        AGE
kubernetes  10.0.0.1    <none>        443/TCP       4d
webtest    10.0.0.87    <nodes>       5000:32131/TCP  4m
praparns-MacBook-Pro:WorkShop_1.2_Pods_Service_Deployment praparn$ curl http://192.168.99.101:32131
<H1> Welcome Page from Container Python Lab </H1>Checkpoint Date/Time: Sun Jul  2 06:04:08 2017
praparns-MacBook-Pro:WorkShop_1.2_Pods_Service_Deployment praparn$
```



# Pods, Container and Services

- Imperative object configuration

```
kubectl create -f <Filename>
```



## Welcome Page from Container Python Lab

Checkpoint Date/Time: Sun Jul 2 06:05:00 2017



# Pods, Container and Services

- Check log on container:

```
kubectl logs <Pods name> -c <container name>
```

```
praparns-MacBook-Pro:singlecontainer praparn$ kubectl logs webtest -c webtest
* Running on http://0.0.0.0:5000/ (Press CTRL+C to quit)
* Restarting with stat
* Debugger is active!
* Debugger PIN: 985-709-866
```

- Shell inside container:

```
kubectl exec -it <Pods name> -c <container name> sh
```

```
praparns-MacBook-Pro:singlecontainer praparn$ kubectl exec -it webtest -c webtest sh
/usr/src/app # ls -lh
total 36
-rw-r--r--  1 root    root        482 Jul  1 03:42 docker-compose.yml
-rw-r--r--  1 root    root       345 Jul  1 02:10 dockerfile_nginx
-rw-r--r--  1 root    root        80 Jun 30 17:32 dockerfile_python
-rw-r--r--  1 root    root        88 Jul  2 03:29 dockerfile_python_lite
-rw-r--r--  1 root    root      2.7K Jul  2 03:01 main.py
-rw-r--r--  1 root    root      291 Jul  2 03:46 mainlite.py
-rw-r--r--  1 root    root     1.2K Jul  1 03:51 nginx.conf
-rw-r--r--  1 root    root      24 Jun 18 04:33 requirements.txt
-rw-r--r--  1 root    root       6 Jul  2 03:32 requirementslite.txt
/usr/src/app # hostname
webtest
/usr/src/app #
```



# Pods, Container and Services

- Check detail property of Pods/Service

```
kubectl describe <Pods/SVC/etc> <Name>
```

```
praparns-MacBook-Pro:WorkShop_1.2_Pods_Service_Deployment praparn$ kubectl describe pods webtest
Name:           webtest
Namespace:      default
Node:          minikube/192.168.99.101
Start Time:    Sun, 02 Jul 2017 12:56:50 +0700
Labels:         environment=development
                module=WebServer
                name=web
                owner=Praparn_L
                version=1.0
Annotations:   <none>
Status:        Running
IP:            172.17.0.4
Controllers:   <none>
Containers:
  webtest:
    Container ID:    docker://04b9cdfdd6451a4e78c873f704fb4d35de7bba082343d0773c7ea0ebbb3f03a
    Image:          labdockerc/cluster:webserviceelite
    Image ID:       docker://sha256:837c8f41c918ede06f05f9b554b6120fdb654cc2a8eb7eec74bc383b09865f2b
    Port:          5000/TCP
    State:         Running
    Started:      Sun, 02 Jul 2017 12:56:51 +0700
    Ready:         True
    Restart Count: 0
    Environment:   <none>
    Mounts:
      /var/run/secrets/kubernetes.io/serviceaccount from default-token-vxm58 (ro)
Conditions:
  Type      Status
  Initialized  True
  Ready      True
  PodScheduled  True
Volumes:
  default-token-vxm58:
    Type:  Secret (a volume populated by a Secret)
    SecretName: default-token-vxm58
    Optional:  false
  QoS Class:  BestEffort
  Node-Selectors: <none>
  Tolerations: <none>
Events:
FirstSeen  LastSeen  Count  From             SubObjectPath          Type   Reason   Message
-----  -----  ----  -----  -----  -----
14m        14m       1  default-scheduler   spec.containers{webtest}  Normal  Scheduled  Successfully assigned webtest to minikube
14m        14m       1  kubelet, minikube   spec.containers{webtest}  Normal  Pulled    Container image "labdockerc/cluster:webserviceelite" already
y present on machine
14m        14m       1  kubelet, minikube   spec.containers{webtest}  Normal  Created   Created container with id 04b9cdfdd6451a4e78c873f704fb4d3
5de7bba082343d0773c7ea0ebbb3f03a
14m        14m       1  kubelet, minikube   spec.containers{webtest}  Normal  Started   Started container with id 04b9cdfdd6451a4e78c873f704fb4d3
5de7bba082343d0773c7ea0ebbb3f03a
praparns-MacBook-Pro:WorkShop_1.2_Pods_Service_Deployment praparn$
```



# Pods, Container and Services

- Check detail property of Pods/Service

```
kubectl describe <Pods/SVC/etc> <Name>
```

```
praparns-MacBook-Pro:WorkShop_1.2_Pods_Service_Deployment praparn$ kubectl describe svc webtest
Name:           webtest
Namespace:      default
Labels:         environment=development
                module=WebServer
                name=web
                owner=Praparn_L
                version=1.0
Annotations:   <none>
Selector:      environment=development,module=WebServer,name=web,owner=Praparn_L,version=1.0
Type:          NodePort
IP:            10.0.0.87
Port:          http    5000/TCP
NodePort:      http    32131/TCP
Endpoints:    172.17.0.4:5000
Session Affinity: None
Events:        <none>
praparns-MacBook-Pro:WorkShop_1.2_Pods_Service_Deployment praparn$ █
```

# Pods, Container and Services

- Check overall of Pods/Service

```
kubectl get <Pods/SVC/etc>
```

```
praparns-MacBook-Pro:multicontainer praparn$ kubectl get pods
NAME      READY    STATUS    RESTARTS   AGE
maindb    1/1     Running   0          18m
web       3/3     Running   0          16m
praparns-MacBook-Pro:multicontainer praparn$ kubectl get svc
NAME        CLUSTER-IP    EXTERNAL-IP    PORT(S)           AGE
kubernetes  10.0.0.1    <none>        443/TCP         4d
maindb      10.0.0.134   <none>        3306/TCP        17m
web         10.0.0.69    <nodes>       5000:30661/TCP,80:30500/TCP   16m
praparns-MacBook-Pro:multicontainer praparn$ █
```

- Remove Pod/Service

```
kubectl delete -f <Filename>
```

```
praparns-MacBook-Pro:singlecontainer praparn$ kubectl delete -f webtest_svc.yml
service "webtest" deleted █
praparns-MacBook-Pro:singlecontainer praparn$ kubectl delete -f webtest_pod.yml
pod "webtest" deleted
```



# Pods, Container and Services

- Trade-offs
  - Imperative commands:
    - Advantage:
      - Simple & Easy
      - Single Step for All
      - Effective immediate real-time
    - Disadvantage:
      - Hard to review on complete deployment
      - Unable to track change of them/Store source of deployment
      - No template for reiteration
      - Very long syntax when facing with complex configuration



# Pods, Container and Services

- Trade-offs
  - Imperative object configuration
    - Advantage:
      - Deployment source can keep and review process (svn, git etc)
      - Provide formal template for deployment
      - No skill set required deployment process
    - Disadvantage:
      - Need to understand of kubernetes before use
      - Writing YAML file before operate
      - Lost configuration update when it not appear on file (Next replacement will lost)
      - Design for manage via file not directory



# Pods, Container and Services

- Trade-offs
  - Declarative object configuration
    - Advantage:
      - Coverage all change in single command (Entire folder)
      - Fully support live-object configuration
      - Keep track/Merge all change in configuration file
      - Update default value in configuration file
    - Disadvantage:
      - More complicate on configuration file

Field in object configuration file	Field in live object configuration	Field in last-applied-configuration	Action
Yes	Yes	-	Set live to configuration file value.
Yes	No	-	Set live to local configuration.
No	-	Yes	Clear from live configuration.
No	-	No	Do nothing. Keep live value.



# Workshop 1.2: Pods & Service

- Part 1: Deploy simple web pods with single container



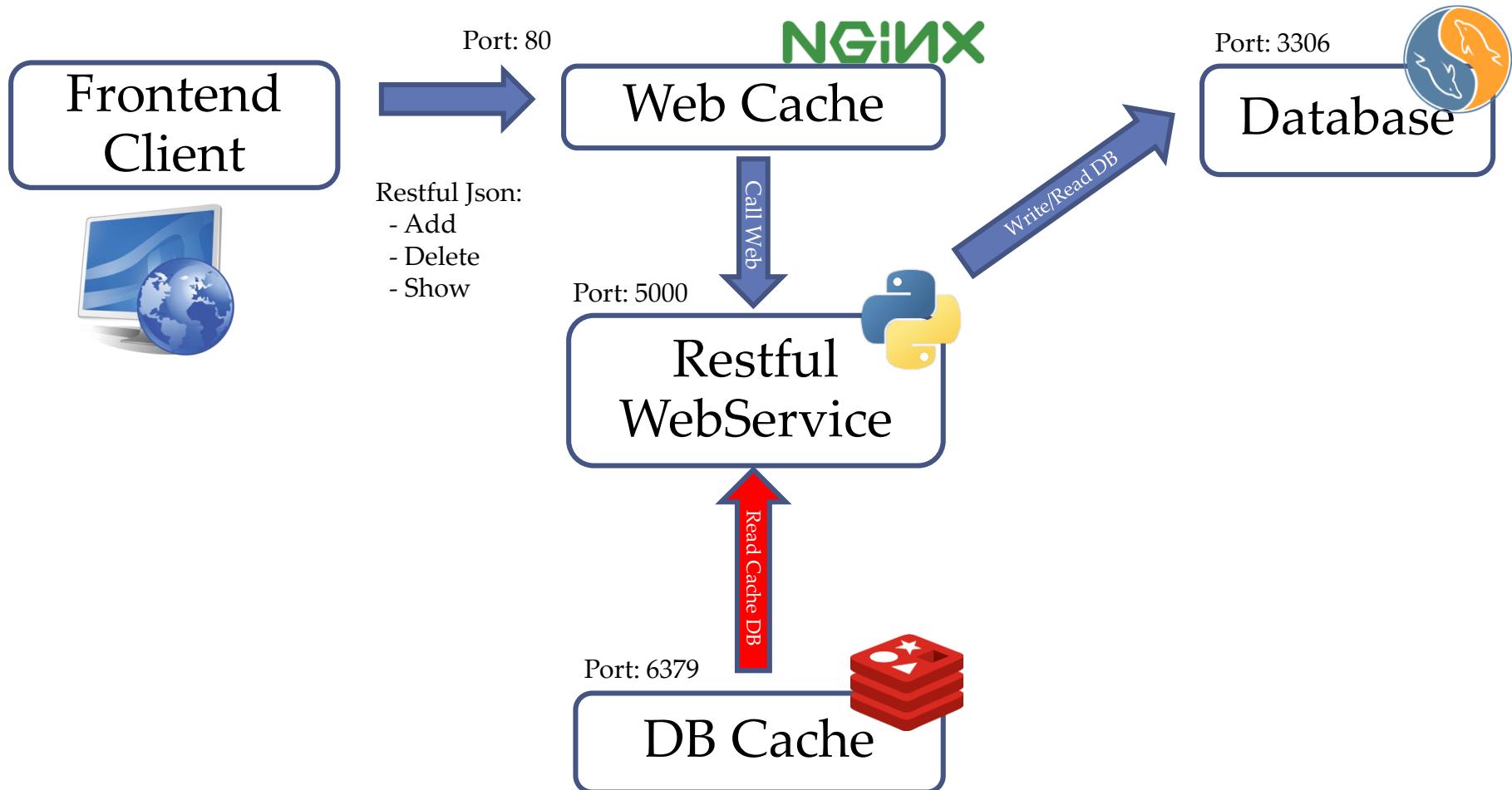
# Pods, Container and Service

- Example Case: Basic Restful API



# Pods, Container and Service

- Example Case: High I/O Restful API



# Pods, Container and Service

- Restful WebService

- /init

```
@app.route('/init')
def init():
    MAIN_DB.execute("DROP DATABASE IF EXISTS ACCTABLE")
    MAIN_DB.execute("CREATE DATABASE ACCTABLE")
    MAIN_DB.execute("USE ACCTABLE")
    sql = """CREATE TABLE users (
        ID int,
        USER char(30),
        DESRIPE char(250)
    )"""
    MAIN_DB.execute(sql)
    db.commit()
    return "##### Database Create New Account Table Done #####"
```

- /insertuser

```
@app.route("/users/insertuser", methods=['POST'])
def add_users():
    req_json = request.get_json()
    MAIN_DB.execute("INSERT INTO ACCTABLE.users (ID, USER, DESRIPE) VALUES (%s,%s,%s)", (req_json['uid'], req_json['user'], req_json['desripe']))
    #curl -i -H "Content-Type: application/json" -X POST -d '{"uid": "1", "user":"Praparn Luangphoonlap", "desripe":"System Engineer"}' http://<IP>
    db.commit()
    return Response("##### Record was added #####", status=200, mimetype='application/json')
```



# Pods, Container and Service

- Restful WebService
  - /removeuser/<uid>

```
@app.route('/users/removeuser/<uid>')
def remove_users(uid):
    hash = hashlib.sha224(str(uid)).hexdigest()
    key = "sql_cache:" + hash
    MAIN_DB.execute("DELETE FROM ACCTABLE.users WHERE ID =" + str(uid))
    db.commit()
    #curl http://<IP Host>:<Port>/users/removeuser/<uid>
    if (CACHE_DB.get(key)):
        CACHE_DB.delete(key)
        return Response("##### Record was deleted (Both Database Cache) #####", status=200, mimetype='application/json')
    else:
        return Response("##### Record was deleted #####", status=200, mimetype='application/json')
```



# Pods, Container and Service

- Restful WebService

- /users/<uid>

```
@app.route('/users/<uid>')
def get_users(uid):
    hash = hashlib.sha224(str(uid)).hexdigest()
    key = "sql_cache:" + hash
    #curl http://<IP Host>:<Port>/users/<uid>
    if (CACHE_DB.get(key)):
        return CACHE_DB.get(key) + "(Database Cache)"
    else:
        MAIN_DB.execute("select USER from ACCTABLE.users where ID=" + str(uid))
        data = MAIN_DB.fetchone()
        if data:
            CACHE_DB.set(key,data[0])
            CACHE_DB.expire(key, 36);
            return CACHE_DB.get(key)
        else:
            return "##### Record not found #####"
```

# Pods, Container and Service

- Web Cache

```
http {
    client_max_body_size 500M;
    client_body_timeout 3000s;
    include /etc/nginx/mime.types;
    default_type application/octet-stream;
    log_format main '$remote_addr - $remote_user [$time_local] "$request" '
    '$status $body_bytes_sent "'.$http_referer"
    '"$http_user_agent" "$http_x_forwarded_for"';

    access_log /var/log/nginx/access.log main;
    tcp_nopush on;

    keepalive_timeout 65;
    gzip on;

    include /etc/nginx/conf.d/*.conf;
server {
    listen 80;
    client_body_buffer_size 50M;
    index index.html      index.htm;
    location / {
        proxy_pass http://webservice:5000;
        proxy_next_upstream error timeout invalid_header http_500 http_502 http_503 http_504;
        proxy_redirect off;
        proxy_buffering off;
        proxy_set_header      Host          $host;
        proxy_set_header      X-Real-IP     $remote_addr;
        proxy_set_header      X-Forwarded-For $proxy_add_x_forwarded_for;
    }
}
```



# Pods, Container and Service

- Database and Database Cache

```
maindb:  
  image: labdocker/mysql:latest  
  container_name: maindb  
  environment:  
    MYSQL_ROOT_PASSWORD: password  
  
cachedb:  
  image: labdocker/redis:latest  
  container_name: cachedb  
  
webservice:  
  build: .  
  dockerfile: dockerfile_python  
  container_name: webservice  
  ports:  
    - "5000:5000"  
  links:  
    - cachedb:cachedb  
    - maindb:maindb  
  
webcache:  
  build: .  
  dockerfile: dockerfile_nginx  
  container_name: webcache  
  ports:  
    - "80:80"  
  links:  
    - webservice:webservice
```



# Pods, Container and Service

- Setup container for test
  - docker-compose build --no-cache
  - docker-compose up -d
  - docker-compose start

```
docker@labdocker:~/PYTHON_REDIS_NGINX/Docker$ docker-compose build --no-cache
cachedb uses an image, skipping
maindb uses an image, skipping
Building webservice
Step 1/3 : FROM labdocker/alpinepython:2.7-onbuild
# Executing 3 build triggers...
Step 1/1 : COPY requirements.txt /usr/src/app/
Step 1/1 : RUN pip install --no-cache-dir -r requirements.txt
--> Running in a4a8824e872b
Collecting flask (from -r requirements.txt (line 1))
  Downloading Flask-0.12.2-py2.py3-none-any.whl (83kB)
Collecting redis (from -r requirements.txt (line 2))
  Downloading redis-2.10.5-py2.py3-none-any.whl (60kB)
Collecting mysql-python (from -r requirements.txt (line 3))
  Downloading MySQL-python-1.2.5.zip (108kB)
Collecting itsdangerous>=0.21 (from flask->-r requirements.txt (line 1))
  Downloading itsdangerous-0.24.tar.gz (46kB)
```

```
docker@labdocker:~/PYTHON_REDIS_NGINX/Docker$ docker-compose up -d
Creating cachedb
Creating maindb
Creating webservice
Creating webcache
docker@labdocker:~/PYTHON_REDIS_NGINX/Docker$ docker-compose start
Starting webservice
```

```
docker@labdocker:~/PYTHON_REDIS_NGINX/Docker$ docker ps
CONTAINER ID        IMAGE               COMMAND                  CREATED             STATUS              PORTS                 NAMES
0948b0369239        docker_webcache    "nginx -c /etc/ngi..."   3 hours ago        Up 3 hours         0.0.0.0:80->80/tcp   webcache
e873e02c3bcf        docker_webservice  "python main.py"       3 hours ago        Up 3 hours         0.0.0.0:5000->5000/tcp  webservice
456afbcce89a4        labdocker/mysql:latest  "docker-entrypoint..."  3 hours ago        Up 3 hours         3306/tcp              maindb
fe5521999d1e        labdocker/redis:latest  "docker-entrypoint..."  3 hours ago        Up 3 hours         6379/tcp              cachedb
docker@labdocker:~/PYTHON_REDIS_NGINX/Docker$
```



# Pods, Container and Service

- How to test ?

```
Set environment:  
export Server_IP=<ip of docker host>  
export Server_Port=80 ==> if need to direct test change to 5000
```

```
Initial Main Database:  
curl http://$Server_IP:$Server_Port/init
```

```
Insert User on Database:  
curl -i -H "Content-Type: application/json" -X POST -d '{"uid": "1", "user":"Praparn Luangphoonlap", "desribe":"Slave"}' http://$Server_IP:$Server_Port/users/insertuser  
curl -i -H "Content-Type: application/json" -X POST -d '{"uid": "2", "user":"Somchai Sunsukan", "desribe":"Security Guard"}' http://$Server_IP:$Server_Port/users/insertuser  
curl -i -H "Content-Type: application/json" -X POST -d '{"uid": "3", "user":"Sanyachan Panrudee", "desribe":"House Keeping"}' http://$Server_IP:$Server_Port/users/insertuser  
curl -i -H "Content-Type: application/json" -X POST -d '{"uid": "4", "user":"Sakkhan Yanyicharoen", "desribe":"Messenger"}' http://$Server_IP:$Server_Port/users/insertuser  
curl -i -H "Content-Type: application/json" -X POST -d '{"uid": "5", "user":"Chatchai Moungang", "desribe":"Programmer"}' http://$Server_IP:$Server_Port/users/insertuser  
curl -i -H "Content-Type: application/json" -X POST -d '{"uid": "6", "user":"Anusit Kannaphat", "desribe":"DevOps Manager"}' http://$Server_IP:$Server_Port/users/insertuser  
curl -i -H "Content-Type: application/json" -X POST -d '{"uid": "7", "user":"Meelarp Maisanuk", "desribe":"System Engineer"}' http://$Server_IP:$Server_Port/users/insertuser  
curl -i -H "Content-Type: application/json" -X POST -d '{"uid": "8", "user":"Pansa Bunsong", "desribe":"Security Guard"}' http://$Server_IP:$Server_Port/users/insertuser  
curl -i -H "Content-Type: application/json" -X POST -d '{"uid": "9", "user":"Wiphanee Wongsaibawon", "desribe":"Administrator"}' http://$Server_IP:$Server_Port/users/insertuser
```

```
Retrieve Data from Database:  
curl http://$Server_IP:$Server_Port/users/1  
curl http://$Server_IP:$Server_Port/users/1 ==> Expect from Cache  
curl http://$Server_IP:$Server_Port/users/4  
curl http://$Server_IP:$Server_Port/users/4 ==> Expect from Cache
```

```
Delete Data from database:  
curl http://$Server_IP:$Server_Port/users/removeuser/1  
curl http://$Server_IP:$Server_Port/users/removeuser/2  
curl http://$Server_IP:$Server_Port/users/removeuser/3  
curl http://$Server_IP:$Server_Port/users/removeuser/4
```



# Pods, Container and Service

- How to test ?
  - Initial database

```
praparns-MacBook-Pro:~ praparn$ export Server_IP=192.168.99.100
praparns-MacBook-Pro:~ praparn$ export Server_Port=80
praparns-MacBook-Pro:~ praparn$ curl http://$Server_IP:$Server_Port/init
##### Database Create New Account Table Done #####
praparns-MacBook-Pro:~ praparn$ █
```

- Insert database

```
praparns-MacBook-Pro:~ praparn$ curl -i -H "Content-Type: application/json" -X POST -d '{"uid": "1", "user":"Praparn Luangphoonlap", "desribe":"Slave"}' http://$Server_IP:$Server_Port/users/insertuser
HTTP/1.1 200 OK
Server: nginx/1.8.1
Date: Sun, 02 Jul 2017 00:48:00 GMT
Content-Type: application/json
Content-Length: 40
Connection: keep-alive
[REDACTED]
#####
Record was added #####
praparns-MacBook-Pro:~ praparn$ curl -i -H "Content-Type: application/json" -X POST -d '{"uid": "2", "user":"Somchai Sunsukwan", "desribe":"Security Guard"}' http://$Server_IP:$Server_Port/users/insertuser
HTTP/1.1 200 OK
Server: nginx/1.8.1
Date: Sun, 02 Jul 2017 00:48:22 GMT
Content-Type: application/json
Content-Length: 40
Connection: keep-alive
[REDACTED]
#####
Record was added #####
praparns-MacBook-Pro:~ praparn$ █
```



# Pods, Container and Service

- How to test ?
  - Retrieve database/cache

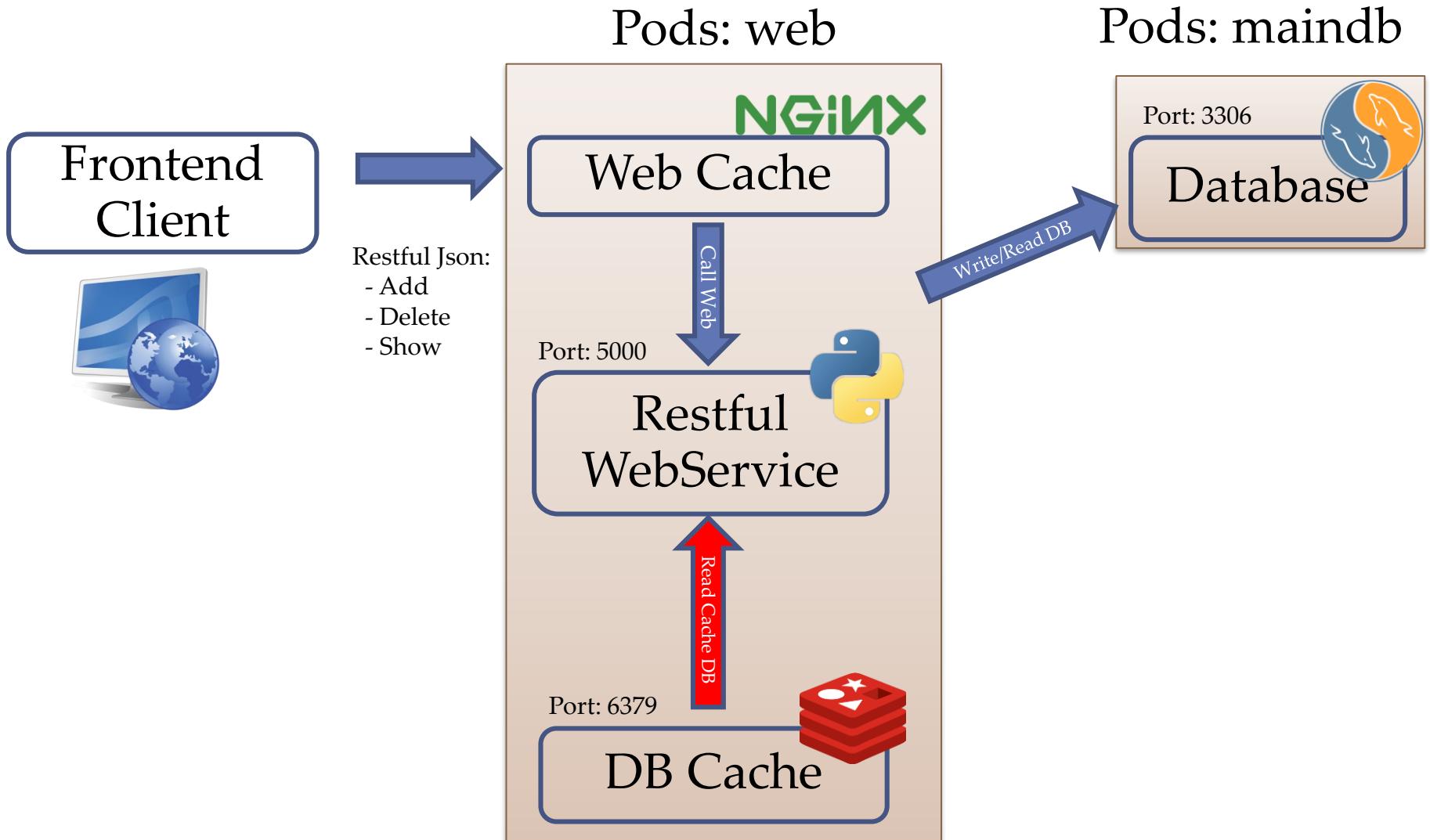
```
praparns-MacBook-Pro:~ paparn$ curl http://$Server_IP:$Server_Port/users/1
Praparn Luangphoonlappraparns-MacBook-Pro:~ paparn$
praparns-MacBook-Pro:~ paparn$ curl http://$Server_IP:$Server_Port/users/1
Praparn Luangphoonlap(Database Cache)praparns-MacBook-Pro:~ paparn$
```

- Delete database

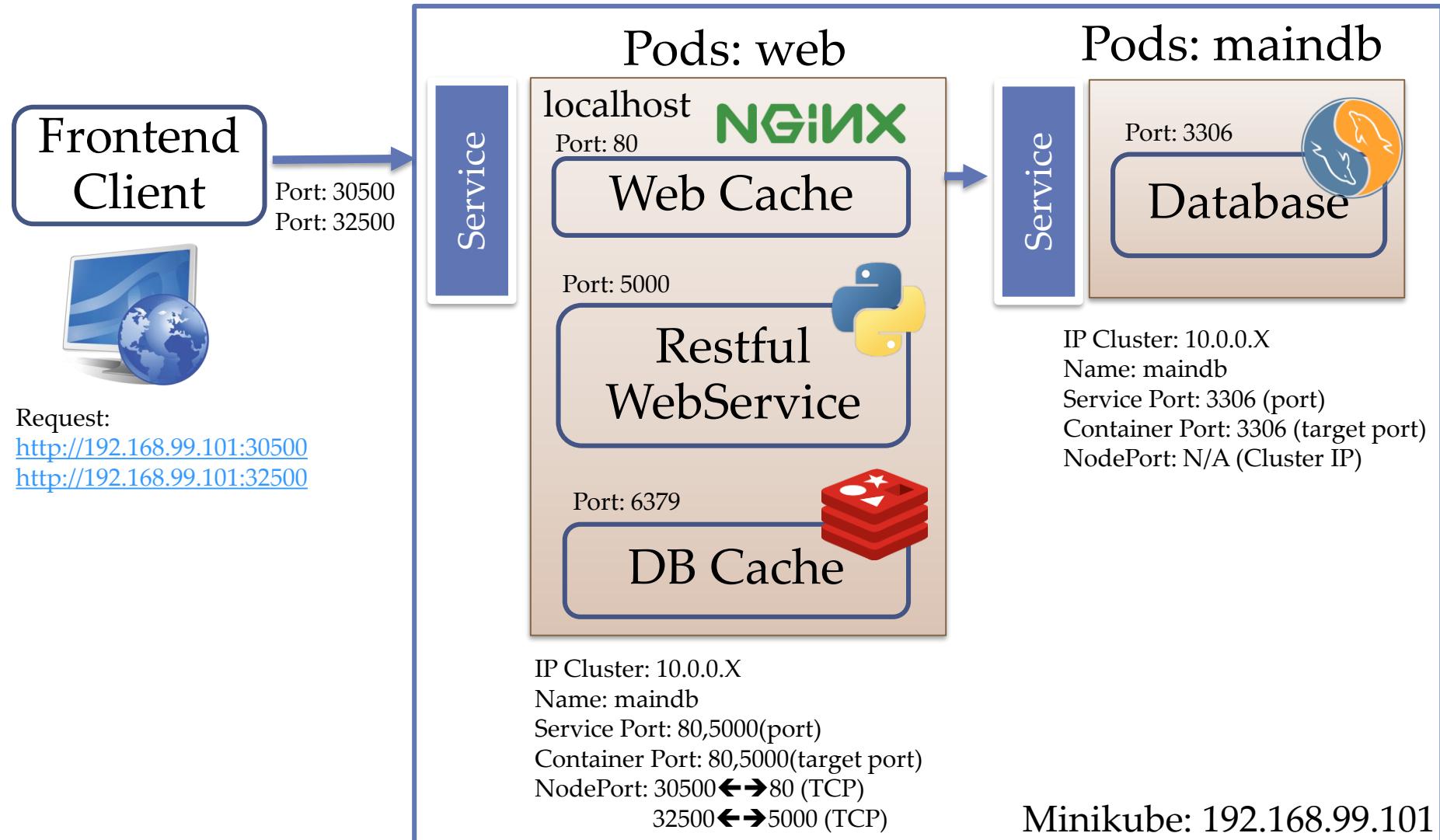
```
praparns-MacBook-Pro:~ paparn$ curl http://$Server_IP:$Server_Port/users/removeuser/1
##### Record was deleted (Both Database Cache) #####praparns-MacBook-Pro:~ paparn$ 
praparns-MacBook-Pro:~ paparn$ curl http://$Server_IP:$Server_Port/users/removeuser/2
##### Record was deleted #####praparns-MacBook-Pro:~ paparn$ 
praparns-MacBook-Pro:~ paparn$ █
```



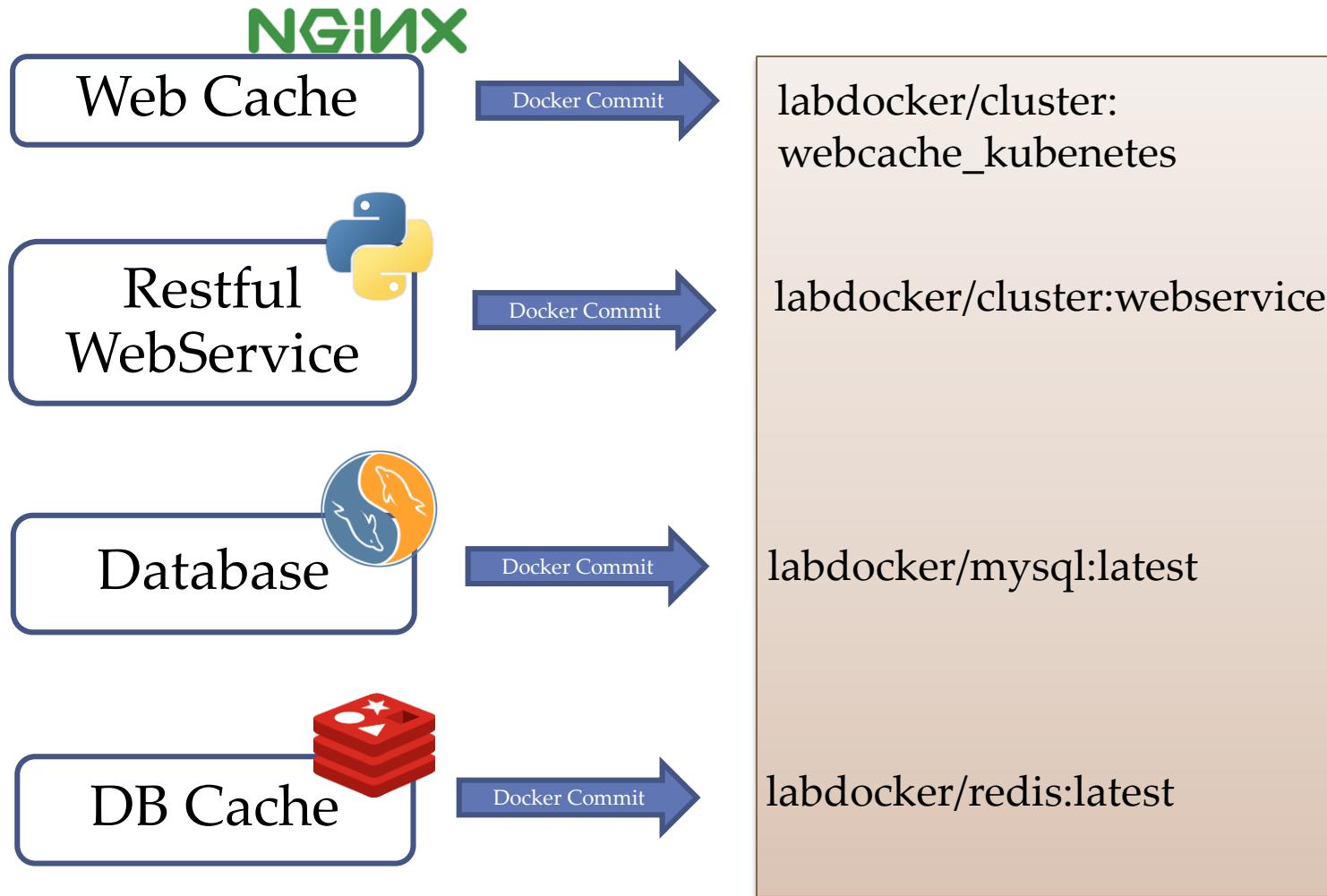
# Pods, Container and Service



# Pods, Container and Service



# Pods, Container and Service



# Pods, Container and Service

- Pods: maindb(YML)

```
1  apiVersion: "v1"
2  kind: Pod
3  metadata:
4    name: maindb
5    labels:
6      name: "maindb"
7      owner: "Praparn_L"
8      version: "1.0"
9      module: "maindb"
10     environment: "development"
11 spec:
12   containers:
13     - name: maindb
14       image: labdocker/mariadb:latest
15       ports:
16         - containerPort: 3306
17           protocol: TCP
18       env:
19         -
20           name: "MYSQL_ROOT_PASSWORD"
21           value: "password"
```

- Service: maindb(YML)

```
1  apiVersion: v1
2  kind: Service
3  metadata:
4    name: maindb
5    labels:
6      name: "maindb"
7      owner: "Praparn_L"
8      version: "1.0"
9      module: "maindb"
10     environment: "development"
11 spec:
12   ports:
13     - port: 3306
14       targetPort: 3306
15   selector:
16     name: "maindb"
17     owner: "Praparn_L"
18     version: "1.0"
19     module: "maindb"
20     environment: "development"
```



# Pods, Container and Service

- Pods: web(YML)

```
1 apiVersion: "v1"
2 kind: Pod
3 metadata:
4   name: web
5   labels:
6     name: "web"
7     owner: "Praparn_L"
8     version: "1.0"
9     module: "web"
10    environment: "development"
11 spec:
12   containers:
13     - name: cachedb
14       image: labdocker/redis:latest
15       ports:
16         - containerPort: 6379
17           protocol: TCP
18     - name: webservice
19       image: labdocker/cluster:webservice
20       env:
21         - name: "REDIS_HOST"
22           value: "localhost"
23       ports:
24         - containerPort: 5000
25           protocol: TCP
26     - name: webcache
27       image: labdocker/cluster:webcache_kubernetes
28       ports:
29         - containerPort: 80
30           protocol: TCP
```

- Service: web (YML)

```
1 apiVersion: v1
2 kind: Service
3 metadata:
4   name: web
5   labels:
6     name: "web"
7     owner: "Praparn_L"
8     version: "1.0"
9     module: "Web"
10    environment: "development"
11 spec:
12   selector:
13     name: "web"
14     owner: "Praparn_L"
15     version: "1.0"
16     module: "web"
17     environment: "development"
18   type: NodePort
19   ports:
20     - port: 5000
21       name: webservice
22       targetPort: 5000
23       protocol: TCP
24       nodePort: 32500
25     - port: 80
26       name: webcache
27       targetPort: 80
28       protocol: TCP
29       nodePort: 30500
```



# Pods, Container and Service

- Create "maindb" Pods and service

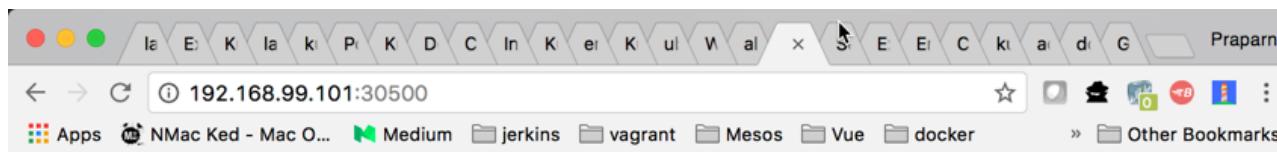
```
[praparns-MacBook-Pro:multicontainer praparn$ kubectl get pods
No resources found.
[praparns-MacBook-Pro:multicontainer praparn$ kubectl get svc
NAME      CLUSTER-IP  EXTERNAL-IP  PORT(S)  AGE
kubernetes  10.0.0.1    <none>        443/TCP  4d
[praparns-MacBook-Pro:multicontainer praparn$ kubectl create -f databasemodule_pod.yml
pod "maindb" created
[praparns-MacBook-Pro:multicontainer praparn$ kubectl get pods
NAME      READY      STATUS      RESTARTS      AGE
maindb   1/1       Running     0            9s
[praparns-MacBook-Pro:multicontainer praparn$ kubectl create -f databasemodule_svc.yml
service "maindb" created
[praparns-MacBook-Pro:multicontainer praparn$ kubectl get svc
NAME      CLUSTER-IP  EXTERNAL-IP  PORT(S)  AGE
kubernetes  10.0.0.1    <none>        443/TCP  4d
maindb     10.0.0.134  <none>        3306/TCP  7s
praparns-MacBook-Pro:multicontainer praparn$ ]
```



# Pods, Container and Service

- Create “web” Pods and service

```
praparns-MacBook-Pro:multicontainer praparn$ kubectl create -f webmodule_pod.yml
pod "web" created
praparns-MacBook-Pro:multicontainer praparn$ kubectl get pods
NAME      READY     STATUS    RESTARTS   AGE
maindb    1/1      Running   0          2m
web       3/3      Running   0          29s
praparns-MacBook-Pro:multicontainer praparn$ kubectl create -f webmodule_svc.yml
service "web" created
praparns-MacBook-Pro:multicontainer praparn$ kubectl get svc
NAME            CLUSTER-IP      EXTERNAL-IP      PORT(S)           AGE
kubernetes      10.0.0.1        <none>          443/TCP          4d
maindb          10.0.0.134      <none>          3306/TCP         1m
web             10.0.0.69       <nodes>         5000:30661/TCP,80:30500/TCP   4s
praparns-MacBook-Pro:multicontainer praparn$ █
```



## Welcome Page from Container Python Lab

Checkpoint Date/Time: Sun Jul 2 13:08:00 2017



# Pods, Container and Service

- Initial database and insert data

```
praparns-MacBook-Pro:multicontainer praparn$ export Server_IP=192.168.99.100
praparns-MacBook-Pro:multicontainer praparn$ export Server_Port=30500
praparns-MacBook-Pro:multicontainer praparn$ curl http://$Server_IP:$Server_Port
curl: (7) Failed to connect to 192.168.99.100 port 30500: Connection refused
praparns-MacBook-Pro:multicontainer praparn$ clear
```

```
praparns-MacBook-Pro:multicontainer praparn$ export Server_IP=192.168.99.101
praparns-MacBook-Pro:multicontainer praparn$ export Server_Port=30500
praparns-MacBook-Pro:multicontainer praparn$ curl http://$Server_IP:$Server_Port
<H1> Welcome Page from Container Python Lab </H1>Checkpoint Date/Time: Sun Jul  2 13:18:09 2017
praparns-MacBook-Pro:multicontainer praparn$ curl http://$Server_IP:$Server_Port/init
##### Database Create New Account Table Done #####
```

```
praparns-MacBook-Pro:multicontainer praparn$ curl -i -H "Content-Type: application/json" -X POST -d '{"uid": "1", "user":"Praparn Luangphoonlap", "desribe":"Slave"}' http://$Server_IP:$Server_Port/users/insertuser
HTTP/1.1 200 OK
Server: nginx/1.8.1
Date: Sun, 02 Jul 2017 13:18:45 GMT
Content-Type: application/json
Content-Length: 41
Connection: keep-alive
##### Record was added #####
praparns-MacBook-Pro:multicontainer praparn$
```



# Pods, Container and Service

- Initial database, insert and get data (Direct/Cache)

```
praparns-MacBook-Pro:multicontainer praparn$ export Server_IP=192.168.99.100
praparns-MacBook-Pro:multicontainer praparn$ export Server_Port=30500
praparns-MacBook-Pro:multicontainer praparn$ curl http://$Server_IP:$Server_Port
curl: (7) Failed to connect to 192.168.99.100 port 30500: Connection refused
praparns-MacBook-Pro:multicontainer praparn$ clear
```

```
praparns-MacBook-Pro:multicontainer praparn$ export Server_IP=192.168.99.101
praparns-MacBook-Pro:multicontainer praparn$ export Server_Port=30500
praparns-MacBook-Pro:multicontainer praparn$ curl http://$Server_IP:$Server_Port
<H1> Welcome Page from Container Python Lab </H1>Checkpoint Date/Time: Sun Jul  2 13:18:09 2017
praparns-MacBook-Pro:multicontainer praparn$ curl http://$Server_IP:$Server_Port/init
##### Database Create New Account Table Done #####
```

```
praparns-MacBook-Pro:multicontainer praparn$ curl -i -H "Content-Type: application/json" -X POST -d '{"uid": "1", "user":"Praparn Luangphoonlap", "desribe":"Slave"}' http://$Server_IP:$Server_Port/users/insertuser
HTTP/1.1 200 OK
Server: nginx/1.8.1
Date: Sun, 02 Jul 2017 13:18:45 GMT
Content-Type: application/json
Content-Length: 41
Connection: keep-alive
##### Record was added #####
praparns-MacBook-Pro:multicontainer praparn$
```

```
praparns-MacBook-Pro:multicontainer praparn$ curl http://$Server_IP:$Server_Port/users/1
Praparn Luangphoonlap(Database Direct)
praparns-MacBook-Pro:multicontainer praparn$ curl http://$Server_IP:$Server_Port/users/1
Praparn Luangphoonlap(Database Cache)
praparns-MacBook-Pro:multicontainer praparn$ curl http://$Server_IP:$Server_Port/users/4
Sakkan Yanyicharoen(Database Direct)
praparns-MacBook-Pro:multicontainer praparn$ curl http://$Server_IP:$Server_Port/users/4
Sakkan Yanyicharoen(Database Cache)
```



# Pods, Container and Service

- Delete data (Both cache and database)

```
praparns-MacBook-Pro:multicontainer praparn$ curl http://$Server_IP:$Server_Port/users/removeuser/1
#####
Record was deleted (Both Database Cache)
#####
praparns-MacBook-Pro:multicontainer praparn$ curl http://$Server_IP:$Server_Port/users/removeuser/2
#####
Record was deleted #####
praparns-MacBook-Pro:multicontainer praparn$ curl http://$Server_IP:$Server_Port/users/removeuser/3
#####
Record was deleted #####
praparns-MacBook-Pro:multicontainer praparn$ curl http://$Server_IP:$Server_Port/users/removeuser/4
#####
Record was deleted (Both Database Cache)
#####
praparns-MacBook-Pro:multicontainer praparn$ █
```

- Remove

```
praparns-MacBook-Pro:multicontainer praparn$ kubectl delete svc maindb web
service "maindb" deleted
service "web" deleted
praparns-MacBook-Pro:multicontainer praparn$ kubectl delete pods maindb web
pod "maindb" deleted
pod "web" deleted
praparns-MacBook-Pro:multicontainer praparn$ █
```

# Pods, Container and Services

- Services

- Service is independent from Pods
  - Pods can create / destroy / restart every time (manual/automatic)
  - Mean “Pods” always change their nodes/ip/location everytime
  - Service don't care how Pods are being, But they still can map the Pods
- Service is abstract of Pods (1 – N Pods)
  - Usually defined port by “Label”
  - Expose access Pods/Load Balance with service (kube-proxy: iptables)
    - “port” that service open for access
    - “target port” that map with Pods for access
    - “type” TCP/UDP
  - Discovery service option:
    - ENVIRONMENT:
      - {SVC\_NAME\_SERVICE\_HOST}
      - {SVC\_NAME\_SERVICE\_PORT}
    - DNS (cluster-addon): Name same service name



# Pods, Container and Services

- Services
  - Pods “web”

```
1 apiVersion: "v1"
2 kind: Pod
3 metadata:
4   name: web
5   labels:
6     name: "web"
7     owner: "Praparn_L"
8     version: "1.0"
9     module: "web"
10    environment: "development"
11 spec:
12   containers:
13     - name: cachedb
14       image: labdocker/redis:latest
15       ports:
16         - containerPort: 6379
17           protocol: TCP
18     - name: webservice
19       image: labdocker/cluster:webservice
20       env:
21         - name: "REDIS_HOST"
22           value: "localhost"
23       ports:
24         - containerPort: 5000
25           protocol: TCP
26     - name: webcache
27       image: labdocker/cluster:webcache_kubernetes
28       ports:
29         - containerPort: 80
30           protocol: TCP
```

Pods “web2”

```
1 apiVersion: "v1"
2 kind: Pod
3 metadata:
4   name: web2
5   labels:
6     name: "web"
7     owner: "Praparn_L"
8     version: "1.0"
9     module: "web"
10    environment: "development"
11 spec:
12   containers:
13     - name: cachedb
14       image: labdocker/redis:latest
15       ports:
16         - containerPort: 6379
17           protocol: TCP
18     - name: webservice
19       image: labdocker/cluster:webservice2
20       env:
21         - name: "REDIS_HOST"
22           value: "localhost"
23       ports:
24         - containerPort: 5000
25           protocol: TCP
26     - name: webcache
27       image: labdocker/cluster:webcache_kubernetes
28       ports:
29         - containerPort: 80
30           protocol: TCP
```

Service “web”

```
1 apiVersion: v1
2 kind: Service
3 metadata:
4   name: web
5   labels:
6     name: "web"
7     owner: "Praparn_L"
8     version: "1.0"
9     module: "Web"
10    environment: "development"
11 spec:
12   selector:
13     name: "web"
14     owner: "Praparn_L"
15     version: "1.0"
16     module: "web"
17     environment: "development"
18   type: NodePort
19   ports:
20     - port: 5000
21       name: webservice
22       targetPort: 5000
23       protocol: TCP
24       nodePort: 32500
25     - port: 80
26       name: webcache
27       targetPort: 80
28       protocol: TCP
29       nodePort: 30500
```

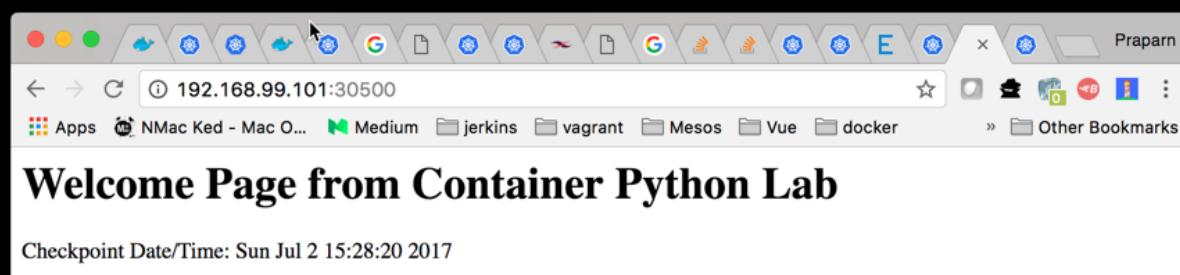


# Pods, Container and Services

- Services

- Existing Pods “web”

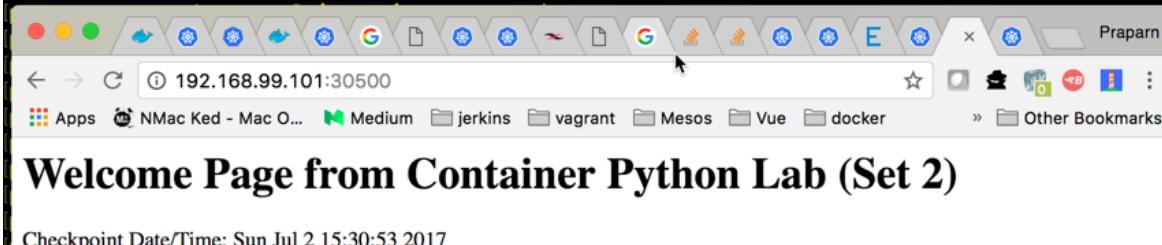
```
praparns-MacBook-Pro:multicontainer praparn$ kubectl get pods
NAME          READY   STATUS    RESTARTS   AGE
curl-1580724602-gjihq   0/1     CrashLoopBackOff  27      1h
maindb        1/1     Running   0          56m
web           3/3     Running   0          7m
praparns-MacBook-Pro:multicontainer praparn$ curl http://$Server_IP:$Server_Port
<H1> Welcome Page from Container Python Lab </H1>Checkpoint Date/Time: Sun Jul  2 15:28:13 2017
praparns-MacBook-Pro:multicontainer praparn$ 
```



```
praparns-MacBook-Pro:multicontainer praparn$ kubectl get svc
NAME      CLUSTER-IP   EXTERNAL-IP   PORT(S)           AGE
kubernetes  10.0.0.1    <none>        443/TCP         5d
maindb     10.0.0.236   <none>        3306/TCP        1m
web        10.0.0.212   <nodes>       5000:32500/TCP,80:30500/TCP   1m
praparns-MacBook-Pro:multicontainer praparn$ 
```

# Pods, Container and Services

- Services
  - Replace new Pods “web2”

```
praparns-MacBook-Pro:multicontainer praparn$ kubectl create -f webmodule_pod2.yml
pod "web2" created
praparns-MacBook-Pro:multicontainer praparn$ kubectl get pods
NAME        READY   STATUS    RESTARTS   AGE
curl-1580724602-gjjhq  0/1     CrashLoopBackOff  27          1h
maindb      1/1     Running   0           58m
web         3/3     Running   0           10m
web2        3/3     Running   0           1m
praparns-MacBook-Pro:multicontainer praparn$ kubectl delete pods web
pod "web" deleted
praparns-MacBook-Pro:multicontainer praparn$ kubectl get pods
NAME        READY   STATUS    RESTARTS   AGE
curl-1580724602-gjjhq  0/1     CrashLoopBackOff  27          1h
maindb      1/1     Running   0           59m
web2        3/3     Running   0           2m

praparns-MacBook-Pro:multicontainer praparn$ kubectl get svc
NAME      CLUSTER-IP   EXTERNAL-IP   PORT(S)           AGE
kubernetes  10.0.0.1    <none>        443/TCP          5d
maindb     10.0.0.236   <none>        3306/TCP          1m
web        10.0.0.212   <nodes>       5000:32500/TCP,80:30500/TCP  1m
praparns-MacBook-Pro:multicontainer praparn$
```



# Pods, Container and Services

- Services

- Publish Service Type:

- CLUSTER-IP (Default): blind port with ip address of cluster (Accessible from internal cluster system)
    - NodePort: blind port with ip address of node. By default kubernetes will random port (30000-32757). If we need to specify set the option: "nodePort: XXXXX"

```
18 type: NodePort
19 ports:
20 - port: 5000
21   name: webservice
22   targetPort: 5000
23   protocol: TCP
24   nodePort: 32500
25 - port: 80
26   name: webcache
27   targetPort: 80
28   protocol: TCP
29   nodePort: 30500
```

```
praparns-MacBook-Pro:multicontainer praparn$ kubectl get svc
NAME      CLUSTER-IP  EXTERNAL-IP  PORT(S)          AGE
kubernetes  10.0.0.1    <none>       443/TCP        5d
maindb     10.0.0.236   <none>       3306/TCP       1m
web        10.0.0.212   <nodes>      5000:32500/TCP,80:30500/TCP  1m
praparns-MacBook-Pro:multicontainer praparn$ █
```



# Pods, Container and Services

- Services
  - Publish Service Type:
    - LoadBalance (Usually from cloud provider): service will allow loadbalance send traffic through Pods directly

```
1 kind: Service
2 apiVersion: v1
3 metadata:
4   name: my-service
5 spec:
6   selector:
7     app: MyApp
8   ports:
9     - protocol: TCP
10    port: 80
11    targetPort: 9376
12    nodePort: 30061
13  clusterIP: 10.0.171.239
14  loadBalancerIP: 78.11.24.19
15  type: LoadBalancer
16 status:
17   loadBalancer:
18     ingress:
19       - ip: 146.148.47.155
20
```



# Pods, Container and Services

- Services

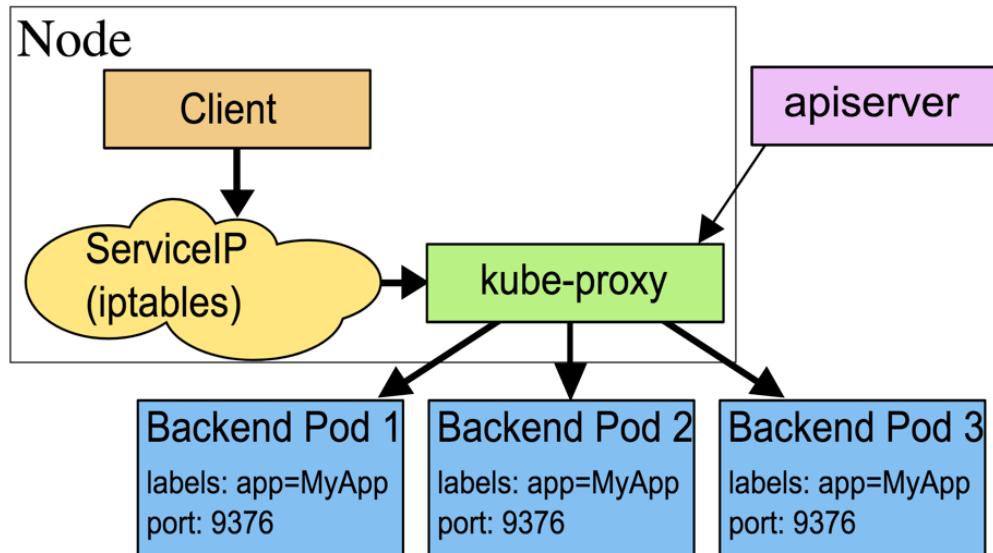
- Publish Service Type:
  - ExternalName:
    - No selector / No define pods / No endpoints
    - Use for return CNAME record for DNS-Load Balance
    - Work with kube-dns (Kubernetes V1.7 or higher)

```
1 kind: Service
2 apiVersion: v1
3 metadata:
4   name: my-service
5   namespace: prod
6 spec:
7   type: ExternalName
8   externalName: my.database.example.com
```

- nslookup "my-service.prod.svc.CLUSTER" → return CNAME: "my.database.example.com"

# Pods, Container and Services

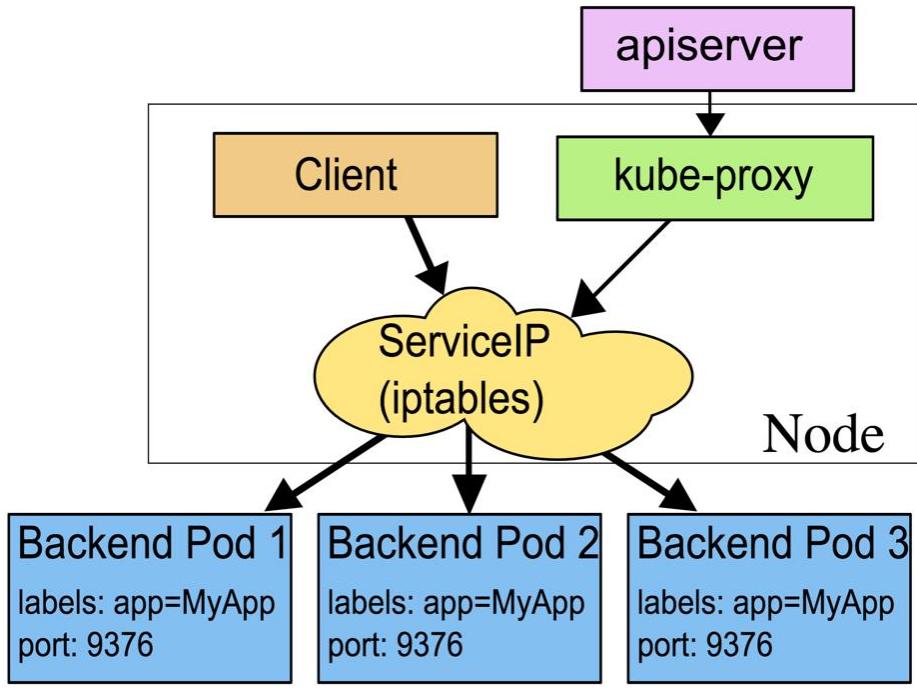
- kube-proxy (proxy-mode)
  - Every node on K8S will use kube-proxy for response to service
    - Initial Virtual IP for service (except External Name)
    - Vary “proxy-mode” for support in kube-proxy
  - Proxy-mode: userspace (default on kubernetes v1.0 – 1.7)
    - Open port on local node (random) and proxy to backend pods
    - Userspace (binary) will terminate and establish new connect to pods
    - Round robin traffic / retry on case pods fail



# Pods, Container and Services

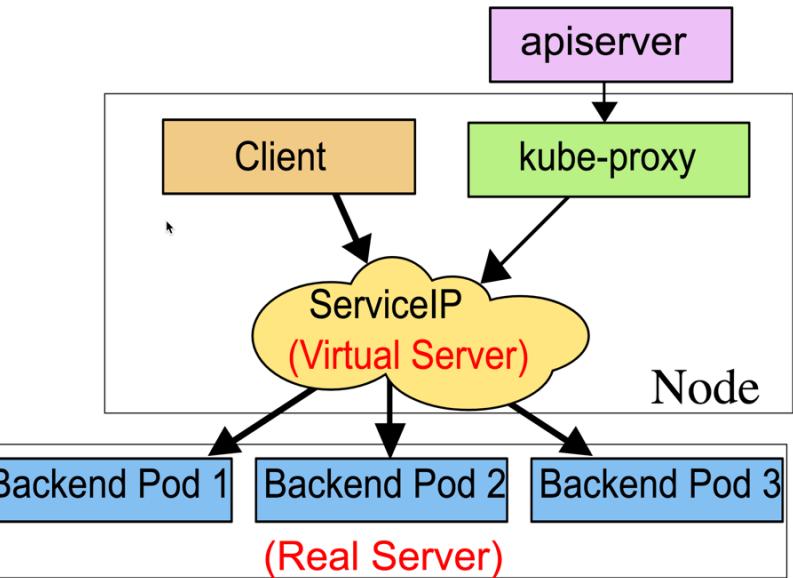
- kube-proxy (proxy-mode)

- Proxy-mode: iptables (default on kubernetes v1.8 – current)
  - Install iptable rule on ServiceIP (VIP) for capture traffic and port
  - Redirect traffic to local node for load balance traffic to pods
  - User kernelspace that faster than userspace (No switch between kernelspace and user space)
  - Not support in case pods fail



# Pods, Container and Services

- kube-proxy (proxy-mode)
  - Proxy-mode: ipvs (beta on kubernetes v1.9)
    - Create “netlink” interface for establish connection via IPVS
    - Establish IPVS (IP Virtual Server) rule and sync (periodic for consistency before establish)
    - Pure 100% kernelspace and better performance
    - Multiple option for load balance
      - rr: round-robin
      - lc: least connection
      - dh: destination hash
      - sh: source hash
      - sed: shortest expected delay
      - nq: never queue



# Pods, Container and Services

- Configure kube-proxy (proxy-mode)

## How to use IPVS

This document shows how to use kube-proxy ipvs mode.

### What is IPVS

IPVS (IP Virtual Server) implements transport-layer load balancing, usually called Layer 4 LAN switching, as part of Linux kernel.

IPVS runs on a host and acts as a load balancer in front of a cluster of real servers. IPVS can direct requests for TCP and UDP-based services to the real servers, and make services of real servers appear as virtual services on a single IP address.

### Run kube-proxy in ipvs mode

Currently, local-up scripts and kubeadm support switching IPVS proxy mode via exporting environment variables or specifying flags.

#### Local UP Cluster

Kube-proxy will run in iptables mode by default in a [local-up cluster](#).

Users should export the env `KUBE_PROXY_MODE=ipvs` to specify the ipvs mode before deploying the cluster if want to run kube-proxy in ipvs mode.

#### Cluster Created by Kubeadm

Kube-proxy will run in iptables mode by default in a cluster deployed by [kubeadm](#).

If you are using kubeadm with a [configuration file](#), you can specify the ipvs mode adding `SupportIPVSPProxyMode: true` below the `kubeProxy` field. Then the configuration file is similar to:

```
kind: MasterConfiguration
apiVersion: kubeadm.k8s.io/v1alpha1
...
kubeProxy:
  config:
    featureGates: SupportIPVSPProxyMode=true
    mode: ipvs
  ...
...
```

**Note:** ipvs mode assumes IPVS kernel modules are installed on the node before running kube-proxy. When kube-proxy starts with ipvs proxy mode, kube-proxy would validate if IPVS modules are installed on the node, if it's not installed kube-proxy will fall back to iptables proxy mode.

<https://github.com/kubernetes/kubernetes/tree/master/pkg/proxy/ipvs>

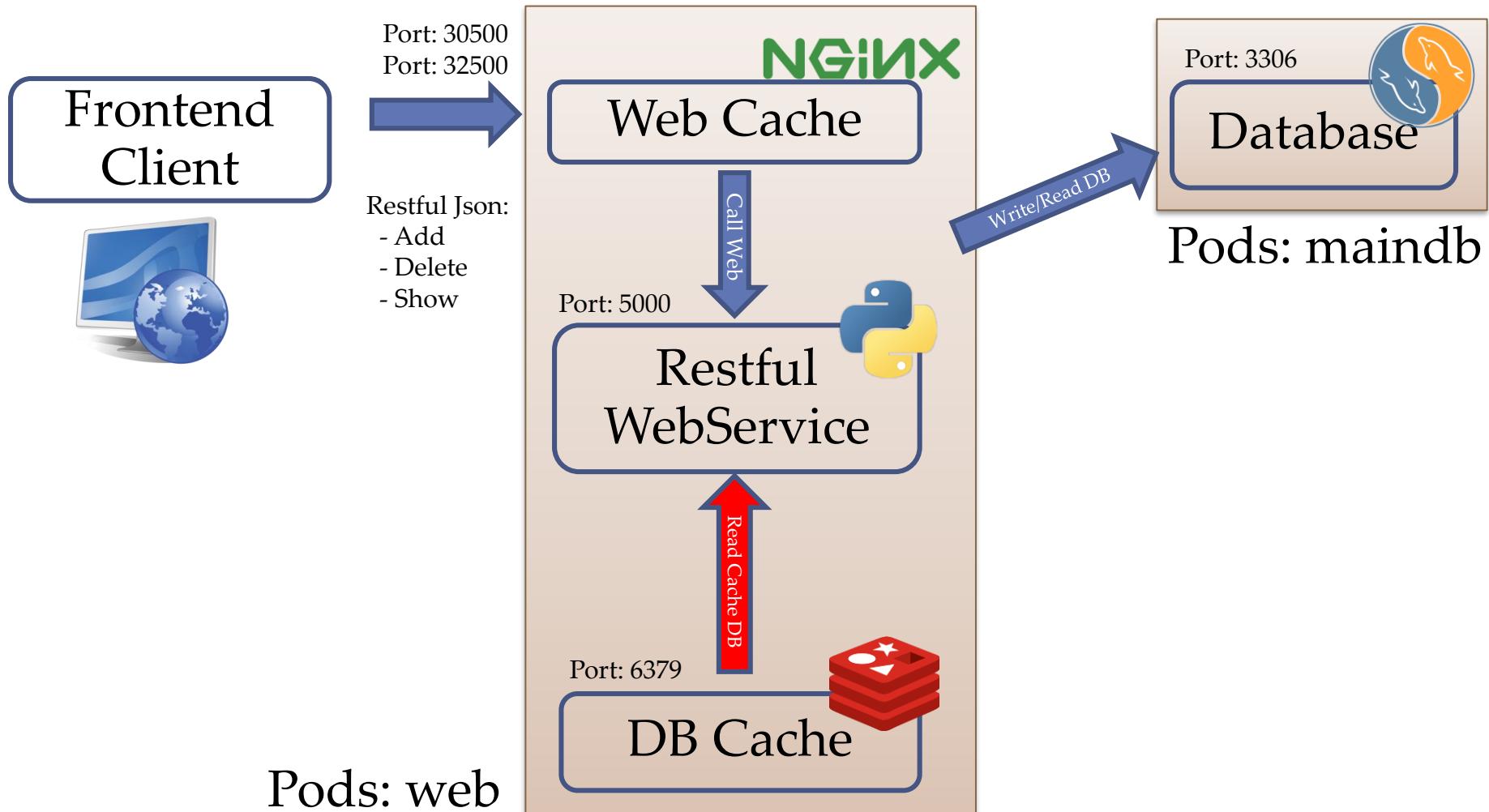
Kubernetes: Production Workload Orchestration



**kubernetes**  
by Google

# Workshop 1.2: Pods & Service

- Part 2: Deploy web pods with multi container



# Pods, Container and Services

- Other Command

The screenshot shows a web browser displaying the Kubernetes documentation at <https://kubernetes.io/docs/user-guide/kubectl/v1.7/#-strong-getting-started-strong->. The page title is "GETTING STARTED". On the left, there's a sidebar with sections for "GETTING STARTED" (run, expose), "APP MANAGEMENT" (annotate, autoscale, convert, create, delete, edit, get, label, patch, replace, rolling-update, rollout, scale, set), and "DECLARATIVE APP MANAGEMENT". The main content area starts with a list of basic commands: "run" and "expose". Below that, it says "Once your workloads are running, you can use the commands in the WORKING WITH APPS section to inspect them." A section titled "run" follows, with descriptions for "Create and run a particular image, possibly replicated." and "Creates a deployment or job to manage the created container(s.)". A usage section shows the command syntax: `$ run NAME --image=image [--env="key=value"] [--port=port] [--replicas=replicas] [--dry-run=bool] [--overrides=inline-json] [--command] -- [COMMAND] [args...]`. To the right, there are two examples: "Start a single instance of nginx." with the command `kubectl run nginx --image=nginx`, and "Start a single instance of hazelcast and let the container expose port 5701 ." with the command `kubectl run hazelcast --image=hazelcast --port=5701`.

Ref <https://kubernetes.io/docs/user-guide/kubectl/v1.7/>

Kubernetes: Production Workload Orchestration

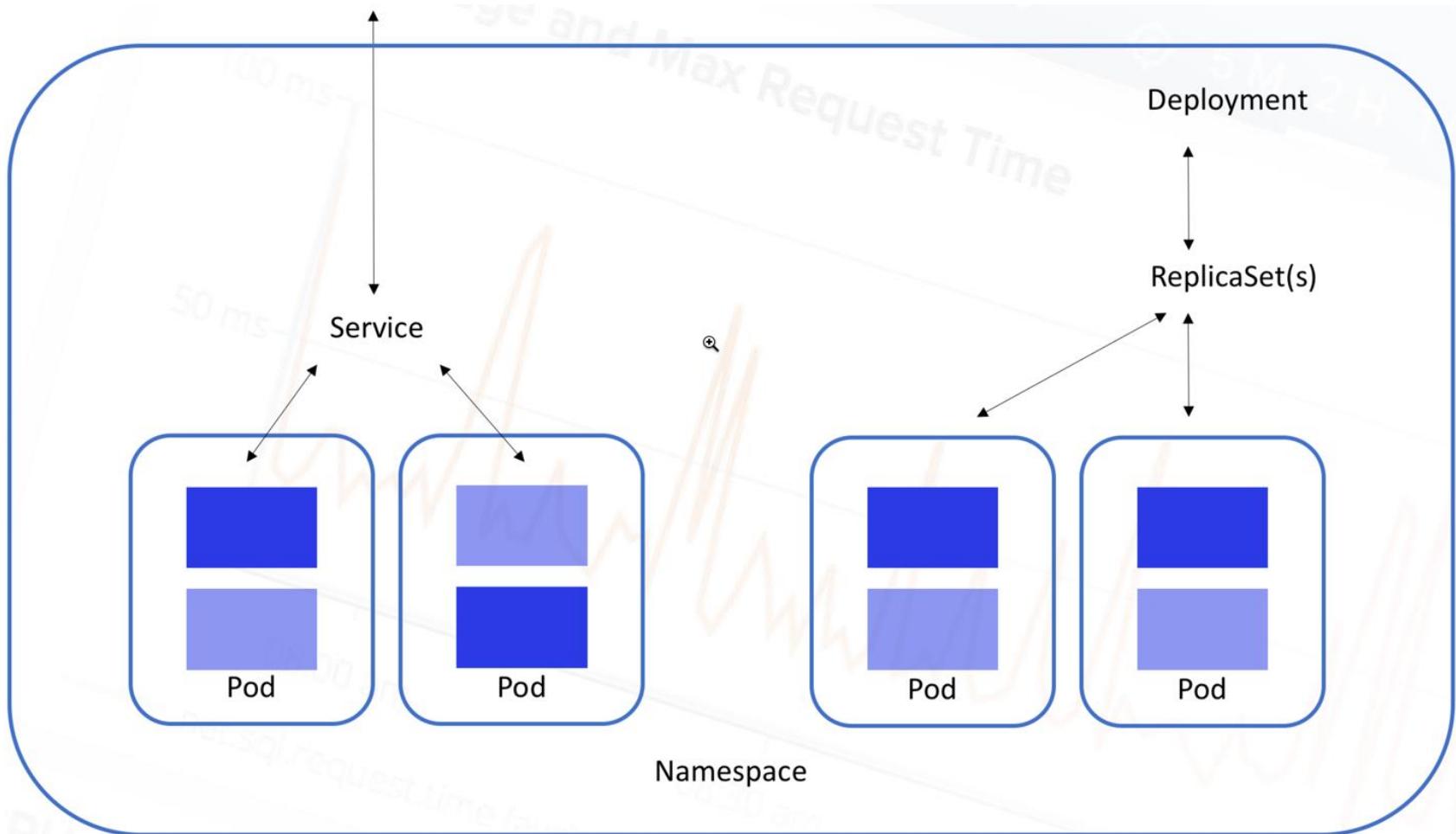


**kubernetes**  
by Google

# Daemon Set and RC



# Daemon Set and RC



# Daemon Set and RC

- What is Daemon Set

- On basic pods and service can make microservice up and run!
- But...
  - No maintain about available of Pods
  - Not response Pods scaling
  - Etc
- Daemon Set will response:
  - Make sure that Pods run on all (or some) node in cluster
  - When node add to cluster. Pods will deploy automatic
  - When node remove, GC will automatic remove Pod
  - When remove Daemon Set, Pods will automatic remove
- General Use Case
  - Storage Daemon (Ceph etc)
  - Node Monitor Daemon (Prometheus Agent etc)



# Replication Controller (RC)

- What is RC
  - Daemon Set and Replication Controller is work similar.
  - RC (Replication Controller) will response:
    - Create/Maintain Pods as "Replication Controller" (Pods Farm)
    - Keep copy of Pods (Replicas) as design
    - Ensure that Pods is up and run with amount like design
      - If too much, It will kill some Pods
      - If too kill, It will create another replicas of Pods
    - Auto healing if some Pods crash with any reason
    - Maintenance on cluster-level not node level



# Replication Controller (RC)

- Replication Controller (RC)
  - RC is first version of module to maintain Pods available in cluster
  - Use Case...
    - Rescheduling
    - Scaling
    - Rolling updates (Complicate)
    - Map with service for manage release
  - RC is running base on label type: “Equality-based requirement”
  - Ex:

```
selector:  
  name: web  
  owner: Praparn_L      I  
  version: "1.0"  
  module: WebServer  
  environment: development
```

# Replication Controller (RC)

- Example

- Pods “webtest”

```
1 apiVersion: "v1"
2 kind: Pod
3 metadata:
4   name: webtest
5   labels:
6     name: web
7     owner: Praparn_L
8     version: "1.0"
9     module: WebServer
10    environment: development
11  spec:
12    containers:
13      - name: webtest
14        image: labdocker/cluster:webservicelite
15        ports:
16          - containerPort: 5000
17            protocol: TCP
```

- RC “webtest”

```
1 apiVersion: v1
2 kind: ReplicationController
3 metadata:
4   name: webtest
5   labels:
6     name: web
7     owner: Praparn_L
8     version: "1.0"
9     module: WebServer
10    environment: development
11  spec:
12    replicas: 3
13    template:
14      metadata:
15        labels:
16          name: web
17          owner: Praparn_L
18          version: "1.0"
19          module: WebServer
20          environment: development
21      spec:
22        containers:
23          - name: webtest
24            image: labdocker/cluster:webservicelite
25            ports:
26              - containerPort: 5000
27                protocol: TCP
```

- SVC “webtest”

```
1 apiVersion: v1
2 kind: Service
3 metadata:
4   name: webtest
5   labels:
6     name: web
7     owner: Praparn_L
8     version: "1.0"
9     module: WebServer
10    environment: development
11  spec:
12    selector:
13      name: web
14      owner: Praparn_L
15      version: "1.0"
16      module: WebServer
17      environment: development
18
19    type: NodePort
20    ports:
21      - port: 5000
22        name: http
23        targetPort: 5000
24        protocol: TCP
25        nodePort: 32500
```



# Replication Controller (RC)

- Create rc “webtest”

```
praparns-MacBook-Pro:ReplicationController praparn$ kubectl create -f webtest_rc.yml
replicationcontroller "webtest" created
praparns-MacBook-Pro:ReplicationController praparn$ kubectl get rc
NAME      DESIRED   CURRENT   READY    AGE
webtest   3          3          3        2m
praparns-MacBook-Pro:ReplicationController praparn$ kubectl get pods
NAME        READY   STATUS    RESTARTS   AGE
webtest-9m8tx  1/1     Running   0          3m
webtest-9xgt3  1/1     Running   0          3m
webtest-cns49  1/1     Running   0          3m
```

- Create svc “webtest”

```
praparns-MacBook-Pro:ReplicationController praparn$ kubectl create -f webtest_svc.yml
service "webtest" created
[praparns-MacBook-Pro:ReplicationController praparn$ kubectl get svc
NAME      CLUSTER-IP    EXTERNAL-IP    PORT(S)        AGE
kubernetes  10.0.0.1    <none>        443/TCP       8d
webtest     10.0.0.6    <nodes>       5000:32500/TCP  6s
praparns-MacBook-Pro:ReplicationController praparn$ ]
```



## Welcome Page from Container Python Lab

Checkpoint Date/Time: Wed Jul 5 15:55:31 2017



# Replication Controller (RC)

- Test delete some Pods from command line

```
praparns-MacBook-Pro:ReplicationController praparn$ kubectl get pods
NAME      READY   STATUS    RESTARTS   AGE
webtest-9m8tx  1/1     Running   0          11m
webtest-9xgt3  1/1     Running   0          11m
webtest-cns49  1/1     Running   0          11m
praparns-MacBook-Pro:ReplicationController praparn$ kubectl delete pods webtest-9m8tx
pod "webtest-9m8tx" deleted
```

- Recheck Pods unit and available

```
praparns-MacBook-Pro:ReplicationController praparn$ kubectl get pods
NAME      READY   STATUS    RESTARTS   AGE
webtest-9xgt3  1/1     Running   0          21m
webtest-cns49  1/1     Running   0          21m
webtest-lmn54  1/1     Running   0          8m
praparns-MacBook-Pro:ReplicationController praparn$ curl http://192.168.99.100:32500
<H1> Welcome Page from Container Python Lab </H1>Checkpoint Date/Time: Wed Jul  5 15:51:59 2017
praparns-MacBook-Pro:ReplicationController praparn$
```



## Welcome Page from Container Python Lab

Checkpoint Date/Time: Wed Jul 5 15:55:31 2017



# Replication Controller (RC)

- Check detail of create process on RC

```
praparns-MacBook-Pro:ReplicationController praparn$ kubectl describe rc webtest
Name:           webtest
Namespace:      default
Selector:       environment=development,module=WebServer,name=web,owner=Praparn_L,version=1.0
Labels:         environment=development
                module=WebServer
                name=web
                owner=Praparn_L
                version=1.0
Annotations:    <none>
Replicas:       3 current / 3 desired
Pods Status:   3 Running / 0 Waiting / 0 Succeeded / 0 Failed
Pod Template:
  Labels:        environment=development
                module=WebServer
                name=web
                owner=Praparn_L
                version=1.0
  Containers:
    webtest:
      Image:        labdocker/cluster:webserviceelite
      Port:         5000/TCP
      Environment:  <none>
      Mounts:       <none>
      Volumes:      <none>
Events:
FirstSeen     LastSeen     Count  From            SubObjectPath  Type    Reason          Message
-----     -----     ----  ----            -----          ----   -----          -----
26m          26m          1      replication-controller      Normal  SuccessfulCreate  Created pod: webtest-9m8tx
26m          26m          1      replication-controller      Normal  SuccessfulCreate  Created pod: webtest-cns49
26m          26m          1      replication-controller      Normal  SuccessfulCreate  Created pod: webtest-9xgt3
13m          13m          1      replication-controller      Normal  SuccessfulCreate  Created pod: webtest-lmn54
praparns-MacBook-Pro:ReplicationController praparn$
```



# Replication Controller (RC)

- Scale up replicas on RC

```
kubectl scale <option> --replicas <Type/Name>
```

```
praparns-MacBook-Pro:ReplicationController praparn$ kubectl scale --replicas=10 rc/webtest
replicationcontroller "webtest" scaled
praparns-MacBook-Pro:ReplicationController praparn$ kubectl get rc
NAME      DESIRED   CURRENT   READY    AGE
webtest   10        10        5       32m
praparns-MacBook-Pro:ReplicationController praparn$ kubectl get pods
NAME        READY   STATUS    RESTARTS   AGE
webtest-2hgdq 1/1     Running   0          18s
webtest-9xgt3 1/1     Running   0          32m
webtest-cns49 1/1     Running   0          32m
webtest-jbqdq 1/1     Running   0          18s
webtest-lgprd 1/1     Running   0          18s
webtest-lmn54 1/1     Running   0          19m
webtest-sqsjk 1/1     Running   0          18s
webtest-thhxif 1/1    Running   0          18s
webtest-tx0px  1/1    Running   0          18s
webtest-v0n6s  1/1    Running   0          18s
```

```
praparns-MacBook-Pro:ReplicationController praparn$ kubectl scale --replicas=5 -f webtest_rc.yml
replicationcontroller "webtest" scaled
praparns-MacBook-Pro:ReplicationController praparn$ kubectl get rc webtest
NAME      DESIRED   CURRENT   READY    AGE
webtest   5         5         5       40m
praparns-MacBook-Pro:ReplicationController praparn$ kubectl get pods
NAME        READY   STATUS    RESTARTS   AGE
webtest-9xgt3 1/1     Running   0          40m
webtest-cns49 1/1     Running   0          40m
webtest-lmn54 1/1     Running   0          27m
webtest-tx0px  1/1    Running   0          7m
webtest-v0n6s  1/1    Running   0          7m
praparns-MacBook-Pro:ReplicationController praparn$
```



# Replication Controller

- Check detail of create process on RC

```
Containers:
  webtest:
    Image:          labdocker/cluster:webservicelite
    Port:           5000/TCP
    Environment:   <none>
    Mounts:         <none>
    Volumes:        <none>

Events:
FirstSeen     LastSeen   Count  From            SubObjectPath  Type    Reason           Message
-----     -----   ----  -----            -----          -----   -----  -----
42m          42m       1      replication-controller      Normal  SuccessfulCreate  Created pod: webtest-cns49
42m          42m       1      replication-controller      Normal  SuccessfulCreate  Created pod: webtest-9xgt3
42m          42m       1      replication-controller      Normal  SuccessfulCreate  Created pod: webtest-9m8tx
29m          29m       1      replication-controller      Normal  SuccessfulCreate  Created pod: webtest-lmn54
9m           9m        1      replication-controller      Normal  SuccessfulCreate  Created pod: webtest-lgprd
9m           9m        1      replication-controller      Normal  SuccessfulCreate  Created pod: webtest-v0n6s
9m           9m        1      replication-controller      Normal  SuccessfulCreate  Created pod: webtest-thhx
9m           9m        1      replication-controller      Normal  SuccessfulCreate  Created pod: webtest-sqsjk
9m           9m        1      replication-controller      Normal  SuccessfulCreate  Created pod: webtest-tx0px
9m           9m        1      replication-controller      Normal  SuccessfulCreate  Created pod: webtest-2hgdq
9m           9m        1      replication-controller      Normal  SuccessfulCreate  Created pod: webtest-jbqqd
2m            2m       1      replication-controller      Normal  SuccessfulDelete  Deleted pod: webtest-lgprd
2m            2m       1      replication-controller      Normal  SuccessfulDelete  Deleted pod: webtest-thhx
2m            2m       1      replication-controller      Normal  SuccessfulDelete  Deleted pod: webtest-2hgdq
2m            2m       1      replication-controller      Normal  SuccessfulDelete  Deleted pod: webtest-sqsjk
2m            2m       1      replication-controller      Normal  SuccessfulDelete  Deleted pod: webtest-jbqqd
praparns-MacBook-Pro:ReplicationController praparn$
```



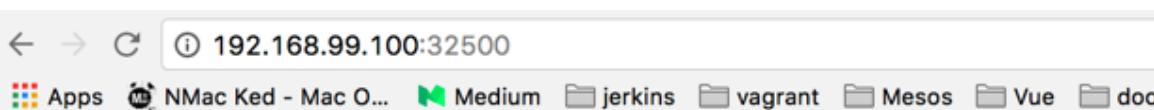
# Replication Controller

- Test delete some Pods from command line

```
praparns-MacBook-Pro:ReplicationController praparn$ kubectl get pods
NAME      READY   STATUS    RESTARTS   AGE
webtest-9m8tx  1/1     Running   0          11m
webtest-9xgt3  1/1     Running   0          11m
webtest-cns49  1/1     Running   0          11m
praparns-MacBook-Pro:ReplicationController praparn$ kubectl delete pods webtest-9m8tx
pod "webtest-9m8tx" deleted
```

- Recheck Pods unit and available

```
praparns-MacBook-Pro:ReplicationController praparn$ kubectl get pods
NAME      READY   STATUS    RESTARTS   AGE
webtest-9xgt3  1/1     Running   0          21m
webtest-cns49  1/1     Running   0          21m
webtest-lmn54  1/1     Running   0          8m
praparns-MacBook-Pro:ReplicationController praparn$ curl http://192.168.99.100:32500
<H1> Welcome Page from Container Python Lab </H1>Checkpoint Date/Time: Wed Jul  5 15:51:59 2017
praparns-MacBook-Pro:ReplicationController praparn$
```



## Welcome Page from Container Python Lab

Checkpoint Date/Time: Wed Jul 5 15:55:31 2017



# Replication Controller

- Cleanup Lab

```
praparns-MacBook-Pro:ReplicationController praparn$ kubectl delete -f webtest_svc.yml
service "webtest" deleted
praparns-MacBook-Pro:ReplicationController praparn$ kubectl delete -f webtest_rc.yml
replicationcontroller "webtest" deleted
praparns-MacBook-Pro:ReplicationController praparn$ kubectl get rc
No resources found.
praparns-MacBook-Pro:ReplicationController praparn$ kubectl get pods
No resources found.
praparns-MacBook-Pro:ReplicationController praparn$ kubectl get svc
NAME      CLUSTER-IP    EXTERNAL-IP    PORT(S)    AGE
kubernetes  10.0.0.1    <none>        443/TCP   8d
praparns-MacBook-Pro:ReplicationController praparn$ █
```



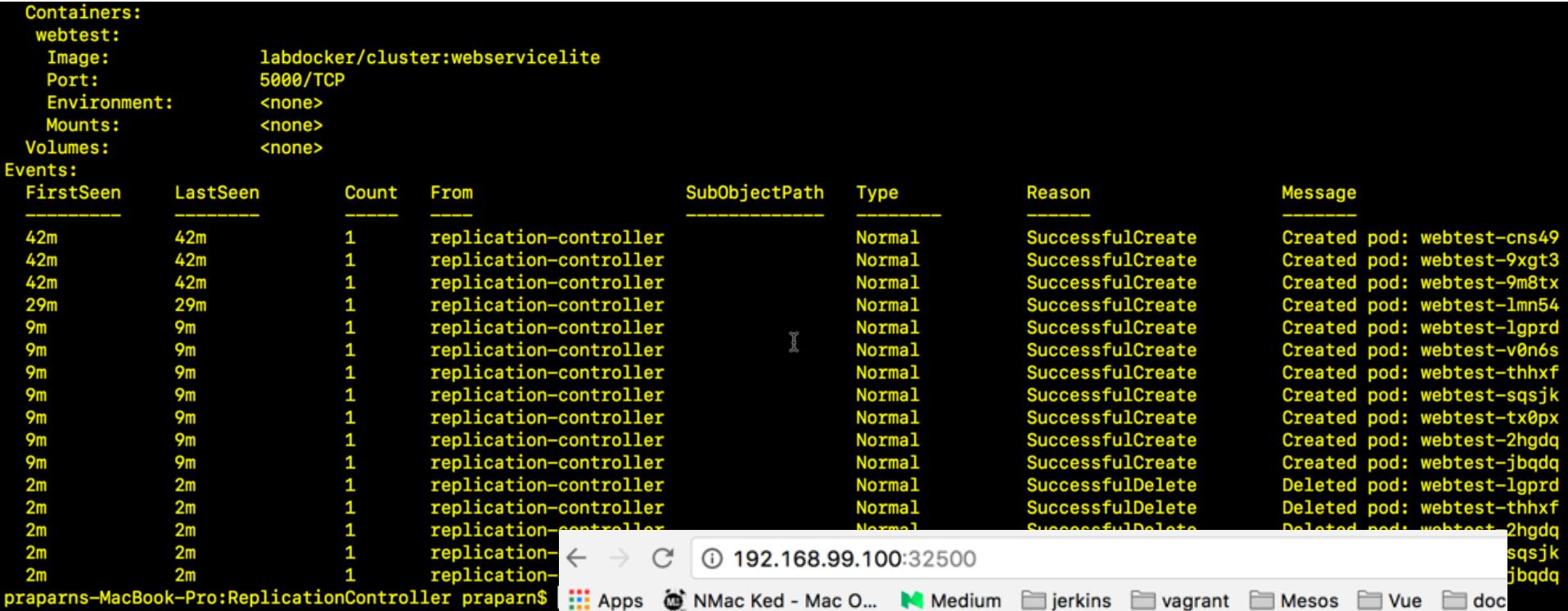
# Workshop 1.3: RC

- Deploy replication controller

```
Containers:
  webtest:
    Image:          labdocker/cluster:webservicelite
    Port:           5000/TCP
    Environment:   <none>
    Mounts:         <none>
    Volumes:        <none>

Events:
  FirstSeen     LastSeen   Count  From            SubObjectPath  Type    Reason               Message
  ----          ----      ---   ---            ---          ---      ---               ---
  42m          42m       1      replication-controller   Normal   SuccessfulCreate  Created pod: webtest-cns49
  42m          42m       1      replication-controller   Normal   SuccessfulCreate  Created pod: webtest-9xgt3
  42m          42m       1      replication-controller   Normal   SuccessfulCreate  Created pod: webtest-9m8tx
  29m          29m       1      replication-controller   Normal   SuccessfulCreate  Created pod: webtest-lmn54
  9m           9m        1      replication-controller   Normal   SuccessfulCreate  Created pod: webtest-lgprd
  9m           9m        1      replication-controller   Normal   SuccessfulCreate  Created pod: webtest-v0n6s
  9m           9m        1      replication-controller   Normal   SuccessfulCreate  Created pod: webtest-thhx
  9m           9m        1      replication-controller   Normal   SuccessfulCreate  Created pod: webtest-sqsjk
  9m           9m        1      replication-controller   Normal   SuccessfulCreate  Created pod: webtest-tx0px
  9m           9m        1      replication-controller   Normal   SuccessfulCreate  Created pod: webtest-2hgdq
  9m           9m        1      replication-controller   Normal   SuccessfulCreate  Created pod: webtest-jbqqd
  2m            2m        1      replication-controller   Normal   SuccessfulDelete  Deleted pod: webtest-lgprd
  2m            2m        1      replication-controller   Normal   SuccessfulDelete  Deleted pod: webtest-thhx
  2m            2m        1      replication-controller   Normal   SuccessfulDelete  Deleted pod: webtest-2hgdq
  2m            2m        1      replication-          Normal   SuccessfulDelete  Deleted pod: webtest-sqsjk
  2m            2m        1      replication-          Normal   SuccessfulDelete  Deleted pod: webtest-jbqqd
praparns-MacBook-Pro:ReplicationController praparn$
```

192.168.99.100:32500



Welcome Page from Container Python Lab

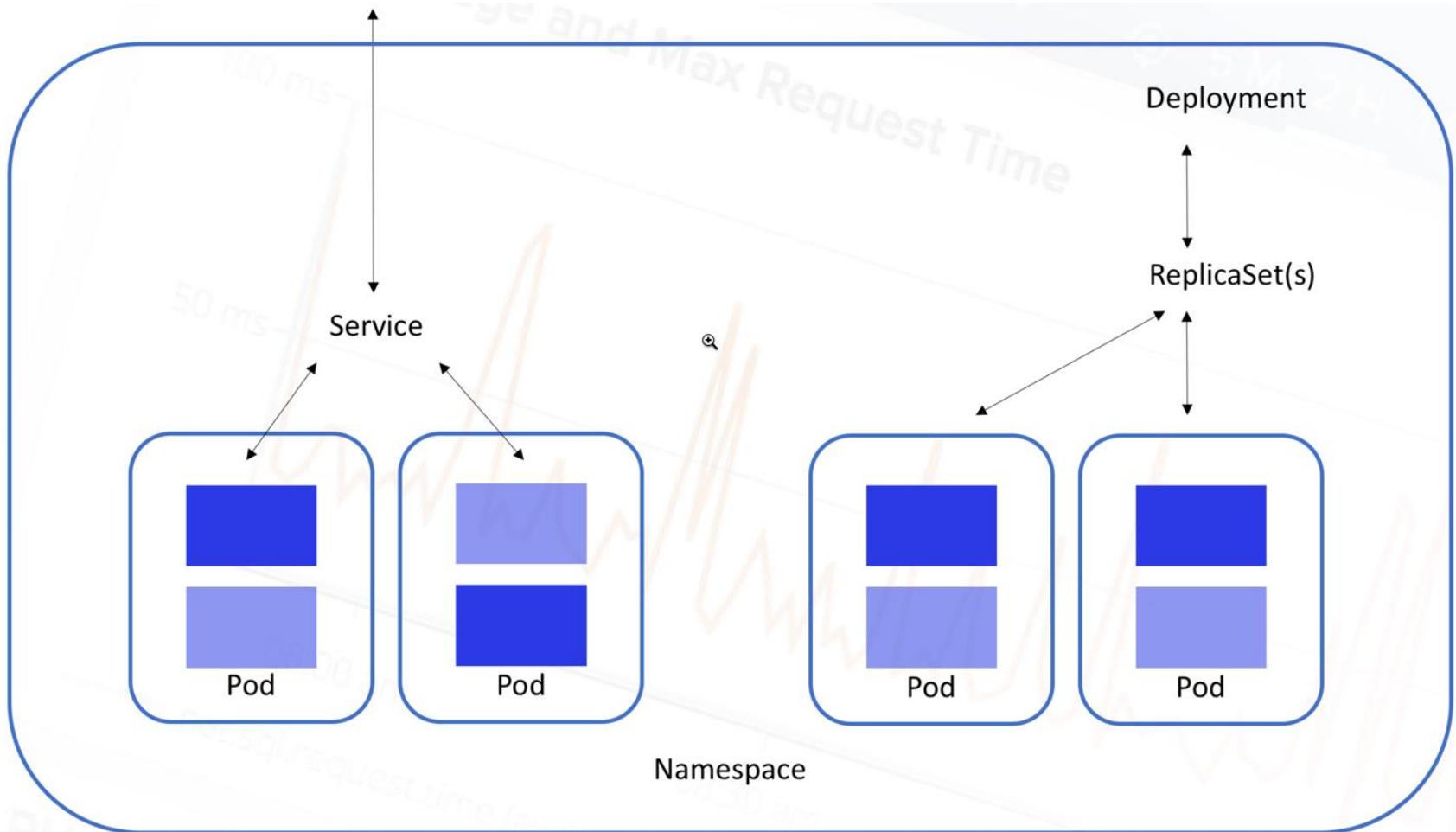
Checkpoint Date/Time: Wed Jul 5 15:55:31 2017



# Deployment/RS and Update



# Deployment/RS and Update



# Deployment/RS and Update

- What is deployment/RS?
  - Deployment and RS (ReplicaSet) is set “next-generation of RC” by provide full function to maintain versioning of Pods in production (No downtime: On-the-fly)
    - Update new version (Rollout)
    - Revert old version (Rollback)
    - Pause/Resume process
    - Check status
  - By design deployment will order job to ReplicaSet(RS) for create Pods as design for up and run
  - When new version was rollout from deployment (Automatic)
    - Create new RS and start to scale as desired
    - Scale down existing RS to 0
    - Delete existing RS

# Deployment/RS and Update

- ReplicaSet(RS) vs Replication Controller (RC)
  - RS is generation that evolution from RC with capability more dynamic
  - RC support label with method “Equality-based requirement”

```
selector:  
  name: web  
  owner: Praparn_L      I  
  version: "1.0"  
  module: WebServer  
  environment: development
```

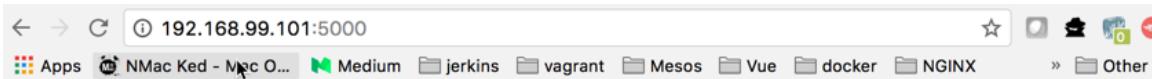
- RS support label with method “Equality-based requirement” and “Set-based requirement”

```
selector:  
  matchLabels:  
    environment: development  
  matchExpressions:  
    - {key: environment, operator: In, values: [development]}
```

# Deployment/RS and Update

- Example

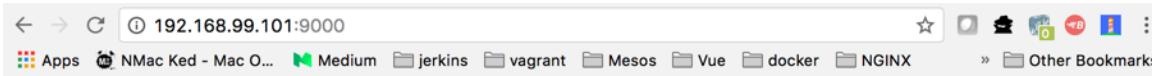
- labdocker/cluster:webservicelite\_v1



## Welcome Page from Container Python Lab Web Version 1.00

Checkpoint Date/Time: Thu Jul 6 15:19:27 2017

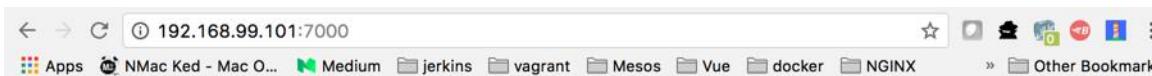
- labdocker/cluster:webservicelite\_v1.51rc



## Welcome Page from Container Python Lab Web Version 1.51 RC

Checkpoint Date/Time: Thu Jul 6 15:39:05 2017

- labdocker/cluster:webservicelite\_v1.8ga



## Welcome Page from Container Python Lab Web Version 1.80 GA

Checkpoint Date/Time: Thu Jul 6 15:36:54 2017



# Deployment/RS and Update

- Example
  - Deployment “webtest”

```
1 apiVersion: apps/v1
2 kind: Deployment
3 metadata:
4   name: webtest
5   labels:
6     name: web
7     owner: Paparn_L
8     version: "1.0"
9     module: WebServer
10    environment: development
11
12  spec:
13    replicas: 3
14    selector:
15      matchLabels:
16        name: web
17        owner: Paparn_L
18        version: "1.0"
19        module: WebServer
20        environment: development
21    template:
22      metadata:
23        labels:
24          name: web
25          owner: Paparn_L
26          version: "1.0"
27          module: WebServer
28          environment: development
29    spec:
30      containers:
31        - name: webtest
32          image: labdocker/cluster:webservicelite_v1
33          ports:
34            - containerPort: 5000
35              protocol: TCP
```

- SVC “webtest”

```
1 apiVersion: v1
2 kind: Service
3 metadata:
4   name: webtest
5   labels:
6     name: web
7     owner: Paparn_L
8     version: "1.0"
9     module: WebServer
10    environment: development
11
12  spec:
13    selector:
14      name: web
15      owner: Paparn_L
16      version: "1.0"
17      module: WebServer
18      environment: development
19
20    type: NodePort
21    ports:
22      - port: 5000
23        name: http
24        targetPort: 5000
25        protocol: TCP
26        nodePort: 32500
```



# Deployment/RS and Update

- Create deployment “webtest” and ReplicaSet (RS)

```
praparns-MacBook-Pro:WorkShop_1.4_Deployment praparn$ kubectl create -f webtest_deploy.yml --record
deployment "webtest" created
praparns-MacBook-Pro:WorkShop_1.4_Deployment praparn$ kubectl get deployment webtest
NAME      DESIRED   CURRENT   UP-TO-DATE   AVAILABLE   AGE
webtest   3          3          3           3           10s
praparns-MacBook-Pro:WorkShop_1.4_Deployment praparn$ kubectl get rs
NAME      DESIRED   CURRENT   READY      AGE
webtest-4261491039 3          3          3           16s
praparns-MacBook-Pro:WorkShop_1.4_Deployment praparn$ kubectl get pods
NAME            READY   STATUS    RESTARTS   AGE
webtest-4261491039-b7gkv 1/1     Running   0          20s
webtest-4261491039-p231t 1/1     Running   0          20s
webtest-4261491039-rjzk4 1/1     Running   0          20s
praparns-MacBook-Pro:WorkShop_1.4_Deployment praparn$
```

- Create svc “webtest”

```
praparns-MacBook-Pro:WorkShop_1.4_Deployment praparn$ kubectl create -f webtest_svc.yml --record
service "webtest" created
praparns-MacBook-Pro:WorkShop_1.4_Deployment praparn$ kubectl get svc
NAME      CLUSTER-IP   EXTERNAL-IP   PORT(S)      AGE
kubernetes  10.0.0.1    <none>        443/TCP    9d
webtest    10.0.0.97   <nodes>        5000:32500/TCP 4s
praparns-MacBook-Pro:WorkShop_1.4_Deployment praparn$
```



# Deployment/RS and Update

- Procedure for deployment operate
  - Check existing RS (0 when create new)
  - Create new RS
  - Scale RS to designed replicas

```
praparns-MacBook-Pro:WorkShop_1.4_Deployment praparn$ kubectl describe deployment/webtest
Name:           webtest
Namespace:      default
CreationTimestamp:  Thu, 06 Jul 2017 23:17:25 +0700
Labels:         environment=development
                module=WebServer
                name=web
                owner=Praparn_L
                version=1.0
Annotations:    deployment.kubernetes.io/revision=1
Selector:       environment=development,module=WebServer,name=web,owner=Praparn_L,version=1.0
Replicas:       3 desired | 3 updated | 3 total | 3 available | 0 unavailable
StrategyType:   RollingUpdate
MinReadySeconds: 0
RollingUpdateStrategy: 1 max unavailable, 1 max surge
Pod Template:
  Labels:      environment=development
                module=WebServer
                name=web
                owner=Praparn_L
                version=1.0
```

```
Conditions:
  Type     Status  Reason
  ----
  Available  True    MinimumReplicasAvailable
OldReplicaSets: <none>
NewReplicaSet:  webtest-4261491039 (3/3 replicas created)
Events:
  FirstSeen  LastSeen  Count  From            SubObjectPath  Type        Reason          Message
  -----  -----  -----  ----  -----  -----  -----  -----
  10m       10m       1      deployment-controller      Normal      ScalingReplicaSet  Scaled up replica set webtest-4
261491039 to 3
praparns-MacBook-Pro:WorkShop_1.4_Deployment praparn$
```



# Deployment/RS and Update

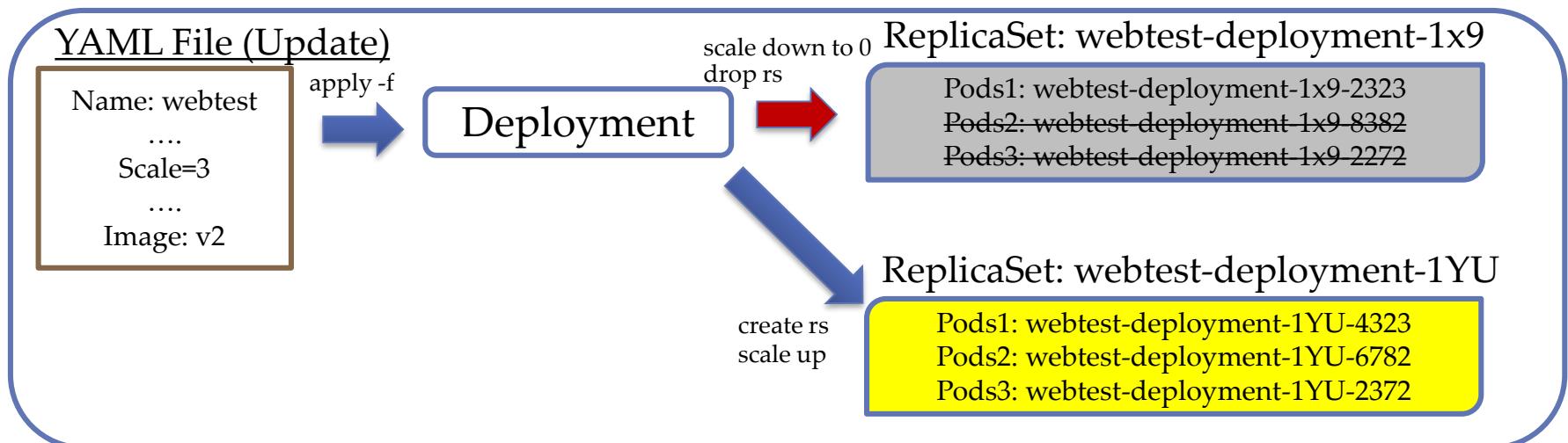
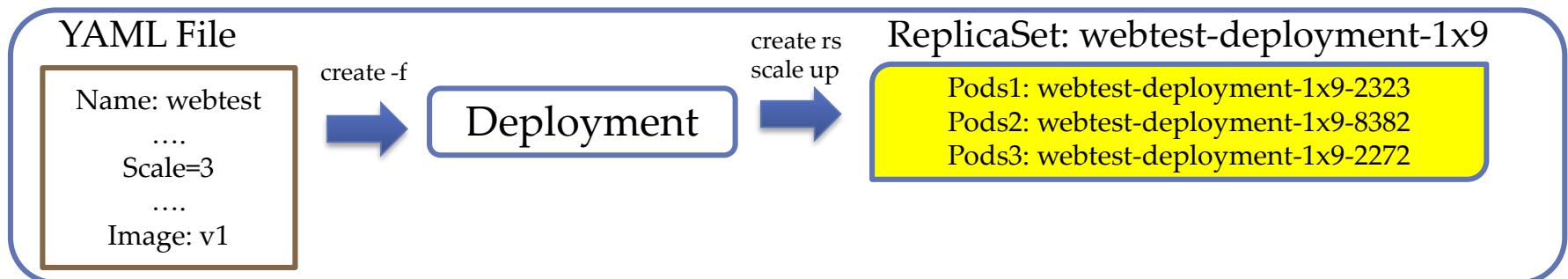
- Deployment update strategy (Rollout)
  - Update will start trigger when some of “spec:template” is changed

```
1  apiVersion: apps/v1
2  kind: Deployment
3  metadata:
4    name: webtest
5    labels:
6      name: web
7      owner: Praparn_L
8      version: "1.0"
9      module: WebServer
10     environment: development
11   spec:
12     replicas: 3
13     selector:
14       matchLabels:
15         name: web
16         owner: Praparn_L
17         version: "1.0"
18         module: WebServer
19         environment: development
20     template:
21       metadata:
22         labels:
23           name: web
24           owner: Praparn_L
25           version: "1.0"
26           module: WebServer
27           environment: development
28     
```

- Step for produce update (rollout) with Each Change
  - Scale down existing RS to 1 (1 max unavailable)
  - Create new RS for template change
  - Scale new RS as designed (No more than design +1: 1 max surge)
  - Delete existing RS

# Deployment/RS and Update

- Deployment update strategy (Rollout)



# Deployment/RS and Update

- Deployment update strategy (Rollout)

- Trigger Change on Deployment
  - **Method1: Set online**

```
kubectl set <Property> <Type/Name> Variable=Value
```

- Ex: kubectl set image deployment/webtest webtest:betaversion

- **Method2: Edit online**

```
kubectl edit <Type/Name>
```

- Ex: kubectl edit deployment/webtest

- **Method3: Edit YAML File and Apply**

```
Edit file <FileName> .YML
```

```
kubectl apply -f <FileName>
```

# Deployment/RS and Update

- Check status of deployment's update (rollout)
  - Use “rollout” utility

```
kubectl rollout <Option> <Type/Name>
```

- Ex:
  - Check status of rollout process:
    - kubectl rollout status deployment/webtest
  - Check history of rollout process:
    - Kubectl rollout history deployment/webtest
  - Rollback rollout process:
    - kubectl rollout undo deployment/webtest --to-revision=2
  - Pause/Resume process:
    - kubectl rollout pause/resume deployment/webtest

# Deployment/RS and Update

- Deployment update strategy
  - Set new image on deployment

```
ubuntu@ip-10-0-1-211:~$ kubectl set image deployment/webtest webtest=labdocker/cluster:webservicelite_v1.51rc --record=true
deployment.extensions/webtest image updated
ubuntu@ip-10-0-1-211:~$ kubectl rollout status deployment/webtest
Waiting for deployment "webtest" rollout to finish: 1 old replicas are pending termination...
Waiting for deployment "webtest" rollout to finish: 1 old replicas are pending termination...
deployment "webtest" successfully rolled out
ubuntu@ip-10-0-1-211:~$ kubectl get deployment
NAME      DESIRED   CURRENT   UP-TO-DATE   AVAILABLE   AGE
webtest   3          3          3           3           98s
ubuntu@ip-10-0-1-211:~$ kubectl get rs
NAME      DESIRED   CURRENT   READY     AGE
webtest-594bdc7f5d   3          3          3           17s
webtest-7dc5bdcdd7   0          0          0           102s
ubuntu@ip-10-0-1-211:~$ kubectl get pods
NAME            READY   STATUS    RESTARTS   AGE
webtest-594bdc7f5d-2pqwf   1/1     Running   0          22s
webtest-594bdc7f5d-fngzv   1/1     Running   0          19s
webtest-594bdc7f5d-wwkqj   1/1     Running   0          20s
ubuntu@ip-10-0-1-211:~$ kubectl set image deployment/webtest webtest=labdocker/cluster:webservicelite_v1.8ga --record=true
deployment.extensions/webtest image updated
ubuntu@ip-10-0-1-211:~$ kubectl rollout status deployment/webtest
deployment "webtest" successfully rolled out
ubuntu@ip-10-0-1-211:~$
```

- Rollout History

# Deployment/RS and Update

- Deployment update strategy
  - Rollout History

```
ubuntu@ip-10-0-1-211:~$ kubectl rollout history deployment/webtest
deployment.extensions/webtest
REVISION  CHANGE-CAUSE
1          kubectl create --filename=https://raw.githubusercontent.com/praparn/kubernetes_20180701/master/WorkShop_1.4_Deployment/webtest_deploy.yml --record=true
2          kubectl set image deployment/webtest webtest=labdocker/cluster:webservicelite_v1.51rc --record=true
3          kubectl set image deployment/webtest webtest=labdocker/cluster:webservicelite_v1.8ga --record=true

ubuntu@ip-10-0-1-211:~$ █
```



# Deployment/RS and Update

- Deployment update strategy
  - Rollback process

```
[ubuntu@ip-10-0-1-211:~$ kubectl rollout undo deployment/webtest --to-revision=2
deployment.extensions/webtest
[ubuntu@ip-10-0-1-211:~$ kubectl rollout status deployment/webtest
deployment "webtest" successfully rolled out
[ubuntu@ip-10-0-1-211:~$ curl http://10.0.1.211:32500
<H1> Welcome Page from Container Python Lab Web Version 1.51 RC </H1>Checkpoint Date/Time: Mon Oct 29 08:10:17 2018
ubuntu@ip-10-0-1-211:~$ ]
```

- Rollout History

```
[ubuntu@ip-10-0-1-211:~$ kubectl rollout history deployment/webtest
deployment.extensions/webtest
REVISION  CHANGE-CAUSE
1          kubectl create --filename=https://raw.githubusercontent.com/praparn/kubernetes_20180701/master/WorkShop_1.4_Deployment/webtest_deploy.yml --record=true
3          kubectl set image deployment/webtest webtest=labdocker/cluster:webservicelite_v1.8ga --record=true
4          kubectl set image deployment/webtest webtest=labdocker/cluster:webservicelite_v1.51rc --record=true

ubuntu@ip-10-0-1-211:~$ ]
```



# Deployment/RS and Update

- How to be grateful rollout/rollback
  - Set the rollingupdate's strategy

```
replicas: 3
```

```
strategy:
```

```
type: RollingUpdate
```

```
rollingUpdate:
```

```
maxUnavailable: 50%
```

```
maxSurge: 100%
```

- Setup "terminationGracePeriodSeconds" (After SIGTERM)

```
spec:
```

```
terminationGracePeriodSeconds: 30
```

- Setup "readiness" for indicate application is ready (Next chapter) and script for set readiness fail when get "SIGTERM"

# Volume



# Volume

- By default all container in same Pods will share storage (emptyDir)
  - This storage will keep all read/write for all container in Pods
  - Persistent storage for container as long as Pods still available
  - Container crash not effect to this storage type
  - When Pods was delete from node. emptyDir was deleted forever
- Data in container/Pods is “ephemeral” that may loss when Pods was restart/distribute
- Kubernetes support many type of volume on system

# Volume

- List of support storage
  - EmptyDir
  - **hostPath**
  - gcePersistent
  - awsElasticBlockStore
  - Nfs
  - Iscsi
  - fc(fibrechannel)
  - Flocker
  - Glusterfs
  - Rbd
  - Cephfs
  - gitRepo (deprecated)
  - Secret
  - [persistentVolumeClaim \(PVC\) \(Talk Day2\)](#)
  - downwardAPI
  - Projected
  - azureDisk
  - azureFile
  - vsphereVolume
  - Quobyte
  - PortworxVolume
  - ScaleIO
  - StorageOS
  - Local
  - ConfigMap
  - Secret
  - csi

# Volume

- hostPath:
  - Mount file/directory on host to Pods
  - Recommend for Pods that need read some data on host path (Such as cAdvisor etc)
  - Consideration
    - hostPath may effect to some of path/file not equal on different host
    - Kubernetes resource scheduling cannot check readiness of hostPath
    - Some hostPath may need privilege for access. This need to consideration.



# Volume

- hostPath:

```
32     name: cadvisor
33     owner: Praparn_L
34     version: "1.0"
35     module: Monitor
36     environment: development
37   spec:
38     replicas: 1
39     selector:
40       matchLabels:
41         name: cadvisor
42         owner: Praparn_L
43         version: "1.0"
44         module: Monitor
45         environment: development
46     template:
47       metadata:
48         labels:
49           name: cadvisor
50           owner: Praparn_L
51           version: "1.0"
52           module: Monitor
53           environment: development
54       spec:
55         containers:
56           - name: cadvisor
57             volumeMounts:
58               - mountPath: /var/run
59                 name: volrun
60               - mountPath: /sys
61                 name: volsys
62               - mountPath: /var/lib/docker/
63                 name: voldocker
64                 image: labdocker/cadvisor:latest
65               ports:
66                 - containerPort: 8080
67                   protocol: TCP
68             volumes:
69               - name: volrun
70                 hostPath:
71                   path: /var/run
72               - name: volsys
73                 hostPath:
74                   path: /sys
75               - name: voldocker
76                 hostPath:
77                   path: /var/lib/docker/
```



# Volume

- hostPath:
- Container create file

Host check file

```
praparnlueangphoonlap — Terminal MAC Pro — kubectl exec -it cadvisor
~ — Terminal MAC Pro — ssh + minikube ssh
praparn-MacBook-Pro% kubectl get pods
NAME           READY   STATUS    RESTARTS   AGE
cAdvisor-1335144146-jgm3h   1/1     Running   0          15m
praparn-MacBook-Pro% kubectl exec -it cAdvisor-1335144146-jgm3h sh
/ # touch /var/lib/docker/test_cAdvisor.txt
/ # ls -lh /var/lib/docker
total 52
drwx----- 28 root      root      4.0K Sep 24 15:57 containers
drwx-----  3 root      root      4.0K Sep 24 04:02 image
drwxr-x---  3 root      root      4.0K Sep 24 04:02 network
drwx----- 155 root      root     20.0K Sep 24 15:57 overlay
drwx-----  2 root      root      4.0K Sep 24 04:02 swarm
-rw-r--r--  1 root      root      0 Sep 24 16:12 test_cAdvisor.txt
-rw-r--r--  1 root      root      0 Sep 24 16:00 testfile.txt
drwx-----  2 root      root      4.0K Sep 24 15:13 tmp
drwx-----  2 root      root      4.0K Sep 24 04:02 trust
drwx-----  2 root      root      4.0K Sep 24 09:27 volumes
/ #
```

```
praparn-MacBook-Pro% minikube ssh
$ sudo su -
# ls /var/lib/docker
containers image network overlay swarm test_cAdvisor.txt testfile.txt tmp trust volumes
#
```



# Volume

- hostPath:
- Create another Pods and check file

```
1  apiVersion: "v1"
2  kind: Pod
3  metadata:
4    name: webtest
5    labels:
6      name: web
7      owner: Paparn_L
8      version: "1.0"
9      module: WebServer
10     environment: development
11 spec:
12   containers:
13     - name: webtest
14       image: labdocker/cluster:webservicelite_v1
15       ports:
16         - containerPort: 5000
17           protocol: TCP
18       volumeMounts:
19         - mountPath: /temp
20           name: voldocker
21   volumes:
22     - name: voldocker
23       hostPath:
24         path: /var/lib/docker/
```

```
praparns-MacBook-Pro% kubectl create -f webtest_pod.yml
pod "webtest" created
praparns-MacBook-Pro% kubectl get pods
NAME          READY   STATUS    RESTARTS   AGE
cadvisor-1335144146-jgm3h   1/1     Running   0          21m
webtest        1/1     Running   0          3s
praparns-MacBook-Pro% kubectl exec -it webtest sh
/usr/src/app # ls -lh /temp
total 56
drwx----- 32 root    root    4.0K Sep 24 16:18 containers
drwx----- 3 root    root    4.0K Sep 24 04:02 image
drwxr-x--- 3 root    root    4.0K Sep 24 04:02 network
drwx----- 163 root   root   24.0K Sep 24 16:18 overlay
drwx----- 2 root    root    4.0K Sep 24 04:02 swarm
-rw-r--r--  1 root    root    0 Sep 24 16:12 test_cAdvisor.txt
-rw-r--r--  1 root    root    0 Sep 24 16:00 testfile.txt
drwx----- 2 root    root    4.0K Sep 24 15:13 tmp
drwx----- 2 root    root    4.0K Sep 24 04:02 trust
drwx----- 2 root    root    4.0K Sep 24 09:27 volumes
/usr/src/app #
```



# Workshop 1.5: Volume

```
32      name: cadvisor
33      owner: Praparn_L
34      version: "1.0"
35      module: Monitor
36      environment: development
37  spec:
38    replicas: 1
39    selector:
40      matchLabels:
41        name: cadvisor
42        owner: Praparn_L
43        version: "1.0"
44        module: Monitor
45        environment: development
46  template:
47    metadata:
48      labels:
49        name: cadvisor
50        owner: Praparn_L
51        version: "1.0"
52        module: Monitor
53        environment: development
54    spec:
55      containers:
56        - name: cadvisor
57          volumeMounts:
58            - mountPath: /var/run
59              name: volrun
60            - mountPath: /sys
61              name: volsys
62            - mountPath: /var/lib/docker/
63              name: voldocker
64          image: labdockerc/cadvisor:latest
65      ports:
66        - containerPort: 8080
67          protocol: TCP
68    volumes:
69      - name: volrun
70        hostPath:
71          path: /var/run
72      - name: volsys
73        hostPath:
74          path: /sys
75      - name: voldocker
76        hostPath:
77          path: /var/lib/docker/
```



/

root

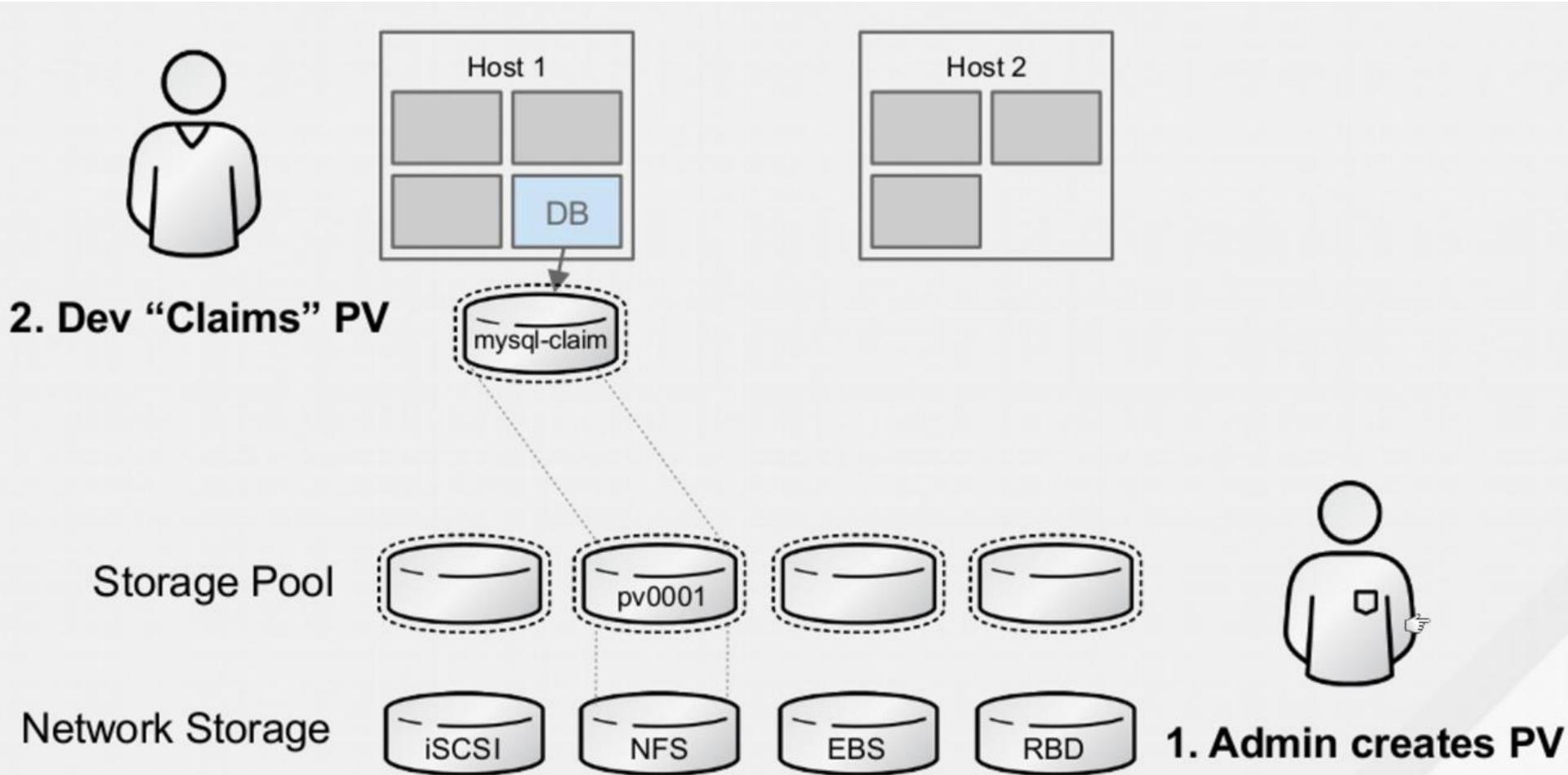
Docker Containers

Subcontainers

- /init.scope
- /kubepods
- /system.slice
- /user.slice



# Volume



# Liveness and Readiness Probe



# Liveness and Readiness Probe

- Pods are you still alright ?
  - Normally kubernetes will check Pods status and process criteria for orchestrator following “restartPolicy”
    - Always (Default)
    - On-Failure
    - None
  - Pods status is depend on “ContainerState” in that Pods (1-M)
    - Waiting (ContainerStateWaiting)
    - Running (ContainerStateRunning)
    - Terminated (ContainerStateTerminated)



# Liveness and Readiness Probe

- Pods are you still alright ?
  - When Pods receive status from container. It will set Pod's status to inform kubelet for operate with Pods (Remain / Terminated / Restart)
  - Pods Status (Phase Value)
    - Pending: When initial Pods and loading images for container
    - Running: Some container running but not all
    - Successed: All container fullfill running
    - Failed: All container exit fail
    - Unknow: Can not monitor state
- Do we need more specific health-check?
  - Depend on container (application) fail condition.
  - If container fail condition will make process “crash” or effect to container down/unhealth. This no need to operate more check.
  - If container fail condition may occur inside application that possible process still online. This need more health check

# Liveness and Readiness Probe

- Container probe process
  - Kubernetes have function for make properly make sure that container (inside Pods) still healthy by three options
    - ExecAction: Execute some command inside container (expect result: return 0)
    - TCPSocketAction: Start TCP communication on specific port of container (expect result: port open)
    - HTTPGetAction: Send http/https request to specific port and path (expect result: return 200 for OK)
  - Probe's result
    - Success
    - Failed
    - Unknown
  - livenessProbe and readinessProbe Difference
    - livenessProbe: check status of container is running properly or not ?
    - readinessProbe: check readiness for process service or not ?

Ref: <https://kubernetes.io/docs/concepts/workloads/pods/pod-lifecycle/>

Kubernetes: Production Workload Orchestration



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by Google

# Liveness and Readiness Probe

- Container Lifecycle Hooks
  - On kubernetes we can provide some process to hook on container Life cycle that kubernetes support in 2 event
  - PostStart:
    - Run some activity immediate when container is created (No guarantee to execute before “ENTRYPOINT” of container)
  - PreStop:
    - Run some activity immediate before container terminate (Delete, Liveness Fail) This is will blocking to do this task before terminate

Ref: <https://kubernetes.io/docs/concepts/workloads/pods/pod-lifecycle/>

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# Liveness and Readiness Probe

```
41      - name: ES_JAVA_OPTS
42        value: -Xms5g -Xmx5g
43      - name: bootstrap.memory_lock
44        value: "false"
45      - name: cluster.name
46        value: pam-es-docker-cluster
47      - name: xpack.security.enabled
48        value: "false"
49    image: "3dsinteractive/elasticsearch-std:6.6"
50    lifecycle:
51      postStart:
52        exec:
53          command: ["/bin/sh", "-c", "chown -R 1000:1000 /usr/share/elasticsearch/data && chmod -R 777 /usr/share/elasticsearch/data"]
54
55  #       imagePullPolicy: Always
56  ports:
57    - name: "elastic9200"
58      containerPort: 9200
59    - name: "elastic9300"
60      containerPort: 9300
61
62  resources:
```

```
1  apiVersion: app/v1
2  kind: Deployment
3  metadata:
4    name: nginx
5  spec:
6    template:
7      metadata:
8        labels:
9          app: nginx
10     spec:
11       containers:
12         - name: nginx
13           image: nginx
14           ports:
15             - containerPort: 80
16           lifecycle:
17             preStop:
18               exec:
19                 command: ["nginx","-s","quit"]
```

Ref: <https://kubernetes.io/docs/concepts/workloads/pods/pod-lifecycle/>

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# Liveness and Readiness Probe

- ExecAction:

```
1  apiVersion: apps/v1
2  kind: Deployment
3  metadata:
4    name: webtest
5    labels:
6      name: web
7      owner: Paparn_L
8      version: "1.0"
9      module: WebServer
10     environment: development
11
12    spec:
13      replicas: 1
14      selector:
15        matchLabels:
16          name: web
17          owner: Paparn_L
18          version: "1.0"
19          module: WebServer
20          environment: development
21      template:
22        metadata:
23          labels:
24            name: web
25            owner: Paparn_L
26            version: "1.0"
27            module: WebServer
28            environment: development
29
30        spec:
31          containers:
32            - name: webtest
33              image: labdockerc/cluster:webservicelite_v1
34              ports:
35                - containerPort: 5000
36                  protocol: TCP
37                  readinessProbe:
38                    exec:
39                      command:
40                        - cat
41                        - /usr/src/app/main.py
42                    initialDelaySeconds: 15
43                    periodSeconds: 5
44                    livenessProbe:
45                      exec:
46                        command:
47                          - cat
48                          - /usr/src/app/main.py
49                    initialDelaySeconds: 15
50                    periodSeconds: 15
```

Ref: <https://kubernetes.io/docs/concepts/workloads/pods/pod-lifecycle/>

Kubernetes: Production Workload Orchestration

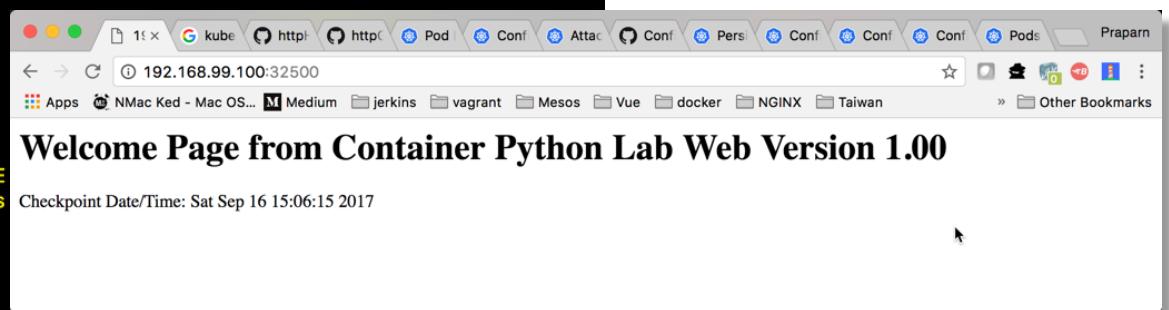


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# Liveness and Readiness Probe

- ExecAction:

```
praparns-MacBook-Pro% kubectl create -f webtest_deploy_liveness_readiness_exec.yml
    kubectl create -f webtest_svc.yml
deployment "webtest" created
service "webtest" created
praparns-MacBook-Pro% kubectl get svc/webtest
NAME      CLUSTER-IP   EXTERNAL-IP   PORT(S)        AGE
webtest   10.0.0.127   <nodes>       5000:32500/TCP  20s
praparns-MacBook-Pro% kubectl get deployment/webtest
NAME        DESIRED   CURRENT   UP-TO-DATE   AVAILABLE   AGE
webtest     1          1          1           1           33s
praparns-MacBook-Pro% kubectl describe deployment/webtest
Name:           webtest
Namespace:      default
CreationTimestamp: Sat, 16 Sep 2017 22:04:07 +0700
Labels:         environment=development
                module=WebServer
                name=web
                owner=Praparn_L
                version=1.0
Annotations:    deployment.kubernetes.io/revision=1
Selector:       environment=development,module=WebServer,name=web,owner=Praparn_L,version=1.0
Replicas:       1 desired | 1 updated | 1 total | 1 available | 0 unavailable
StrategyType:  RollingUpdate
MinReadySeconds: 0
RollingUpdateStrategy: 1 max unavailable, 1 max surge
Pod Template:
  Labels:      environment=development
                module=WebServer
                name=web
                owner=Praparn_L
                version=1.0
  Containers:
    webtest:
      Image:      labdocker/cluster:webservicelite_v1
      Port:       5000/TCP
      Liveness:   exec [cat /usr/src/app/main.py] delay=15s timeout=1s period=15s #success=1 #failure=3
      Readiness:  exec [cat /usr/src/app/main.py] delay=15s timeout=1s period=5s #success=1 #failure=3
      Environment: <none>
```



Ref: <https://kubernetes.io/docs/concepts/workloads/pods/pod-lifecycle/>

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# Liveness and Readiness Probe

- ExecAction:

```
praparns-MacBook-Pro% kubectl get pods
NAME           READY   STATUS    RESTARTS   AGE
webtest-336910061-26pdb  1/1     Running   0          4m
praparns-MacBook-Pro% kubectl exec -it webtest-336910061-26pdb sh
/usr/src/app # ls
docker-compose.yml      dockerfile_python_lite  nginx.conf
dockerfile_nginx         main.py                 requirements.txt
dockerfile_python        mainlite.py            requirementslite.txt
/usr/src/app # rm main.py
/usr/src/app # exit
praparns-MacBook-Pro%
```

```
praparns-MacBook-Pro% kubectl get pods
NAME           READY   STATUS    RESTARTS   AGE
webtest-336910061-26pdb  1/1     Running   1          7m
praparns-MacBook-Pro% kubectl describe pods/webtest-336910061-26pdb
Name:           webtest-336910061-26pdb
Namespace:      default
Node:           minikube/192.168.99.100
Start Time:    Sat, 16 Sep 2017 22:04:07 +0700
Labels:         environment=development
               module=WebServer
               name=web
               owner=Praparn_L
               pod-template-hash=336910061
               version=1.0
Annotations:   kubernetes.io/created-by={"kind":"SerializedReference","apiVersion":"v1","reference":{"kind":"ReplicaSet","namespace":"default","name":"webtest-336910061","uid":"4992f987-9af0-11e7-bc1a-080027fb95be"},...}
Status:        Running
```

Ref: <https://kubernetes.io/docs/concepts/workloads/pods/pod-lifecycle/>

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# Liveness and Readiness Probe

- ExecAction:

Events:								
FirstSeen	LastSeen	Count	From	SubObjectPath	Type	Reason	Message	
7m	7m	1	default-scheduler		Normal	Scheduled	Successful	
y assigned webtest-336910061-26pdb to minikube							MountVolume	
7m	7m	1	kubelet, minikube		Normal	SuccessfulMountVolume	MountVolume	
.SetUp succeeded for volume "default-token-pcw4h"								
2m	2m	8	kubelet, minikube	spec.containers{webtest}	Warning	Unhealthy	Readiness p	
robe failed: cat: can't open '/usr/src/app/main.py': No such file or directory								
2m	2m	3	kubelet, minikube	spec.containers{webtest}	Warning Unhealthy	Liveness probe failed: cat: can't open '/us		
r/src/app/main.py': No such file or directory								
7m	2m	2	kubelet, minikube	spec.containers{webtest}	Normal Pulled	Container image "labdocker/cluster:webservicelite_v		
1" already present on machine								
7m	2m	2	kubelet, minikube	spec.containers{webtest}	Normal Created	Created container		
7m	2m	2	kubelet, minikube	spec.containers{webtest}	Normal Started	Started container		
2m	2m	1	kubelet, minikube	spec.containers{webtest}	Normal Killing	Killing container with id docker://webtest:pod "web		
test-336910061-26pdb_default(499cef14-9af0-11e7-bc1a-080027fb95be)" container "webtest" is unhealthy, it will be killed and re-created.								
praparns-MacBook-Pro% █								

Ref: <https://kubernetes.io/docs/concepts/workloads/pods/pod-lifecycle/>

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# Liveness and Readiness Probe

- TCPSocketAction:

```
1  apiVersion: apps/v1
2  kind: Deployment
3  metadata:
4    name: webtest
5    labels:
6      name: web
7      owner: Praparn_L
8      version: "1.0"
9      module: WebServer
10     environment: development
11
12   spec:
13     replicas: 1
14     selector:
15       matchLabels:
16         name: web
17         owner: Praparn_L
18         version: "1.0"
19         module: WebServer
20         environment: development
21     template:
22       metadata:
23         labels:
24           name: web
25           owner: Praparn_L
26           version: "1.0"
27           module: WebServer
28           environment: development
29
30     spec:
31       containers:
32         - name: webtest
33           image: labdocker/cluster:webservicelite_v1
34           ports:
35             - name: webservice
36               containerPort: 5000
37               protocol: TCP
38             readinessProbe:
39               tcpSocket:
40                 port: 5000
41               initialDelaySeconds: 15
42               periodSeconds: 5
43             livenessProbe:
44               tcpSocket:
45                 port: 5000
46               initialDelaySeconds: 15
47               periodSeconds: 15
```

Ref: <https://kubernetes.io/docs/concepts/workloads/pods/pod-lifecycle/>

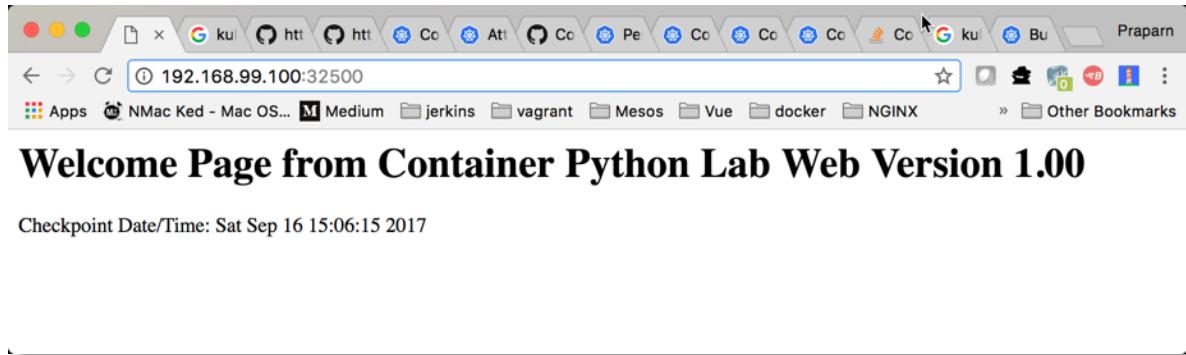
Kubernetes: Production Workload Orchestration



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# Liveness and Readiness Probe

- TCPSocketAction:



```
[praparns-MacBook-Pro% kubectl create -f webtest_deploy_liveness_readiness_port.yml
deployment "webtest" created
[praparns-MacBook-Pro% kubectl get deployment/webtest
NAME      DESIRED   CURRENT   UP-TO-DATE   AVAILABLE   AGE
webtest   1          1          1           0           14s
[praparns-MacBook-Pro% kubectl get pods --show-labels
NAME            READY   STATUS    RESTARTS   AGE   LABELS
webtest-3579274848-1w2mn   0/1     Running   0        18s   environment=development,modu
hash=3579274848,version=1.0
```

Events:							
FirstSeen	LastSeen	Count	From	SubObjectPath	Type	Reason	Message
2m	2m	1	default-scheduler		Normal	Scheduled	Successful
y	assigned webtest-3579274848-1w2mn to minikube						
2m	2m	1	kubelet, minikube		Normal	SuccessfulMountVolume	MountVolume
.SetUp succeeded for volume "default-token-pcw4h"							
2m	2m	1	kubelet, minikube	spec.containers{webtest}	Normal	Pulled	Container i
mage	image "labdocke/cluster:webservicelite_v1" already present on machine						
2m	2m	1	kubelet, minikube	spec.containers{webtest}	Normal	Created	Created con
tainer							
2m	2m	1	kubelet, minikube	spec.containers{webtest}	Normal	Started	Started con
tainer							

Ref: <https://kubernetes.io/docs/concepts/workloads/pods/pod-lifecycle/>

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# Liveness and Readiness Probe

- TCPSocketAction:

```
instruction.txt ! webtest_deploy_liveness_readiness_port.yml •  
21     spec:  
22       containers:  
23         - name: webtest  
24           image: labdocker/cluster:webserviceelite_v1  
25           ports:  
26             - name: webservice  
27               containerPort: 5000  
28               protocol: TCP  
29             readinessProbe:  
30               tcpSocket:  
31                 port: 3000  
32               initialDelaySeconds: 15  
33               periodSeconds: 5  
34             livenessProbe:  
35               tcpSocket:  
36                 port: 3000  
37               initialDelaySeconds: 15  
38               periodSeconds: 15
```

```
praparns-MacBook-Pro% kubectl apply -f webtest_deploy_liveness_readiness_port.yml  
deployment "webtest" configured  
praparns-MacBook-Pro% kubectl get pods  
NAME          READY     STATUS    RESTARTS   AGE  
webtest-1810247028-x5xdf   0/1      Running   0          13s  
praparns-MacBook-Pro% kubectl describe pods/webtest-1810247028-x5xdf  
Name:           webtest-1810247028-x5xdf  
Namespace:      default  
Node:           minikube/192.168.99.100  
Start Time:     Sat, 16 Sep 2017 22:32:18 +0700  
Labels:          environment=development  
                  module=WebServer  
                  name=web  
                  owner=Praparn_L  
                  pod-template-hash=1810247028  
                  version=1.0  
Annotations:    kubernetes.io/created-by={"kind":"SerializedReference","apiVersion":"v1","reference":{"kind":"ReplicaSet","namespace":"default","name":"webtest-1810247028","uid":"38ea7253-9af4-11e7-bc1a-080027fb95be"}...
```



# Liveness and Readiness Probe

- TCPSocketAction:

Events:								
FirstSeen	LastSeen	Count	From	SubObjectPath	Type	Reason	Message	
4m	4m	1	default-scheduler		Normal	Scheduled	Successful	
y assigned webtest-1810247028-x5xdf to minikube								
4m	4m	1	kubelet, minikube		Normal	SuccessfulMountVolume	MountVolume	
.setUp succeeded for volume "default-token-pcw4h"								
4m	38s	6	kubelet, minikube	spec.containers{webtest}	Normal	Pulled	Container i	
mage "labdocker/cluster:webservicelite_v1" already present on machine								
tainer	38s	6	kubelet, minikube	spec.containers{webtest}	Normal	Created	Created con	
tainer	38s	6	kubelet, minikube	spec.containers{webtest}	Normal	Started	Started con	
3m	38s	5	kubelet, minikube	spec.containers{webtest}	Normal	Killing	Killing con	
tainer with id docker://webtest:pod "webtest-1810247028-x5xdf_default(38f840f4-9af4-11e7-bc1a-080027fb95be)" container "webtest" is unhealthy, it w								
ill be killed and re-created.								
obe failed: dial tcp 172.17.0.6:3000: getsockopt: connection refused	9s	12	kubelet, minikube	spec.containers{webtest}	Warning	Unhealthy	Liveness pr	
robe failed: dial tcp 172.17.0.6:3000: getsockopt: connection refused	4s	37	kubelet, minikube	spec.containers{webtest}	Warning	Unhealthy	Readiness p	
www. www. Macbook Pro% █								

# Liveness and Readiness Probe

- HTTPGetAction:



## Welcome Page from Container Python Lab Web Version 1.00

Checkpoint Date/Time: Sat Sep 16 15:54:10 2017

A screenshot of the Postman application. The left sidebar shows a history of requests: a GET request to "http://192.168.99.100:32500" (today), and several requests made on "September 8" (GET, POST, GET, POST, GET, GET). The main panel shows a request configuration for "http://192.168.99.100:32500" using the "Builder" tab. The "Authorization" tab is selected, showing "No Auth". The "Headers" tab is also visible, listing "content-length", "content-type", "date", and "server". The status bar indicates "Status: 200 OK" and "Time: 46 ms".



# Liveness and Readiness Probe

- HTTPGetAction:

```
1  apiVersion: apps/v1
2  kind: Deployment
3  metadata:
4    name: webtest
5    labels:
6      name: web
7      owner: Praparn_L
8      version: "1.0"
9      module: WebServer
10     environment: development
11
12    spec:
13      replicas: 1
14      selector:
15        matchLabels:
16          name: web
17          owner: Praparn_L
18          version: "1.0"
19          module: WebServer
20          environment: development
21      template:
22        metadata:
23          labels:
24            name: web
25            owner: Praparn_L
26            version: "1.0"
27            module: WebServer
28            environment: development
```

```
28
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52
53
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55
56
57
58
59
60
61
62
63
64
65
spec:
  containers:
    - name: webtest
      image: labdocker/cluster:webservicelite_v1
      ports:
        - name: webservice
          containerPort: 5000
          protocol: TCP
      readinessProbe:
        httpGet:
          # Optional "host: my-host" for set specific ip of Pods
          # Optional "scheme: HTTPS"
          #schema: HTTPS
          path: /
          port: webservice
          httpHeaders:
            - name: server
              value: "Werkzeug/0.12.2 Python/2.7.13"
      initialDelaySeconds: 15
      periodSeconds: 5
      timeoutSeconds: 10
      successThreshold: 1
      failureThreshold: 3
    livenessProbe:
      httpGet:
        # Optional "host: my-host" for set specific ip of Pods
        # Optional "scheme: HTTPS"
        #schema: HTTPS
        path: /
        port: webservice
        httpHeaders:
          - name: server
            value: "Werkzeug/0.12.2 Python/2.7.13"
      initialDelaySeconds: 15
      periodSeconds: 5
      timeoutSeconds: 10
      successThreshold: 1
      failureThreshold: 3
```



# Liveness and Readiness Probe

- HTTPGetAction:

```
praparns-MacBook-Pro% kubectl create -f webtest_deploy_liveness_readiness_http.yml
  kubectl get deployment/webtest
  kubectl get pods --show-labels
deployment "webtest" created
NAME      DESIRED   CURRENT   UP-TO-DATE   AVAILABLE   AGE
webtest   1          0          0           0           0s
NAME              READY   STATUS        RESTARTS   AGE   LABELS
webtest-1098172621-zvd22  0/1   ContainerCreating   0          0s   environment=development,module=WebServer,name=web,owner=Praparn_L,pod
-ttemplate-hash=1098172621,version=1.0
Events:
FirstSeen   LastSeen   Count   From               SubObjectPath   Type   Reason   Message
-----   -----   ----   -----   -----   -----   -----   -----
9m         9m         1   default-scheduler
y assigned webtest-1098172621-zvd22 to minikube
  9m         9m         1   kubelet, minikube
 SetUp succeeded for volume "default-token-pcw4h"
  9m         9m         1   kubelet, minikube   spec.containers{webtest}
image "labdocker/cluster:webserviceelite_v1" already present on machine
  9m         9m         1   kubelet, minikube   spec.containers{webtest}
tainer
  9m         9m         1   kubelet, minikube   spec.containers{webtest}
tainer
  9m         9m         1   kubelet, minikube
```



# Liveness and Readiness Probe

- HTTPGetAction:

```
29      livenessProbe:  
30          httpGet:  
31              # Optional "host: my-host" for set specific ip of Pods  
32              # Optional "scheme: HTTPS"  
33              #schema: HTTPS  
34              path: /init  
35              port: webservice  
36              httpHeaders:  
37                  - name: server  
38                  value: "Werkzeug/0.12.2 Python/2.7.13"  
39              initialDelaySeconds: 15  
40              periodSeconds: 5  
41              timeoutSeconds: 5  
42              successThreshold: 1  
43              failureThreshold: 3  
44      livenessProbe:  
45          httpGet:  
46              # Optional "host: my-host" for set specific ip of Pods  
47              # Optional "scheme: HTTPS"  
48              #schema: HTTPS  
49              path: /init  
50              port: webservice  
51              httpHeaders:  
52                  - name: server  
53                  value: "Werkzeug/0.12.2 Python/2.7.13"  
54              initialDelaySeconds: 15  
55              periodSeconds: 5  
56              timeoutSeconds: 5  
57              successThreshold: 1  
58              failureThreshold: 3
```

```
praparns-MacBook-Pro% kubectl apply -f webtest_deploy_liveness_readiness_http.yml  
deployment "webtest" configured  
praparns-MacBook-Pro% kubectl get deployment/webtest  
NAME      DESIRED   CURRENT   UP-TO-DATE   AVAILABLE   AGE  
webtest   1          1          1           0           14m  
praparns-MacBook-Pro% kubectl get deployment/webtest  
NAME      DESIRED   CURRENT   UP-TO-DATE   AVAILABLE   AGE  
webtest   1          1          1           0           15m  
praparns-MacBook-Pro% kubectl get pods  
NAME                READY   STATUS    RESTARTS   AGE  
webtest-692878837-fxpw4   0/1     Running   3          1m
```



# Liveness and Readiness Probe

- HTTPGetAction:

Events:								
FirstSeen	LastSeen	Count	From	SubObjectPath	Type	Reason	Message	
1m	1m	1	default-scheduler		Normal	Scheduled	Successful	
y assigned webtest-692878837-fxpw4 to minikube								
1m	1m	1	kubelet, minikube		Normal	SuccessfulMountVolume	MountVolume	
.SetUp succeeded for volume "default-token-pcw4h"								
1m	13s	5	kubelet, minikube	spec.containers{webtest}	Normal	Pulled	Container i	
mage "labdocker/cluster:webservicelite_v1" already present on machine								
1m	13s	9	kubelet, minikube	spec.containers{webtest}	Warning	Unhealthy	Readiness p	
robe failed: HTTP probe failed with statuscode: 404								
1m	13s	9	kubelet, minikube	spec.containers{webtest}	Warning	Unhealthy	Liveness pr	
obe failed: HTTP probe failed with statuscode: 404								
1m	13s	4	kubelet, minikube	spec.containers{webtest}	Normal	Killing	Killing con	
tainer with id docker://webtest:pod "webtest-692878837-fxpw4_default(4f6f205f-9b00-11e7-bc1a-080027fb95be)" container "webtest" is unhealthy, it wi								
ll be killed and re-created.								
1m	12s	5	kubelet, minikube	spec.containers{webtest}	Normal	Created	Created con	
tainer								
1m	12s	5	kubelet, minikube	spec.containers{webtest}	Normal	Started	Started con	
praparns-MacBook-Pro%								

# Workshop 1.6: Liveness and Readiness

The image shows two screenshots side-by-side. The left screenshot is a web browser window with multiple tabs open, displaying the URL `192.168.99.100:32500`. The title bar says "Welcome Page from Container Python Lab Web Version 1.00". Below the title, it says "Checkpoint Date/Time: Sat Sep 16 15:54:10 2017". The right screenshot is a screenshot of the Postman API testing tool. It shows a "Builder" tab selected. On the left, there's a history panel with several API calls listed under "Today" and "September 8". On the right, there's a request configuration panel for a GET request to `http://192.168.99.100:32500`. The "Headers" tab is selected, showing four headers: "content-length" (113), "content-type" (text/html; charset=utf-8), "date" (Sat, 16 Sep 2017 15:56:21 GMT), and "server" (Werkzeug/0.12.2 Python/2.7.13). The status is 200 OK and the time is 46 ms.



# Resource Management and HPA

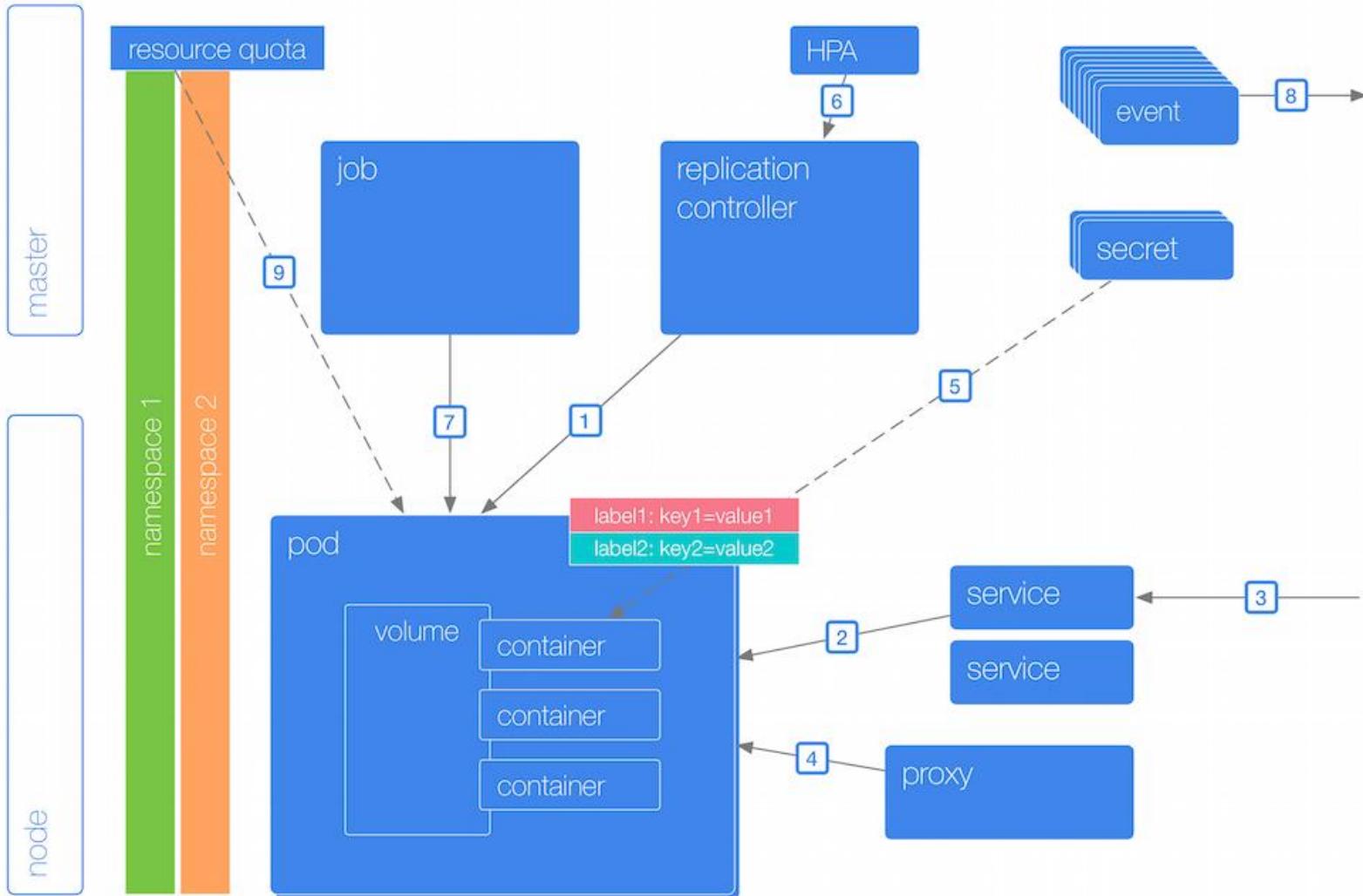


Kubernetes: Production Workload Orchestration



**kubernetes**  
by Google

# Resource Management and HPA



Ref: <http://k8s.info/cs.html>

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# Resource Management and HPA

- Kubernetes can manage resource in 2 ways
  - Container level configuration
    - Scope on Container unit independence
    - Use in case experiment/test purpose
    - etc
  - Namespace level configuration
    - Scope on Pods and Container level
    - Create global limit and assign to namespace
    - Apply namespace to any Pods (Template Resource Limit)
- What happen when Container resource exceed ?
  - CPU
    - Container will not get CPU as it need and the free-slot of CPU was distributed to all container's request with ratio
  - Memory
    - Container was killed and restart it again



# Resource Management and HPA

- Container level configuration
  - CPU
    - Request:
      - XXXm(Unit: millicores) (Ratio: 1024)
      - 0.1= 100m
      - 1 CPU =
        - 1 vCPU (AWS)
        - 1 GCP (Google Cloud)
        - 1 Azure v Core
        - 1 Hyper thread (Bare Metal)
      - Consider as “--cpu-share”
    - Limit:
      - XXXm(Unit: millicores) (Ratio:100000/1000: ~1000)
      - Consider as “--cpu-quota”
  - Memory
    - Request:
      - XXX (Unit:Ki, Mi, Gi, Pi, Ei)
    - Limit
      - XXX (Unit:Ki, Mi, Gi, Pi, Ei)

Ref: <https://github.com/kubernetes/community/blob/master/contributors/design-proposals/resource-qos.md>

Kubernetes: Production Workload Orchestration



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by Google

# Resource Management and HPA

- Container level configuration

- Pods “webtest”

## System status

```
1 apiVersion: "v1"
2 kind: Pod
3 metadata:
4   name: webtest
5   labels:
6     name: web
7     owner: Praparn_L
8     version: "1.0"
9   module: WebServer
10  environment: development
11 spec:
12   containers:
13     - name: webtest
14       image: labdocker/cluster:webservicelite_v1
15       resources:
16         requests:
17           memory: "16Mi"
18           cpu: "100m"
19         limits:
20           memory: "32Mi"
21           cpu: "1"
22       ports:
23         - containerPort: 5000
24           protocol: TCP
```

```
...ckage/kubernetes — Terminal MAC Pro — zsh docker@iZj6chay173lo9ivaj1drnZ: ~ — -bash Terminal MAC Pro — ssh + minikube ssh
top - 07:39:14 up 4:10, 1 user, load average: 0.06, 0.29, 0.34
Tasks: 233 total, 1 running, 232 sleeping, 0 stopped, 0 zombie
%CPU0 : 0.0/0.0 0[ ]
%CPU1 : 0.0/0.0 0[ ]
%CPU2 : 0.7/0.7 1[ ]
%CPU3 : 0.0/0.0 0[ ]
%CPU4 : 0.0/0.0 0[ ]
%CPU5 : 0.0/0.0 0[ ]
%CPU6 : 0.7/0.7 1[ ]
%CPU7 : 0.0/1.3 1[ ]
%CPU8 : 0.0/0.0 0[ ]
%CPU9 : 0.7/0.7 1[ ]
GiB Mem : 30.2/1.953 [███████████] 0.0%
GiB Swap: 0.0/0.977 [ ]
```

PID	USER	PR	NI	VIRT	RES	%CPU	%MEM	TIME+	S	COMMAND
1	root	20	0	37.8m	5.9m	0.0	0.3	0:14.97	S	systemd
1440	root	20	0	65.9m	20.9m	0.0	1.0	0:06.73	S	`- systemd-journal
2311	root	20	0	25.6m	3.2m	0.0	0.2	0:01.81	S	`- systemd-udevd
2608	root	20	0	8.9m	0.4m	0.0	0.0	0:00.46	S	`- getty
2617	root	20	0	24.2m	2.0m	0.0	0.1	0:00.02	S	`- rpcbind
2638	root	20	0	25.5m	2.8m	0.0	0.1	0:00.17	S	`- systemd-logind



# Resource Management and HPA

- Container level configuration
  - Allocate status on node

Namespace	Name	CPU Requests	CPU Limits	Memory Requests	Memory Limits
default	cadvisor-76c9899d7f-pbz29	0 (0%)	0 (0%)	0 (0%)	0 (0%)
default	webtest	100m (1%)	1 (10%)	16Mi (0%)	32Mi (1%)
kube-system	default-http-backend-xq22v	10m (0%)	10m (0%)	20Mi (1%)	20Mi (1%)
kube-system	heapster-4nfdm	0 (0%)	0 (0%)	0 (0%)	0 (0%)
kube-system	influxdb-grafana-kzmsf	0 (0%)	0 (0%)	0 (0%)	0 (0%)
kube-system	kube-addon-manager-minikube	5m (0%)	0 (0%)	50Mi (2%)	0 (0%)
kube-system	kube-dns-54cccfbd8-tqh5l	260m (2%)	0 (0%)	110Mi (5%)	170Mi (8%)
kube-system	kubernetes-dashboard-77d8b98585-z4lxz	0 (0%)	0 (0%)	0 (0%)	0 (0%)
kube-system	nginx-ingress-controller-hjwt6	0 (0%)	0 (0%)	0 (0%)	0 (0%)
kube-system	storage-provisioner	0 (0%)	0 (0%)	0 (0%)	0 (0%)



# Resource Management and HPA

- Container level configuration
  - Create Load on CPU (T1)

```
[praparns-MacBook-Pro% kubectl create -f webtest_pod.yml
pod "webtest" created
[praparns-MacBook-Pro% kubectl get pods
NAME      READY     STATUS    RESTARTS   AGE
webtest   1/1      Running   0          13m
[praparns-MacBook-Pro% kubectl exec webtest -c webtest md5sum /dev/urandom
^C
praparns-MacBook-Pro%
```

- System status

```
top - 07:45:00 up 4:16, 1 user, load average: 0.69, 0.35, 0.33
Tasks: 234 total, 2 running, 232 sleeping, 0 stopped, 0 zombie
%Cpu0 : 0.0/0.0  0[                ]
%Cpu1 : 0.0/1.3  1[                ]
%Cpu2 : 0.0/0.0  0[                ]
%Cpu3 : 26.2/73.8 100[███████████]
%Cpu4 : 0.7/0.0  1[                ]
%Cpu5 : 0.7/0.0  1[                ]
%Cpu6 : 0.7/0.0  1[                ]
%Cpu7 : 0.7/0.7  1[                ]
%Cpu8 : 0.7/0.0  1[                ]
%Cpu9 : 0.7/0.7  1[                ]
GiB Mem : 31.2/1.953 [███████████]
GiB Swap: 0.0/0.977 [                ]
```

# Resource Management and HPA

- Container level configuration

- Create Load on CPU (T2)

```
[praparns-MacBook-Pro% kubectl create -f webtest_pod.yml
pod "webtest" created
[praparns-MacBook-Pro% kubectl get pods
NAME      READY      STATUS      RESTARTS      AGE
webtest   1/1       Running    0           13m
[praparns-MacBook-Pro% kubectl exec webtest -c webtest md5sum /dev/urandom
^C
[praparns-MacBook-Pro% kubectl exec webtest -c webtest md5sum /dev/urandom
^C
praparns-MacBook-Pro%
```

- ### ○ System status



# Workshop 1.7: Resource MNG/HPA

- Part 1: Container level configuration

```
top - 07:45:00 up 4:16, 1 user, load average: 0.69, 0.35, 0.33
Tasks: 234 total, 2 running, 232 sleeping, 0 stopped, 0 zombie
%Cpu0 : 0.0/0.0   0[ ]
%Cpu1 : 0.0/1.3   1[ ]
%Cpu2 : 0.0/0.0   0[ ]
%Cpu3 : 26.2/73.8 100[███████████] 26.2%
%Cpu4 : 0.7/0.0   1[ ]
%Cpu5 : 0.7/0.0   1[ ]
%Cpu6 : 0.7/0.0   1[ ]
%Cpu7 : 0.7/0.7   1[ ]
%Cpu8 : 0.7/0.0   1[ ]
%Cpu9 : 0.7/0.7   1[ ]
GiB Mem : 31.2/1.953 [███████████] 1.953%
GiB Swap: 0.0/0.977 [ ] 0.977%
```



# Resource Management and HPA

- Namespace level configuration
  - Name space provide collection of resource of cluster system that easy to defined and apply to object in cluster system
  - Name space can apply with
    - Pods
    - Services
    - Replication Controller
    - Deployment and ReplicaSets
    - Quota
    - LimitRange
    - Etc
  - For resource management resource in name space level. We will use Quota and LimitRange
    - Quota: Summary of resource control on name space
    - LimitRange: Resource admission control/Default resource define



# Resource Management and HPA

- Quota
  - Compute resource
    - CPU
      - Limits
      - Request
    - Memory
      - Limits
      - Request
  - Disk I/O
    - PersistentVolumeClaims
    - Request.Storage
  - Counting Object
    - Pods
    - Service
    - Replication Controller
    - ConfigMap
    - Secrets

```
1  apiVersion: v1
2  kind: ResourceQuota
3  metadata:
4    name: webtest-quota
5    labels:
6      name: webtest_quota
7      owner: Praparn_L
8      version: "1.0"
9      module: Quota
10     environment: development
11   spec:
12     hard:
13       pods: "4"
14       requests.cpu: "1"
15       requests.memory: 1Gi
16       limits.cpu: "4"
17       limits.memory: 4Gi
```

Ref: <https://kubernetes.io/docs/concepts/policy/resource-quotas>

Kubernetes: Production Workload Orchestration



kubernetes  
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# Resource Management and HPA

- LimitRange
  - Type: (Pods/Container)
    - Max
      - CPU:
      - Memory:
    - Min
      - CPU
      - Memory
  - Default (Limit Default for Container)
    - CPU
    - Memory
  - DefaultRequest (Default for Container)
    - CPU
    - Memory

```
1  apiVersion: v1
2  kind: LimitRange
3  metadata:
4    name: webtest_limit
5    labels:
6      name: webtest_limit
7      owner: Praparn_L
8      version: "1.0"
9      module: LimitRange
10     environment: development
11   spec:
12     limits:
13       - max:
14         cpu: "1"
15         memory: 1Gi
16       min:
17         cpu: 200m
18         memory: 6Mi
19       type: Pod
20     default:
21       cpu: 300m
22       memory: 200Mi
23     defaultRequest:
24       cpu: 200m
25       memory: 100Mi
26     max:
27       cpu: "1"
28       memory: 1Gi
29     min:
30       cpu: 100m
31       memory: 3Mi
32     type: Container
```

Ref: <https://kubernetes.io/docs/tasks/administer-cluster/apply-resource-quota-limit/>

Kubernetes: Production Workload Orchestration



**kubernetes**  
by Google

# Resource Management and HPA

- Create Namespace, assign quota with name space

```
kubectl create namespace <name>
```

```
kubectl create -f <Quota File> -- namespace <name>
```

```
praparns-MacBook-Pro% kubectl create namespace webtest-namespace
namespace "webtest-namespace" created
praparns-MacBook-Pro% kubectl create -f webtest_quota.yml --namespace=webtest-namespace
resourcequota "webtest-quota" created
praparns-MacBook-Pro% kubectl describe namespace webtest-namespace
Name:           webtest-namespace
Labels:         <none>
Annotations:    <none>
Status:         Active
                □

Resource Quotas
  Name:          webtest-quota
  Resource      Used   Hard
  ----          ---   ---
  limits.cpu    0      4
  limits.memory 0      4Gi
  pods          0      4
  requests.cpu  0      1
  requests.memory 0     1Gi

  No resource limits.
praparns-MacBook-Pro%
```

Ref: <https://kubernetes.io/docs/concepts/policy/resource-quotas>

Kubernetes: Production Workload Orchestration



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# Resource Management and HPA

- Deployment

```
1  apiVersion: v1
2  kind: Service
3  metadata:
4    name: webtest
5    labels:
6      name: web
7      owner: Praparn_L
8      version: "1.0"
9      module: WebServer
10     environment: development
11
12   spec:
13     selector:
14       name: web
15       owner: Praparn_L
16       version: "1.0"
17       module: WebServer
18       environment: development
19
20     type: NodePort
21     ports:
22       - port: 5000
23         name: http
24         targetPort: 5000
25         protocol: TCP
26         nodePort: 32500
27
28   apiVersion: apps/v1
29   kind: Deployment
30   metadata:
31     name: webtest
32     labels:
33       name: web
34       owner: Praparn_L
35       version: "1.0"
```

```
35     module: WebServer
36     environment: development
37   spec:
38     replicas: 1
39     template:
40       metadata:
41         labels:
42           name: web
43           owner: Praparn_L
44           version: "1.0"
45           module: WebServer
46           environment: development
47
48         spec:
49           containers:
50             - name: webtest
51               image: labdocker/cluster:webservicelite_v1
52               ports:
53                 - containerPort: 5000
54                   protocol: TCP
```



# Resource Management and HPA

- Create Deployment and check result

```
kubectl create -f <Deployment File> --namespace <name>
```

```
praparns-MacBook-Pro% kubectl create -f webtest_deploy.yml --namespace=webtest-namespace
service "webtest" created
deployment "webtest" created
praparns-MacBook-Pro% kubectl get deployment/webtest --namespace=webtest-namespace
NAME      DESIRED   CURRENT   UP-TO-DATE   AVAILABLE   AGE
webtest   1          0          0           0           5m
praparns-MacBook-Pro% kubectl get rs --namespace=webtest-namespace
NAME      DESIRED   CURRENT   READY   AGE
webtest-4261491039  1          0          0           5m
praparns-MacBook-Pro% kubectl get svc/webtest --namespace=webtest-namespace
NAME      CLUSTER-IP   EXTERNAL-IP   PORT(S)      AGE
webtest  10.0.0.48    <nodes>       5000:32500/TCP  5m
praparns-MacBook-Pro% kubectl get pods --namespace=webtest-namespace
No resources found.
praparns-MacBook-Pro%
```

# Resource Management and HPA

- Why it fail ?

```
kubectl describe rs --namespace <name>
```

```
Events:
FirstSeen      LastSeen      Count   From            SubObjectPath  Type    Reason          Message
-----      -----      ----   ----            -----      ----    ----          -----
6m           5m           15   replicaset-controller      Warning       FailedCreate  Error creating: pods "webtest-4261491039-" is forbidden: failed quota: webtest-quota: must specify limits.cpu,limits.memory,requests.cpu,requests.memory
```

```
spec:
  replicas: 1
  template:
    metadata:
      labels:
        name: web
        owner: Praparn_L
        version: "1.0"
        module: WebServer
        environment: development
    spec:
      containers:
        - name: webtest
          image: labdocker/cluster:webservicelite_v1
          ports:
            - containerPort: 5000
              protocol: TCP
```



# Resource Management and HPA

- Create LimitRange and check result

```
kubectl create -f <LimitRange File> --namespace <name>
```

```
praparns-MacBook-Pro% kubectl create -f webtest_limit.yml --namespace=webtest-namespace
limitrange "webtest-limit" created
praparns-MacBook-Pro% kubectl describe namespace/webtest-namespace
Name:           webtest-namespace
Labels:         <none>
Annotations:    <none>
Status:         Active

Resource Quotas
Name:           webtest-quota
Resource        Used   Hard
-----
limits.cpu      0      4
limits.memory   0      4Gi
pods            0      4
requests.cpu    0      1
requests.memory 0      1Gi

Resource Limits
Type          Resource     Min   Max   Default Request Default Limit   Max Limit/Request Ratio
Pod           cpu          200m  1      -              -              -
Pod           memory       6Mi   1Gi   -              -              -
Container     cpu          100m  1      200m          300m          -
Container     memory       3Mi   1Gi   100Mi        200Mi        -
praparns-MacBook-Pro%
```

# Resource Management and HPA

- Recreate Deployment and check result

```
praparns-MacBook-Pro% kubectl delete -f webtest_deploy.yml --namespace=webtest-namespace
service "webtest" deleted
deployment "webtest" deleted
praparns-MacBook-Pro% kubectl create -f webtest_deploy.yml --namespace=webtest-namespace
service "webtest" created
deployment "webtest" created
praparns-MacBook-Pro% kubectl get deployment/webtest --namespace=webtest-namespace
NAME      DESIRED   CURRENT   UP-TO-DATE   AVAILABLE   AGE
webtest   1          1          1           1           5m
praparns-MacBook-Pro% kubectl get rs --namespace=webtest-namespace
NAME      DESIRED   CURRENT   READY     AGE
webtest-4261491039  1          1          1           5m
praparns-MacBook-Pro% kubectl get svc/webtest --namespace=webtest-namespace
NAME      CLUSTER-IP    EXTERNAL-IP    PORT(S)        AGE
webtest  10.0.0.125 <nodes>    5000:32500/TCP  5m
praparns-MacBook-Pro% kubectl get pods --namespace=webtest-namespace
NAME            READY   STATUS    RESTARTS   AGE
webtest-4261491039-pft5m  1/1     Running   0          5m
praparns-MacBook-Pro% curl http://192.168.99.100:32500
<H1> Welcome Page from Container Python Lab Web Version 1.00 </H1>Checkpoint Date/Time: Sat Jul  8 13:44:12 2017
praparns-MacBook-Pro%
```

# Resource Management and HPA

- Check describe of Pods

```
kubectl describe pods --namespace <name>
```

```
Status:          Running
IP:             172.17.0.2
Controllers:    ReplicaSet/webtest-4261491039
Containers:
  webtest:
    Container ID:      docker://0acf26d00b7b9f28b200fdfc
    Image:            labdocker/cluster:webserviceelite_
    Image ID:         docker-pullable://labdocker/clust
    Port:             5000/TCP
    State:            Running
    Started:          Sat, 08 Jul 2017 20:43:27 +0700
    Ready:            True
    Restart Count:   0
    Limits:
      cpu:        300m
      memory:     200Mi
    Requests:
      cpu:        200m
      memory:     100Mi
    Environment:    <none>
    Mounts:
```



# Resource Management and HPA

- Test burn cpu utilize and monitor

```
praparns-MacBook-Pro% kubectl exec -it webtest-4261491039-pft5m -c webtest md5sum /dev/urandom --namespace=webtest-namespace

top - 13:57:03 up 7:33, 1 user,  load average: 0.22, 0.35, 0.20
Tasks: 228 total,  2 running, 226 sleeping,  0 stopped,  0 zombie
%Cpu0 : 0.0/0.0   0[ ]
%Cpu1 : 0.7/0.7   1[||]
%Cpu2 : 0.0/0.0   0[ ]
%Cpu3 : 0.0/0.0   0[ ]
%Cpu4 : 0.0/0.0   0[ ]
%Cpu5 : 0.0/0.7   1[|]
%Cpu6 : 0.0/0.0   0[ ]
%Cpu7 : 0.7/0.7   1[||]
%Cpu8 : 7.9/21.9  30[||||||||||||||||||||||||||||||||]
%Cpu9 : 0.0/0.0   0[ ]
GiB Mem : 32.4/1.953 [███████████]
GiB Swap: 0.0/0.977 [
```



# Resource Management and HPA

- Edit deployment for update cpu/memory Limits,request

```
[praparns-MacBook-Pro% kubectl set resources deployment/webtest --limits=cpu="1",memory=1Gi --requests=cpu="0.8",memory=800Mi --record
--namespace=webtest-namespace
deployment "webtest" resource requirements updated

[praparns-MacBook-Pro% kubectl describe pods webtest-d6986bb64-bm5q9 --namespace=webtest-namespace
Name:           webtest-d6986bb64-bm5q9
Namespace:      webtest-namespace
Node:          minikube/192.168.99.100
Start Time:    Wed, 21 Mar 2018 00:46:27 +0700
Labels:         environment=development
                module=WebServer
                name=web
                owner=Praparn_L
                pod-template-hash=825426620
                version=1.0
Annotations:   <none>
Status:        Running
IP:            172.17.0.11
Controlled By: ReplicaSet/webtest-d6986bb64
Containers:
  webtest:
    Container ID:  docker://7e1ae95ed7db8fb9c91b9bcf89b97aedef9e8592d129852930835e744a12b6b6
    Image:         labdocker/cluster:webserviceelite_v1
    Image ID:     docker-pullable://labdocker/cluster@sha256:f0f261307a9a0ce8acf317f533e22c3aa438b3a7c5d4c0b5705ce67504326940
    Port:          5000/TCP
    State:        Running
      Started:    Wed, 21 Mar 2018 00:46:28 +0700
    Ready:        True
    Restart Count: 0
    Limits:
      cpu: 1
      memory: 1Gi
    Requests:
      cpu: 800m
      memory: 800Mi
    Environment:  <none>
    Mounts:
      /var/run/secrets/kubernetes.io/serviceaccount from default-token-n8h4m (ro)
```



# Workshop 1.7: Resource MNG/HPA

- Part 2: Namespace level configuration



192.168.99.100:32500

Apps NMac Ked - Mac O... Medium jenkins vagrant Mesos Vue docker NGINX Taiwan Kuberr

## Welcome Page from Container Python Lab Web Version 1.00

Checkpoint Date/Time: Sat Jul 8 14:10:26 2017

System Info:	Value				
Machine ID:	88a2186a47ff442aa72465d9e09fc21f				
System UUID:	F631F911-A47C-493D-BFCB-872F1F5C2D30				
Boot ID:	99b9bb5a-67ba-43d0-bed1-e64fe04c367d				
Kernel Version:	4.9.13				
OS Image:	Buildroot 2017.02				
Operating System:	linux				
Architecture:	amd64				
Container Runtime Version:	docker://1.12.6				
Kubelet Version:	v1.7.0-alpha.2				
Kube-Proxy Version:	v1.7.0-alpha.2				
ExternalID:					
Non-terminated Pods:	(4 in total)				
Namespace	Name	CPU Requests	CPU Limits	Memory Requests	Memory Limits
kube-system	kube-addon-manager-minikube	5m (0%)	0 (0%)	50Mi (2%)	0 (0%)
kube-system	kube-dns-268032401-9h5s6	260m (2%)	0 (0%)	110Mi (5%)	170Mi (8%)
kube-system	kubernetes-dashboard-2vk98	0 (0%)	0 (0%)	0 (0%)	0 (0%)
webtest-namespace	webtest-4261491039-pft5m	200m (2%)	300m (3%)	100Mi (5%)	200Mi (10%)
Allocated resources:	(Total limits may be over 100 percent, i.e., overcommitted.)				
CPU Requests	CPU Limits	Memory Requests	Memory Limits		
465m (4%)	300m (3%)	260Mi (13%)	370Mi (19%)		

Page 1



# Resource Management and HPA

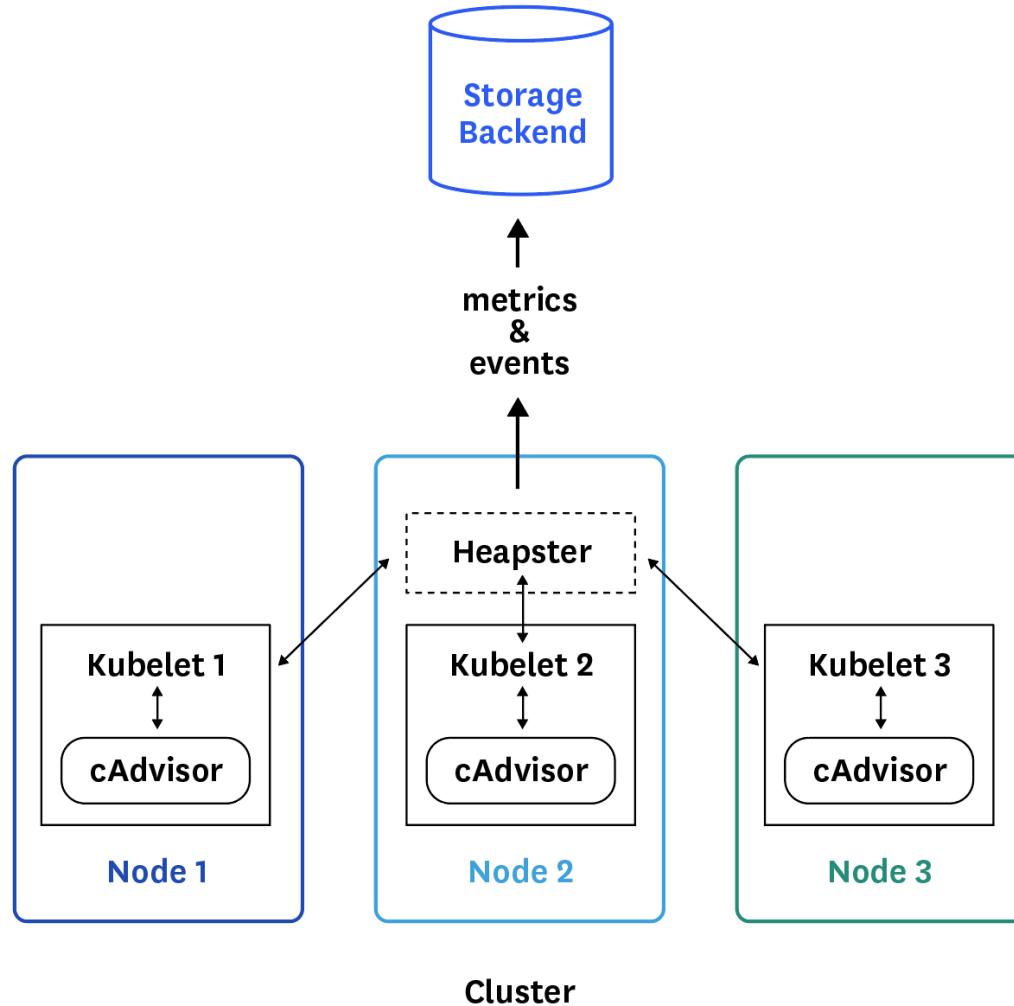
- Horizontal Pod Autoscaling (HPA)
  - The scale is easy to operate with "kubectl scale --replicas=XXX deployment/<name>" with single command
  - But..
    - How can you scale meet up/down actual required ?
  - HPA will response for monitor workload on Pods (Now base on CPU) and automatic trigger deployment to scale-up application

```
kubectl autoscale <type/name> <option:>
```

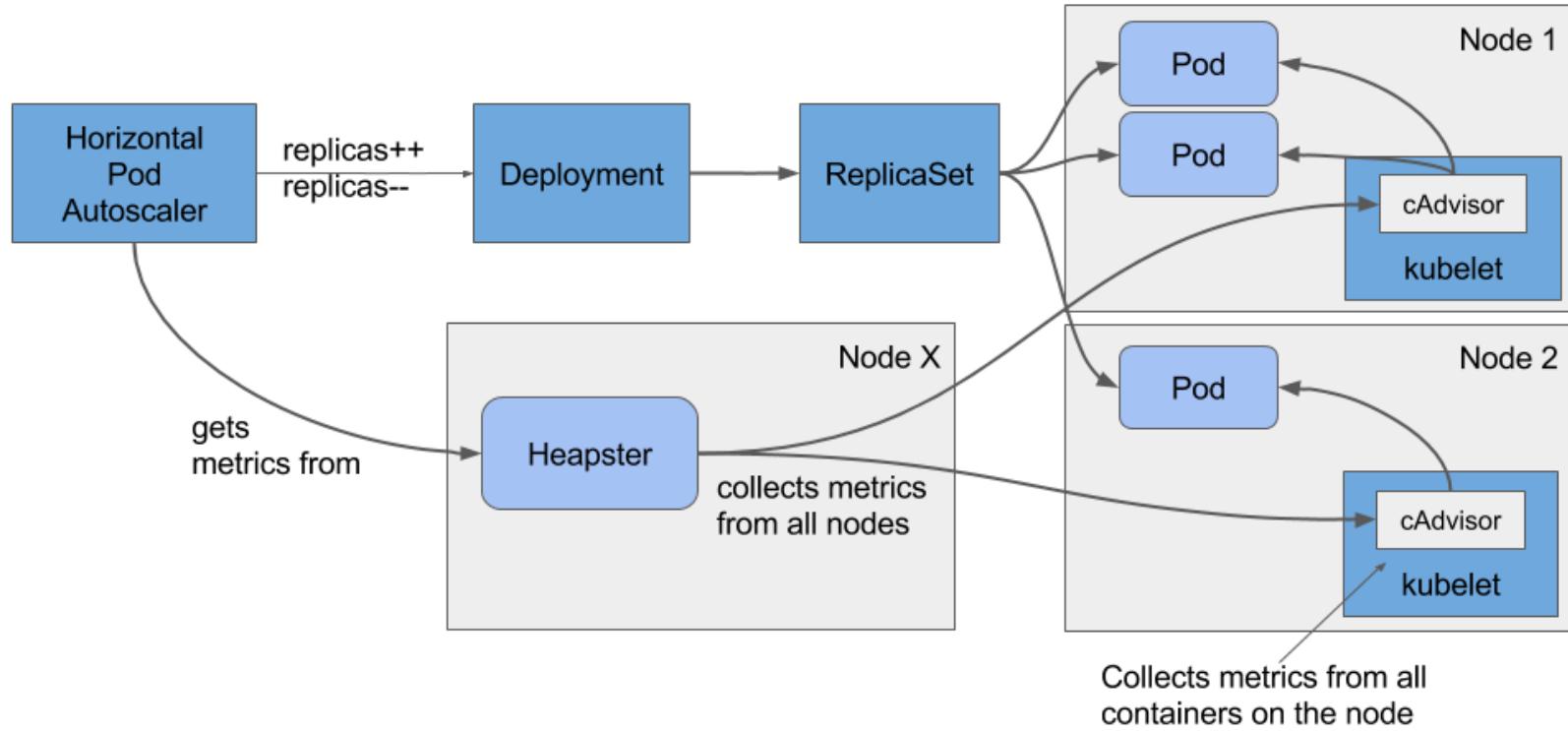
- Ex: kubectl autoscale deployment/webtest --min=1--max=10 --cpu-percent=80



# Resource Management and HPA

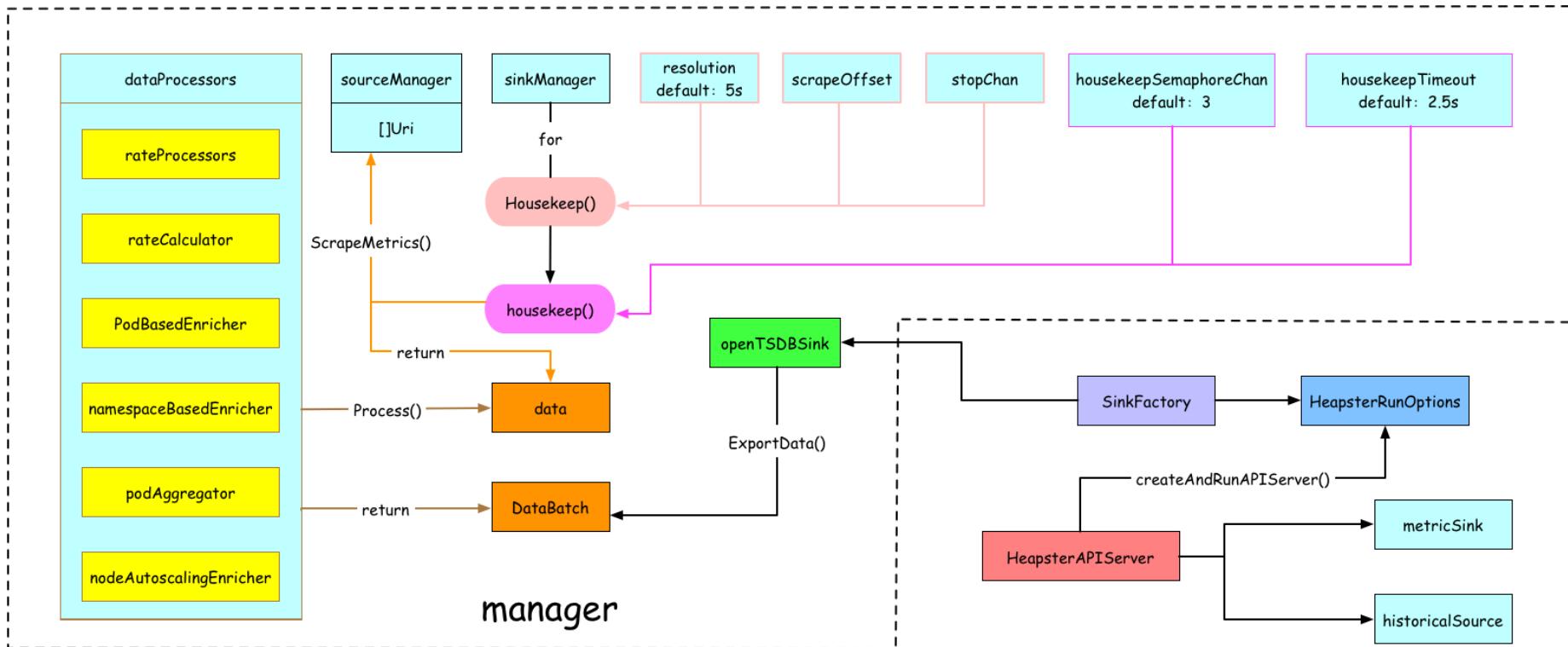


# Resource Management and HPA



# Resource Management and HPA

## Heapster



© Jimmy Song <https://github.com/rootsongjc/kubernetes-handbook>



# Resource Management and HPA

A screenshot of a GitHub issue thread. The URL is <https://github.com/kubernetes/kubernetes/issues/57673>. The title is "the cadvisor works well, because the dashboard shows workload metrics.". There are two comments:

- gjmzj commented on Dec 28, 2017:

I found a solution in my case:  
`kube-controller-manager`'s parameter `--horizontal-pod-autoscaler-use-default` value is `true`, while in k8s 1.8.x is `false`. Change it to `false` and it works.
- MaciekPytel commented on Dec 28, 2017:

With `--horizontal-pod-autoscaler-use-rest-clients=true` HPA uses new instead of old way of getting metrics. Setting it to `false` as you did works, long term solution is to run metrics server as part of your cluster set up. T  
<https://kubernetes.io/docs/tasks/debug-application-cluster/core-metrics-pipeline/>

A screenshot of a GitHub issue thread. The URL is <https://github.com/juju-solutions/bundle-canonical-kubernetes/issues/484>. The title is "Autoscaler with CDK v1.9 #484". There are two comments:

- ktsakalozos commented 2 days ago:

Starting with v1.9 HPA uses new resource metrics API that is not available in CDK out of the box. If you want to use autoscaler you should do a:  
`--controller-manager-extra-args="--horizontal-pod-autoscaler-use-rest-clients=false"`  
Based on the discussion here [kubernetes/kubernetes#57673](https://github.com/kubernetes/kubernetes#57673) we can either set the `--horizontal-pod-autoscaler-use-rest-clients=false` or deploy this Metrics server:  
<https://kubernetes.io/docs/tasks/debug-application-cluster/core-metrics-pipeline/>
- hyperbolic2346 commented 2 days ago:

The metrics server is deployed by default in kube-up. I would think we should deploy it as well.

## Core metrics pipeline

Starting from Kubernetes 1.8, resource usage metrics, such as container CPU and memory usage, are available in Kubernetes through the Metrics API. These metrics can be either accessed directly by user, for example by using `kubectl top` command, or used by a controller in the cluster, e.g. Horizontal Pod Autoscaler, to make decisions.

## The Metrics API

Through the Metrics API you can get the amount of resource currently used by a given node or a given pod. This API doesn't store the metric values, so it's not possible for example to get the amount of resources used by a given node 10 minutes ago.

The API is no different from any other API:

- it is discoverable through the same endpoint as the other Kubernetes APIs under `/apis/metrics.k8s.io/` path
- it offers the same security, scalability and reliability guarantees

The API is defined in [k8s.io/metrics](https://k8s.io/metrics) repository. You can find more information about the API there.

**Note:** The API requires metrics server to be deployed in the cluster. Otherwise it will be not available.

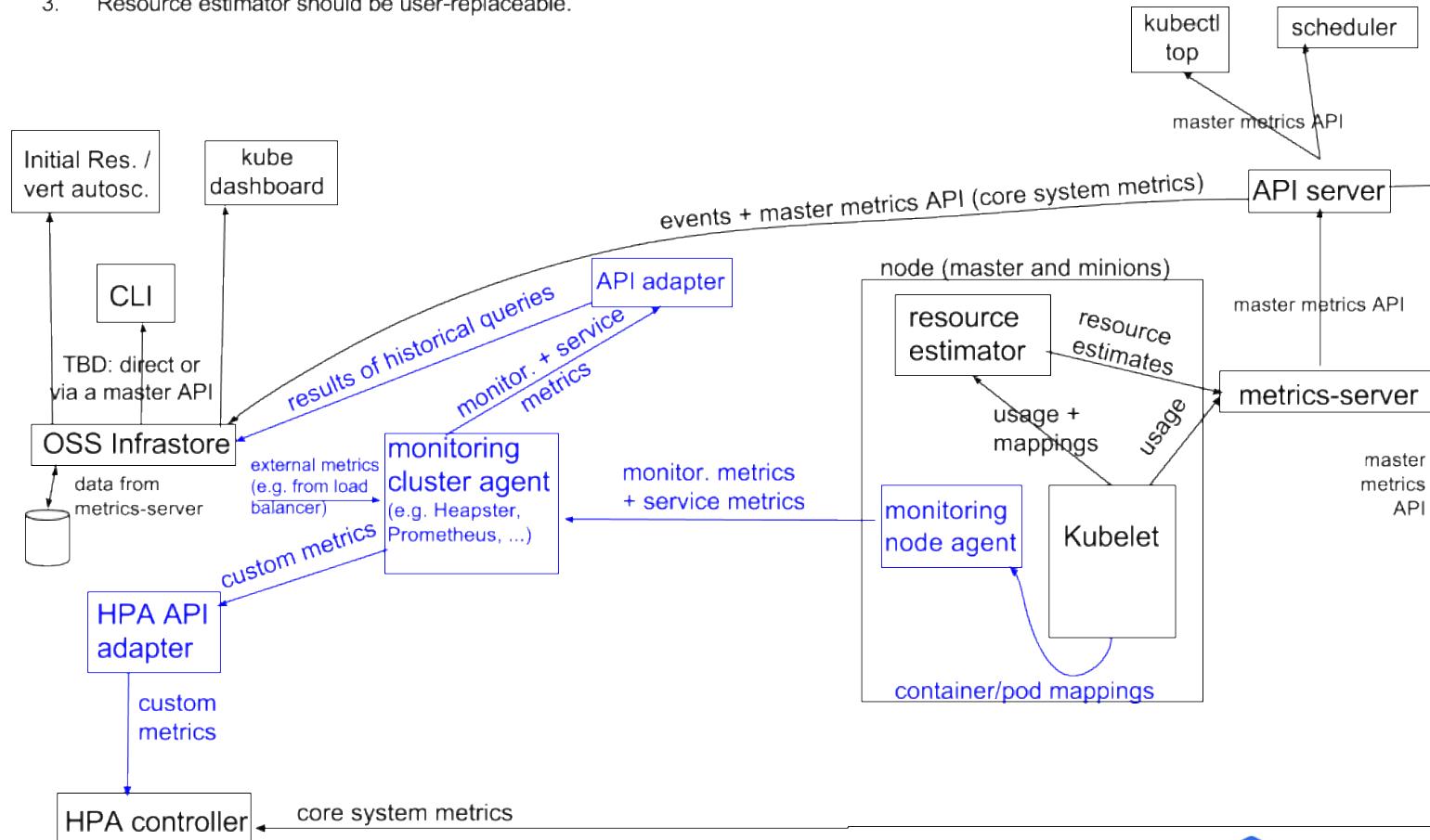


# Resource Management and HPA

Monitoring architecture proposal: OSS  
(arrows show direction of metrics flow)

## Notes

1. Arrows show direction of metrics flow.
2. **Monitoring pipeline is in blue**. It is user-supplied and optional.
3. Resource estimator should be user-replaceable.



# Resource Management and HPA

kubernetes / heapster

Watch 149 Star 2,363 Fork 1,132

Code Issues 28 Pull requests 7 Projects 0 Wiki Insights

Branch: master heapster / docs / deprecation.md Find file Copy path

AdamDang Typo fix: encorgaged->encouraged 85593b6 on Aug 21

2 contributors

49 lines (34 sloc) 2.04 KB Raw Blame History

## Heapster Deprecation Timeline

This is the (proposed) timeline for Heapster deprecation. Any changes made to the timeline will be reflected here. Note that this is the timeline for the official Heapster repository. Individual distributions are encouraged to follow suit in deprecating Heapster, but may continue to support it on their own.

### Summary

Kubernetes Release	Action	Policy/Support
Kubernetes 1.11	Initial Deprecation	No new features or sinks are added. Bugfixes may be made.
Kubernetes 1.12	Setup Removal	The optional to install Heapster via the Kubernetes setup script is removed.
Kubernetes 1.13	Removal	No new bugfixes will be made. Move to kubernetes-retired organization.



# Resource Management and HPA

[kubernetes / kubernetes](#)

Watch 2,788 Star 43,351 Fork 15,077

Code Issues 2,196 Pull requests 942 Projects 12 Insights

Branch: master kubernetes / cluster / addons / metrics-server / Create new file Upload files Find file History

DirectXMan12 Bump metrics-server to v0.3.1 ... Latest commit 13d59fd on Sep 17

..

<a href="#">OWNERS</a>	Add kawych to Metrics Server owners	10 months ago
<a href="#">README.md</a>	Add Troubleshooting sections to Heapster and Metrics Server addons do...	8 months ago
<a href="#">auth-delegator.yaml</a>	Made metrics-server critical service managed by addon-manager	a year ago
<a href="#">auth-reader.yaml</a>	Made metrics-server critical service managed by addon-manager	a year ago
<a href="#">metrics-apiservice.yaml</a>	Bumped Metrics Server to v0.2.0	a year ago
<a href="#">metrics-server-deployment.yaml</a>	Bump metrics-server to v0.3.1	2 months ago
<a href="#">metrics-server-service.yaml</a>	Made metrics-server critical service managed by addon-manager	a year ago
<a href="#">resource-reader.yaml</a>	Autoscaler metrics-server with pod-nanny	a year ago

[README.md](#)

## Metrics Server

Metrics Server exposes core Kubernetes metrics via metrics API.

More details can be found in [Core metrics pipeline documentation](#).

## Troubleshooting

Metrics Server supports up to 30 pods per cluster node. In clusters where there are more running pods, Metrics Server may be throttled or fail with OOM error. Starting with Kubernetes 1.9.2, Metrics Server resource requirements may be overwritten manually. [Learn more about Addon Resizer configuration](#)

## Important notices

Decreasing resource requirements for cluster addons may cause system instability. The effects may include (but are not limited to):

- [Horizontal Pod Autoscaler not working](#)
- [kubectl top not working \(starting with Kubernetes 1.10\)](#)

Overwritten configuration persists through cluster updates, therefore may cause all effects above after a cluster update.



# Resource Management and HPA

- Example: Deployment for python

```
1  apiVersion: v1
2  kind: Service
3  metadata:
4    name: webtest
5    labels:
6      name: web
7      owner: Praparn_L
8      version: "1.0"
9      module: WebServer
10     environment: development
11 spec:
12   selector:
13     name: web
14     owner: Praparn_L
15     version: "1.0"
16     module: WebServer
17     environment: development
18
19   type: NodePort
20   ports:
21     - port: 5000
22       name: http
23       targetPort: 5000
24       protocol: TCP
25       nodePort: 32500
```

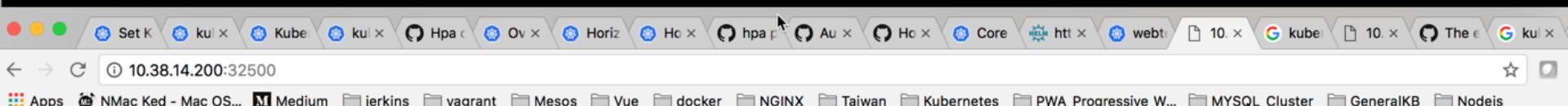
```
27  apiVersion: apps/v1
28  kind: Deployment
29  metadata:
30    name: webtest
31    labels:
32      name: web
33      owner: Praparn_L
34      version: "1.0"
35      module: WebServer
36      environment: development
37  spec:
38    replicas: 1
39    selector:
40      matchLabels:
41        name: web
42        owner: Praparn_L
43        version: "1.0"
44        module: WebServer
45        environment: development
46    template:
47      metadata:
48        labels:
49          name: web
50          owner: Praparn_L
51          version: "1.0"
52          module: WebServer
53          environment: development
54
55    spec:
56      containers:
57        - name: webtest
58          image: labdockerc/cluster:webservicelite_v1
59          resources:
60            requests:
61              cpu: "200m"
62          ports:
63            - containerPort: 5000
64              protocol: TCP
```



# Resource Management and HPA

- Create deployment for python

```
docker@kubernetes-ms:~$ kubectl create -f https://raw.githubusercontent.com/praparn/kubernetes_20170128/master/WorkShop_1.7_Resource_Management_and_HPA/webtest_hpa.yml
service "webtest" created
deployment "webtest" created
docker@kubernetes-ms:~$ kubectl get pods/webtest -o wide
Error from server (NotFound): pods "webtest" not found
docker@kubernetes-ms:~$ kubectl get svc/webtest -o wide
NAME      CLUSTER-IP      EXTERNAL-IP      PORT(S)        AGE      SELECTOR
webtest   10.107.217.17    <nodes>        5000:32500/TCP  5s      environment=development,module=WebServer,name=web,owner=Praparn_L,version=1.0
docker@kubernetes-ms:~$ kubectl get deployment/webtest -o wide
NAME      DESIRED   CURRENT   UP-TO-DATE   AVAILABLE   AGE      CONTAINER(S)   IMAGE(S)        SELECTOR
webtest   1         1         1            1           18s     webtest       labdockerc/cluster:webserviceelite_v1   environment=development,module=WebServer,name=web,owner=Praparn_L,version=1.0
Server,name=web,owner=Praparn_L,version=1.0
docker@kubernetes-ms:~$ kubectl get svc/webtest -o wide
NAME      CLUSTER-IP      EXTERNAL-IP      PORT(S)        AGE      SELECTOR
webtest   10.107.217.17    <nodes>        5000:32500/TCP  19s     environment=development,module=WebServer,name=web,owner=Praparn_L,version=1.0
docker@kubernetes-ms:~$ 
```



# Resource Management and HPA

- Apply HPA for monitor and scale (TARGET CPU 10%)

```
docker@kubernetes-ms:~$ kubectl autoscale deployment/webtest --min=1 --max=10 --cpu-percent=10
deployment "webtest" autoscaled
docker@kubernetes-ms:~$ kubectl get hpa/webtest
NAME      REFERENCE      TARGETS      MINPODS      MAXPODS      REPLICAS      AGE
webtest   Deployment/webtest   <unknown> / 10%    1            10           0            10s
docker@kubernetes-ms:~$ kubectl get hpa/webtest
NAME      REFERENCE      TARGETS      MINPODS      MAXPODS      REPLICAS      AGE
webtest   Deployment/webtest   2% / 10%    1            10           1            59s
docker@kubernetes-ms:~$ kubectl describe hpa/webtest
Name:                  webtest
Namespace:             default
Labels:                <none>
Annotations:           <none>
CreationTimestamp:     Fri, 02 Feb 2018 10:29:38 -0600
Reference:             Deployment/webtest
Metrics:               resource cpu on pods  (as a percentage of request): 2% (5m) / 10%
Min replicas:          1
Max replicas:          10
Conditions:
  Type        Status  Reason
  ----        ----  -----
  AbleToScale  True    ReadyForNewScale
  ScalingActive True    ValidMetricFound
  Events:      <none>
  ScalingLimited False   DesiredWithinRange
  Message:    the last scale time was sufficiently old as to warrant a new scale
               the HPA was able to successfully calculate a replica count from cpu resource utilization (percentage of request)
  Message:    the desired count is within the acceptable range
docker@kubernetes-ms:~$
```



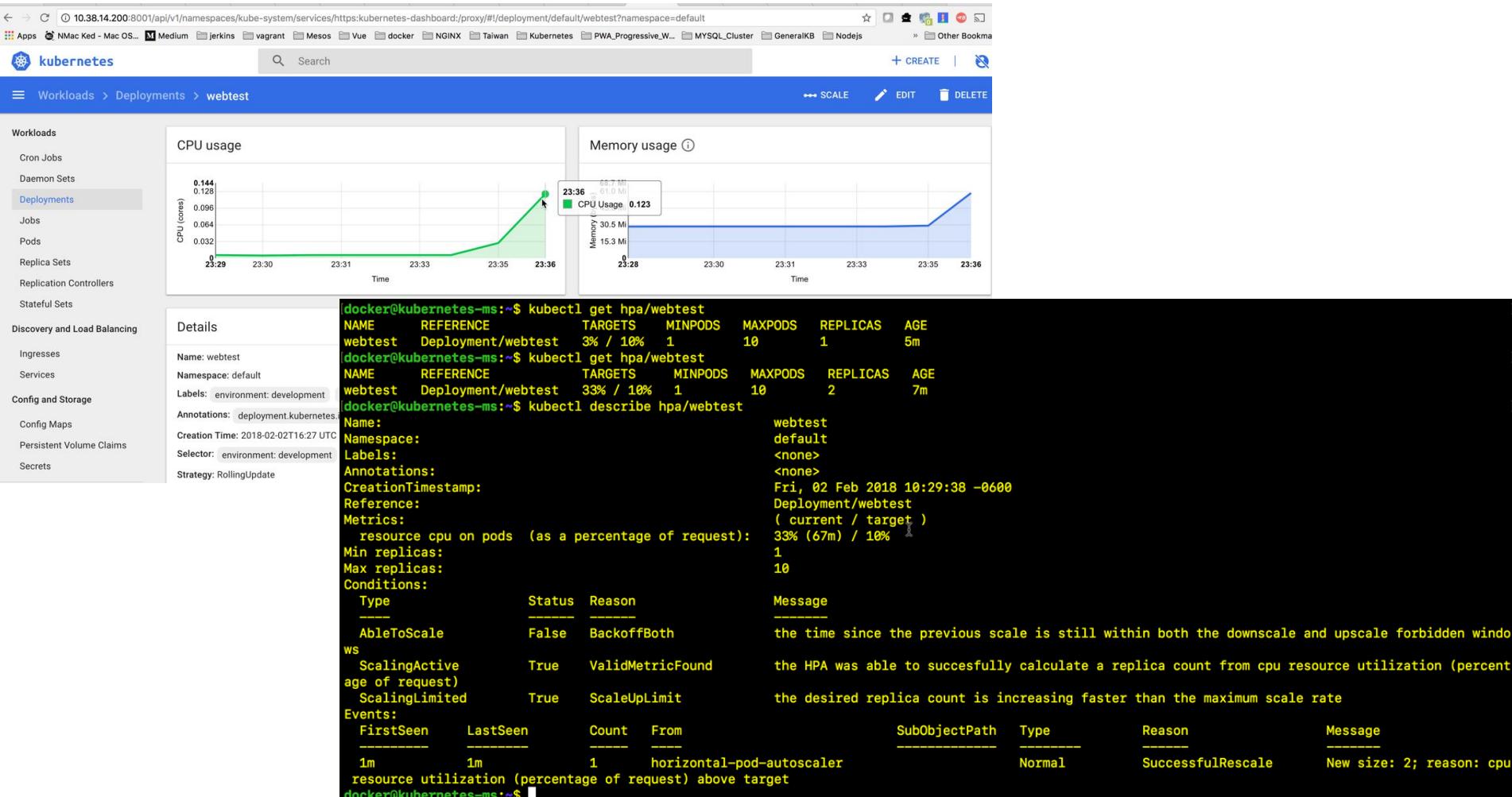
# Resource Management and HPA

- Generate load by busybox (wget every 10 ms)

```
[docker@kubernetes-ms:~$ kubectl top nodes
NAME          CPU(cores)   CPU%    MEMORY(bytes)   MEMORY%
kubernetes-ms  283m        14%    1868Mi        48%
kubernetes-1   83m         4%    1434Mi        37%
kubernetes-2   114m        5%    1410Mi        36%
[docker@kubernetes-ms:~$ kubectl top pods
NAME          CPU(cores)   MEMORY(bytes)
webtest-7d89786977-6zktl  29m      29Mi
[docker@kubernetes-ms:~$ kubectl get hpa/webtest
```

# Resource Management and HPA

- Load increase and HPA scale-out



# Resource Management and HPA

- HPA Scale-Out until meet target (Interval every 5 min)

```
docker@kubernetes-ms:~$ kubectl top pods
NAME                               CPU(cores)   MEMORY(bytes)
webtest-7d89786977-6zktl          69m         29Mi
load-generator-5c4d59d5dd-psqm9   120m        7Mi
webtest-7d89786977-xsp6t          65m         29Mi
docker@kubernetes-ms:~$ kubectl get hpa
NAME      REFERENCE      TARGETS      MINPODS   MAXPODS   REPLICAS   AGE
webtest   Deployment/webtest  33% / 10%   1          10          4          10m
docker@kubernetes-ms:~$ kubectl get hpa
NAME      REFERENCE      TARGETS      MINPODS   MAXPODS   REPLICAS   AGE
webtest   Deployment/webtest  18% / 10%   1          10          4          11m
docker@kubernetes-ms:~$ kubectl get hpa
NAME      REFERENCE      TARGETS      MINPODS   MAXPODS   REPLICAS   AGE
webtest   Deployment/webtest  18% / 10%   1          10          8          14m
docker@kubernetes-ms:~$ kubectl get hpa
NAME      REFERENCE      TARGETS      MINPODS   MAXPODS   REPLICAS   AGE
webtest   Deployment/webtest  13% / 10%   1          10          8          15m
docker@kubernetes-ms:~$ kubectl get hpa
NAME      REFERENCE      TARGETS      MINPODS   MAXPODS   REPLICAS   AGE
webtest   Deployment/webtest  11% / 10%   1          10          8          16m
docker@kubernetes-ms:~$ kubectl get hpa
NAME      REFERENCE      TARGETS      MINPODS   MAXPODS   REPLICAS   AGE
webtest   Deployment/webtest  11% / 10%   1          10          8          17m
docker@kubernetes-ms:~$ kubectl get hpa
NAME      REFERENCE      TARGETS      MINPODS   MAXPODS   REPLICAS   AGE
webtest   Deployment/webtest  10% / 10%   1          10          9          19m
```

# Resource Management and HPA

- Stop load and HPA Scale-down

# Resource Management and HPA

- Stop load and HPA Scale-down

```
docker@kubernetes-ms:~$ kubectl top nodes
NAME          CPU(cores)   CPU%   MEMORY(bytes)  MEMORY%
kubernetes-2  374m        18%    1526Mi        39%
kubernetes-ms  390m        19%    1956Mi        58%
kubernetes-1  184m        9%     1537Mi        39%
docker@kubernetes-ms:~$ kubectl get hpa
NAME      REFERENCE   TARGETS   MINPODS   MAXPODS   REPLICAS   AGE
webtest  Deployment/webtest  5% / 10%   1          10         9          22m
docker@kubernetes-ms:~$ kubectl get hpa
NAME      REFERENCE   TARGETS   MINPODS   MAXPODS   REPLICAS   AGE
webtest  Deployment/webtest  3% / 10%   1          10         3          25m
docker@kubernetes-ms:~$ kubectl get hpa
NAME      REFERENCE   TARGETS   MINPODS   MAXPODS   REPLICAS   AGE
webtest  Deployment/webtest  3% / 10%   1          10         1          30m
docker@kubernetes-ms:~$ kubectl describe hpa/webtest
Name:           webtest
Namespace:      default
Labels:          <none>
Annotations:    <none>
CreationTimestamp: Fri, 02 Feb 2018 10:29:38 -0600
Reference:      Deployment/webtest
Metrics:        resource cpu on pods  (as a percentage of request): 3% (6m) / 10%
Min replicas:   1
Max replicas:   10
Conditions:
  Type        Status  Reason
  ----        ----  -----
  AbleToScale False   BackoffBoth
  ScalingActive True    ValidMetricFound
  ScalingLimited False   DesiredWithinRange
Events:
  FirstSeen  LastSeen  Count  From                    SubObjectPath  Type        Reason
  -----  -----  -----  -----                    -----  -----  -----
  24m       24m       1      horizontal-pod-autoscaler      Normal      SuccessfulRescale
  (percentage of request) above target
  21m       21m       1      horizontal-pod-autoscaler      Normal      SuccessfulRescale
  (percentage of request) above target
  17m       17m       1      horizontal-pod-autoscaler      Normal      SuccessfulRescale
  (percentage of request) above target
  13m       13m       1      horizontal-pod-autoscaler      Normal      SuccessfulRescale
  (percentage of request) above target
  7m        7m        1      horizontal-pod-autoscaler      Normal      SuccessfulRescale
  1m        1m        1      horizontal-pod-autoscaler      Normal      SuccessfulRescale
  docker@kubernetes-ms:~$
```

# Recap Day 1

- Container concept (Recap)
- Introduction to Kubernetes
- System Architecture
- Fundamental of Kubernetes
  - Pods, Container and Services
  - Replication Controller (RC)
  - Deployment/Replica-Set (RS) and Rolling update
  - Volume
  - Liveness and Readyness Probe
  - Resource Management and Horizontal Pods Autoscaling (HPA)



# Outline Day 2

- Fundamental of Kubernetes (Con't)
  - ConfigMap Secret
  - Job and CronJob
  - Log and Monitoring
- Ingress Networking
- Kubernetes in real world
  - Cluster Setup for Bare Metal
  - Orchestrator Assignment
    - nodeSelector
    - Interlude
    - Affinity
    - Taints/Tolerations
- Stateful application deployment
  - Consideration and Awareness
  - Persistent Volumes
  - StatefulSets



# Question & Answer Section



By: Praparn L (eva10409@gmail.com)



**kubernetes**  
by Google

# WORKSHOP ADVANCED DOCKER



สอนการ deploy Dockers ด้วย Kubernetes  
จากประสบการณ์ใช้งานจริงบน Production ของ  
application ระดับประเทศ

วิทยากร : คุณ PRAPARN LUNGPOONLARP  
INFRASTRUCTURE ENGINEER, NETWORK ENGINEER,  
SYSTEM ENGINEER



kubernetes



Day 2



# Outline Day 2

- Fundamental of Kubernetes
  - ConfigMap Secret
  - Job and CronJob
  - Log and Monitoring
- Ingress Networking
- Kubernetes in real world
  - Cluster Setup for Bare Metal
  - Orchestrator Assignment
    - nodeSelector
    - Interlude
    - Affinity
    - Taints/Tolerations
- Stateful application deployment
  - Consideration and Awareness
  - Persistent Volumes
  - StatefulSets



# Outline Day 2

- Fundamental of Kubernetes
  - ConfigMap Secret
  - Job and CronJob
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    - nodeSelector
    - Interlude
    - Affinity
    - Taints/Tolerations
- Stateful application deployment
  - Consideration and Awareness
  - Persistent Volumes
  - StatefulSets



# ConfigMap and Secret



Kubernetes: Production Workload Orchestration



**kubernetes**  
by Google

# ConfigMap and Secret

- Make secret data and configuration great again !
- Many container need some configuration/potential data for make it work. But is it should store in image/configuration (Container, Pods, Deployment, RC etc)?
  - Root password of database
  - Environment variable
  - Custom variable
  - Path of mount volume data
  - Etc
- ConfigMap will provide central configuration for Pods operate
- Secret will encode sensitive data for keep secret



# ConfigMap and Secret

- ConfigMap
  - ConfigMap belong to namespace scope
  - Option to create:
    - literal values
    - From file or folder
    - YAML file

```
kubectl create configmap <name> <option>
```

- Ex: “kubectl create configmap webmodule\_configmap --from-literal=REDIS\_HOST=localhost”
- Ex: “kubectl create -f webmodule\_configmap.yml”

```
1 apiVersion: v1
2 kind: ConfigMap
3 metadata:
4   name: webmodule_configmap
5   namespace: webmicroservice
6   labels:
7     name: "webmodule_configmap"
8     owner: "Praparn_L"
9     version: "1.0"
10    module: "ConfigMap"
11    environment: "development"
12 data:
13   REDIS_HOST: localhost
```



# ConfigMap and Secret

- Secret
  - ConfigMap will encode64 algorithm
  - Option to create:
    - From file <store confidential value>
    - YAML file

```
kubectl create secret generic <name> <option>
```

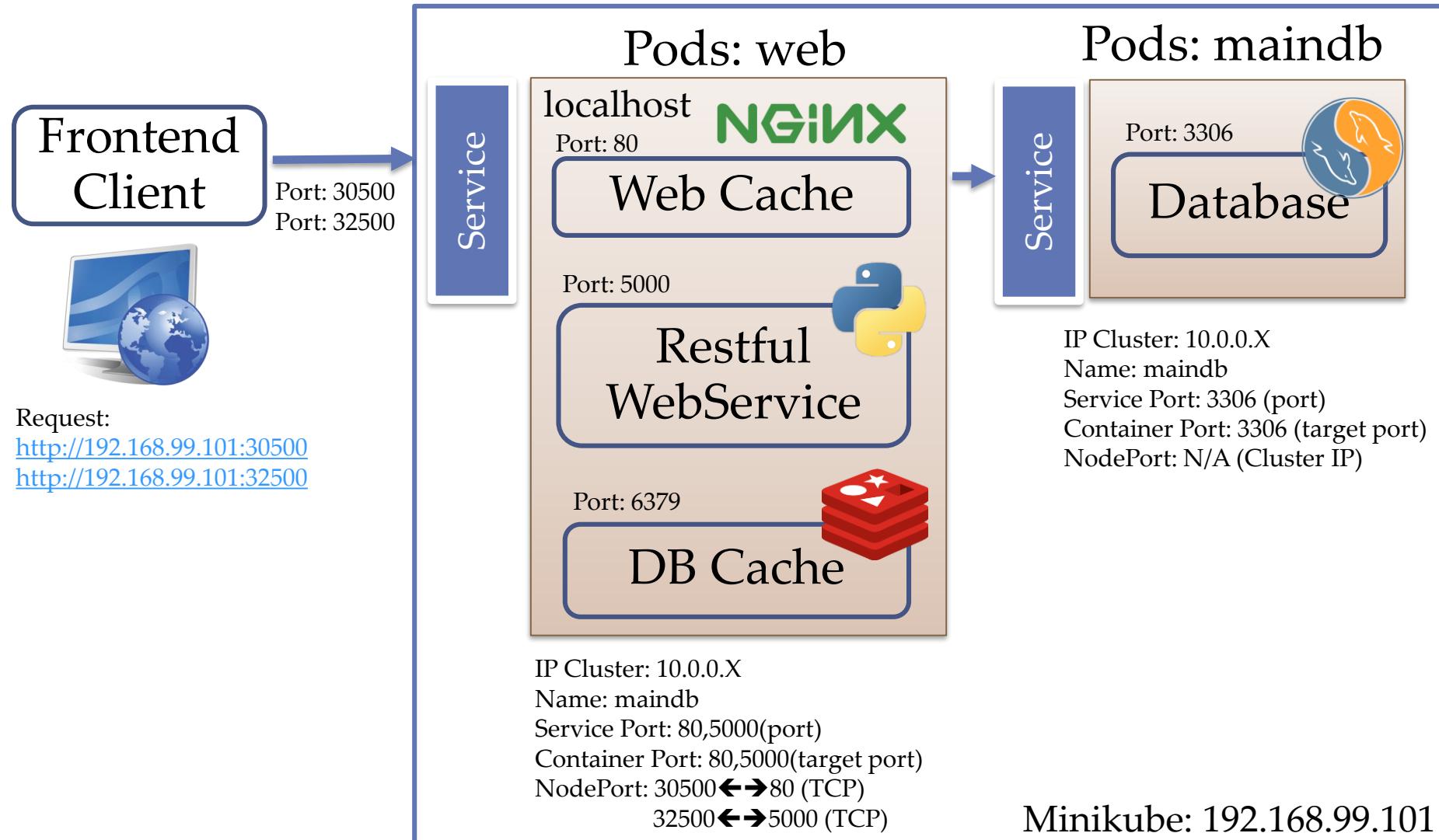
- Ex: “kubectl create secret generic databasemodule\_secret --from-file=./username.txt --from-file=./password.txt”
- Ex: “kubectl create -f databasemodule\_secret.yml”

```
|praparns-MBP:~ praparn$ echo -n "root" |base64  
cm9vdA==  
|praparns-MBP:~ praparn$ echo -n "password" |base64  
cGFzc3dvcmQ=  
praparns-MBP:~ praparn$ █
```

```
1  apiVersion: v1  
2  kind: Secret  
3  metadata:  
4    name: databasemodule_secret  
5    namespace: webmicroservice  
6    labels:  
7      name: "databasemodule_secret"  
8      owner: "Praparn_L"  
9      version: "1.0"  
10     module: "Secret"  
11     environment: "development"  
12   type: Opaque  
13   data:  
14     username: cm9vdA==  
15     password: cGFzc3dvcmQ=
```



# ConfigMap and Secret



# ConfigMap and Secret

Service

Port: 3306

Database



Pods.yml: databasemodule\_pod.yml

```
containers:
  - name: maindb
    image: labdocker/mysql:latest
    ports:
      - containerPort: 3306
        protocol: TCP
    env:
      -
        name: "MYSQL_ROOT_PASSWORD"
        value: "password"
```

Service

localhost



Port: 80

Web Cache



Port: 5000

Restful  
WebService

Port: 6379

DB Cache



Sourcecode: main.py

```
Shotnote instruction.txt databasemod... webmodule_... main.py webmodule_... databasemod...
6 CACHE_DB = redis.Redis(host=os.environ.get('REDIS_HOST', 'cachedb'), port=6379)
7 db = MySQLdb.connect("maindb","root","password")
8 MAIN_DB = db.cursor()
```

Pods.yml: webmodule\_pod.yml

```
18   - name: webservice
19     image: labdocker/cluster:webservice
20   env:
21     -
22       name: "REDIS_HOST"
23       value: "localhost"
```



# ConfigMap and Secret

Service

Port: 3306

Database



Secret.yml: databasemodule\_secret.yml

```
1 apiVersion: v1
2 kind: Secret
3 metadata:
4   name: databasemodule-secret
5   namespace: webmicroservice
6   labels:
7     name: "databasemodule-secret"
8     owner: "Praparn_L"
9     version: "1.0"
10    module: "Secret"
11    environment: "development"
12 type: Opaque
13 data:
14   username: cm9vdA==
15   password: cGFzc3dvcmQ=
```



Deploy.yml: databasemodule\_deploy\_config.yml

```
22 apiVersion: "v1"
23 kind: Deployment
24 metadata:
25   name: maindb
26   labels:
27     name: "maindb"
28     owner: "Praparn_L"
29     version: "1.0"
30   module: "maindb"
31   environment: "development"
32 spec:
33   replicas: 1
34   template:
35     metadata:
36       labels:
37     spec:
38       containers:
39         - name: maindb
40           image: labdocker/mysql:latest
41           ports:
42             - containerPort: 3306
43               protocol: TCP
44           env:
45             - name: username
46               valueFrom:
47                 secretKeyRef:
48                   name: databasemodule-secret
49                   key: username
50             - name: password
51               valueFrom:
52                 secretKeyRef:
53                   name: databasemodule-secret
54                   key: password
```

# ConfigMap and Secret

Secret.yaml:

databasemodule\_secret.yaml

```
1 apiVersion: v1
2 kind: Secret
3 metadata:
4   name: databasemodule-secret
5   namespace: webmicroservice
6   labels:
7     name: "databasemodule-secret"
8     owner: "Praparn_L"
9     version: "1.0"
10    module: "Secret"
11    environment: "development"
12   type: Opaque
13  data:
14    username: cm9vdA==
15    password: cGFzc3dvcmQ=
```

Deploy.yaml:

webmodule\_deploy\_config.yaml

```
46 spec:
47   containers:
48     - name: cachedb
49       image: labdocker/redis:latest
50       ports:
51         - containerPort: 6379
52           protocol: TCP
53     - name: webservice
54       image: labdocker/cluster:webservice
55       env:
56         - name: REDIS_HOST
57           valueFrom:
58             configMapKeyRef:
59               name: webmodule_configmap
60               key: REDIS_HOST
61         - name: username
62           valueFrom:
63             secretKeyRef:
64               name: databasemodule-secret
65               key: username
66         - name: password
67           valueFrom:
68             secretKeyRef:
69               name: databasemodule-secret
70               key: password
71       ports:
72         - containerPort: 5000
73           protocol: TCP
```

ConfigMap.yaml:

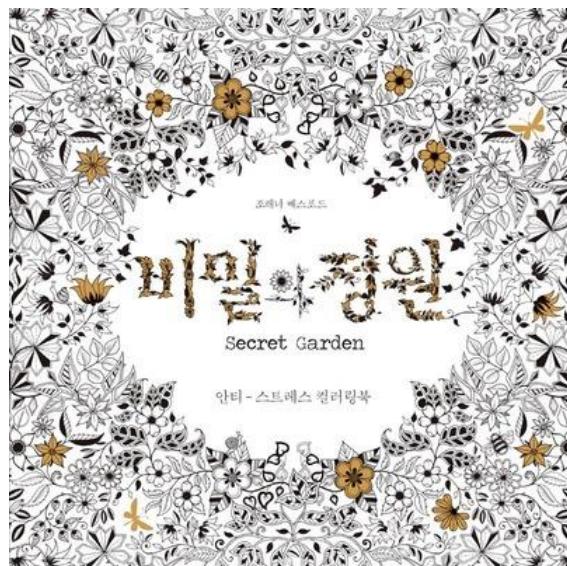
webmodule\_configmap.yaml

```
1 apiVersion: v1
2 kind: ConfigMap
3 metadata:
4   name: webmodule-configmap
5   namespace: webmicroservice
6   labels:
7     name: "webmodule-configmap"
8     owner: "Praparn_L"
9     version: "1.0"
10    module: "ConfigMap"
11    environment: "development"
12   data:
13     REDIS_HOST: localhost
```



# Workshop 2.1: ConfigMap and Secret

```
~ — Terminal MAC Pro — zsh          Terminal MAC Pro — WinSCP.exe TERM...      Terminal MAC Pro — ssh + docker-mach...      ~ — Terminal MAC Pro — -bash
Environment:
  username:           <set to the key 'username' in secret 'databasemodule-secret'>  Optional: false
  MYSQL_ROOT_PASSWORD: <set to the key 'password' in secret 'databasemodule-secret'>  Optional: false
Mounts:
  /var/run/secrets/kubernetes.io/serviceaccount from default-token-ts1ql (ro)
Conditions:
  Type      Status
  Initialized  True
  Ready        True
  PodScheduled  True
Volumes:
  default-token-ts1ql:
    Type:     Secret (a volume populated by a Secret)
    SecretName: default-token-ts1ql
    Optional:  false
QoS Class:  BestEffort
Node-Selectors: <none>
Tolerations:  <none>
```



```
praparn-MacBook-Pro% kubectl describe configmap/webmodule-configmap --namespace webmicroservice
Name:            webmodule-configmap
Namespace:       webmicroservice
Labels:          environment=development
                  module=ConfigMap
                  name=webmodule-configmap
                  owner=Praparn_L
                  version=1.0
Annotations:    <none>

Data
=====
REDIS_HOST:
-----
localhost

praparn-MacBook-Pro% kubectl describe secret/databasemodule-secret --namespace webmicroservice
Name:            databasemodule-secret
Namespace:       webmicroservice
Labels:          environment=development
                  module=Secret
                  name=databasemodule-secret
                  owner=Praparn_L
                  version=1.0
Annotations:    <none>

Type:  Opaque

Data
=====
password:        8 bytes
username:        4 bytes
```



# Job and Cron Jobs



Kubernetes: Production Workload Orchestration



**kubernetes**  
by Google

# Job and Cron Job

- Some task on kubernetes will batch process or non-interactive job
  - Update EOD Process
  - Monitor System Health
  - Calculate Balance
  - Run reindexing file/database
  - etc

```
kubectl create -f <YAML File>
```

- “Job” on kubernetes was design to operate special purpose
  - Job will track status of complete job
  - Job will autostart new Pods when it failed or deleted
  - Job will delete Pods when job was deleted

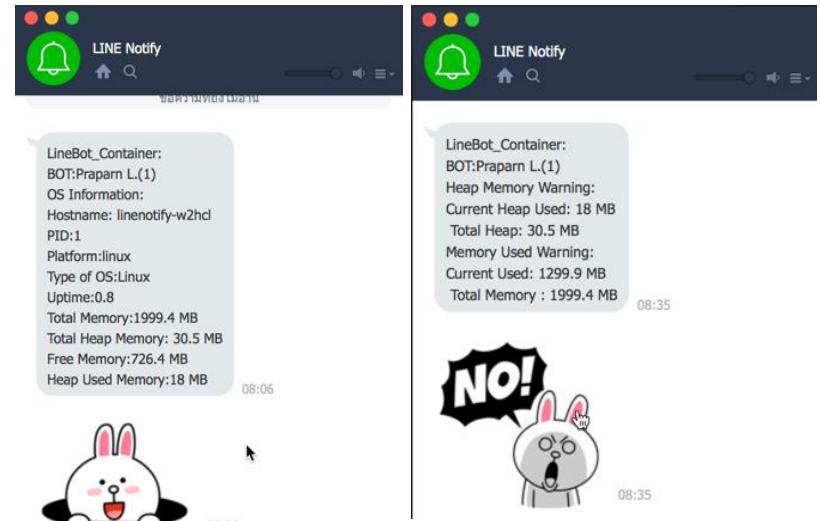


# Job and Cron Job

Job.yml: job.yml

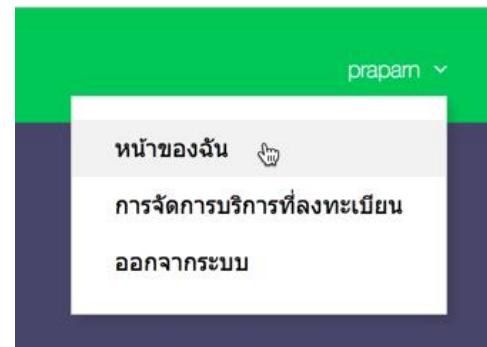
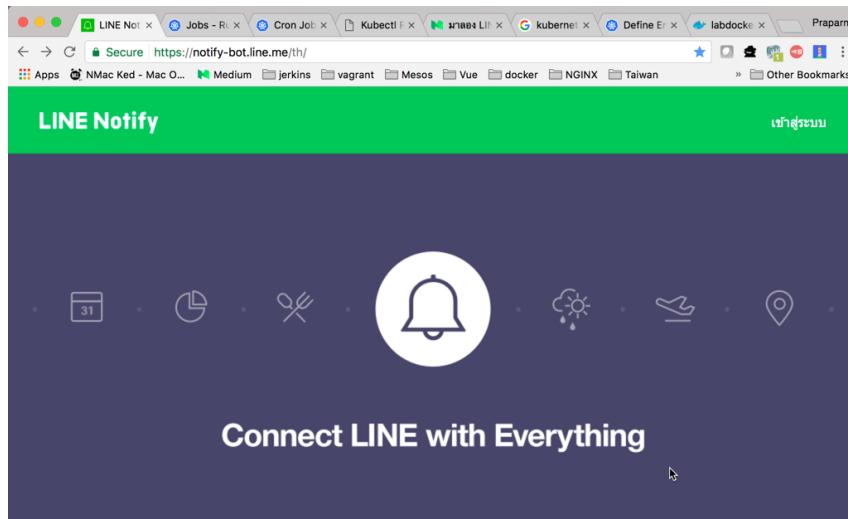
```
1  apiVersion: batch/v1
2  kind: Job
3  metadata:
4      name: linenotify
5      labels:
6          name: linenotify
7          owner: Praparn_L
8          version: "1.0"
9          module: Job
10         environment: development
11
12     spec:
13         template:
14             metadata:
15                 name: linenotify
16             spec:
17                 containers:
18                     - name: linenotify
19                         image: labdocker/linenotify
20                         env:
21                             - name: TITLE
22                             value: "BOT:Praparn L."
23                             - name: INTERVAL
24                             value: "10000"
25                             - name: HEAP_HIGH
26                             value: "40"
27                             - name: MEM_HIGH
28                             value: "20"
29                             - name: SH_OS
30                             value: "Y"
31                             - name: TOKEN
32                             value: "E1eqyillzkpaCo1R0rebZTcGbIyzDZHp0jcdd0t6CX"
33             restartPolicy: Never
```

```
praparns-MacBook-Pro% kubectl create -f job.yml
job "linenotify" created
praparns-MacBook-Pro% kubectl get jobs
NAME      DESIRED   SUCCESSFUL   AGE
linenotify 1          0           1m
praparns-MacBook-Pro% kubectl get pods
NAME        READY   STATUS    RESTARTS   AGE
linenotify-w2hcl  1/1    Running   0          2m
praparns-MacBook-Pro% kubectl describe jobs/linenotify
Name:            linenotify
Namespace:       default
Selector:        controller-uid=e816fc3f-6e79-11e7-9aa8-08002763e747
Labels:          environment=development
                  module=Job
                  name=linenotify
                  owner=Praparn_L
                  version=1.0
Annotations:    <none>
```



# Workshop 2.2: Job and CronJob

- Task0: Generate LINE token
  - <https://notify-bot.line.me>



## ออก Access Token (สำหรับผู้พัฒนา)

เมื่อใช้ Access Token แบบบุคคล จะสามารถตั้งค่าการแจ้งเตือนได้โดยไม่ต้องลงทะเบียนกับเว็บเซอร์วิส



# Workshop 2.2: Job and CronJob

ออก Token

โปรดใส่ชื่อ Token (จะแสดงเมื่อมีการแจ้งเตือน)

LINEBOT

โปรดเลือกห้องแขวงที่ต้องการส่งข้อความแจ้งเตือน

Search by group name

 รับการแจ้งเตือนแบบตัวต่อตัวจาก LINE Notify

Token ที่ออก

zHOlcJCcpIIS8mEedn

ถ้าออกจากหน้านี้ ระบบจะไม่แสดง Token ที่ออกใหม่ถ้าต่อไป โปรดลอก Token ก่อนออกจากหน้านี้

ดูผล

ปิด



2017.07.19 23:42  
From: LineBot\_Container  
To: praparn

ยกเลิก



# Workshop 2.2: Job and CronJob

- Task1: Create Jobs for Monitor System via LINE

```
1  apiVersion: batch/v1
2  kind: Job
3  metadata:
4    name: linenotify
5    labels:
6      name: linenotify
7      owner: Praparn_L
8      version: "1.0"
9      module: Job
10     environment: development
11
12    spec:
13      template:
14        metadata:
15          name: linenotify
16        spec:
17          containers:
18            - name: linenotify
19              image: labdocker/linenotify
20              env:
21                - name: TITLE
22                  value: "BOT:Praparn L."
23                - name: INTERVAL
24                  value: "10000"
25                - name: HEAP_HIGH
26                  value: "20"
27                - name: MEM_HIGH
28                  value: "20"
29                - name: SH_OS
30                  value: "N"
31                - name: TOKEN
32                  value: "EIEeqyillzkpaCo1R0rebZTcGbIyzDZHp0jcd0t6CX"
33
34      restartPolicy: Never
```



TITLE: ➔ Input Name  
INTERVAL : ➔ Input Check Interval (ms)  
HEAP\_HIGH: ➔ % of Heap Memory Warn  
MEM\_HIGH: ➔ % of Memory Used Warn  
SH\_OS: ➔ Mode  
(Show information:Y, Show only Warning  
Reach:N)  
TOKEN: ➔ Input LINE TOKEN

# Job and Cron Job

- “CronJob” is time base “Jobs” with
  - Run on specific point-in-time
  - Repeat point in time
  - etc

```
* * * * * command to be executed
- - - - -
| | | | |
| | | | ----- Day of week (0 - 7) (Sunday=0 or 7)
| | | ----- Month (1 - 12)
| | ----- Day of month (1 - 31)
| ----- Hour (0 - 23)
----- Minute (0 - 59)
```



[Documentation](#) [Blog](#) [Partners](#) [Community](#) [Case Studies](#)

## Cron Job Limitations

A cron job creates a job object *about* once per execution time of its schedule. We say “about” because there are certain circumstances where two jobs might be created, or no job might be created. We attempt to make these rare, but do not completely prevent them. Therefore, jobs should be *idempotent*.

The job is responsible for retrying pods, parallelism among pods it creates, and determining the success or failure of the set of pods. A cron job does not examine pods at all.



# Job and Cron Job

- AutoCleanup Job

Kubernetes Operator to automatically delete completed Jobs and their Pods

kubernetes kubernetes-operator golang

Branch: master ▾ New pull request

Create new file Upload files Find file Clone or download ▾

File	Description	Last Commit
Iwolf committed 26 days ago go fmt, update README, more flexible makefile	go fmt, update README, more flexible makefile	26 days ago
cmd	go fmt, update README, more flexible makefile	26 days ago
deploy	Fix rbac permissions, improve readme	5 months ago
pkg/controller	go fmt, update README, more flexible makefile	26 days ago
.gitignore	initial commit	5 months ago
.travis.yml	Feature/makefile (#10)	26 days ago
Dockerfile	Feature/makefile (#10)	26 days ago
Gopkg.lock	initial commit	5 months ago
Gopkg.toml	initial commit	5 months ago
LICENSE	Initial commit	5 months ago
Makefile	go fmt, update README, more flexible makefile	26 days ago
README.md	go fmt, update README, more flexible makefile	26 days ago

README.md

### Kubernetes cleanup operator

build passing

Experimental Kubernetes Operator to automatically delete completed Jobs and their Pods. Controller listens for changes in Pods created by Jobs and deletes it on Completion.

Some defaults:

- All Namespaces are monitored by default
- Only Pods created by Jobs are monitored

<https://github.com/lwolf/kube-cleanup-operator>



# Debug Log and Monitoring



Kubernetes: Production Workload Orchestration



**kubernetes**  
by Google

# Debug Log and Monitoring

- Normally kubernetes provide tool for check log on Pods and container level with several option

```
kubectl logs pods/<pods name> -c <container name> <option>
```

- Option:
  - -p, --previous=false ➔ Printout last container fail in Pods
  - -f, --follow=false ➔ Follow stream log
  - -c, --container ➔ Specific container for check log
  - -l, --selector ➔ Select filter some label for check log
- Ex:
  - kubectl logs -f pods/maindb -c maindb

# Debug Log and Monitoring

- Monitoring kubernetes system via dashboard

minikube dashboard

The screenshot shows the 'Workloads' section of the minikube dashboard. On the left is a sidebar with navigation links for Admin, Namespaces, Nodes, Persistent Volumes, Storage Classes, Namespace (default), Workloads, Deployments, Replica Sets, Replication Controllers, Daemon Sets, Stateful Sets, Jobs, Pods, Services and discovery, Services, Ingresses, and Storage. The 'Workloads' link is currently selected. The main area displays two Deployments:

Name	Labels	Pods	Age	Images
maindb	environment: development module: maindb	2 / 1	48 seconds	labdocker/mysql:latest
web	environment: development module: web	2 / 1	41 seconds	labdocker/redis:latest labdocker/cluster/webservi... labdocker/cluster/webcach...

Below the Deployments is a section for Replica Sets, showing the 'maindb-1334333237' replica set with 1 / 1 pods running.

The screenshot shows the 'Edit a Service' dialog. The title is 'Edit a Service'. The main area displays the JSON configuration for a service named 'kubernetes' in the 'default' namespace. The configuration includes:

```
Service {5}
  kind: Service
  apiVersion: v1
  metadata: {7}
    name: kubernetes
    namespace: default
    selfLink: /api/v1/namespaces/default/services/kubernetes
    uid: a0367a8c-640c-11e7-92a2-08002763e747
    resourceVersion: 8
    creationTimestamp: 2017-07-08T18:38:24Z
  labels: {2}
    component: apiserver
    provider: kubernetes
  spec: {4}
    ports: [1]
```

At the bottom right are 'CANCEL' and 'UPDATE' buttons.



# Workshop 2.3: Log and Monitoring



# Ingress Network



Kubernetes: Production Workload Orchestration



**kubernetes**  
by Google

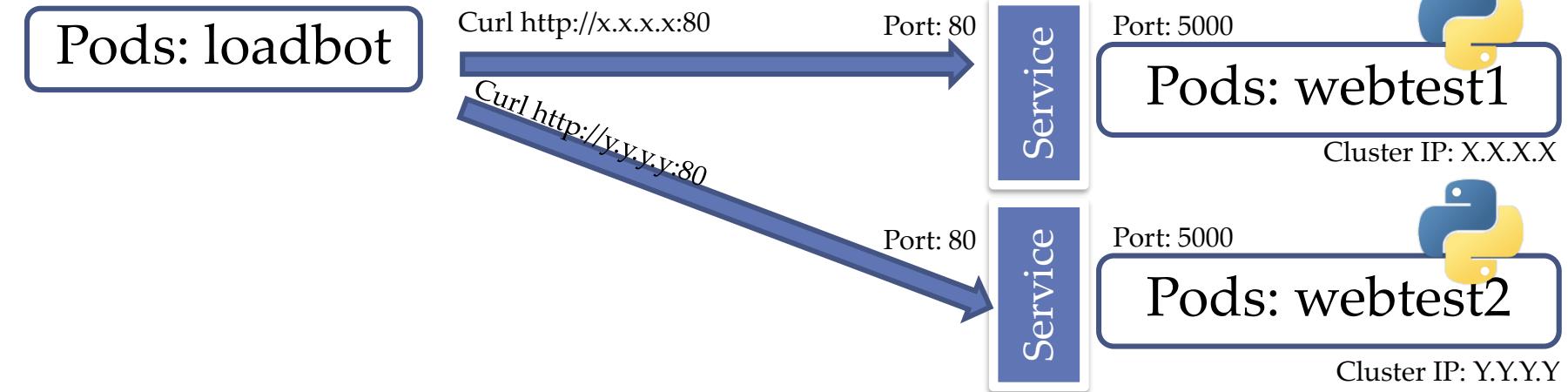
# Ingress Network

- Remember Service ?
  - Service will expose for other Pods / External to connect and access service on Pods inside

```
praparns-MacBook-Pro:multicontainer praparn$ kubectl get svc
NAME      CLUSTER-IP   EXTERNAL-IP   PORT(S)           AGE
kubernetes  10.0.0.1    <none>        443/TCP          4d
maindb     10.0.0.134   <none>        3306/TCP         17m
web        10.0.0.69    <nodes>       5000:30661/TCP,80:30500/TCP  16m
praparns-MacBook-Pro:multicontainer praparn$
```
  - Service quite limit and non flexible for operate
    - How to handle for multiple service on same port ?
    - How to limit protocol for access ? (HTTP/HTTPS/FTP etc)
    - How to binding with hostname ? ([www.xxxx.yyy](http://www.xxxx.yyy))
    - How to TLS connection ?
    - etc
- Ingress is tool will operate for that
  - Give some customize label for classify host and define some selector criteria for specific node run Pods

# Ingress Network

- Service:



Frontend Client



Request:

<http://192.168.99.101:30500>  
<http://192.168.99.101:32500>

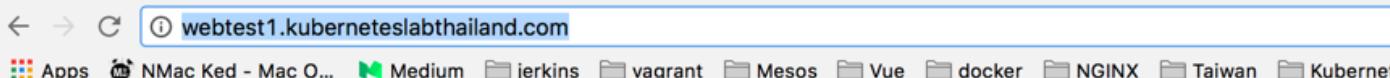
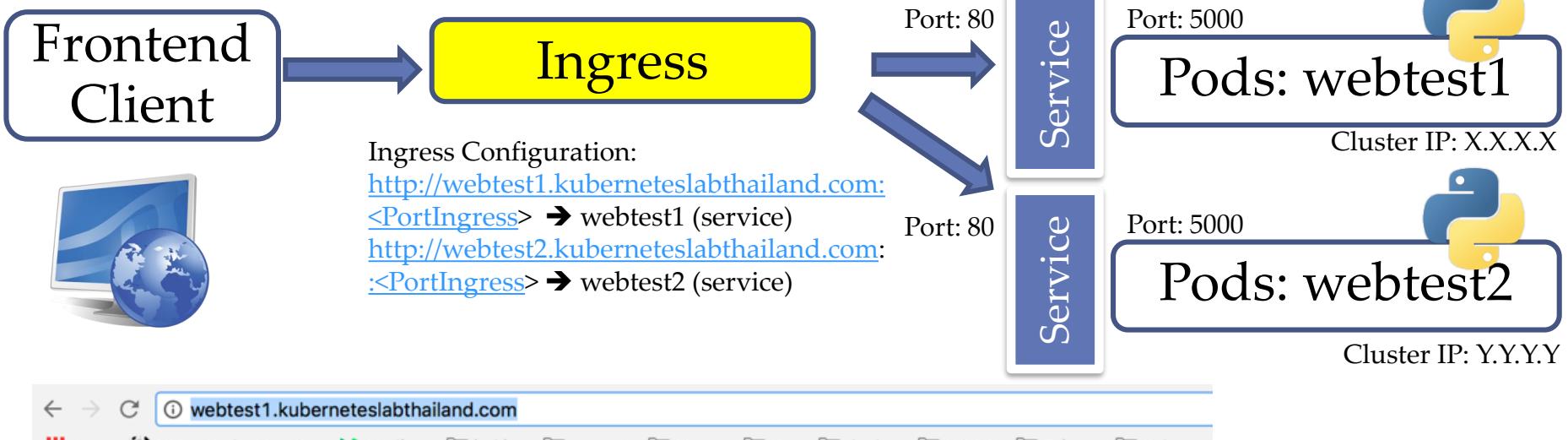
Kubernetes: Production Workload Orchestration



**kubernetes**  
by Google

# Ingress Network

- Ingress:



## Welcome Page from Container Python Lab Web Version 1.00

Checkpoint Date/Time: Wed Jul 26 15:44:27 2017



## Welcome Page from Container Python Lab Web Version 1.51 RC

Checkpoint Date/Time: Wed Jul 26 15:49:23 2017



# Ingress Network

SVC: webtest1

```
1 apiVersion: v1
2 kind: Service
3 metadata:
4   name: webtest1
5   labels:
6     name: webtest1
7     owner: Paparn_L
8     version: "1.0"
9   module: WebServer
10  environment: development
11
12 spec:
13   selector:
14     name: webtest1
15     owner: Paparn_L
16     version: "1.0"
17     module: WebServer
18     environment: development
19
20 ports:
21   - port: 80
22     name: http
23     targetPort: 5000
24     protocol: TCP
```

SVC: webtest2

```
1 apiVersion: v1
2 kind: Service
3 metadata:
4   name: webtest2
5   labels:
6     name: webtest2
7     owner: Paparn_L
8     version: "1.0"
9   module: WebServer
10  environment: development
11
12 spec:
13   selector:
14     name: webtest2
15     owner: Paparn_L
16     version: "1.0"
17     module: WebServer
18     environment: development
19
20 ports:
21   - port: 80
22     name: http
23     targetPort: 5000
24     protocol: TCP
```

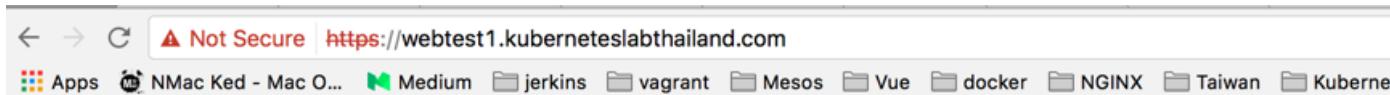
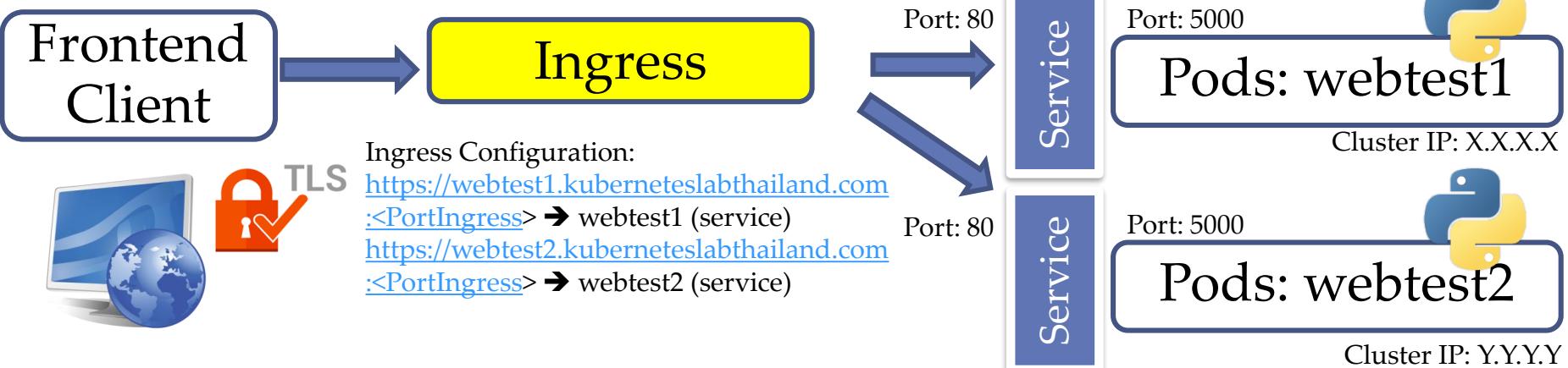
Ingress: ingresswebtest

```
1 apiVersion: extensions/v1beta1
2 kind: Ingress
3 metadata:
4   name: ingresswebtest
5 spec:
6   rules:
7     - host: webtest1.kuberneteslabthailand.com
8       http:
9         paths:
10           - backend:
11             serviceName: webtest1
12             servicePort: 80
13     - host: webtest2.kuberneteslabthailand.com
14       http:
15         paths:
16           - backend:
17             serviceName: webtest2
18             servicePort: 80
```



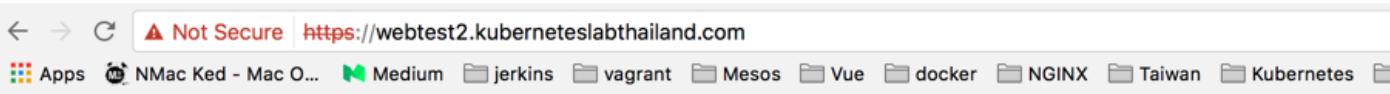
# Ingress Network

- Ingress (TLS):



## Welcome Page from Container Python Lab Web Version 1.00

Checkpoint Date/Time: Wed Jul 26 16:36:39 2017



## Welcome Page from Container Python Lab Web Version 1.51 RC

Checkpoint Date/Time: Wed Jul 26 16:39:09 2017



# Ingress Network

① www.selfsignedcertificate.com  
NMac Ked - Mac O... Medium jenkins vagrant Mesos Vue docker NGINX Taiwan Kubernetes PWA\_Progressive\_... MYSQL\_Cluster GeneralKB Nodejs

Self-Signed Certificate Generator   Development Tips   About

## Self-Signed Certificate Generator

Self-signed ssl certificates can be used to set up temporary ssl servers. You can use it for test and development servers where security is not a big concern. Use the form below to generate a self-signed ssl certificate and key.

Server name:  Generate »

**About SSL Certificates**  
SSL certificates are required in order to run web sites using the HTTPS protocol. For professional web sites, you usually buy such a certificate from Verisign, Thawte or any other ssl certificate vendor. SSL certificates use a chain of trust, where each certificate is signed (trusted) by a higher, more credible certificate. At the top of the chain of trust are the root certificates, owned by Verisign and others. These certificates are typically shipped with your operating system or web browser.





# Ingress Network

SVC: webtest1

```
1 apiVersion: v1
2 kind: Service
3 metadata:
4   name: webtest1
5   labels:
6     name: webtest1
7     owner: Praparn_L
8     version: "1.0"
9   module: WebServer
10  environment: development
11 spec:
12   selector:
13     name: webtest1
14     owner: Praparn_L
15     version: "1.0"
16     module: WebServer
17     environment: development
18
19 ports:
20 - port: 80
21   name: http
22   targetPort: 5000
23   protocol: TCP
24
```

SVC: webtest2

```
1 apiVersion: v1
2 kind: Service
3 metadata:
4   name: webtest2
5   labels:
6     name: webtest2
7     owner: Praparn_L
8     version: "1.0"
9   module: WebServer
10  environment: development
11 spec:
12   selector:
13     name: webtest2
14     owner: Praparn_L
15     version: "1.0"
16     module: WebServer
17     environment: development
18
19 ports:
20 - port: 80
21   name: http
22   targetPort: 5000
23   protocol: TCP
24
```

Ingress: ingresswebtest

```
1 apiVersion: extensions/v1beta1
2 kind: Ingress
3 metadata:
4   name: ingresswebtest1
5 spec:
6   tls:
7     - hosts:
8       - webtest1.kuberneteslabthailand.com
9         secretName: webtest1secret
10    - hosts:
11      - webtest2.kuberneteslabthailand.com
12        secretName: webtest2secret
13    rules:
14      - host: webtest1.kuberneteslabthailand.com
15        http:
16          paths:
17            - backend:
18              serviceName: webtest1
19              servicePort: 80
20      - host: webtest2.kuberneteslabthailand.com
21        http:
22          paths:
23            - backend:
24              serviceName: webtest2
25              servicePort: 80
```

Secret: webtest1

```
1 apiVersion: v1
2 data:
3   tls.crt: LS0tLS1CRUdJTiBDRVJUSUZJQ0FURS0tLS0tCk1JSURMVENDQWhXZ0F3SUJBZ0LKC
4   tls.key: LS0tLS1CRUdJTiBSU0EgUFJJVkfURSBLRVktLS0tLQpNSU1Fb3dJQkFBS0NBUVBKA
5 kind: Secret
6 metadata:
7   name: webtest1secret
8   namespace: default
9 type: Opaque
```

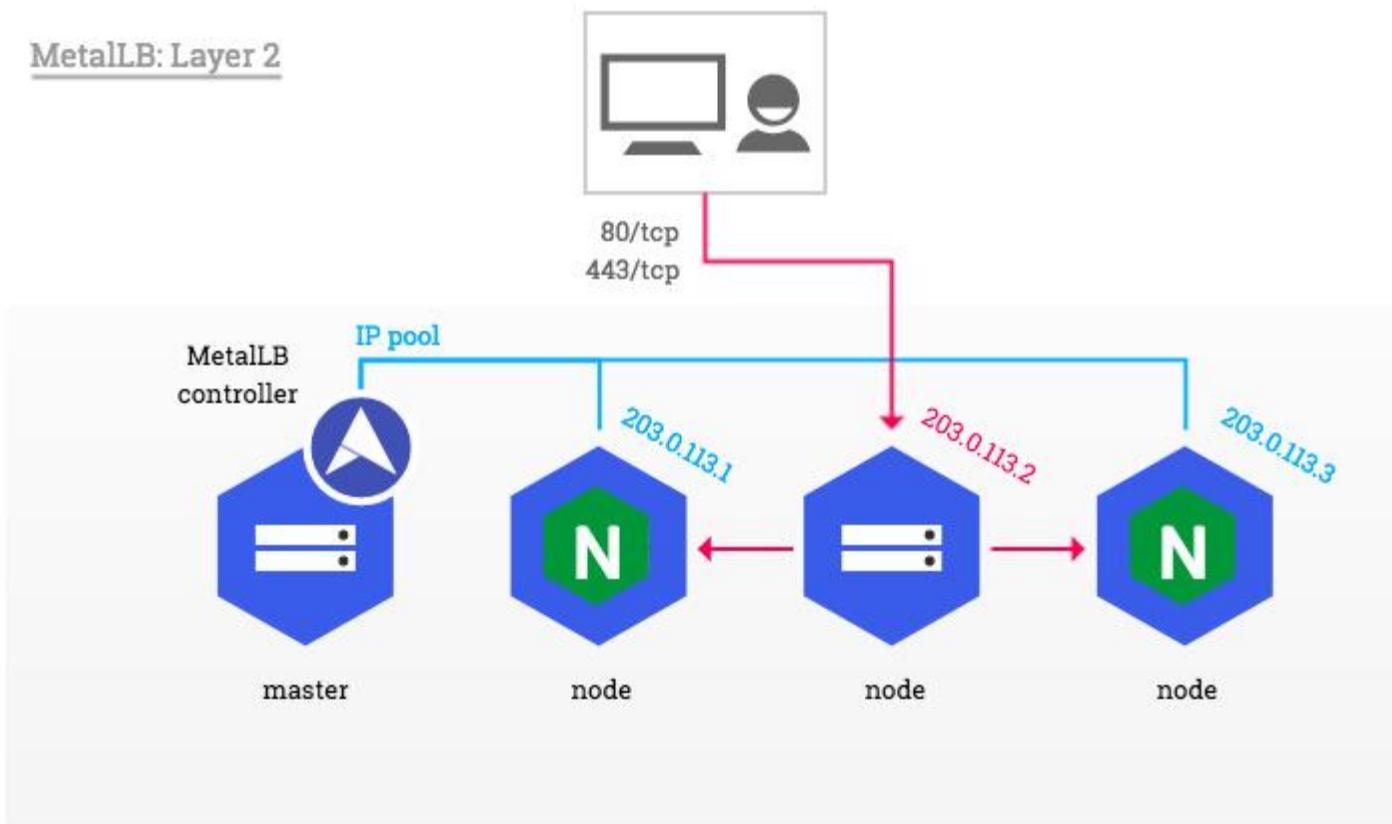
Secret: webtest2

```
1 apiVersion: v1
2 data:
3   tls.crt: LS0tLS1CRUdJTiBDRVJUSUZJQ0FURS0tLS0tCk1JSURMVENDQWhXZ0F3SUJBZ0LKC
4   tls.key: LS0tLS1CRUdJTiBSU0EgUFJJVkfURSBLRVktLS0tLQpNSU1FcEFJQkFBS0NBUVBKA
5 kind: Secret
6 metadata:
7   name: webtest2secret
8   namespace: default
9 type: Opaque
```



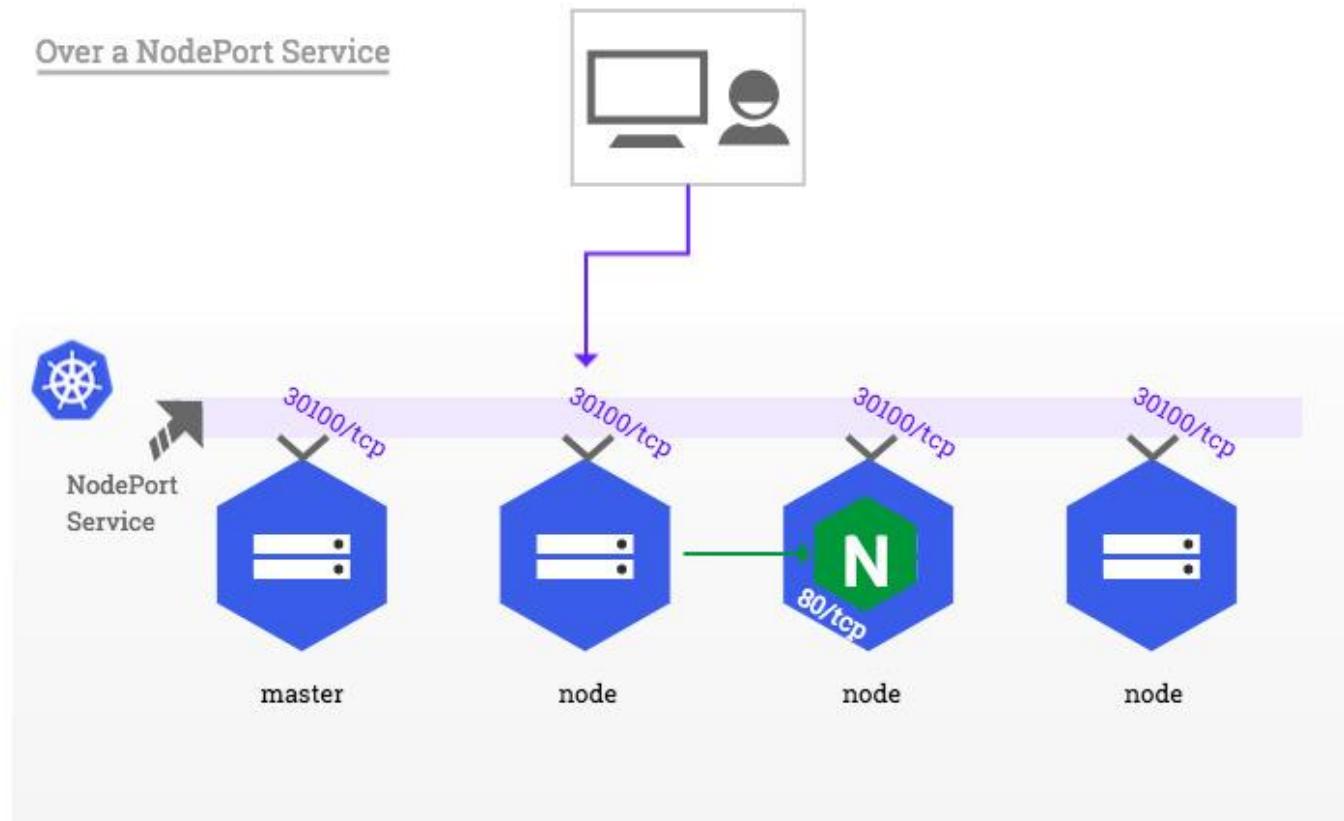
# Ingress Network

- Ingress for On-prem strategy
  - MetalLB (L2 Load Balance)



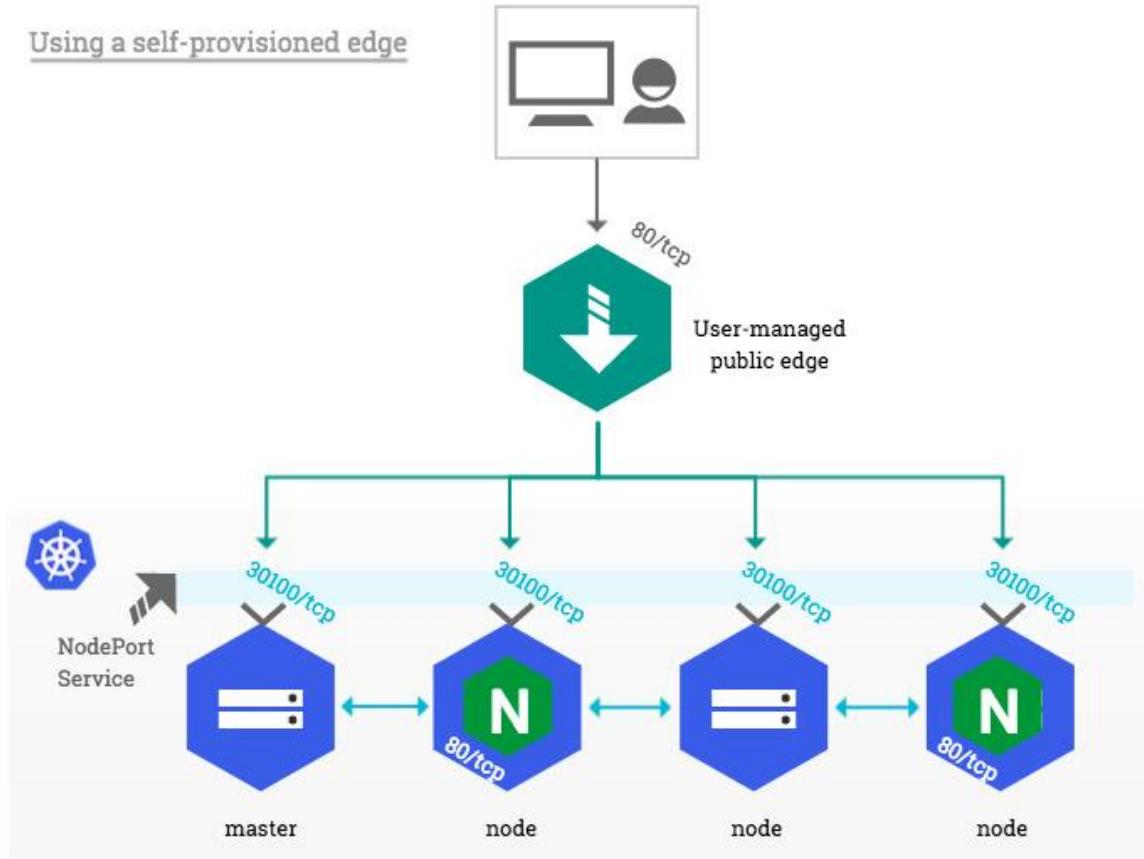
# Ingress Network

- Ingress for On-prem strategy
  - NodePort (External Load Balance)



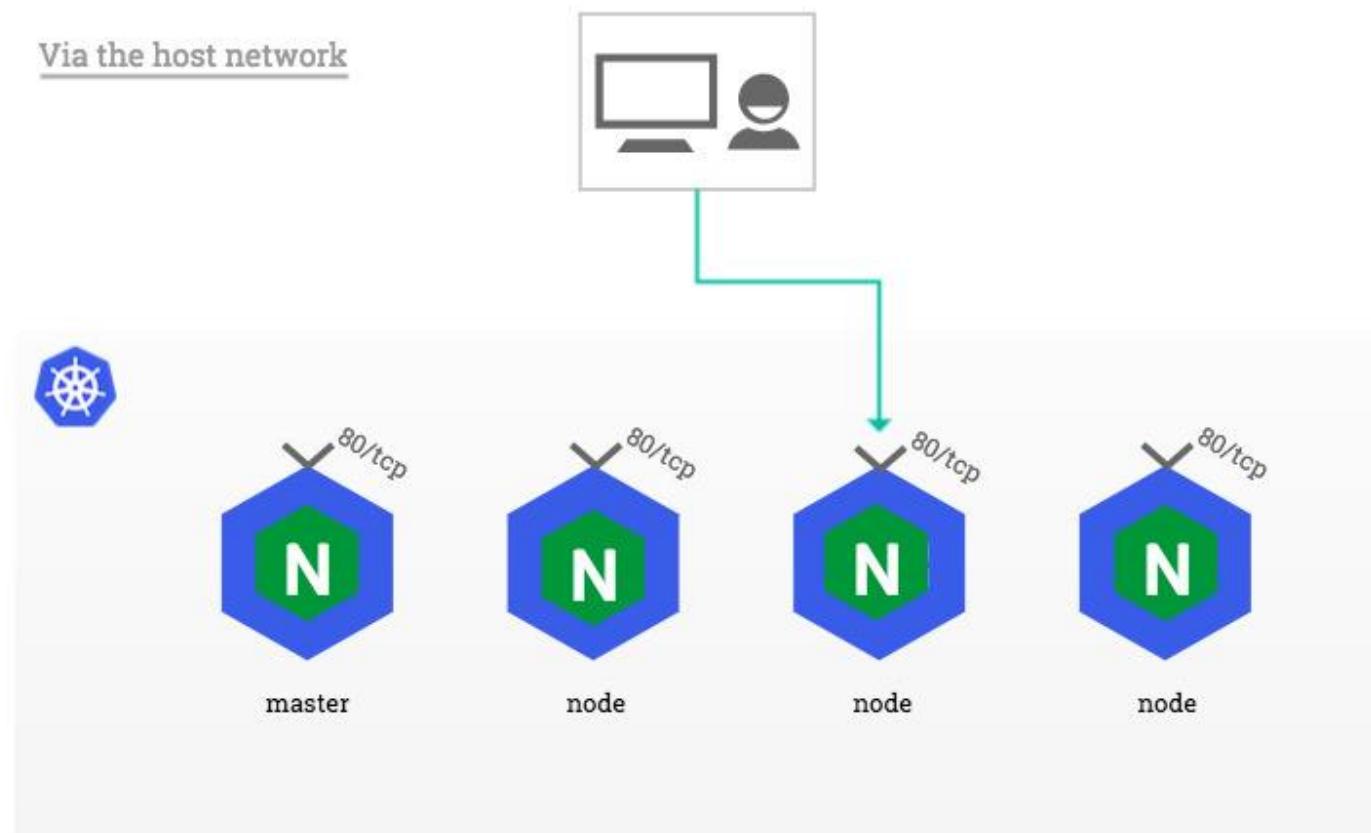
# Ingress Network

- Ingress for On-prem strategy
  - NodePort (External Load Balance)



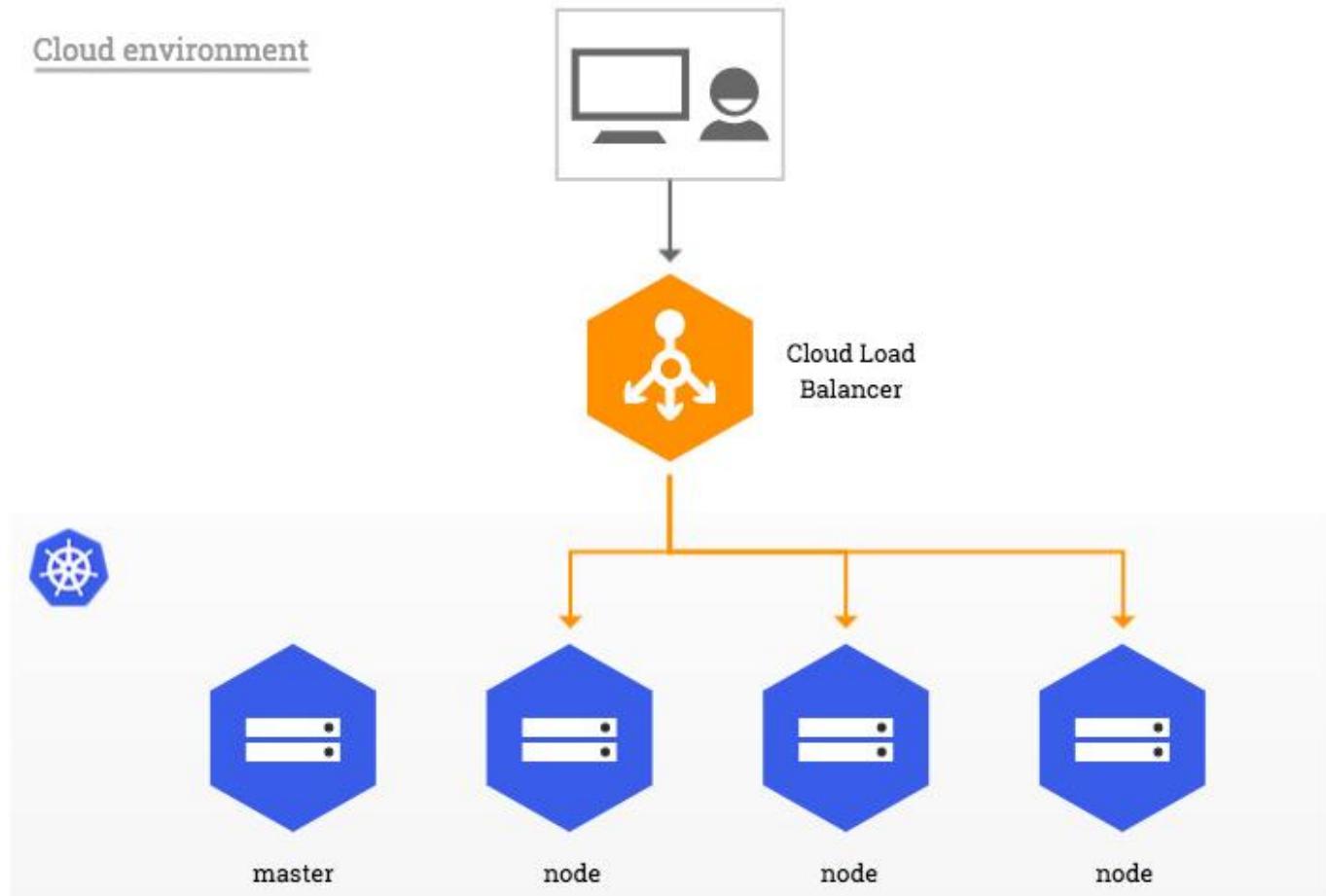
# Ingress Network

- Ingress for On-prem strategy
  - Host network (Security concern, Not recommend)



# Ingress Network

- Ingress for Cloud strategy



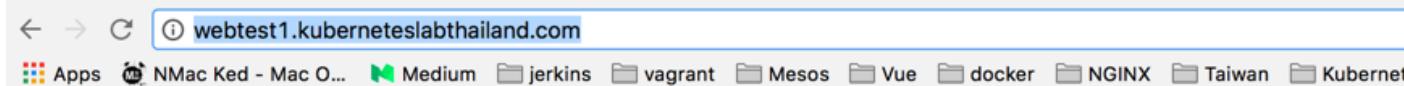
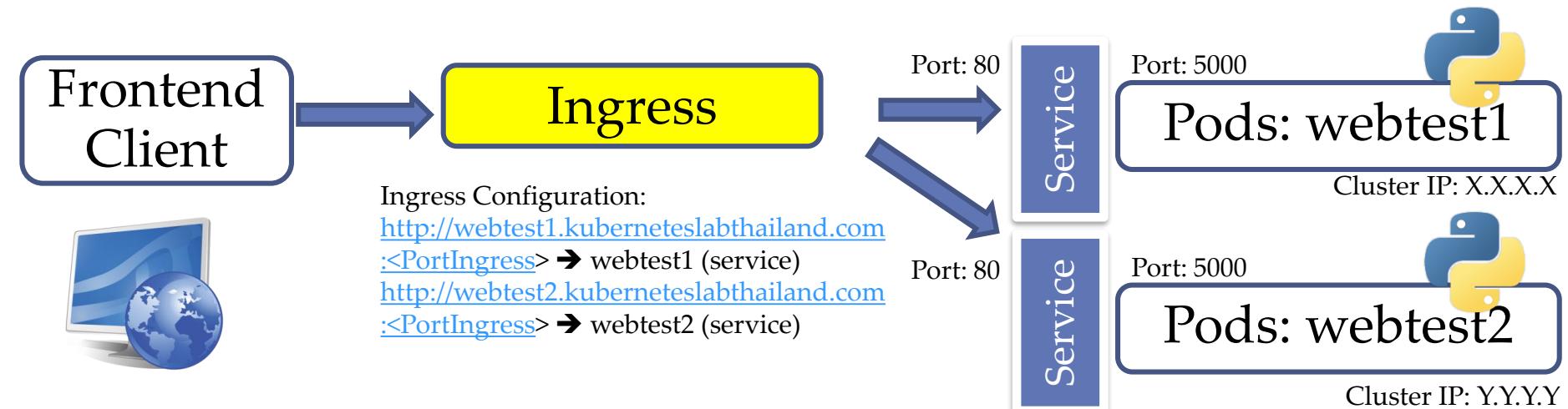
# Ingress Network

- Ingress for Cloud strategy (Example: AWS)
  - Create Tag: kubernetes.io/cluster/<Cluster Name> for all resource
    - EC2 (VMWare Machine)
    - VPC
    - Subnet
    - Routing Table

Key	Value	
AZ	ap-southeast-1a	Show Column
Categories	traning	Show Column
Environment	uat	Show Column
Module	kubernetes farm	Show Column
Name	Training_DockerZerotoHero_StudentG5_1	Hide Column
Region	ap-southeast-1	Show Column
Zone	private	Show Column
kubernetes.io/cluster/T	me	Show Column



# Workshop 2.4: Ingress Network



# Kubernetes in real world



Kubernetes: Production Workload Orchestration



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# Kubernetes in real world

- Kubernetes have a lot of component need to install / configuration on real world
- Normally kubernetes need some 3<sup>rd</sup> tool for deployment
  - Ubuntu(MAAS, JUiu)
  - CoreOS
  - Fedora (Ansible)
- provide new solution for create cluster system with kubernetes orchestrator

## kubeadm <init>

- Option:
  - --apiserver-advertise-address= x.x.x.x (Default: First Interface)
  - --apiserver-bind-port = xxx (Default: 6443)
  - --kubernetes-version = xxx (Default: latest)
  - --pod-network-cidr = x.x.x.x (CNI), Need for Flennel
  - --token = xxxx (Default: auto gen)
  - --skip-preflight-checks
  - etc



# Kubernetes in real world

- Kubernetes have a lot of component need to install / configuration on real world
- Normally kubernetes need some 3<sup>rd</sup> tool for deployment
  - Ubuntu(MAAS, JUiu)
  - CoreOS
  - Fedora (Ansible)
- Since kubernetes 1.6 and later. Cluster system can make with command “kubeadm”
- Prerequisite
  - Docker Engine
  - Kubernetes Engine (Kubelet, Kubectl, Kubeadm)
- Role of the cluster system
  - Master:
    - Control all activity on cluster system (Pods, Services, Job, CronJob, RS, RC etc)
  - Node:
    - Worker for running as Master's order

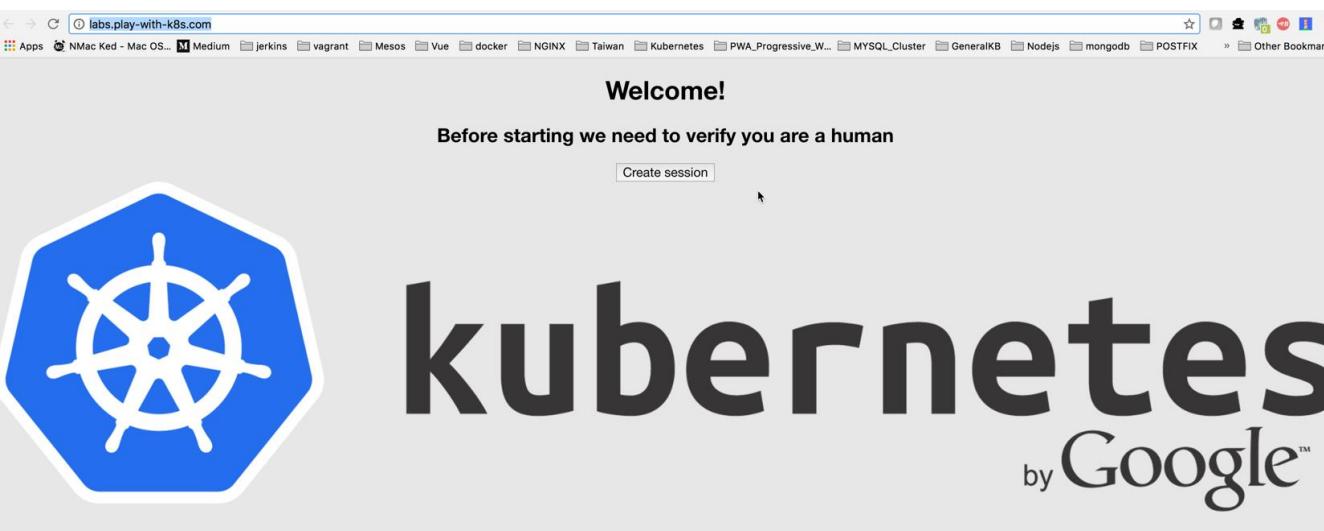


# Kubernetes in real world

- Create cluster from bare metal
- Step for setup
  - Phase 1: Install prerequisite component
    - Docker Engine
    - Kubelet Engine
    - Kubeadm Engine
  - Phase 2: Initialize Master node
    - `kubeadm init <option>`
  - Phase 3: Install Pods Network (3<sup>rd</sup> party) with CNI support
    - Flannel (Support Cross-Platform)
    - Weave Net (Support Cross-Platform)
    - Calico
    - Canal (Flannel + Calico)
    - Contiv
    - Romana
    - Etc
  - Phase 4: Join node to cluster system
    - `kubeadm join <option>`



# Kubernetes in real world

A screenshot of a web application interface for managing Kubernetes nodes. At the top, there's a header bar with a back arrow, forward arrow, and refresh icon, followed by the URL host2.labs.play-with-k8s.com/p/d7498ce6-f563-4e73-b7e7-62503f1db77b#d7498ce6\_node1. Below the header, there's a sidebar with a clock icon showing "03:52:40" and a "CLOSE SESSION" button. The main area shows two nodes: "d7498ce6\_node1" and "d7498ce6\_node2". Node 1 has an IP of 10.0.12.3, 27.21% memory usage (1.087GiB / 3.996GiB), and 27.32% CPU usage. It also has a "DELETE" button. A terminal window at the bottom shows the output of "kubectl get svc" and "kubectl get pods".

```
[node1 /]$ kubectl get svc
NAME      CLUSTER-IP    EXTERNAL-IP    PORT(S)    AGE
kubernetes  10.96.0.1    <none>        443/TCP   4m

[node1 /]$ kubectl get pods
No resources found.

[node1 /]$
```

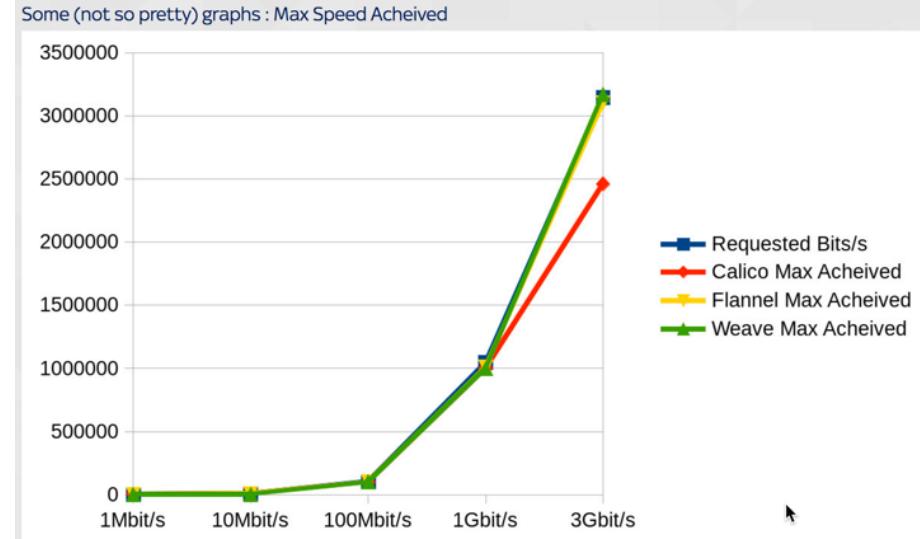
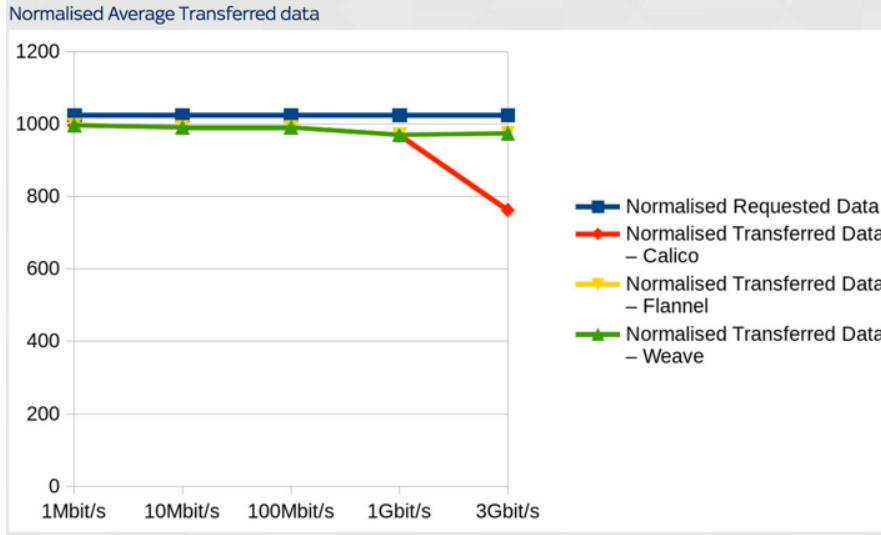
Kubernetes: Production Workload Orchestration



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# Kubernetes in real world

- Network Optional



## And Finally... Interesting lessons learned

- Be sure to check your hosts have the "Check Source/Dest" disabled if you're running an overlay network on AWS or you may have issues. Unfortunately there's no way to set this on an ASG/Launch config level, so if you want to auto-scale, you'll need to give the hosts permission to set this on boot.
- Calico did happen to go non-responsive on one host machine multiple times during my tests, but I didn't really have time to investigate why, and I'd got the performance data I needed, but it's another reason I wouldn't feel comfortable choosing that tech.
- Keep your eye on your network as well as CPU utilisation on your container clusters if running on AWS – consider upgrading to the more expensive hosts if you see latency issues.
- Flannel can be a pain to get running, especially in AWS, I struggled to install it in the same way as the others to keep the data equivalent but fell back to running it in the "CoreOS" way.
- Once you hit 100Mbps/s of UDP traffic, packet loss hits you, hard. This was borne out in testing not only on AWS but also on VMWare, so it isn't something "new" about overlay networks but is interesting.



[Documentation](#) [Blog](#) [Partners](#) [Community](#) [Case Studies](#)

If you are on another architecture than amd64, you should use the flannel or Weave Net overlay networks as described in [the multi-platform section](#)

Once a pod network has been installed, you can confirm that it is working by checking that the kube-dns pod is Running in the output of `kubectl get pods --all-namespaces`. And once the kube-dns pod is up and running, you can continue by joining your nodes.

If your network is not working or kube-dns is not in the Running state, check out the [troubleshooting section](#) below.

<http://engineering.skybettingandgaming.com/2017/02/03/overlay-network-performance-testing/>

Kubernetes: Production Workload Orchestration



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# Kubernetes in real world

- Initial Master role

```
kubeadm <init>
```

- Option:
  - apiserver-advertise-address= x.x.x.x (Default: First Interface)
  - apiserver-bind-port = xxx (Default: 6443)
  - kubernetes-version = xxx (Default: latest)
  - pod-network-cidr = x.x.x.x (CNI), Need for Flannel
  - token = xxxx (Default: auto gen)
  - skip-preflight-checks
  - Etc

- Join Node in Cluster

```
kubeadm <init>
```

- Option:
  - apiserver-advertise-address= x.x.x.x (Default: First Interface)
  - apiserver-bind-port = xxx (Default: 6443)
  - kubernetes-version



# Kubernetes in real world

- Initial Master role by config file

```
kubeadm init --config <configuration file>
```

```
Untitled-2 • instruction.txt ! kubeadm-init.yaml x
1  apiVersion: kubeadm.k8s.io/v1beta1
2  bootstrapTokens:
3    - groups:
4      - system:bootstrappers:kubeadm:default-node-token
5        ttl: 24h0m0s
6        usages:
7          - signing
8          - authentication
9    kind: InitConfiguration
10   localAPIEndpoint:
11     bindPort: 6443
12   nodeRegistration:
13     criSocket: /var/run/dockershim.sock
14     name: hostnamemaster
15     kubeletExtraArgs:
16       cloud-provider: aws
17     taints:
18       - effect: NoSchedule
19         key: node-role.kubernetes.io/master
20 ---
```

```
20  ---
21  apiServer:
22    certSANs:
23      - 1.1.1.1
24    extraArgs:
25      | authorization-mode: Node,RBAC
26      | timeoutForControlPlane: 4m0s
27
28  apiVersion: kubeadm.k8s.io/v1beta1
29  certificatesDir: /etc/kubernetes/pki
30  clusterName: Kubernetes
31  controlPlaneEndpoint: ""
32  controllerManager:
33    extraArgs:
34      | cloud-provider: aws
35      | configure-cloud-routes: "false"
36      | address: 0.0.0.0
37  dns:
38    type: CoreDNS
39  etcd:
40    local:
41      | dataDir: /var/lib/etcd
42  imageRepository: k8s.gcr.io
43  kind: ClusterConfiguration
44  kubernetesVersion: v1.13.0
45  networking:
46    dnsDomain: cluster.local
47    podSubnet: 192.168.0.0/16
48    serviceSubnet: 10.96.0.0/12
49  scheduler:
50    extraArgs:
51      | address: 0.0.0.0
```

Ref: <https://godoc.org/k8s.io/kubernetes/cmd/kubeadm/app/apis/kubeadm/v1beta1>

Kubernetes: Production Workload Orchestration



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# Kubernetes in real world

- Join Worker role by config file

```
kubeadm join --config <configuration file>
```

```
Untitled-2 ● instruction.txt kubeadm-join.yaml x
1 apiVersion: kubeadm.k8s.io/v1beta1
2 caCertPath: /etc/kubernetes/pki/ca.crt
3 discovery:
4   bootstrapToken:
5     token: tokenid
6     apiServerEndpoint: hostnamemaster:6443
7     caCertHashes:
8       - "sha256:cahash"
9     timeout: 5m0s
10    kind: JoinConfiguration
11    nodeRegistration:
12      name: hostnameworker
13      kubeletExtraArgs:
14        cloud-provider: aws
```

Ref: <https://godoc.org/k8s.io/kubernetes/cmd/kubeadm/app/apis/kubeadm/v1beta1>

Kubernetes: Production Workload Orchestration



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# Kubernetes in real world

- Other parameter

```
apiVersion: kubeadm.k8s.io/v1beta1
kind: InitConfiguration
bootstrapTokens:
- token: "9a08jv.c0izixklcxtnm7"
  description: "Kubeadm bootstrap token"
  ttl: "24h"
- token: "783bde.3f89s0fje9f38fhf"
  description: "another bootstrap token"
  usages:
  - authentication
  - signing
  groups:
  - system:bootstrappers:kubeadm:default-node-token
nodeRegistration:
  name: "ec2-10-100-0-1"
  criSocket: "/var/run/dockershim.sock"
  taints:
  - key: "kubeadmNode"
    value: "master"
    effect: "NoSchedule"
  kubeletExtraArgs:
    cgroupDriver: "cgroupfs"
localAPIEndpoint:
  advertiseAddress: "10.100.0.1"
  bindPort: 6443
---
apiVersion: kubeadm.k8s.io/v1beta1
kind: ClusterConfiguration
etcd:
# one of local or external
local:
  imageRepository: "k8s.gcr.io"
  imageTag: "3.2.24"
  dataDir: "/var/lib/etcd"
  extraArgs:
    listen-client-urls: "http://10.100.0.1:2379"
  serverCertSANs:
  - "ec2-10-100-0-1.compute-1.amazonaws.com"
  peerCertSANs:
  - "10.100.0.1"
# external:
# endpoints:
# - "10.100.0.1:2379"
# - "10.100.0.2:2379"
# caFile: "/etc/etcd/kubernetes/pki/etcd/etcd-ca.crt"
# certFile: "/etc/etcd/kubernetes/pki/etcd/etcd.crt"
# keyFile: "/etc/etcd/kubernetes/pki/etcd/etcd.key"
networking:
  serviceSubnet: "10.96.0.0/12"
  podSubnet: "10.100.0.1/24"
  dnsDomain: "cluster.local"
  kubernetesVersion: "v1.12.0"
  controlPlaneEndpoint: "10.100.0.1:6443"
apiServer:
  extraArgs:
    authorization-mode: "Node,RBAC"
  extraVolumes:
  - name: "some-volume"
    hostPath: "/etc/some-path"
    mountPath: "/etc/some-pod-path"
    readOnly: false
    pathType: File
  certSANs:
  - "10.100.1.1"
  - "ec2-10-100-0-1.compute-1.amazonaws.com"
  timeoutForControlPlane: 4m0s
controllerManager:
  extraArgs:
    "node-cidr-mask-size": "20"
  extraVolumes:
  - name: "some-volume"
    hostPath: "/etc/some-path"
    mountPath: "/etc/some-pod-path"
    readOnly: false
    pathType: File
scheduler:
  extraArgs:
    address: "10.100.0.1"
  extraVolumes:
  - name: "some-volume"
    hostPath: "/etc/some-path"
    mountPath: "/etc/some-pod-path"
    readOnly: false
    pathType: File
  certificatesDir: "/etc/kubernetes/pki"
  imageRepository: "k8s.gcr.io"
  useHyperKubeImage: false
  clusterName: "example-cluster"
---
apiVersion: kubelet.config.k8s.io/v1beta1
kind: KubeletConfiguration
# kubelet specific options here
---
apiVersion: kubeproxy.config.k8s.io/v1alpha1
kind: KubeProxyConfiguration
# kube-proxy specific options here
```

Ref: <https://godoc.org/k8s.io/kubernetes/cmd/kubeadm/app/apis/kubeadm/v1beta1>

Kubernetes: Production Workload Orchestration



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# Kubernetes in real world

- Kubeadm support multiple cloud provider
  - AWS
  - Azure
  - CloudStack
  - GCE
  - OpenStack
  - Ovirt
  - Proton
  - Vsphere
  - IBM Cloud Kubernetes Service
  - Baidu Cloud Container Engine
- Get fully benefit for utilize capability from cloud provider. Ex: Storage dynamic provision, Network load balancer etc

Ref: <https://kubernetes.io/docs/concepts/cluster-administration/cloud-providers/>

Kubernetes: Production Workload Orchestration



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# Kubernetes in real world

- Phase 1: Install prerequisite component

```
1 #Install Base docker-engine
2 sudo apt-get remove docker docker-engine
3 sudo apt-get -y install \
4     apt-transport-https \
5     ca-certificates \
6     curl \
7     software-properties-common
8 curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo apt-key add -
9 sudo apt-key fingerprint 0EBFCD88
10 sudo add-apt-repository \
11     "deb [arch=amd64] https://download.docker.com/linux/ubuntu \
12     $(lsb_release -cs) \
13     stable"
14 sudo apt-get update
15 sudo apt-get -y install docker-ce
16 sudo groupadd docker
17 sudo usermod -aG docker $USER
18 sudo systemctl enable docker
19
20 #Install Kubernetes Base
21 curl -LO https://storage.googleapis.com/kubernetes-release/release/v1.7.0/bin/linux/amd64/kubectl
22 chmod +x ./kubectl
23 sudo mv ./kubectl /usr/local/bin/kubectl
24 sudo apt-get update && apt-get install -y apt-transport-https
25 curl -s https://packages.cloud.google.com/apt/doc/apt-key.gpg | sudo apt-key add -
26 sudo touch /etc/apt/sources.list.d/kubernetes.list
27 #sudo bash -c 'echo "deb http://apt.kubernetes.io/ kubernetes-xenial-1.7 main" >
28 /etc/apt/sources.list.d/kubernetes.list'
29 sudo bash -c 'echo "deb http://apt.kubernetes.io/ kubernetes-xenial main" >
30 /etc/apt/sources.list.d/kubernetes.list'
31 sudo apt-get update
32 sudo apt-get install -y kubelet=1.7.0-00 kubeadm=1.7.0-00
```



# Kubernetes in real world

- Phase 2: Initialize Master node

```
praparn@kubernetes-ms:~$ sudo su -
root@kubernetes-ms:~# kubeadm init --kubernetes-version=v1.7.0 --pod-network-cidr=10.244.0.0/16 --token 8c2350.f5534344a6ffc46
[kubeadm] WARNING: kubeadm is in beta, please do not use it for production clusters.
[init] Using Kubernetes version: v1.7.0
[init] Using Authorization modes: [Node RBAC]
[preflight] Running pre-flight checks
[preflight] WARNING: docker version is greater than the most recently validated version. Docker version: 17.06.0-ce. Max validated version: 1.12
[certificates] Generated CA certificate and key.
[certificates] Generated API server certificate and key.
[certificates] API Server serving cert is signed for DNS names [kubernetes-ms kubernetes kubernetes.default kubernetes.default.svc kubernetes.default.svc.cluster.local] and IPs [10.96.0.1 192.168.99.200]
[certificates] Generated API server kubelet client certificate and key.
[certificates] Generated service account token signing key and public key.
[certificates] Generated front-proxy CA certificate and key.
[certificates] Generated front-proxy client certificate and key.
[certificates] Valid certificates and keys now exist in "/etc/kubernetes/pki"
[kubeconfig] Wrote KubeConfig file to disk: "/etc/kubernetes/admin.conf"
[kubeconfig] Wrote KubeConfig file to disk: "/etc/kubernetes/kubelet.conf"
[kubeconfig] Wrote KubeConfig file to disk: "/etc/kubernetes/controller-manager.conf"
[kubeconfig] Wrote KubeConfig file to disk: "/etc/kubernetes/scheduler.conf"
[apiclient] Created API client, waiting for the control plane to become ready
```

```
Your Kubernetes master has initialized successfully!

To start using your cluster, you'll need to run (as a regular user):
  mkdir -p $HOME/.kube
  sudo cp -i /etc/kubernetes/admin.conf $HOME/.kube/config
  sudo chown $(id -u):$(id -g) $HOME/.kube/config

You should now deploy a pod network to the cluster.
Run "kubectl apply -f [podnetwork].yaml" with one of the options listed at:
  http://kubernetes.io/docs/admin/addons/

You can now join any number of machines by running the following on each node
as root:
  kubeadm join --token 8c2350.f5534344a6ffc46 192.168.99.200:6443
root@kubernetes-ms:~#
```



# Kubernetes in real world

- Phase 3: Install Pods Network (3rd party) with CNI support

```
[praparn@kubernetes-ms:~]$ kubectl apply -n kube-system -f "https://cloud.weave.works/k8s/net?k8s-version=$(kubectl version | base64 | tr -d '\n')"
serviceaccount "weave-net" created
clusterrole "weave-net" created
clusterrolebinding "weave-net" created
daemonset "weave-net" created
[praparn@kubernetes-ms:~]$ kubectl get pods --all-namespaces
NAMESPACE      NAME          READY   STATUS    RESTARTS   AGE
kube-system    etcd-kubernetes-ms   1/1     Running   0          2m
kube-system    kube-apiserver-kubernetes-ms   1/1     Running   0          2m
kube-system    kube-controller-manager-kubernetes-ms   1/1     Running   0          2m
kube-system    kube-dns-2425271678-32cjf   0/3     Pending   0          2m
kube-system    kube-proxy-9jtxj   1/1     Running   0          2m
kube-system    kube-scheduler-kubernetes-ms   1/1     Running   0          2m
kube-system    weave-net-bg346   0/2     ContainerCreating   0          15s
[praparn@kubernetes-ms:~]$
```

```
[praparn@kubernetes-ms:~]$ kubectl get pods --all-namespaces
NAMESPACE      NAME          READY   STATUS    RESTARTS   AGE
kube-system    etcd-kubernetes-ms   1/1     Running   0          2m
kube-system    kube-apiserver-kubernetes-ms   1/1     Running   0          2m
kube-system    kube-controller-manager-kubernetes-ms   1/1     Running   0          2m
kube-system    kube-dns-2425271678-32cjf   3/3     Running   0          2m
kube-system    kube-proxy-9jtxj   1/1     Running   0          2m
kube-system    kube-scheduler-kubernetes-ms   1/1     Running   0          2m
kube-system    weave-net-bg346   2/2     Running   0          51s
[praparn@kubernetes-ms:~]$
```



# Kubernetes in real world

- Phase 4: Join node to cluster system

```
[praparn@kubernetes-1:~$ sudo su -
[root@kubernetes-1:~# kubeadm --token 8c2350.f55343444a6ffc46 join 192.168.99.200:6443
[kubeadm] WARNING: kubeadm is in beta, please do not use it for production clusters.
[preflight] Running pre-flight checks
[preflight] WARNING: docker version is greater than the most recently validated version. Docker version: 17.06.0-ce. Max validated version: 1.12
[discovery] Trying to connect to API Server "192.168.99.200:6443"
[discovery] Created cluster-info discovery client, requesting info from "https://192.168.99.200:6443"
[discovery] Cluster info signature and contents are valid, will use API Server "https://192.168.99.200:6443"
[discovery] Successfully established connection with API Server "192.168.99.200:6443"
[bootstrap] Detected server version: v1.7.0
[bootstrap] The server supports the Certificates API (certificates.k8s.io/v1beta1)
[csr] Created API client to obtain unique certificate for this node, generating keys and certificate signing request
[csr] Received signed certificate from the API server, generating KubeConfig...
[kubeconfig] Wrote KubeConfig file to disk: "/etc/kubernetes/kubelet.conf"

Node join complete:
* Certificate signing request sent to master and response received.
* Kubelet informed of new secure connection details.

Run 'kubectl get nodes' on the master to see this machine join.
root@kubernetes-1:~# ]
```

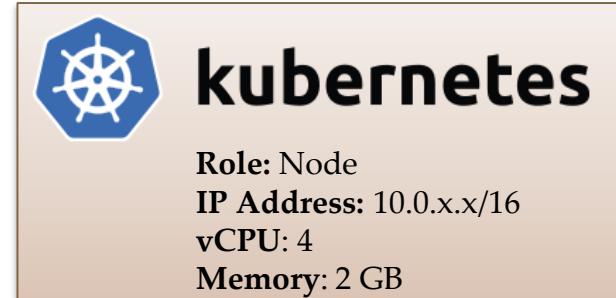
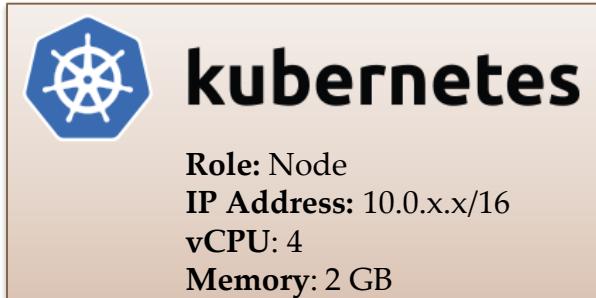
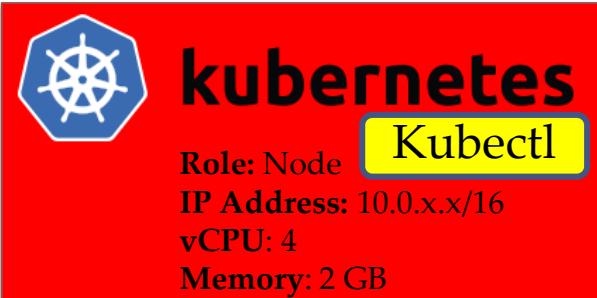
```
[praparn@kubernetes-ms:~$ kubectl get node
NAME        STATUS    AGE      VERSION
kubernetes-1  Ready    5m       v1.7.0
kubernetes-2  Ready    4m       v1.7.0
kubernetes-ms Ready   11m       v1.7.0
praparn@kubernetes-ms:~$ ]
```



# Workshop 2.5: Kubernetes Lab

## Style 1: Google Cloud

Machine: Kubernetes\_MS    Machine: Kubernetes\_1    Machine: Kubernetes\_2



Kubernetes: Production Workload Orchestration



**kubernetes**  
by Google

# Kubernetes in real world

- Multiple Master

The screenshot shows the Kubernetes documentation website. The top navigation bar includes links for Documentation, Blog, Partners, Community, Case Studies, English, and v1.13. The main navigation menu has categories: HOME, SETUP (which is highlighted), CONCEPTS, TASKS, TUTORIALS, REFERENCE, and CONTRIBUTE. A search bar is also present. The left sidebar contains a tree view of the setup documentation, with 'Creating Highly Available Clusters with kubeadm' currently selected. The main content area is titled 'Creating Highly Available Clusters with kubeadm'. It explains two approaches: stacked control plane nodes (requiring less infrastructure) and an external etcd cluster (requiring more infrastructure). It also notes that the page does not address running on cloud providers due to limitations with LoadBalancers and PersistentVolumes. A note states that the alpha feature gate 'HighAvailability' is deprecated in v1.12 and removed in v1.13. A 'See also' section links to 'The HA upgrade documentation'. A blue pencil icon in the top right corner indicates the page can be edited.

Ref: <https://kubernetes.io/docs/setup/independent/high-availability/>

Kubernetes: Production Workload Orchestration



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# Orchestrator Assignment



Kubernetes: Production Workload Orchestration



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# Orchestrator Assignment

- Kubernetes have several way for control/restrict pod to run on nodes
- nodeSelector
  - Give some customize label for classify host and define some selector criteria for specific node run Pods
- Interlude
  - Build-in labels with nodes
    - kubernetes.io/hostname
    - failure-domain.beta.kubernetes.io/zone
    - failure-domain.beta.kubernetes.io/region
    - beta.kubernetes.io/instance-type
    - beta.kubernetes.io/arch
- Affinity
  - Node Affinity
  - Inter-Pods Affinity and Anti-Affinity
- Taints and tolerations



# nodeSelector

Nodes: kubernetes-ms, kubernetes-1, kubernetes-2

```
praparn@kubernetes-ms:~$ kubectl label nodes kubernetes-ms storage=M2
node "kubernetes-ms" labeled
praparn@kubernetes-ms:~$ kubectl label nodes kubernetes-1 storage=SSD
node "kubernetes-1" labeled
praparn@kubernetes-ms:~$ kubectl label nodes kubernetes-2 storage=SAS
node "kubernetes-2" labeled
praparn@kubernetes-ms:~$ kubectl describe nodes
Name:           kubernetes-1
Role:           kubernetes-1
Labels:         beta.kubernetes.io/arch=amd64
                beta.kubernetes.io/os=linux
                kubernetes.io/hostname=kubernetes-1
                storage=SSD
```

```
Name:           kubernetes-2
Role:           kubernetes-2
Labels:         beta.kubernetes.io/arch=amd64
                beta.kubernetes.io/os=linux
                kubernetes.io/hostname=kubernetes-2
                storage=SAS
```

```
Name:           kubernetes-ms
Role:           kubernetes-ms
Labels:         beta.kubernetes.io/arch=amd64
                beta.kubernetes.io/os=linux
                kubernetes.io/hostname=kubernetes-ms
                node-role.kubernetes.io/master=
                storage=M2
```

Pods YAML File:

```
1  apiVersion: "v1"
2  kind: Pod
3  metadata:
4    name: webtest
5    labels:
6      name: web
7      owner: Praparn_L
8      version: "1.0"
9      module: WebServer
10     environment: development
11
12   spec:
13     containers:
14       - name: webtest
15         image: labdocker/cluster:webservicelite
16         ports:
17           - containerPort: 5000
18             protocol: TCP
19         nodeSelector:
20           storage: M2
```



# nodeSelector

```
[praparn@kubernetes-ms:~$ kubectl create -f webtest_pod_nodeselector.yml
pod "webtest" created
[praparn@kubernetes-ms:~$ kubectl describe pods/webtest
Name:           webtest
Namespace:      default
Node:          kubernetes-ms/192.168.99.200
Start Time:    Sun, 23 Jul 2017 13:20:34 +0000
Labels:         environment=development
                module=WebServer
                name=web
                owner=Praparn_L
                version=1.0
Annotations:   <none>
Status:        Pending
```

```
Node-Selectors: storage=M2
Tolerations:  node.alpha.kubernetes.io/notReady:NoExecute for 300s
              node.alpha.kubernetes.io/unreachable:NoExecute for 300s
Events:
FirstSeen     LastSeen      Count  From   SubObjectPath      Type  Reason
---          ---          ---   ---   ---          ---   ---
12m          12m          1     default-scheduler      Normal  Scheduled
              Successfully assigned webtest to kubernetes-ms
12m          12m          1     kubelet, kubernetes-ms  Normal  SuccessfulMountVolume
              MountVolume.SetUp succeeded for volume "default-token-1ltqv"
12m          12m          1     kubelet, kubernetes-ms  Normal  Pulling
              pulling image "labdocker/cluster:webservicelite"
11m          11m          1     kubelet, kubernetes-ms  Normal  Pulled
              Successfully pulled image "labdocker/cluster:webservicelite"
11m          11m          1     kubelet, kubernetes-ms  Normal  Created
              Created container
11m          11m          1     kubelet, kubernetes-ms  Normal  Started
              Started container
[praparn@kubernetes-ms:~$ kubectl get pods -o wide
NAME    READY  STATUS    RESTARTS   AGE     IP          NODE
webtest  1/1    Running   0          12m    10.32.0.3  kubernetes-ms
[praparn@kubernetes-ms:~$ ]
```



# Interlude

Nodes: kubernetes-ms, kubernetes-1, kubernetes-2

```
praparn@kubernetes-ms:~$ kubectl label nodes kubernetes-ms storage=M2
node "kubernetes-ms" labeled
praparn@kubernetes-ms:~$ kubectl label nodes kubernetes-1 storage=SSD
node "kubernetes-1" labeled
praparn@kubernetes-ms:~$ kubectl label nodes kubernetes-2 storage=SAS
node "kubernetes-2" labeled
praparn@kubernetes-ms:~$ kubectl describe nodes
Name:           kubernetes-1
Role:           kubernetes-1
Labels:         beta.kubernetes.io/arch=amd64
                beta.kubernetes.io/os=linux
                kubernetes.io/hostname=kubernetes-1
                storage=SSD
```

```
Name:           kubernetes-2
Role:           kubernetes-2
Labels:         beta.kubernetes.io/arch=amd64
                beta.kubernetes.io/os=linux
                kubernetes.io/hostname=kubernetes-2
                storage=SAS
```

```
Name:           kubernetes-ms
Role:           kubernetes-ms
Labels:         beta.kubernetes.io/arch=amd64
                beta.kubernetes.io/os=linux
                kubernetes.io/hostname=kubernetes-ms
                node-role.kubernetes.io/master=
                storage=M2
```

Pods YAML File:

```
1  apiVersion: "v1"
2  kind: Pod
3  metadata:
4    name: webtest
5    labels:
6      name: web
7      owner: Praparn_L
8      version: "1.0"
9      module: WebServer
10     environment: development
11
12   spec:
13     containers:
14       - name: webtest
15         image: labdocker/cluster:webservicelite
16         ports:
17           - containerPort: 5000
18             protocol: TCP
19             nodeSelector:
20               kubernetes.io/hostname: kubernetes-1
```



# Interlude

# Affinity

- Node Affinity
  - Similar to “nodeSelector” but more flexible for selection
    - requiredDuringSchedulingIgnoredDuringExecution (Hard)
    - preferredDuringSchedulingIgnoredDuringExecution (Soft)
  - If Pods was define both “nodeSelector” and “Affinity”. It need to satisfy both for operate
- Inter-pod Affinity and Anti-affinity
  - “based on labels on pods (X) that are already running on the node with criteria (Y)”
  - Add constrain/dependence from Pods
    - podAffinity (Run with existing pods)
    - podAntiAffinity (Not run with existing pods)
  - Criteria(Y) will consider as “topologyKey”
  - Ex:
    - Run pods (podAffinity) on any node with same hostname (topologyKey (Y)=hostname) with existing pods that label “environment=development” (X)



# Node Affinity

Pods YAML File:

```
1  apiVersion: "v1"
2  kind: Pod
3  metadata:
4    name: webtest
5    labels:
6      name: web
7      owner: Paparn_L
8      version: "1.0"
9      module: WebServer
10     environment: development
11
12   spec:
13     affinity:
14       nodeAffinity:
15         requiredDuringSchedulingIgnoredDuringExecution:
16           nodeSelectorTerms:
17             - matchExpressions:
18               - key: beta.kubernetes.io/os
19                 operator: In #In, NotIn, Exists, DoesNotExist, Gt, Lt
20                 values:
21                   - linux
22         preferredDuringSchedulingIgnoredDuringExecution:
23           - weight: 1
24             preference:
25               matchExpressions:
26                 - key: storage
27                   operator: In
28                   values:
29                     - SSD
30
31   containers:
32     - name: webtest
33       image: labdocker/cluster:webservicelite
34       ports:
35         - containerPort: 5000
36           protocol: TCP
```



# Inter-pod Affinity and Anti-affinity

Pods YAML File:

```
1  apiVersion: "v1"
2  kind: Pod
3  metadata:
4    name: webtest2
5    labels:
6      name: web
7      owner: Praparn_L
8      version: "1.0"
9      module: WebServer
10     environment: development
11
12    spec:
13      affinity:
14        podAffinity:
15          requiredDuringSchedulingIgnoredDuringExecution:
16            - labelSelector:
17              matchExpressions:
18                - key: environment
19                  operator: In
20                  values:
21                    - development
22          topologyKey: kubernetes.io/hostname
23
24        podAntiAffinity:
25          preferredDuringSchedulingIgnoredDuringExecution:
26            - weight: 1
27              podAffinityTerm:
28                labelSelector:
29                  matchExpressions:
30                    - key: module
31                      operator: In
32                      values:
33                        - DBServer
34
35          topologyKey: storage
36
37        containers:
38          - name: webtest2
39            image: labdocker/cluster:webservicelite
40            ports:
41              - containerPort: 5000
```

“Run Pods on any node that have existing pods with key (environment=development) on node same hostname”

“Don’t run Pods on any node that have existing pods with key (module=DBServer) on node same storage type”



# Taint and Tolerations

- Node side consideration
- Force/Repel Pods from Node
- Taint will apply to Node for protect “node” to run any pods without “tolerate” match taint
- Tolerations apply to Pods for suggest (Not required) Pods to schedule
- Use Case:
  - Dedicated Node / Maintenance Node
  - Special Hardware Node

# Taint and Tolerations

Taint on Node:

```
praparn@kubernetes-ms:~$ kubectl taint nodes kubernetes-1 dedicated=admin:NoSchedule
node "kubernetes-1" tainted
```

Pods YAML File:

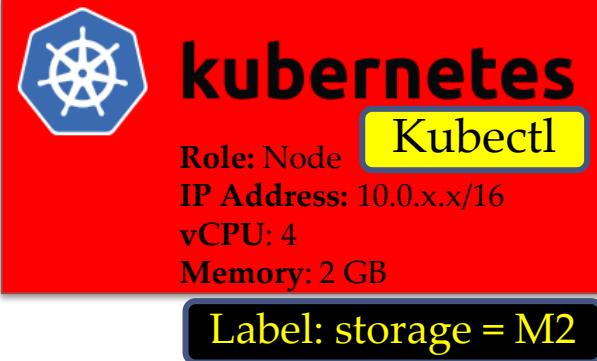
```
1  apiVersion: "v1"
2  kind: Pod
3  metadata:
4    name: webtest
5    labels:
6      name: web
7      owner: Praparn_L
8      version: "1.0"
9      module: WebServer
10     environment: development
11 spec:
12   containers:
13     - name: webtest
14       image: labdocker/cluster:webservicelite
15       ports:
16         - containerPort: 5000
17           protocol: TCP
18   tolerations:
19     - key: "dedicated"
20       operator: "Equal"
21       value: "admin"
22       effect: "NoSchedule"
23   nodeSelector:
24     kubernetes.io/hostname: kubernetes-1
```

Tolerations:  
Key="dedicated"  
Operator="Equal"  
Value="Admin"  
Effect="NoSchedule"

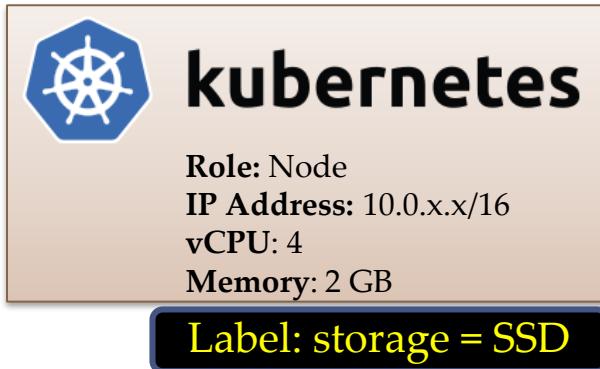


# Workshop 2.6: Orchestrator Assignment

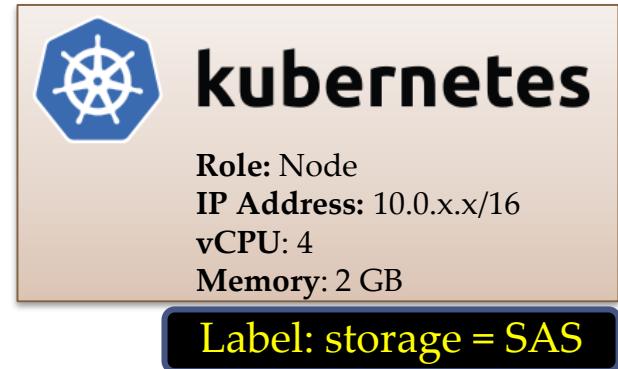
Machine: Kubernetes\_MS



Machine: Kubernetes\_1



Machine: Kubernetes\_2



Role: Client

## Lab Section:

- Part 1: nodeSelector
- Part 2: Interlude
- Part 3: Affinity (Node)
- Part 4: Inter-Pod Affinity and Anti-affinity
- Part 5: Taint and Tolerations

Kubernetes: Production Workload Orchestration



**kubernetes**  
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# Stateful Application Deployment



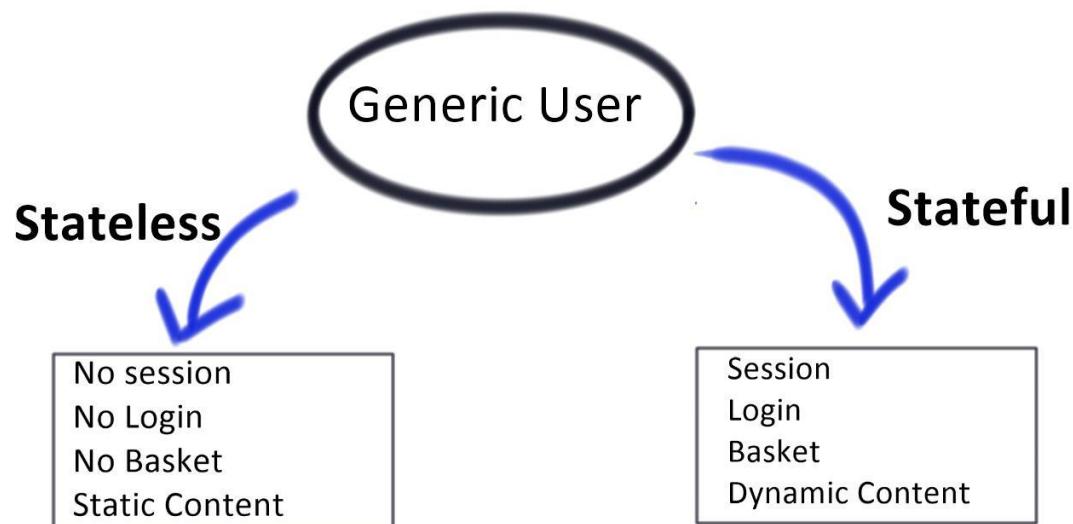
Kubernetes: Production Workload Orchestration



**kubernetes**  
by Google

# Stateful Application Deployment

- Some application need “state” for keep application flow and store some information on “session” (Such as login’s session id) that store on web server or middle tier server module
- Ex: Joomla, Wordpress, Mantis (Bug Tracking), Normal etc

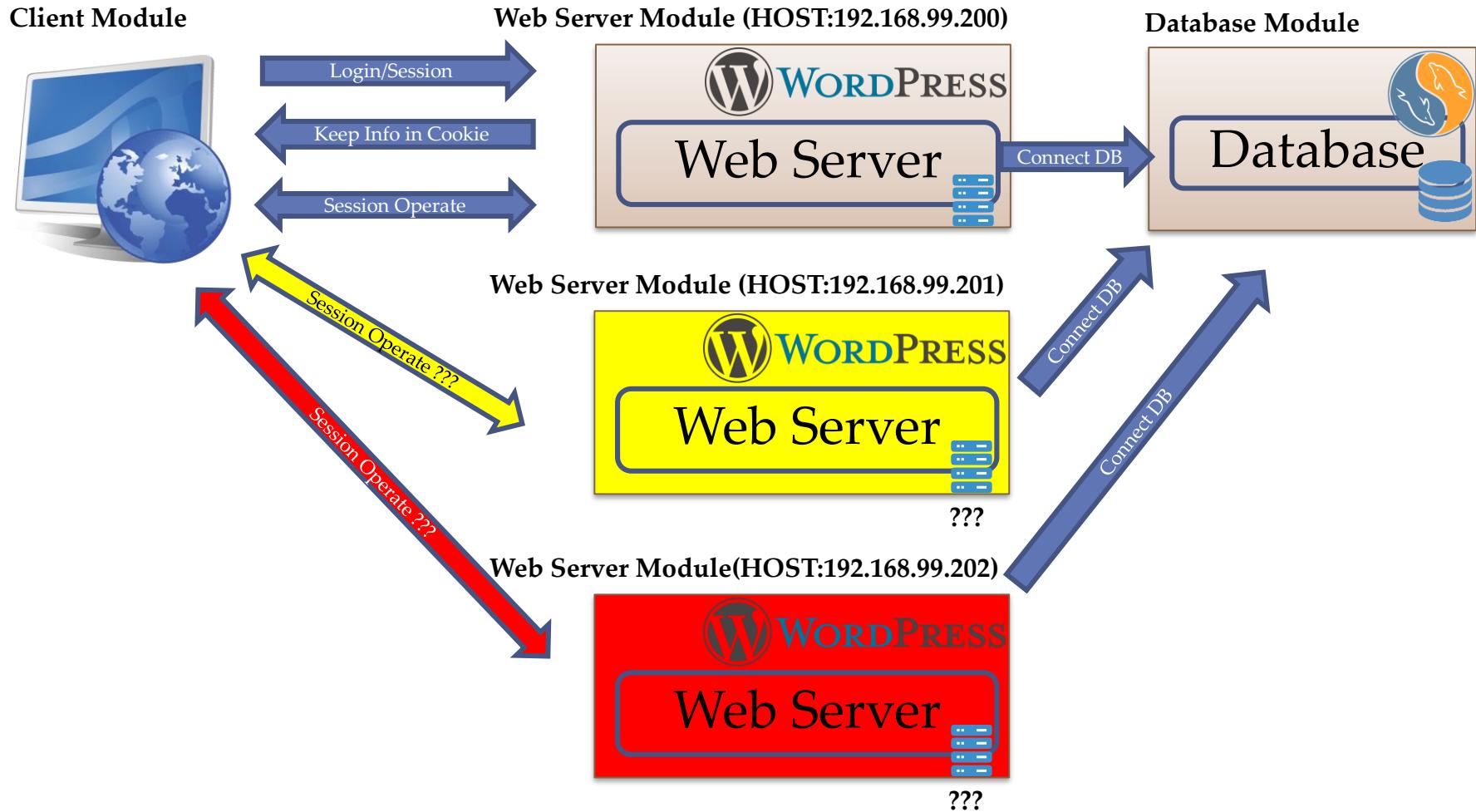


# Stateful Application Deployment

- Considering
  - Original “HTTP” protocol is “stateless”
  - Stateful application need to keep session by web/app server and keep “cookies” on client for pass authentication
  - Work on memory for keep session (Fast/Easy but consume resource)
  - Many problem with native mobile app/Centralize Problem
  - Scale will effect for consideration traffic redirect to correct server (Keep state)
- Awareness
  - Container is naturally design for “stateless” application
  - All load-balance/dispatch job is not aware about “state” of application inside



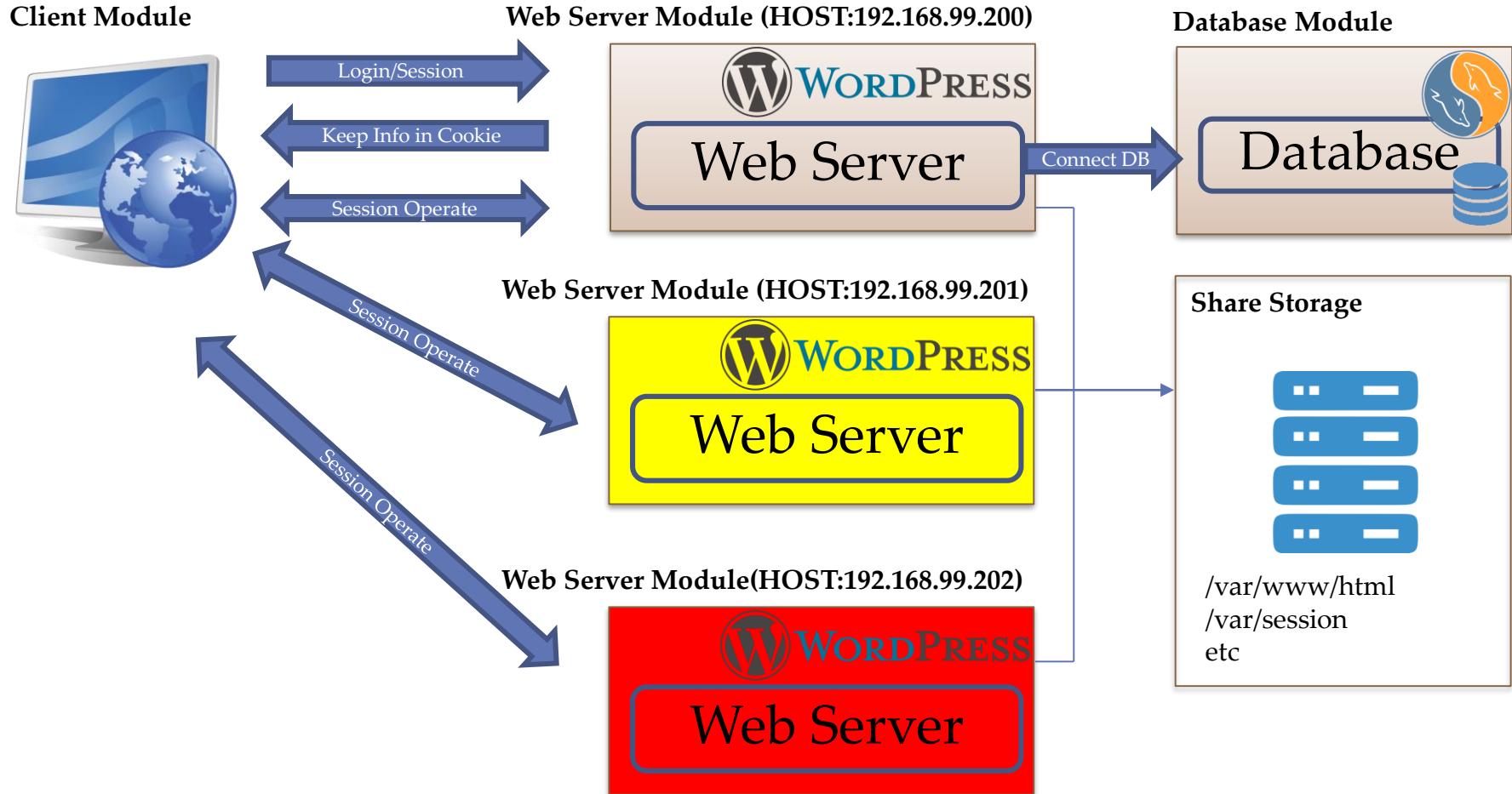
# Stateful Application Deployment



# Stateful Application Deployment

- Solution ?
  - SDS (Software-Defined Storage) for make centralize storage pool
  - Share centralize storage pool for all node
  - For Web/App Server
    - Keep application path / Session path on storage pool
    - Every server will read/write on same place
  - For Database Server
    - Many option for operate (depend on type of database)
      - Active/Active
      - Active/Hot-Passive
      - Active/Cold-Passive
      - Postgres Kubedb Tool (Beta)
    - Idea also keep data on storage pool

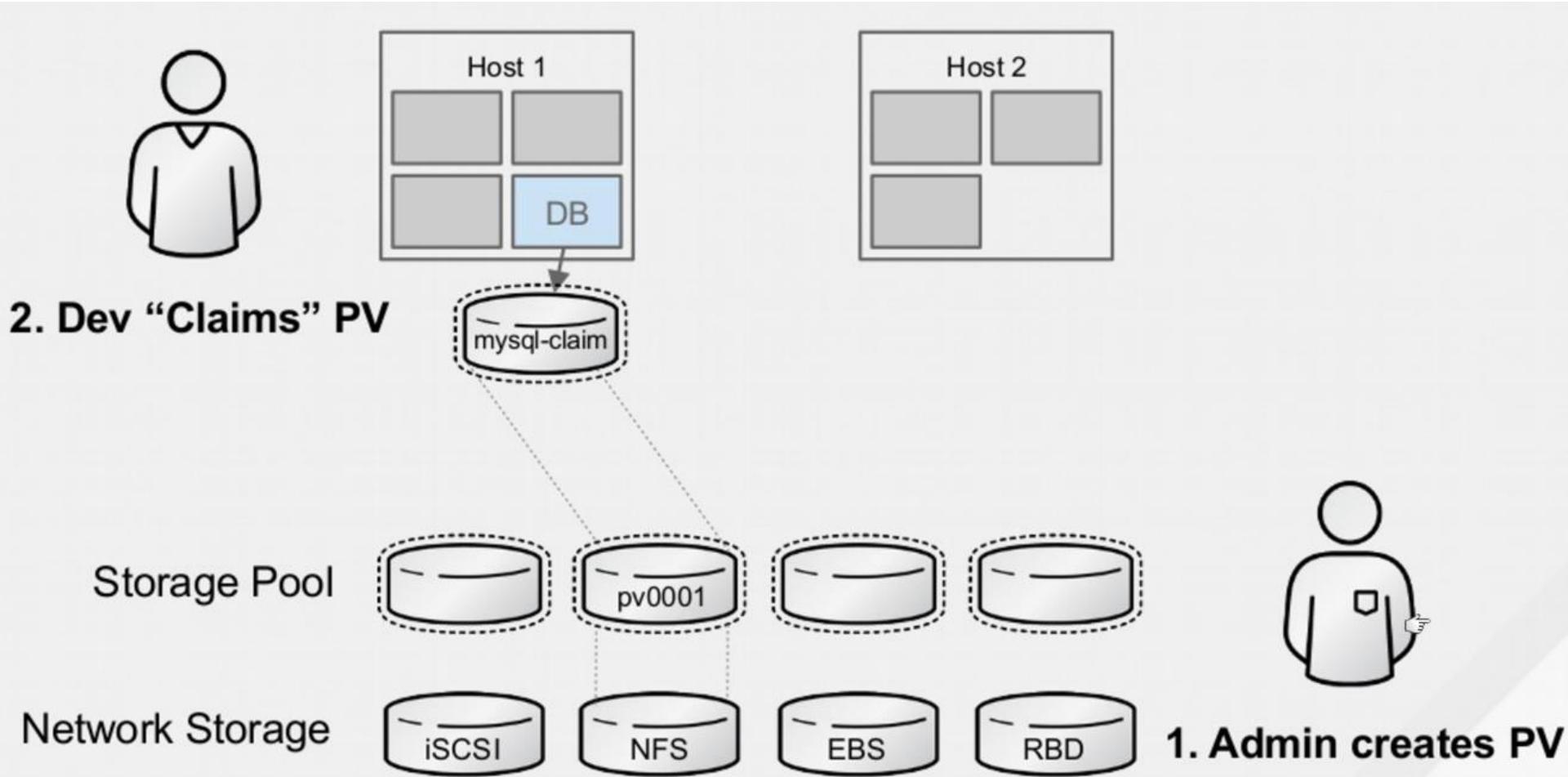
# Stateful Application Deployment



# Persistent Volume



# Persistent Volume



# Persistent Volume

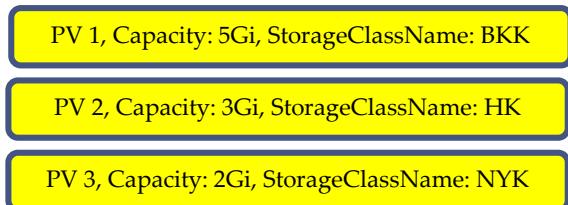
- Persistent Volume (PV)
  - Resource in cluster system
  - Act like pieces of storage (Independence from Pods)
  - Lifecycle was depended on Pods who used PV via PVC(Persistent Volume Claim)
  - Multiple type of PV as plugin support
- Persistent Volume Claim (PVC)
  - Similar Pod, That create for request storage from PV
  - PVC can specific
    - Size: Datasize for claim storage
    - Access Method:
      - ReadWriteOnce (RWO)
      - ReadOnlyMany (ROX)
      - ReadWriteMany (RWX)
- StorageClass
  - “Profiling” storage concept
  - Easy to classify storage (IOPS, Region etc)



# Persistent Volume

- Volume Life Cycle

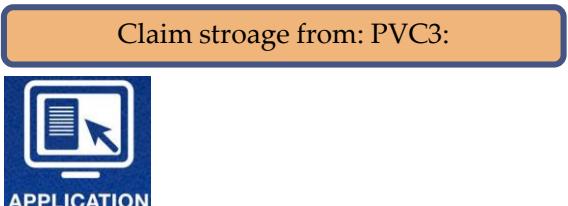
## PV Pool



## PVC Request



## Pods for Application



Static Provision

## Provision

Phase: Available/Fail

Match PV/PVC

## Binding

Phase: Bound

Pod use

## Using

Dynamic Provision

Phase: Release

## Reclaim

- Retaining (Keep Data)
- Recycle (rm -rf /path)
- Delete (Default for Dynamic Provision)

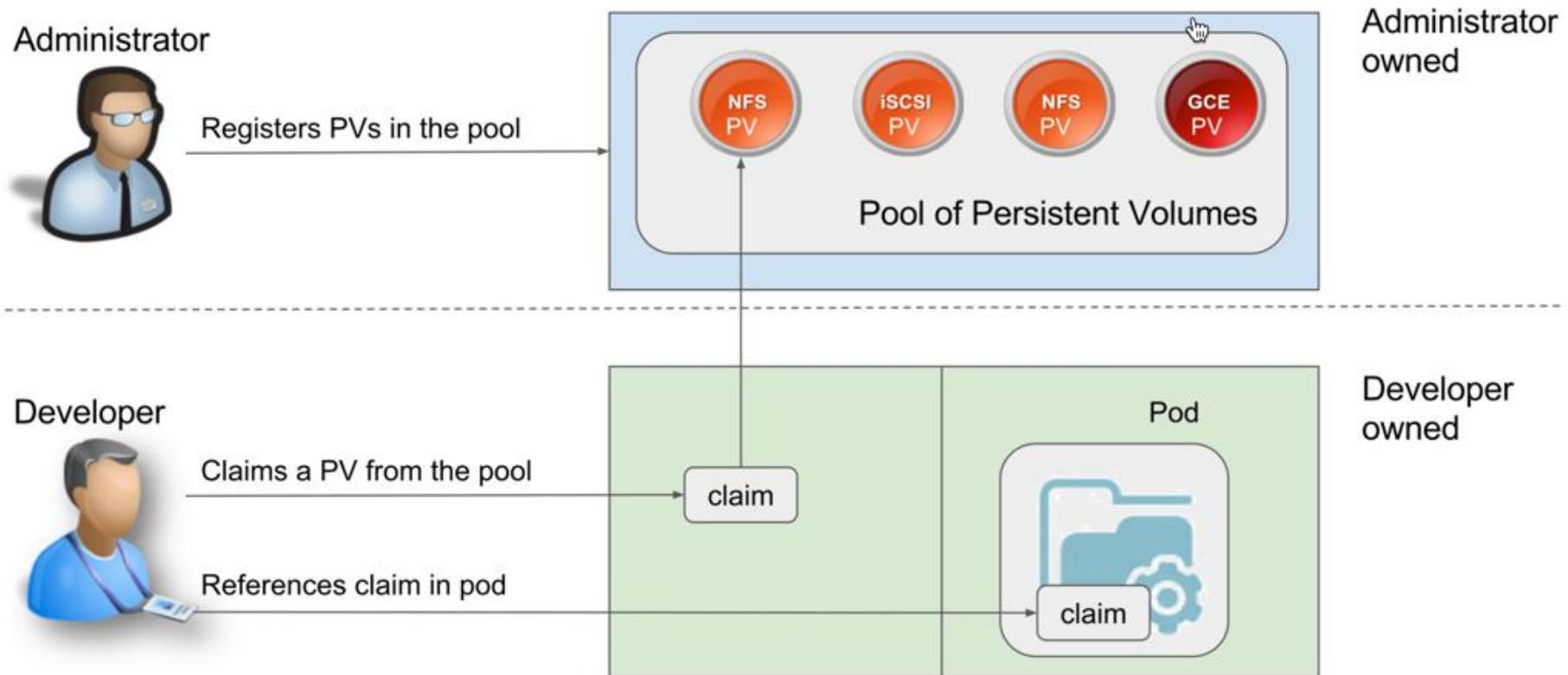
End of Use

## Pods for Application



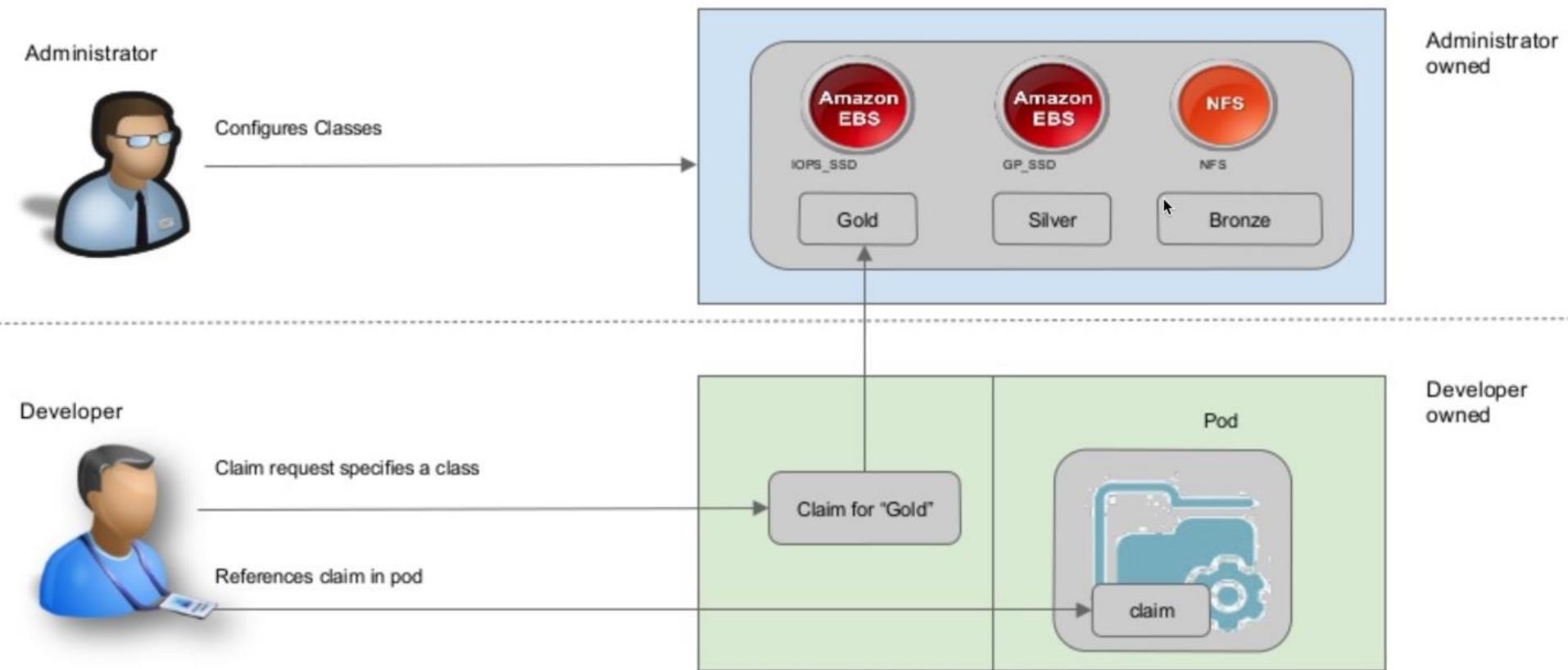
# Persistent Volume

- Static Provision



# Persistent Volume

- Dynamic Provision



# Persistent Volume

- Type of Persistent Volume/Access Method

Volume Plugin	ReadWriteOnce	ReadOnlyMany	ReadWriteMany
AWSElasticBlockStore	✓	-	-
AzureFile	✓	✓	✓
AzureDisk	✓	-	-
CephFS	✓	✓	✓
Cinder	✓	-	-
FC	✓	✓	-
FlexVolume	✓	✓	-
Flocker	✓	-	-
GCEPersistentDisk	✓	✓	-
Glusterfs	✓	✓	✓
HostPath	✓	-	-
iSCSI	✓	✓	-
PhotonPersistentDisk	✓	-	-
Quobyte	✓	✓	✓
NFS	✓	✓	✓
RBD	✓	✓	-
VsphereVolume	✓	-	-
PortworxVolume	✓	-	✓
ScaleIO	✓	✓	-
StorageOS	✓	-	-

# Persistent Volume

- Static Provision
- Persistent Volume

```
1  apiVersion: v1
2  kind: PersistentVolume
3  metadata:
4    name: nfs-share-pv
5    labels:
6      name: nfs-share-pv
7      owner: Praparn_L
8      version: "1.0"
9    module: PV
10   environment: development
11
12  spec:
13    capacity:
14      storage: 1Gi
15    storageClassName: ""
16    accessModes:
17      - ReadWriteMany
18    nfs:
19      server: 192.168.99.200
20      path: "/var/nfsshare"
```

## Persistent Volume Claims

```
1  apiVersion: v1
2  kind: PersistentVolumeClaim
3  metadata:
4    name: nfs-share-pvc
5    labels:
6      name: nfs-share-pvc
7      owner: Praparn_L
8      version: "1.0"
9    module: PVC
10   environment: development
11
12  spec:
13    accessModes:
14      - ReadWriteMany
15    storageClassName: ""
16    resources:
17      requests:
18        storage: 500Mi
19    selector:
20      matchLabels:
21        name: nfs-share-pv
22        owner: Praparn_L
23        version: "1.0"
24        module: PV
25        environment: development
```

# Persistent Volume

- Dynamic Provision
- Storage Class

```
1 kind: StorageClass
2 apiVersion: storage.k8s.io/v1
3 metadata:
4   name: aws-ebs
5   provisioner: kubernetes.io/aws-ebs
6   parameters:
7     type: gp2
8     fsType: ext4
```

## Persistent Volume Claims

```
1   apiVersion: v1
2   kind: PersistentVolumeClaim
3   metadata:
4     name: aws-ebs-pvc
5     annotations:
6       volume.beta.kubernetes.io/storage-class: aws-ebs
7   spec:
8     accessModes:
9       - ReadWriteOnce
10    resources:
11      requests:
12        storage: 5Gi
```



# Persistent Volume

- Dynamic Provision
  - Test create SC/PVC

```
[ubuntu@ip-10-0-1-229:~$ kubectl apply -f ~/kubernetes_201904/WorkShop_2.7_Persistent_Storage/aws_sc.yml
storageclass.storage.k8s.io/aws-ebs created
[ubuntu@ip-10-0-1-229:~$ kubectl describe -f ~/kubernetes_201904/WorkShop_2.7_Persistent_Storage/aws_sc.yml
Name:           aws-ebs
IsDefaultClass: No
Annotations:   kubectl.kubernetes.io/last-applied-configuration={"apiVersion":"storage.k8s.io/v1","kind":"StorageClass","metadata":{"annotations":{},"name":"aws-ebs"},"parameters":{"fsType":"ext4","type":"gp2"},"provisioner":"kubernetes.io/aws-ebs"}
Provisioner:    kubernetes.io/aws-ebs
Parameters:    fsType=ext4,type=gp2
AllowVolumeExpansion: <unset>
MountOptions:  <none>
ReclaimPolicy: Delete
VolumeBindingMode: Immediate
Events:        <none>
[ubuntu@ip-10-0-1-229:~$ kubectl describe sc/aws-ebs
Name:           aws-ebs
IsDefaultClass: No
Annotations:   kubectl.kubernetes.io/last-applied-configuration={"apiVersion":"storage.k8s.io/v1","kind":"StorageClass","metadata":{"annotations":{},"name":"aws-ebs"},"parameters":{"fsType":"ext4","type":"gp2"},"provisioner":"kubernetes.io/aws-ebs"}
Provisioner:    kubernetes.io/aws-ebs
Parameters:    fsType=ext4,type=gp2
AllowVolumeExpansion: <unset>
MountOptions:  <none>
ReclaimPolicy: Delete
VolumeBindingMode: Immediate
Events:        <none>
[ubuntu@ip-10-0-1-229:~$ kubectl apply -f ~/kubernetes_201904/WorkShop_2.7_Persistent_Storage/aws_pvc.yml
persistentvolumeclaim/aws-ebs-pvc created
[ubuntu@ip-10-0-1-229:~$ kubectl get pvc
NAME      STATUS    VOLUME      CAPACITY   ACCESS MODES  STORAGECLASS   AGE
aws-ebs-pvc  Pending          aws-ebs      4s
[ubuntu@ip-10-0-1-229:~$ kubectl get pvc
NAME      STATUS    VOLUME      CAPACITY   ACCESS MODES  STORAGECLASS   AGE
aws-ebs-pvc  Bound    pvc-0a14702e-4268-11e9-9e8e-02d2fffaea91a  5Gi       RWO          aws-ebs     18s
[ubuntu@ip-10-0-1-229:~$ kubectl describe pvc
NAME: aws-ebs-pvc
Status: Pending
```



# Persistent Volume

- Dynamic Provision
  - Test create SC/PVC

```
[ubuntu@ip-10-0-1-229:~$ kubectl get pv
NAME           CAPACITY   ACCESS MODES  RECLAIM POLICY  STATUS    CLAIM          STORAGECLASS  REASON  AGE
pvc-0a14702e-4268-11e9-9e8e-02d2ffaea91a  5Gi        RWO          Delete        Bound    default/aws-ebs-pvc  aws-ebs      26m
[ubuntu@ip-10-0-1-229:~$ kubectl get pvc
NAME      STATUS    VOLUME
aws-ebs-pvc  Bound    pvc-0a14702e-4268-11e9-9e8e-02d2ffaea91a
[ubuntu@ip-10-0-1-229:~$ ]
```

Name	Volume ID	Size	Type	IOPS	Snapshot	Created	Avg.
kubernetes-dynamic-pvc-0a14702e-4268-11e9-9e8e-02d2ffaea91a	vol-0be1ef23e8b209c0d	5 GiB	gp2	100	vol-038c386...	March 9, 2019 at 7:37:09 PM UTC+7	ap-southeast-1a
	vol-038c386...	30 GiB	gp2	100	snap-0f7083a4...	March 8, 2019 at 10:20:20 PM UTC+7	ap-southeast-1a



# Persistent Volume

- Dynamic Provision

The screenshot shows the Kubernetes web interface with the following details:

**Cluster** sidebar items: Namespaces, Nodes, Persistent Volumes, Roles, **Storage Classes** (selected), Namespace, default.

**Storage Classes** page header: Cluster > Storage Classes > aws-ebs. Actions: + CREATE, EDIT, DELETE.

**Details** section for the 'aws-ebs' storage class:

- Name: aws-ebs
- Annotations: kubectl.kubernetes.io/last-applied-configuration
- Creation Time: 2019-03-09T12:34 UTC
- Labels: -
- Provisioner: kubernetes.io/aws-ebs
- Parameters: fsType: ext4 type: gp2

**Persistent Volumes** table:

Name	Capacity	Access Modes	Reclaim Policy	Status	Claim	Storage Class	Reason	Age	⋮
<a href="#">pvc-0a14702e-4...</a>	5Gi	ReadWriteOnce	Delete	Bound	<a href="#">default/aws-ebs-...</a>	aws-ebs	-	29 minutes	⋮



# Persistent Volume

- Dynamic Provision

The screenshot shows two views in the Kubernetes dashboard:

**Persistent Volumes View:**

Name	Capacity	Access Modes	Reclaim Policy	Status	Claim	Storage Class	Reason	Age
pvc-0a14702e-4...	5Gi	ReadWriteOnce	Delete	Bound	default/aws-ebs-...	aws-ebs	-	30 minutes

**Persistent Volume Claims View:**

Name	Status	Volume	Capacity	Access Modes	Storage Class	Age
aws-ebs-pvc	Bound	pvc-0a14702e-4268-11e9-9e8e-02d2ffaea91a	5Gi	ReadWriteOnce	-	30 minutes



# Persistent Volume

- Dynamic Provision

```
[ubuntu@ip-10-0-1-229:~$ kubectl get pv
NAME           CAPACITY   ACCESS MODES  RECLAIM POLICY  STATUS    CLAIM          STORAGECLASS  REASON  AGE
pvc-0a14702e-4268-11e9-9e8e-02d2ffa91a  5Gi        RWO         Delete        Bound     default/aws-ebs-pvc  aws-ebs      37m
[ubuntu@ip-10-0-1-229:~$ kubectl get pvc
NAME      STATUS    VOLUME                                     CAPACITY   ACCESS MODES  STORAGECLASS  AGE
aws-ebs-pvc  Bound    pvc-0a14702e-4268-11e9-9e8e-02d2ffa91a  5Gi        RWO         aws-ebs      37m
[ubuntu@ip-10-0-1-229:~$ kubectl delete -f ~/kubernetes_201904/WorkShop_2.7_Persistent_Storage/aws_pvc.yml
persistentvolumeclaim "aws-ebs-pvc" deleted
[ubuntu@ip-10-0-1-229:~$ kubectl get pv
No resources found.
[ubuntu@ip-10-0-1-229:~$ kubectl get pvc
No resources found.
ubuntu@ip-10-0-1-229:~$ ]
```

EC2 Dashboard

Events

Tags

Reports

Limits

INSTANCES

Instances

Launch Templates

Spot Requests

Create Volume

Actions

Name : kubernetes-dynamic-pvc-0a14702e-4268-11...

Add filter

Name	Volume ID	Size	Volume Type	IOPS
No Volumes found				

Select a volume above



# Persistent Volume

- Deployment reference



Reference for mount disk volume from “PersistentVolumeClaim”

# Persistent Volume

- Deployment reference

```
1 apiVersion: apps/v1
2 kind: Deployment
3 metadata:
4   name: webtest
5   labels:
6     name: web
7     owner: Praparn_L
8     version: "1.0"
9     module: WebServer
10    environment: development
11 spec:
12   replicas: 1
13   selector:
14     matchLabels:
15       name: web
16       owner: "Praparn_L"
17       version: "1.0"
18       module: WebServer
19       environment: development
20   template:
21     metadata:
22       labels:
23         name: web
24         owner: Praparn_L
25         version: "1.0"
26         module: WebServer
27         environment: development
28     spec:
29       containers:
30         - name: webtest
31           image: labdocker/cluster:webserviceelite_v1
32           ports:
33             - containerPort: 5000
34               protocol: TCP
35             volumeMounts:
36               - name: aws-share-pvc
37                 mountPath: /usr/src/app
38           initContainers:
39             - name: download
40               image: labdocker/alpineweb:latest
41               volumeMounts:
42                 - name: aws-share-pvc
43                   mountPath: /source
44               command:
45                 - wget
46                 - "-O"
47                 - "/source/mainlite.py"
48                 - "https://raw.githubusercontent.com/praparn/kubernetes\_201904/master/WorkShop\_2.7\_Persistent\_Storage/mainlite.py"
49             volumes:
50               - name: aws-share-pvc
51                 persistentVolumeClaim:
52                   claimName: aws-ebs-pvc
```



Run iniContainers Process

Reference for mount disk volume from "PVC"



# Persistent Volume

- Dynamic Provision on Deployment

```
[ubuntu@ip-10-0-1-229:~]$ kubectl create -f https://raw.githubusercontent.com/praparn/kubernetes_201904/master/WorkShop_2.7_Persistent_Storage/aws_webtest_deploymentall.yml
deployment.apps/webtest created
[ubuntu@ip-10-0-1-229:~]$ kubectl create -f https://raw.githubusercontent.com/praparn/kubernetes_201904/master/WorkShop_2.7_Persistent_Storage/aws_webtest_svc.yml
service/webtest created
[ubuntu@ip-10-0-1-229:~]$ kubectl get deployment
NAME      READY   UP-TO-DATE   AVAILABLE   AGE
webtest   1/1     1           1           13s
[ubuntu@ip-10-0-1-229:~]$ kubectl get pods
NAME                  READY   STATUS    RESTARTS   AGE
webtest-6f4bdd5f6b-kj4jn 1/1     Running   0          18s
[ubuntu@ip-10-0-1-229:~]$ kubectl describe pods/webtest-6f4bdd5f6b-kj4jn
Name:         webtest-6f4bdd5f6b-kj4jn
Namespace:    default
Priority:    0
PriorityClassName: <none>
Node:        ip-10-0-1-165.ap-southeast-1.compute.internal/10.0.1.165
Start Time:  Sat, 09 Mar 2019 16:05:40 +0000
Labels:      environment=development
             module=WebServer
             name=web
             owner=Praparn_L
             pod-template-hash=6f4bdd5f6b
             version=1.0
Annotations: cni.projectcalico.org/podIP: 192.168.1.40/32
Status:      Running
IP:          192.168.1.40
Controlled By: ReplicaSet/webtest-6f4bdd5f6b

Events:          RENDERED FROM /var/run/secrets/kubernetes.io/serviceaccount/default-pod.log
Type  Reason          Age   From           Message
----  ----          --   --            --
Normal Scheduled   28s   default-scheduler  Successfully assigned default/webtest-6f4bdd5f6b-kj4jn to ip-10-0-1-165.ap-southeast-1.compute.internal
Normal SuccessfulAttachVolume 27s   attachdetach-controller  AttachVolume.Attach succeeded for volume "pvc-e7988ede-4284-11e9-9e8e-02d2ffaea91a"
Normal Pulling      23s   kubelet, ip-10-0-1-165.ap-southeast-1.compute.internal  pulling image "labdocker/alpineweb:latest"
Normal Pulled       19s   kubelet, ip-10-0-1-165.ap-southeast-1.compute.internal  Successfully pulled image "labdocker/alpineweb:latest"
Normal Created     19s   kubelet, ip-10-0-1-165.ap-southeast-1.compute.internal  Created container
Normal Started     19s   kubelet, ip-10-0-1-165.ap-southeast-1.compute.internal  Started container
Normal Pulled       18s   kubelet, ip-10-0-1-165.ap-southeast-1.compute.internal  Container image "labdocker/cluster:webservicelite_v1" already present on machine
Normal Created     18s   kubelet, ip-10-0-1-165.ap-southeast-1.compute.internal  Created container
Normal Started     18s   kubelet, ip-10-0-1-165.ap-southeast-1.compute.internal  Started container
[ubuntu@ip-10-0-1-229:~]$
```



# Persistent Volume

A screenshot of a web browser window. The title bar shows various icons and links: kube, Create, Linu, doc, EC2, prep, Sett, QUI, High, and a red M. The address bar displays a URL: Not Secure | 18.136.102.184:32500. Below the address bar, a message says "Click to go back, hold to see history". The main content area of the browser shows the text "Welcome Page from Container Python Lab". At the bottom of the browser window, there is a navigation bar with icons and labels: Apps, NMac Ked - Mac ..., Medium, Infra, NOVA, jenkins, vagrant, and Mes.

Welcome Page from Container Python Lab

Checkpoint Date/Time: Sat Mar 9 16:08:09 2019



# Persistent Volume

```
...-0-1-77: ~ — -bash | ...orker-1: ~ — -bash | ...-219-46: ~ — -bash
[ubuntu@ip-10-0-1-229:~]$ kubectl get pods
NAME           READY   STATUS    RESTARTS   AGE
webtest-6f4bdd5f6b-kj4jn   1/1     Running   0          2m51s
[ubuntu@ip-10-0-1-229:~]$ kubectl exec -it webtest-6f4bdd5f6b-kj4jn sh
[/usr/src/app # vi mainlite.py
/usr/src/app #
```

```
from flask import Flask
import os
import time
app = Flask(__name__)

@app.route('/')
def hello():
    return '<H1>TEST EDIT Welcome Page from Container Python Lab </H1>Checkpoint Date/Time: ' + time.strftime("%c") +'\\n'

if __name__ == "__main__":
    app.run(host="0.0.0.0", port=5000, debug=True)
~
```

← → ⌂ ⓘ Not Secure | 18.136.102.184:32500

\_apps\_ NMac Ked - Mac ... M Medium \_Infra\_ NOVA \_jenkins\_ vagrant Mesos Vue do

## TEST EDIT Welcome Page from Container Python Lab

Checkpoint Date/Time: Sat Mar 9 16:10:42 2019



# Persistent Volume

- Create Deployment

**Details**

Name:	webtest-6f4bdd5f6b-kj4jn	Network	
Namespace:	default	Node:	ip-10-0-1-165.ap-southeast-1.compute.internal
Labels:	environment: development, module: WebServer, name: web, owner: Praparn_L, pod-template-hash: 6f4bdd5f6b	IP:	192.168.1.40
Annotations:	cni.projectcalico.org/podIP: 192.168.1.40/32		
Creation Time:	2019-03-09T16:05 UTC		
Status:	Running		
QoS Class:	BestEffort		

**Containers**

Container Name:	Image:	Environment variables:	Commands:	Args:
webtest	labdocker/cluster:webservicelite_v1	-	-	-

**Init Containers**

Container Name:	Image:	Environment variables:	Commands:	Args:
download	labdocker/alpineweb:latest	-	wget -O /source/mainlite.py https://raw.githubusercontent.com/praparn/kubernetes_201904/master/WorkShop_2.7_Persistent_Storage/mainlite.py	-



# Persistent Volume

- Create Deployment

The screenshot shows the Kubernetes UI for managing workloads. On the left, a sidebar navigation bar includes options like Cluster, Namespaces, Nodes, Persistent Volumes, Roles, Storage Classes, Namespace (default), Overview, Workloads, Cron Jobs, Daemon Sets, Deployments, Jobs, Pods (selected), Replica Sets, Replication Controllers, Stateful Sets, Discovery and Load Balancing, Ingresses, Services, Config and Storage, Config Maps, Persistent Volume Claims, and Secrets.

The main content area displays the following information:

- Pod Details:** A pod named "webtest-6f4bdd5f6b-kj4jn" is shown in a replicaset. The pod is healthy (green checkmark). Status: 1 / 1. Created: 7 minutes ago. Associated with deployment: labdocker/cluster:webservicelit... (hash: 6f4bdd5f6b).
- Events:** A table showing the events for the pod:

Message	Source	Sub-object	Count	First seen	Last seen
Successfully assigned default/webtest-6f4bdd5f6b-kj4jn to ip-10-0-1-165.ap-southeast-1.compute.internal	default-scheduler	-	1	2019-03-09T16:05 UTC	2019-03-09T16:05 UTC
AttachVolume.Attach succeeded for volume "pvc-e7988ede-4284-11e9-9e8e-02d2ffaea91a"	attachdetach-controller	-	1	2019-03-09T16:05 UTC	2019-03-09T16:05 UTC
pulling image "labdocker/alpineweb:latest"	kubelet ip-10-0-1-165.ap-southeast-1.compute.internal	spec.initContainers{download}	1	2019-03-09T16:05 UTC	2019-03-09T16:05 UTC
Successfully pulled image "labdocker/alpineweb:latest"	kubelet ip-10-0-1-165.ap-southeast-1.compute.internal	spec.initContainers{download}	1	2019-03-09T16:05 UTC	2019-03-09T16:05 UTC
Created container	kubelet ip-10-0-1-165.ap-southeast-1.compute.internal	spec.initContainers{download}	1	2019-03-09T16:05 UTC	2019-03-09T16:05 UTC
Started container	kubelet ip-10-0-1-165.ap-southeast-1.compute.internal	spec.initContainers{download}	1	2019-03-09T16:05 UTC	2019-03-09T16:05 UTC
Container image "labdocker/cluster:webservicelite_v1" already present on machine	kubelet ip-10-0-1-165.ap-southeast-1.compute.internal	spec.containers{webtest}	1	2019-03-09T16:05 UTC	2019-03-09T16:05 UTC
Created container	kubelet ip-10-0-1-165.ap-southeast-1.compute.internal	spec.containers{webtest}	1	2019-03-09T16:05 UTC	2019-03-09T16:05 UTC
Started container	kubelet ip-10-0-1-165.ap-southeast-1.compute.internal	spec.containers{webtest}	1	2019-03-09T16:05 UTC	2019-03-09T16:05 UTC
- Persistent Volume Claims:** A table showing the persistent volume claims:

Name	Status	Volume	Capacity	Access Modes	Storage Class	Age
aws-ebs-pvc	Bound	pvc-e7988ede-4284-11e9-9e8e-02d2ffaea91a	5Gi	ReadWriteOnce	-	9 minutes



# Workshop 2.7: Persistence Storage

Kubernetes dashboard showing the details of a Pod named `webtest-6f4bdd5f6b-kj4jn`.

**Pod Details:**

Field	Value
name	web
owner	Paparn_L
pod-template-hash	6f4bdd5f6b

**Events:**

Message	Source	Sub-object	Count	First seen	Last seen
Successfully assigned default/webtest-6f4bdd5f6b-kj4jn to ip-10-0-1-165.ap-southeast-1.compute.internal	default-scheduler	-	1	2019-03-09T16:05 UTC	2019-03-09T16:05 UTC
AttachVolume.Attach succeeded for volume "pvc-e7988ede-4284-11e9-9e8e-02d2ffaea91a"	attachdetach-controller	-	1	2019-03-09T16:05 UTC	2019-03-09T16:05 UTC
pulling image "labdocker/alpineweb.latest"	kubelet ip-10-0-1-165.ap-southeast-1.compute.internal	spec.initContainers{download}	1	2019-03-09T16:05 UTC	2019-03-09T16:05 UTC
Successfully pulled image "labdocker/alpineweb.latest"	kubelet ip-10-0-1-165.ap-southeast-1.compute.internal	spec.initContainers{download}	1	2019-03-09T16:05 UTC	2019-03-09T16:05 UTC
Created container	kubelet ip-10-0-1-165.ap-southeast-1.compute.internal	spec.initContainers{download}	1	2019-03-09T16:05 UTC	2019-03-09T16:05 UTC
Started container	kubelet ip-10-0-1-165.ap-southeast-1.compute.internal	spec.initContainers{download}	1	2019-03-09T16:05 UTC	2019-03-09T16:05 UTC
Container image "labdocker/cluster:webservice_v1" already present on machine	kubelet ip-10-0-1-165.ap-southeast-1.compute.internal	spec.containers{webtest}	1	2019-03-09T16:05 UTC	2019-03-09T16:05 UTC
Created container	kubelet ip-10-0-1-165.ap-southeast-1.compute.internal	spec.containers{webtest}	1	2019-03-09T16:05 UTC	2019-03-09T16:05 UTC
Started container	kubelet ip-10-0-1-165.ap-southeast-1.compute.internal	spec.containers{webtest}	1	2019-03-09T16:05 UTC	2019-03-09T16:05 UTC

**Persistent Volume Claims:**

Name	Status	Volume	Capacity	Access Modes	Storage Class	Age
aws-ebs-pvc	Bound	pvc-e7988ede-4284-11e9-9e8e-02d2ffaea91a	5Gi	ReadWriteOnce	-	9 minutes



# StatefulSet



Kubernetes: Production Workload Orchestration

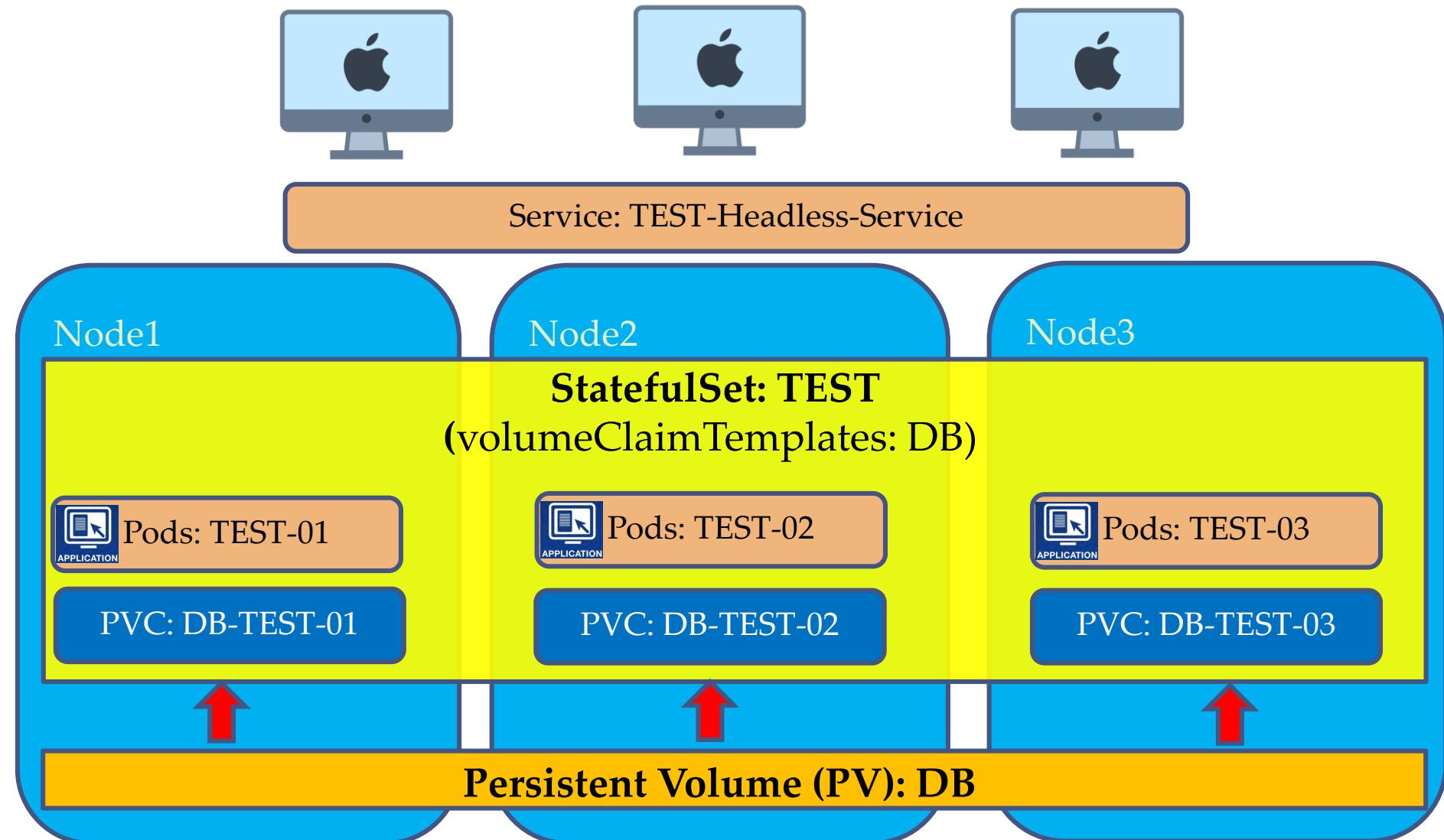


**kubernetes**  
by Google

# StatefulSet

- What is StatefulSet?
  - Do you remember Deployment ?
  - StatefulSet similar with Deployment
  - But StatefulSet is design for applicate that need
    - Persistent Storage
    - Stable Storage/Stable Network
    - Ordered for
      - Deployment (Create)
      - Scale
      - Roll Update
- Benefit from StatefulSet
  - Sequential create/scale/update Pods
  - Each Pods got unique resource
    - Name of Pods
    - Storage on Pods (Dedicate PVC)
    - Exist on Hosts/Network

# StatefulSet



Kubernetes: Production Workload Orchestration



**kubernetes**  
by Google

# StatefulSet

- StatefulSet

```
16  apiVersion: apps/v1beta2
17  kind: StatefulSet
18  metadata:
19    name: TEST
20  spec:
21    serviceName: "TEST"
22    replicas: 3
23    selector:
24      matchLabels:
25        app: nginx
26    template:
27      metadata:
28        labels:
29          app: nginx
30    spec:
31      containers:
32        - name: nginx
33          image: labdocker/nginx:latest
34          ports:
35            - containerPort: 80
36              name: web
37              volumeMounts:
38                - name: DB
39                  mountPath: /usr/share/nginx/html
40    volumeClaimTemplates:
41      - metadata:
42          name: DB
43          spec:
44            accessModes: [ "ReadWriteOnce" ]
45            resources:
46              requests:
47                storage: 1Gi
```

# Service

```
2  apiVersion: v1
3  kind: Service
4  metadata:
5    name: TEST
6    labels:
7      app: TEST
8  spec:
9    ports:
10      - port: 80
11        name: TEST
12        clusterIP: None
13        selector:
14          app: nginx
```



# StatefulSet

[Open](#) apeschel opened this issue on Aug 26 · 2 comments



apeschel commented on Aug 26 • edited

Contributor +

There seems to be a recurring bad practice among the charts in this repository: using a Deployment to manage pods using Persistent Volume Claims, rather than the proper StatefulSet.

To demonstrate just how pervasive the problem is, one can compare the list of charts using a StatefulSet vs a Deployment.

The list of stateful charts using a StatefulSet:

```
$ git grep -li 'kind: *StatefulSet' |  
  awk -F '/' '{print $1}'  
cockroachdb  
concourse  
consul  
ipfs  
memcached  
minio  
mongodb-replicaset  
rethinkdb
```

versus the stateful charts using a Deployment:

```
$ git grep -l -i 'kind: *Deployment' |  
  xargs grep -i PersistentVolumeClaim |  
  awk -F '/' '{print $1}' |  
  sort -u  
artifactory  
chronograf  
dokewiki  
drupal  
factorio  
ghost  
gitlab-ce  
gitlab-ee  
grafana  
influxdb  
jasperreports  
jenkins  
joomla  
kapacitor  
magento  
mariadb  
mediawiki  
minecraft  
minio  
mongodb  
moodle  
mysql  
odoo  
opencart  
openvpn  
orangehrm  
osclass  
owncloud  
percona  
phabricator  
phpbb  
postgresql  
prestashop  
prometheus  
rabbitmq  
redis  
redmine  
rocketchat  
sentry  
testlink  
traefik  
wordpress
```



# Recap Day 2

- Fundamental of Kubernetes
  - ConfigMap Secret
  - Job and CronJob
  - Log and Monitoring
- Ingress Networking
- Kubernetes in real world
  - Cluster Setup for Bare Metal
  - Orchestrator Assignment
    - nodeSelector
    - Interlude
    - Affinity
    - Taints/Tolerations
- Stateful application deployment
  - Consideration and Awareness
  - Persistent Volumes
  - StatefulSet



# Question & Answer Section

