

# 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 Material /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

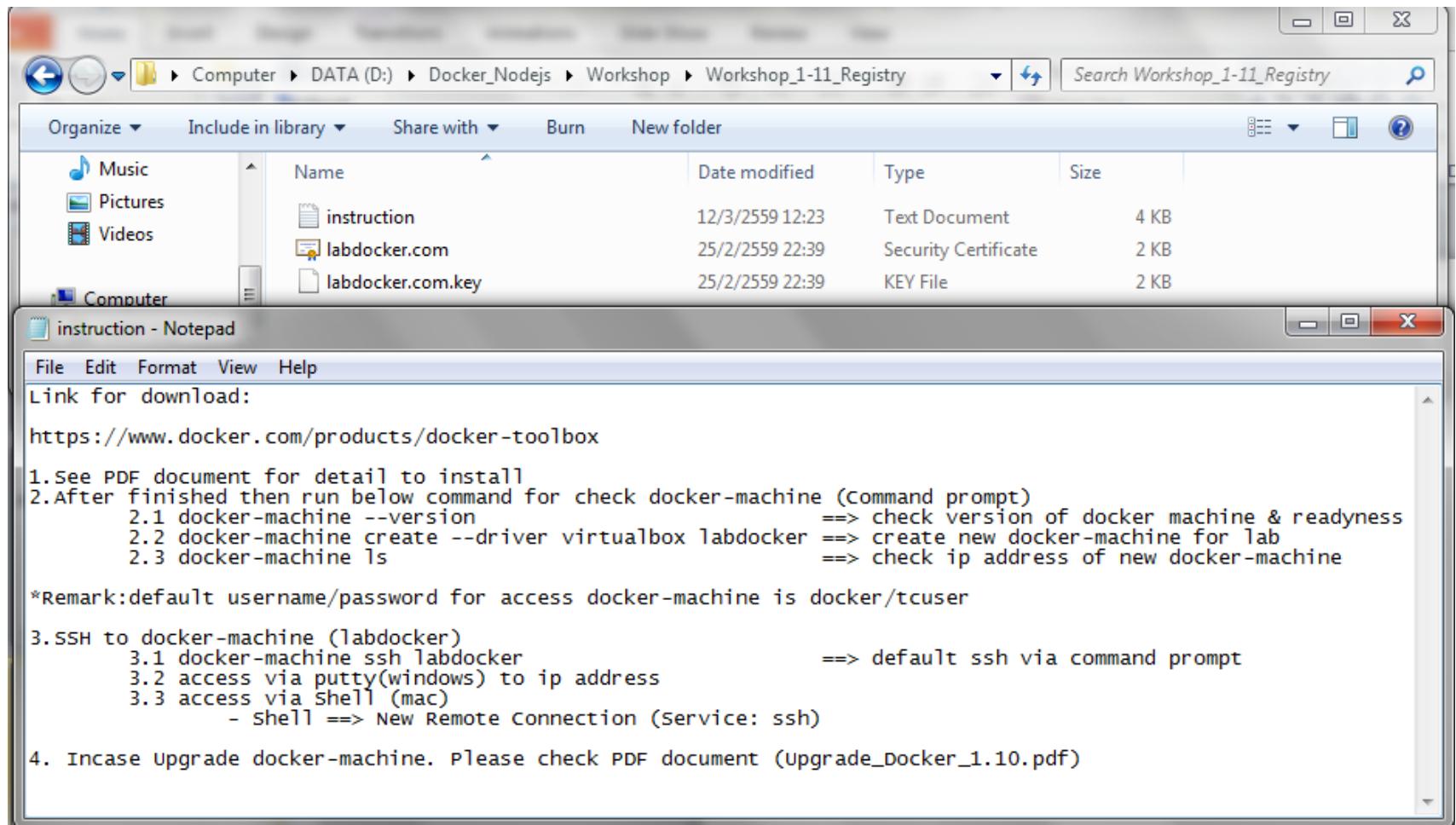
The screenshot shows a search results page for 'labdocker' on a platform that uses a Docker icon in its interface. The search bar at the top contains 'labdocker'. Below the search bar, there is a dropdown menu set to 'All'. The results list three public repositories:

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\\_201907](https://github.com/praparn/kubernetes_201907)

No description, website, or topics provided.

Branch: master ▾ New pull request

File	Created	Last Commit
praparn 2017110214055	2017110214055	an hour ago
WorkShop_1.1_Install_Kubernetes	2017110214055	an hour ago
WorkShop_1.2_Pods_Service_Deployment	2017110214055	an hour ago
WorkShop_1.3_Replication_Controller	2017110214055	an hour ago
WorkShop_1.4_Deployment	2017110214055	an hour ago
WorkShop_1.5_Volume	2017110214055	an hour ago
WorkShop_1.6_Liveness_Readiness_Probe	2017110214055	an hour ago
WorkShop_1.7_Resource_Management_and_HPA	2017110214055	an hour ago
WorkShop_2.1_ConfigMap_Secret	2017110214055	an hour ago
WorkShop_2.3_Log_and_Monitoring	2017110214055	an hour ago
WorkShop_2.4_Ingress_Network	2017110214055	an hour ago
WorkShop_2.5_Kubernetes_RealWorld	2017110214055	an hour ago
WorkShop_2.6_Orchestrator_Assignment	20171108235628	2 days ago
WorkShop_2.7_Persistent_Storage	20171110	23 hours ago
Workshop_2.2_Job_CronJob	2017110214055	an hour ago
.DS_Store	2017110003943	22 hours ago
Kubernetes_Training_master.pdf	2017110003943	22 hours ago
Untitled-1	2017110214055	an hour ago



# Workshop 1.1: Install Kubernetes



Kubernetes: Production Workload Orchestration



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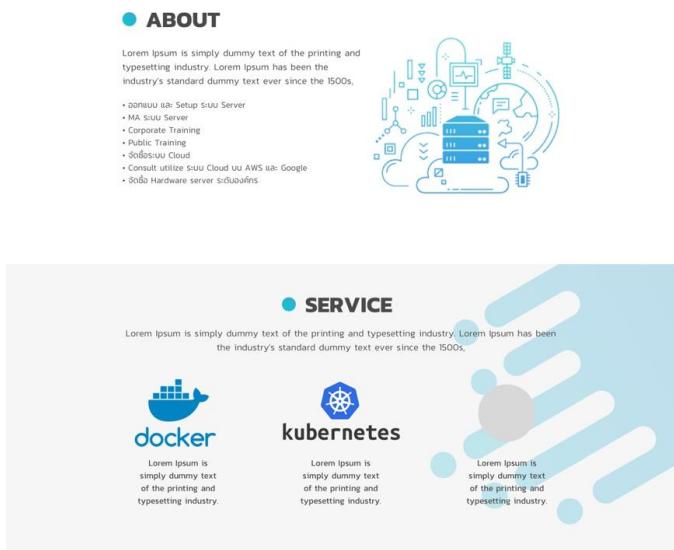
# Workshop 1.1: Install Kubernetes

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

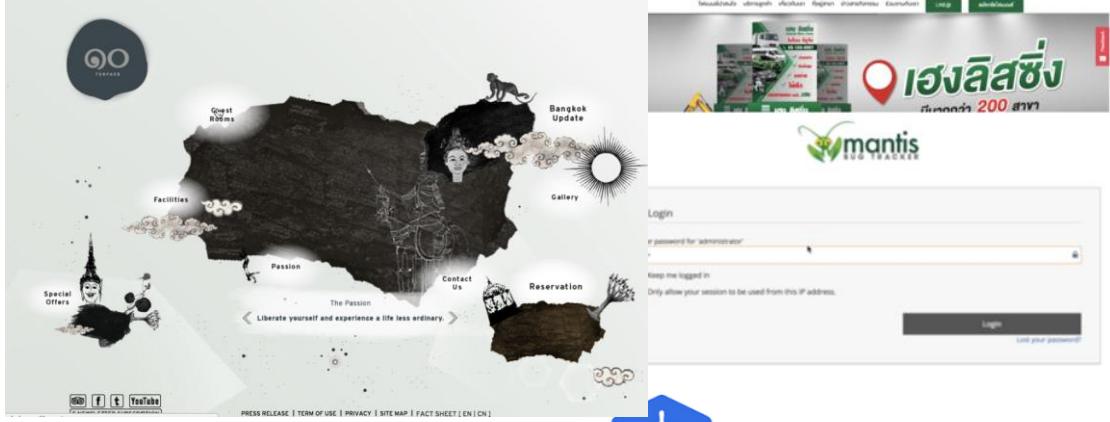
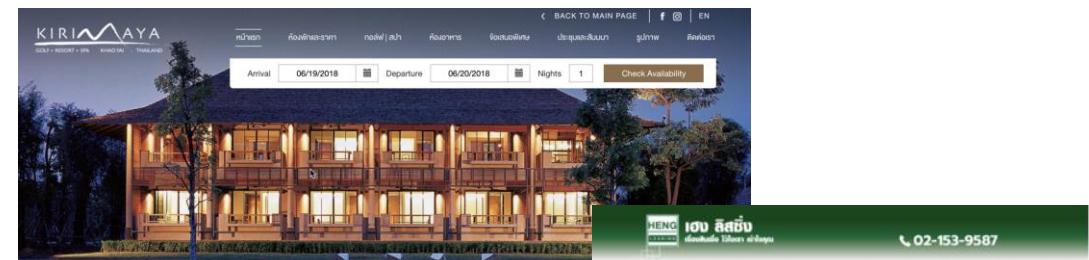
Table No	Group No	No	Public IP Address	Private IP Address	Role
1	1	1	54.169.12.33	10.0.1.25	Master
		2	54.255.243.139	10.0.1.102	Worker
		3	52.221.203.26	10.0.1.254	Worker
	2	1	13.250.121.106	10.0.1.100	Master
		2	54.255.243.173	10.0.1.202	Worker
		3	52.221.232.245	10.0.1.12	Worker
	3	1	54.169.39.94	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 1.15

## Kubernetes v1.15 Release Notes

### 1.15 What's New

A complete changelog for the release notes is now hosted in a customizable format at <https://relnotes.k8s.io/>. Check it out and please give us your feedback!

Kubernetes 1.15 consists of 25 enhancements: 2 moving to stable, 13 in beta, and 10 in alpha. The main themes of this release are:

#### Continuous Improvement

- Project sustainability is not just about features. Many SIGs have been working on improving test coverage, ensuring the basics stay reliable, and stability of the core feature set and working on maturing existing features and cleaning up the backlog.

#### Extensibility

- The community has been asking for continuing support of extensibility, so this cycle features more work around CRDs and API Machinery. Most of the enhancements in this cycle were from SIG API Machinery and related areas.

### Extensibility around core Kubernetes APIs

#### CustomResourceDefinitions Pruning

To enforce both data consistency and security, Kubernetes performs pruning, or the automatic removal of unknown fields in objects sent to a Kubernetes API. An "unknown" field is one that is not specified in the OpenAPI validation schema. This behavior is already in place for native resources and ensures only data structures specified by the CRD developer are persisted to etcd. It will be available as a beta feature in Kubernetes 1.15.

Pruning is activated by setting `spec.preserveUnknownFields: false` in the CustomResourceDefinition. A future `apiextensions.k8s.io/v1` variant of CRDs will enforce pruning.

Pruning requires that CRD developer provides complete, structural validation schemas, either at the top-level or for all versions of the CRD.

#### CustomResourceDefinition Defaulting

CustomResourceDefinitions also have new support for defaulting, with defaults specified using the `default` keyword in the OpenAPI validation schema. Defaults are set for unspecified fields in an object sent to the API, and when reading from etcd.

Defaulting will be available as alpha in Kubernetes 1.15 and requires structural schemas.

#### CustomResourceDefinition OpenAPI Publishing

OpenAPI specs for native types have long been served at `/openapi/v2`, and they are consumed by a number of components, notably kubectl client-side validation, kubectl explain and OpenAPI based client generators.

With Kubernetes 1.15 as beta, OpenAPI schemas are also published for CRDs, as long as their schemas are structural.

Ref: <https://github.com/kubernetes/kubernetes/blob/master/CHANGELOG-1.15.md>

#### Cluster Lifecycle

- `kubeadm upgrade` now renews all the certificates used by a component before upgrading the component itself, with the exception of certificates signed by external CAs. User can eventually opt-out of certificate renewal during upgrades by setting the new flag `--certificate-renewal` to false. (#76862, @fabriziopandini)
- `kubeadm` still generates RSA keys when deploying a node, but also accepts ECDSA keys if they already exist in the directory specified in the `--cert-dir` option. (#76390, @rojkov)
- `kubeadm` now implements CRI detection for Windows worker nodes (#78053, @ksubrmnn)
- Added `--image-repository` flag to `kubeadm config images`. (#75866, @jmkeyes)
- `kubeadm`: The `kubeadm reset` command has now been exposed as phases. (#77847, @yagonobre)
- `kubeadm`: Improved resiliency when it comes to updating the `kubeadm-config` configmap upon new control plane joins or resets. This allows for safe multiple control plane joins and/or resets. (#76821, @ereslibre)
- `kubeadm`: Bumped the minimum supported Docker version to 1.13.1 (#77051, @chenzhiwei)
- Reverted the CoreDNS version to 1.3.1 for `kubeadm` (#78545, @neolit123)
- `kubeadm`: Fixed the machine readability of `kubeadm token create --print-join-command` (#75487, @displague)
- `kubeadm alpha certs renew --csr-only` now reads the current certificates as the authoritative source for certificates attributes (same as `kubeadm alpha certs renew`). (#77780, @fabriziopandini)
- `kubeadm`: You can now delete multiple bootstrap tokens at once. (#75646, @bart0sh)
- `util/init/system`: Added support for the OpenRC init system (#73101, @oz123)
- Default TTL for DNS records in kubernetes zone has been changed from 5s to 30s to keep consistent with old dnsmasq based kube-dns. The TTL can be customized with command `kubectl edit -n kube-system configmap/coredns`. (#76238, @Dieken)
- Communication between the etcd server and kube-apiserver on master is now overridden to use HTTPS instead of HTTP when mTLS is enabled in GCE. (#74690, @wenjaswe)



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# Kubernetes 1.15

## Docker Enterprise Edition 2.1

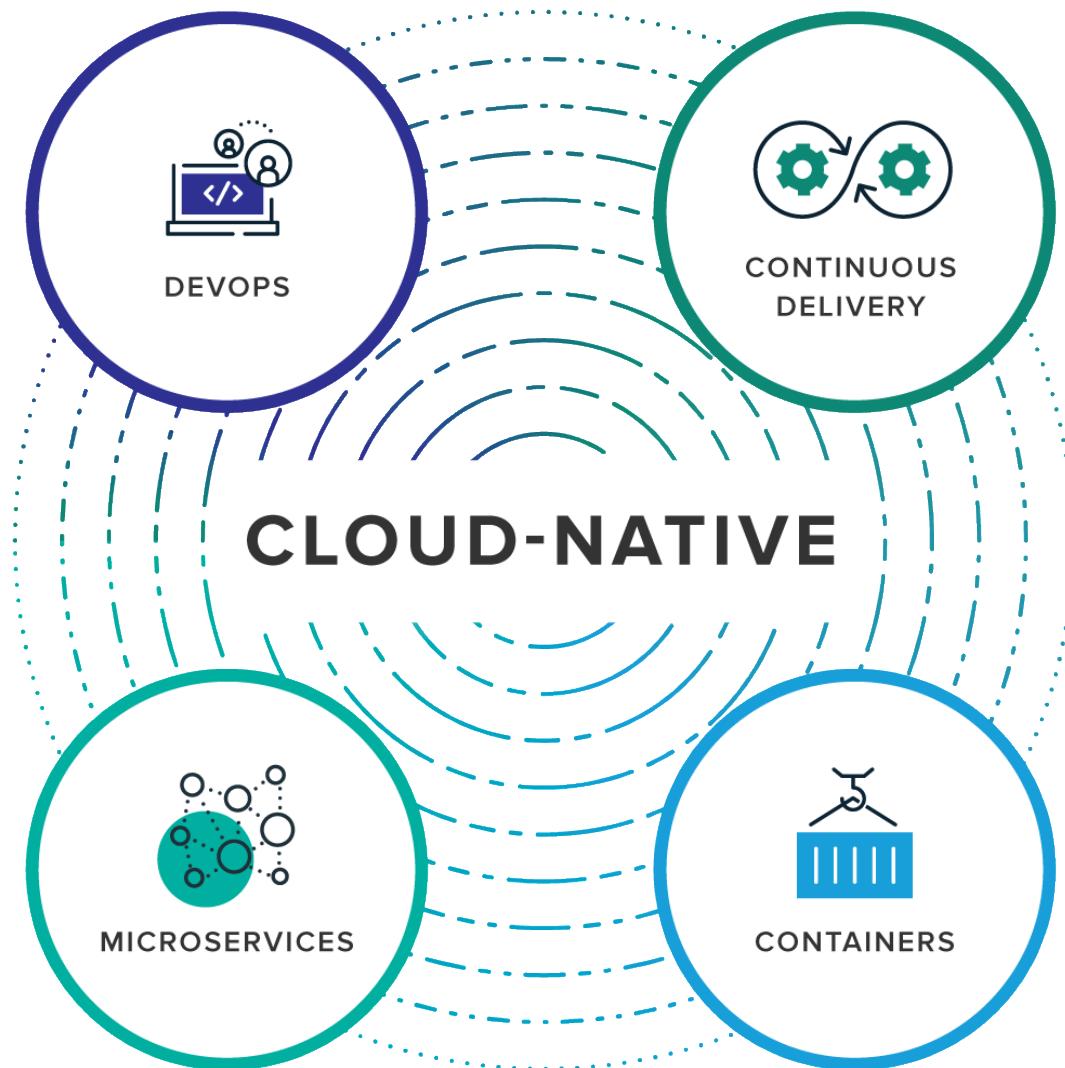
OS Distribution (x86_64)	Enterprise Engine	UCP	DTR	Storage Driver	Orchestration	DTR Storage Backend
RHEL 7.4 <sup>1</sup>	18.09.x	3.1.x	2.6.x	overlay2, devicemapper	Swarm mode, Kubernetes	NFSv4, NFSv3, Amazon S3, S3 Compliant Alternatives, Azure Storage (Blob), Google Cloud Storage, OpenStack Swift, 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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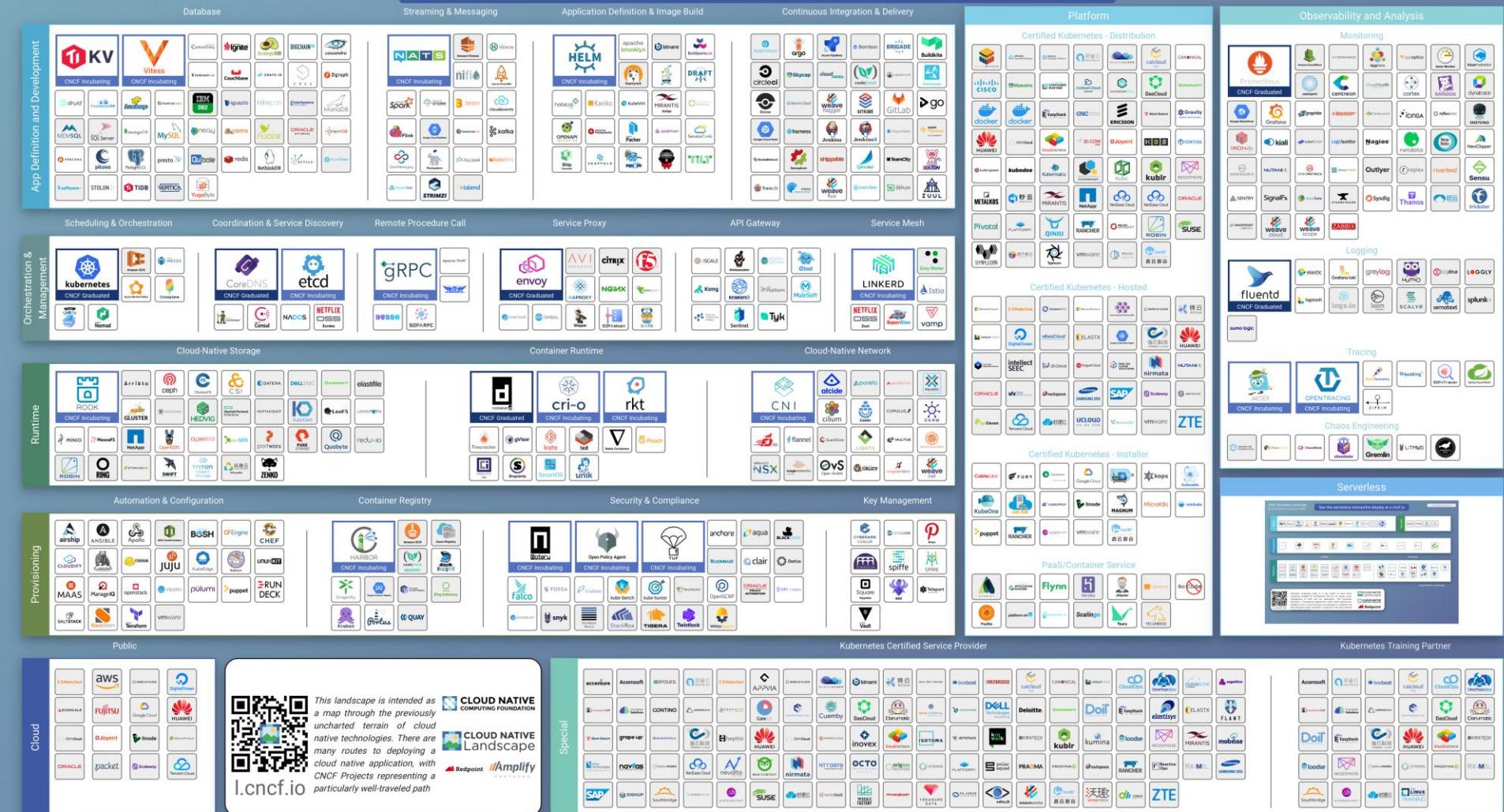
# Landscape of the world now



# Landscape of the world now

Overwhelmed? Please see the CNCF Trail Map. That and the interactive landscape are at [l.cncf.io](https://l.cncf.io)

Greyed logos are not open source



# Kubernetes: Production Workload Orchestration



# kubernetes

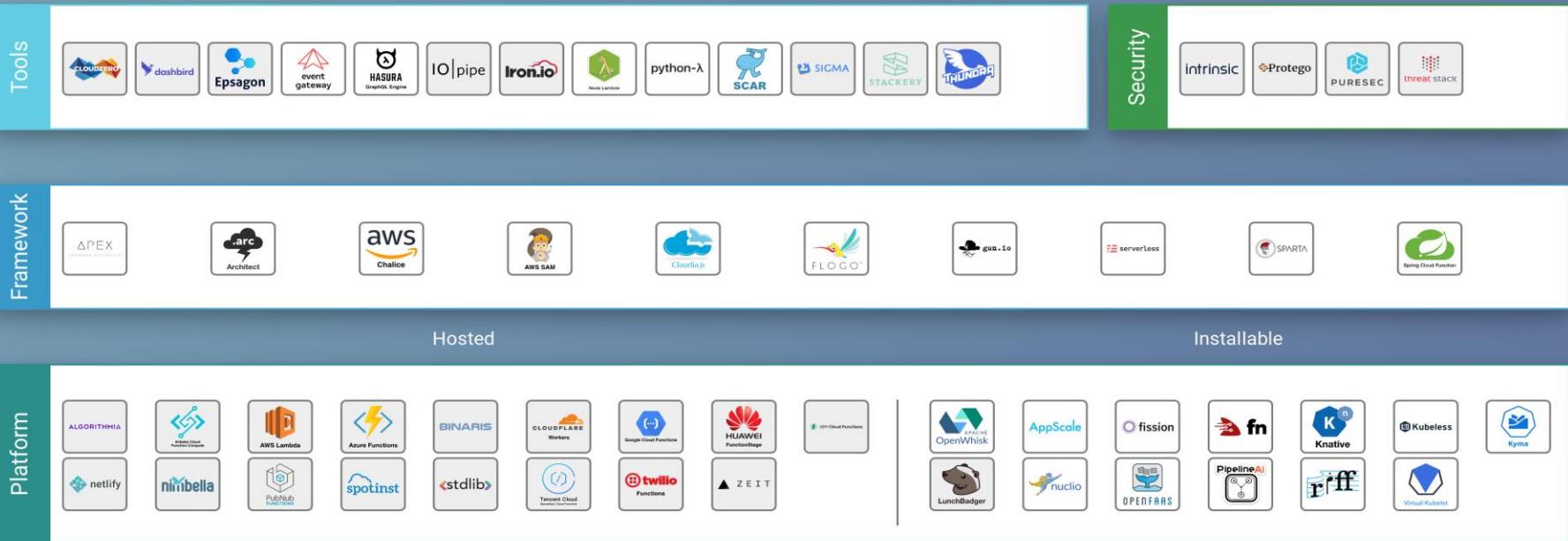
by Google

# Landscape of the world now

CNCF Serverless Landscape  
2019-06-24T02:22:03Z 617fb95

See the serverless interactive display at [s.cncf.io](https://s.cncf.io)

Greyed logos are not open source



Serverless computing refers to a new model of cloud native computing, enabled by architectures that do not require server management to build and run applications. This landscape illustrates a finer-grained deployment model where applications, bundled as one or more functions, are uploaded to a platform and then executed, scaled, and billed in response to the exact demand needed at the moment.

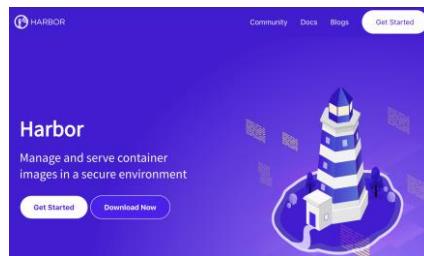


Kubernetes: Production Workload Orchestration



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# KubeCon19



OpenEBS

Resources

Docs

Blog

Community

REQUEST A DEMO

GET STARTED

Leading Open Source  
**Container Attached Storage**  
**(CAS)** [What is CAS?](#) →

👍 100% Open Source

💻 Container Native Architecture

🌐 Stateful Applications / Workloads on  
Kubernetes simplified



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# 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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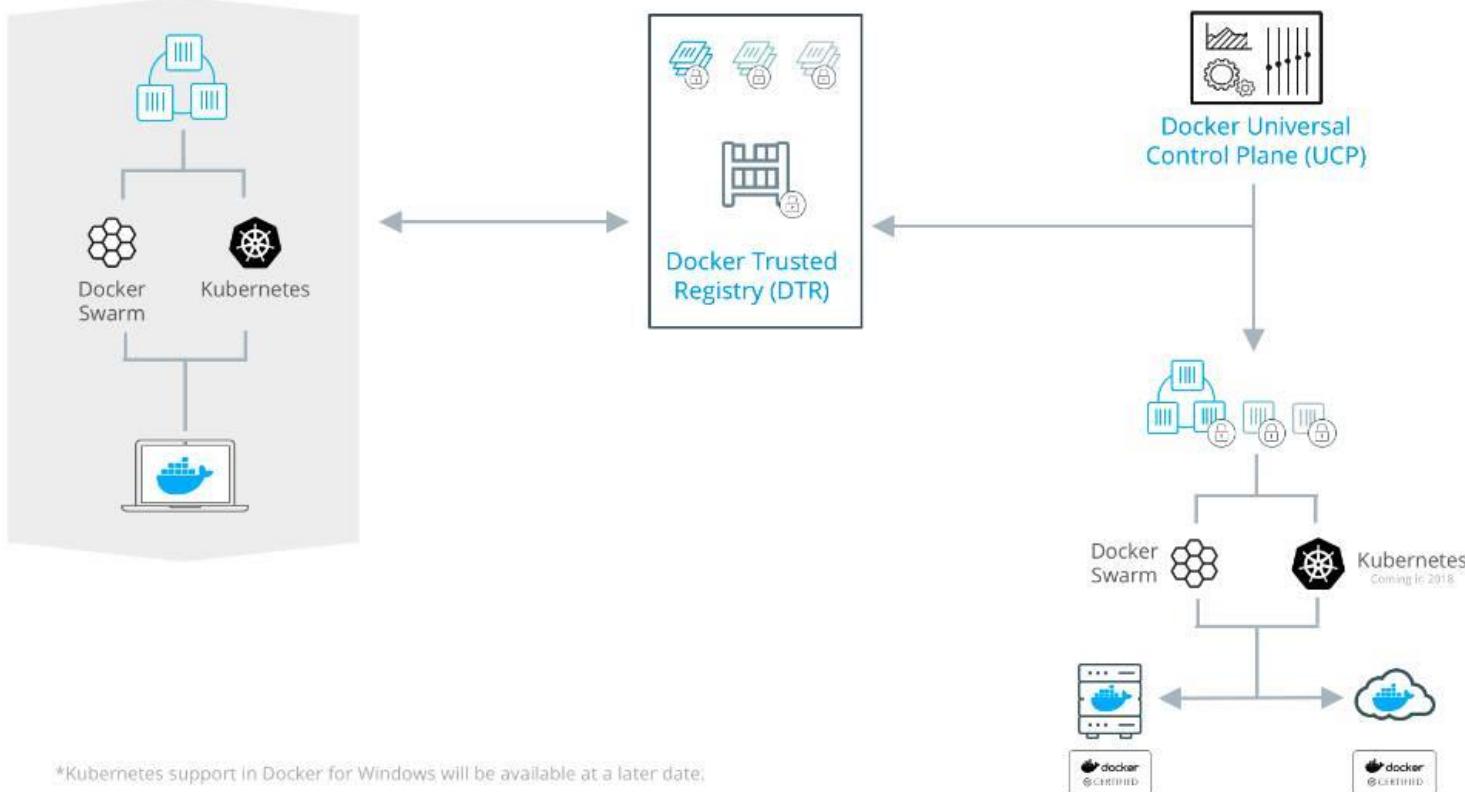
# Landscape of the world now

Docker for Mac  
Docker for Windows\*

Build Test Ship

Docker  
Enterprise Edition

Secure Deploy Manage

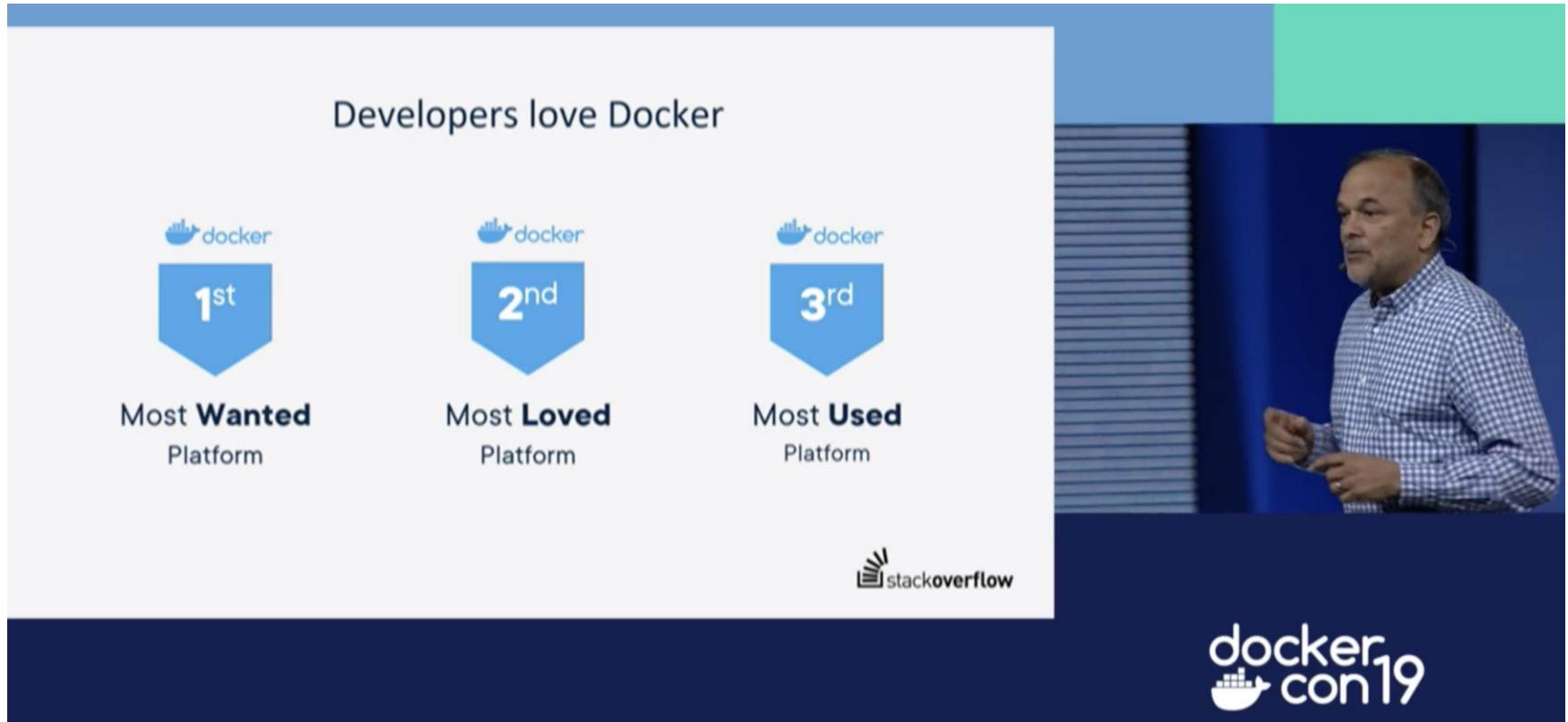


Kubernetes: Production Workload Orchestration



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# Landscape of the world now



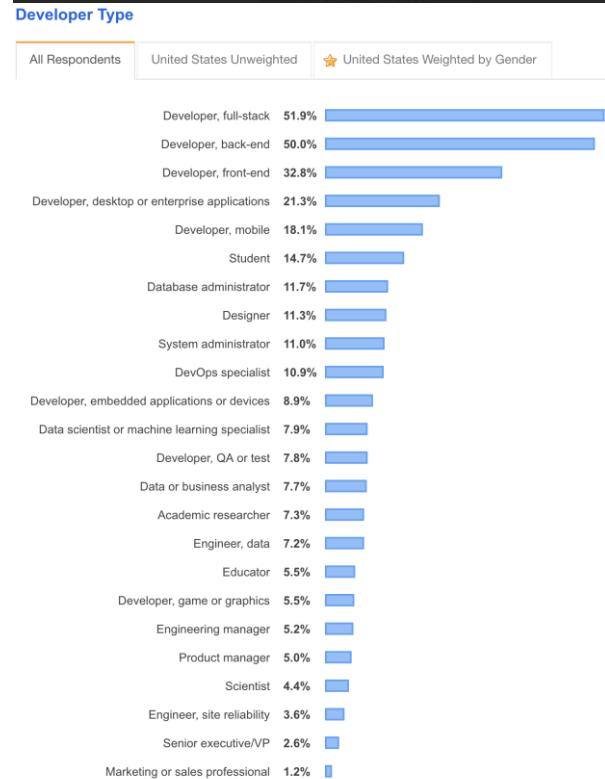
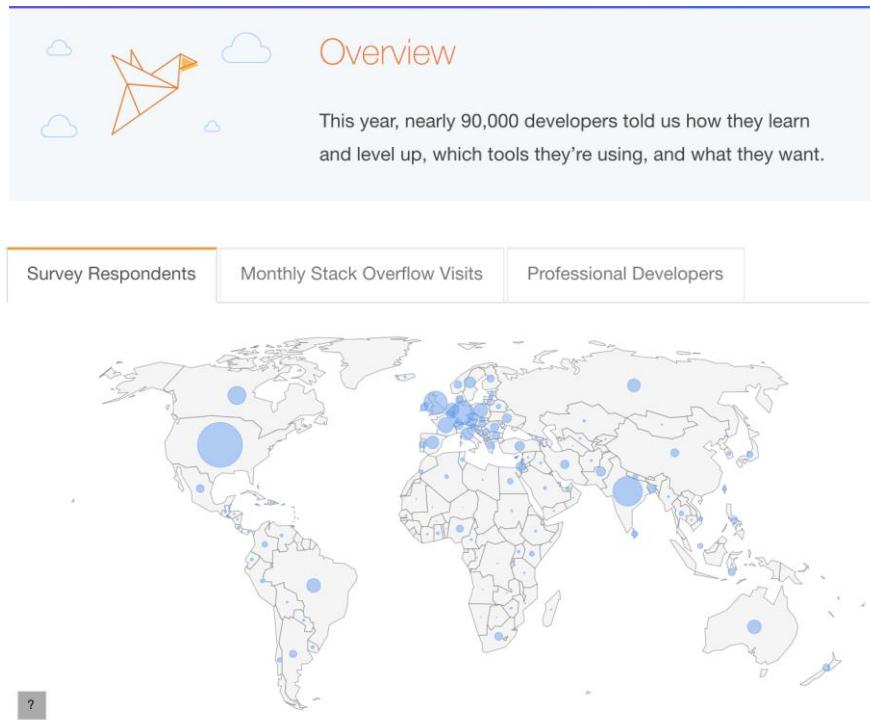
Docker: The Next-Gen of Virtualization



kubernetes  
by Google

# Landscape of the world now

- Stackoverflow 2019



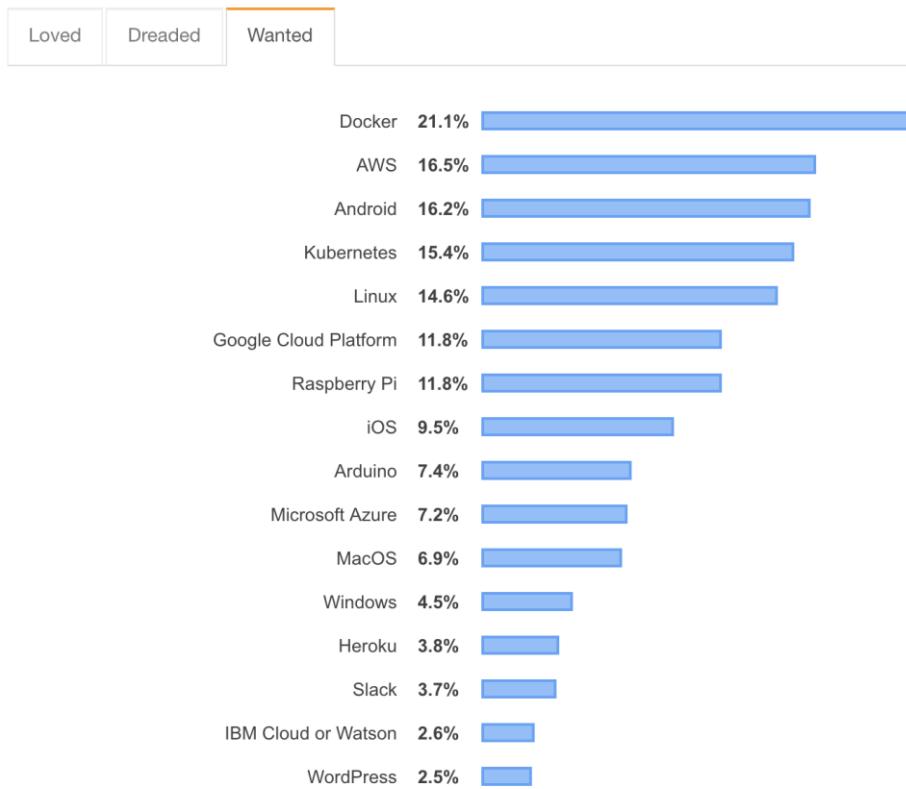
81,335 responses; select all that apply

Ref: [https://insights.stackoverflow.com/survey/2019?fbclid=IwAR0njf6xPP3uxisQ\\_Dfl8sOILZxnd9fkMEvtWDcdw6BsunI47fZ-5CWe4GE](https://insights.stackoverflow.com/survey/2019?fbclid=IwAR0njf6xPP3uxisQ_Dfl8sOILZxnd9fkMEvtWDcdw6BsunI47fZ-5CWe4GE)

# Landscape of the world now

- Stackoverflow 2019

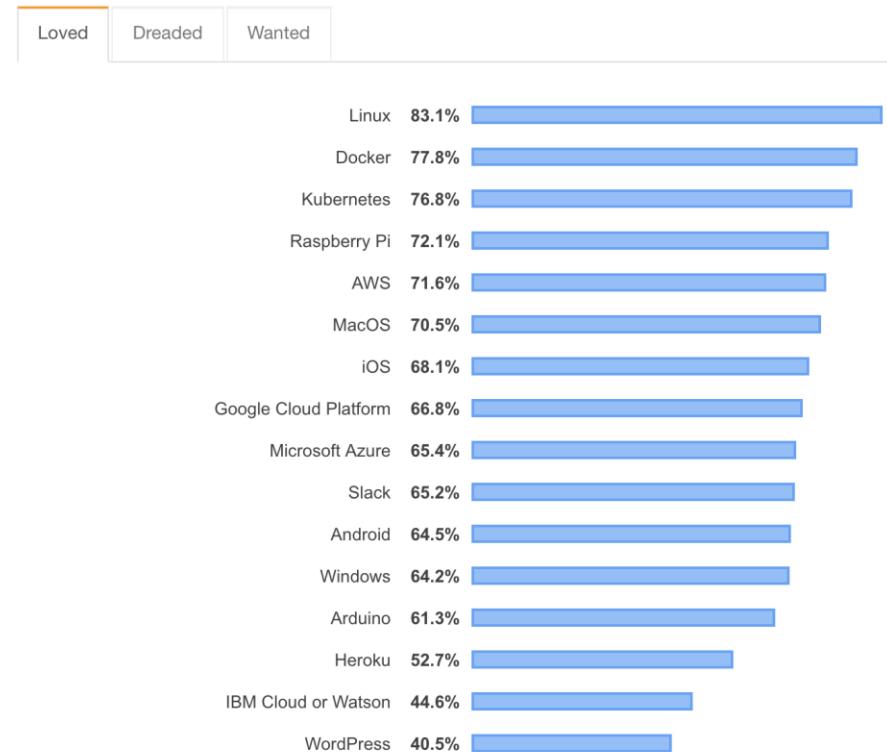
Most Loved, Dreaded, and Wanted Platforms



% of developers who are not developing with the language or technology but have expressed interest in developing with it

Ref: [https://insights.stackoverflow.com/survey/2019?fbclid=IwAR0njf6xPP3uxisQ\\_Dfl8sOILZxnd9fkMEvtWDcdw6BsunI47fZ-5CWe4GE](https://insights.stackoverflow.com/survey/2019?fbclid=IwAR0njf6xPP3uxisQ_Dfl8sOILZxnd9fkMEvtWDcdw6BsunI47fZ-5CWe4GE)

Most Loved, Dreaded, and Wanted Platforms



% of developers who are developing with the language or technology and have expressed interest in continuing to develop with it



# Landscape of the world now



SOLUTIONS PRODUCTS CUSTOMERS SERVICES COMMUNITY PARTNERS COMPANY

EN ▾



PRESS RELEASE

## F5 Completes Acquisition of NGINX

PUBLISHED MAY 09, 2019

SEATTLE – F5 Networks (NASDAQ: FFIV), the global leader in multi-cloud application services, announced today that it has completed the acquisition of [NGINX](#), an open source leader in application delivery. On March 11, 2019, F5 announced that it had entered into an agreement to acquire NGINX.

### PRESS CONTACTS

**Nathan Misner**  
Sr. Director of Global Communications  
F5 Networks  
(206) 272-7494  
[n.misner@F5.com](mailto:n.misner@F5.com)

**Suzanne DuLong**  
VP, Investor Relations  
F5 Networks  
(206) 272-7049

The combined company will enable multi-cloud application services across all environments, providing the ease-of-use and flexibility developers require while also delivering the scale, security, reliability and enterprise readiness network operations teams demand. Visit [F5.com/nginx](https://F5.com/nginx) for more details.

Additional perspective on the acquisition can be found in blog posts from F5 and NGINX leadership:

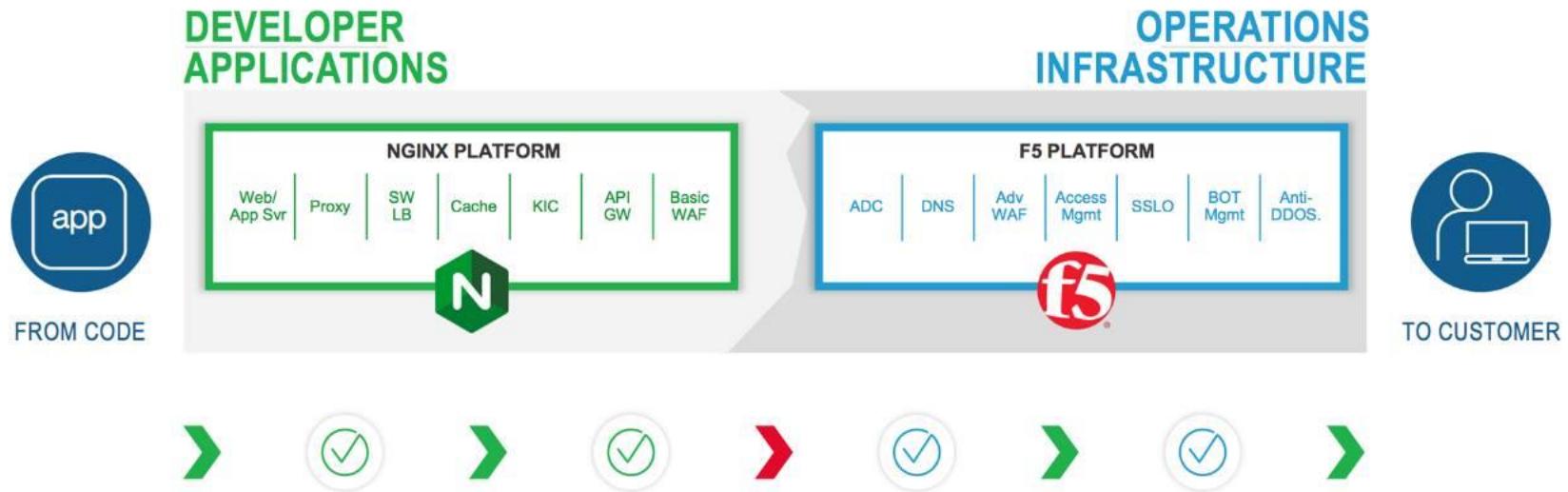
- [NGINX Is Now Officially Part of F5](#)
- [F5 and NGINX: Bridging the Divide](#)
- [Open Letter from François Louchard Announcing NGINX Acquisition](#)
- [NGINX to Join F5: Proud to Finish One Chapter and Excited to Start the Next](#)

Seamless development on cloud with K8S



**kubernetes**  
by Google

# Landscape of the world now



Seamless development on cloud with K8S

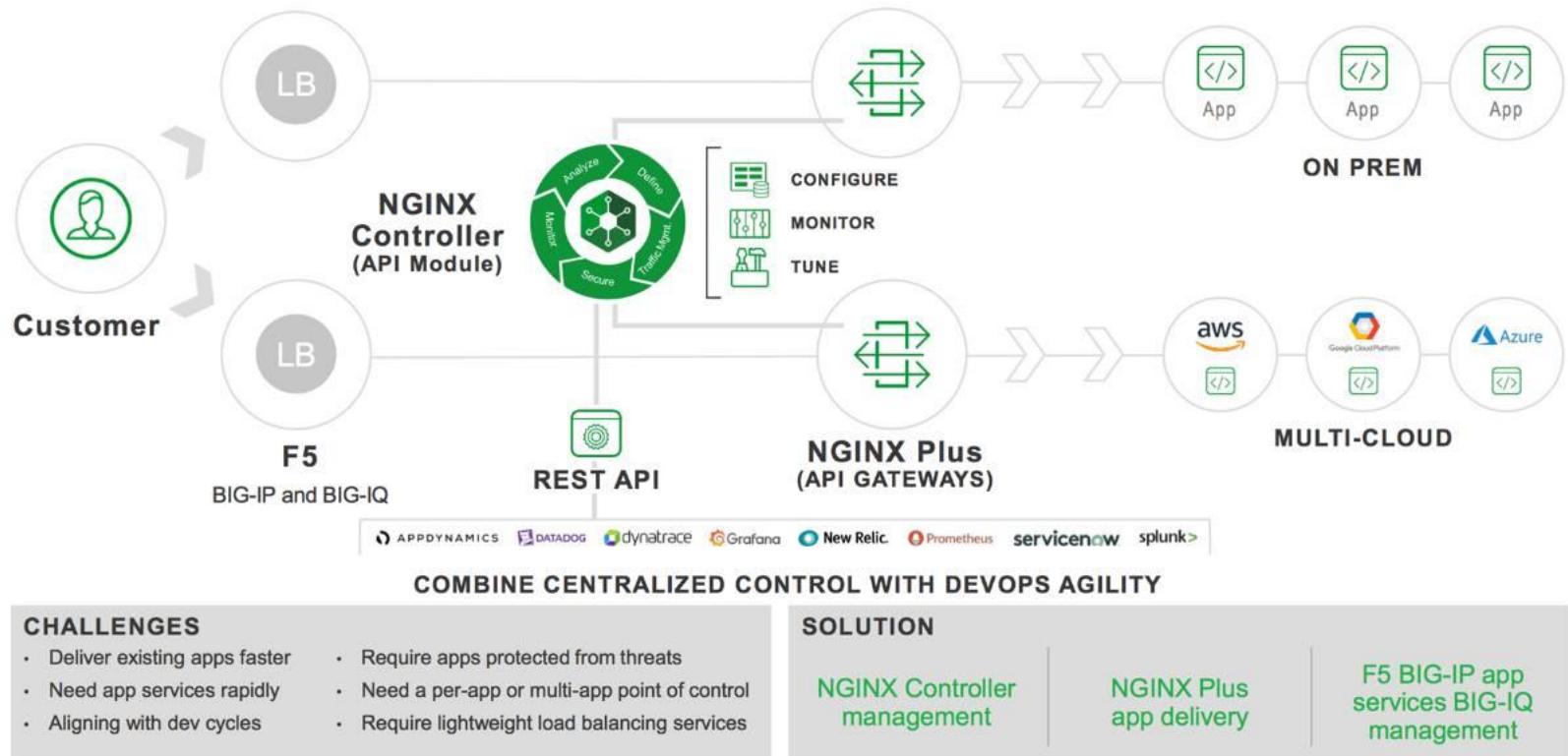


**kubernetes**  
by Google

# Landscape of the world now

## API Management

A LIGHTWEIGHT SOLUTION FOR END-TO-END API LIFECYCLE MANAGEMENT



25 | ©2019 F5 NETWORKS

Seamless development on cloud with K8S



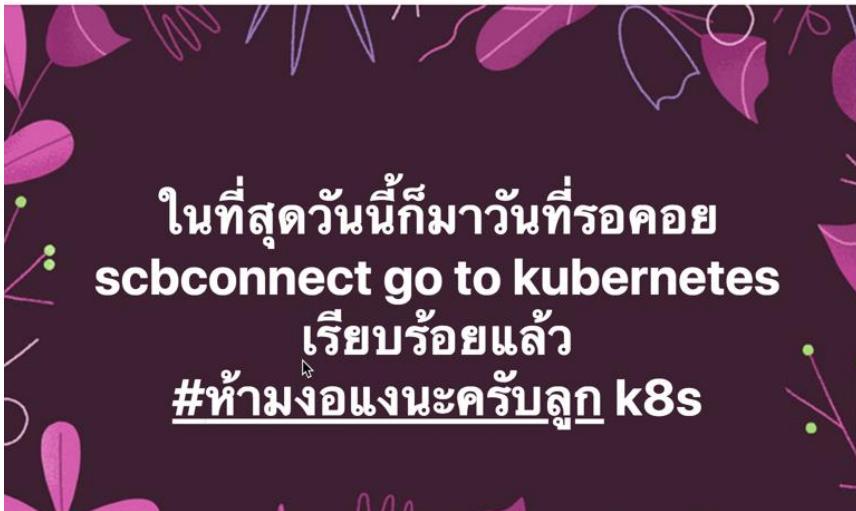
kubernetes  
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# Landscape of the world now



Zippyzippys Chantaban

July 21 at 4:30 AM ·



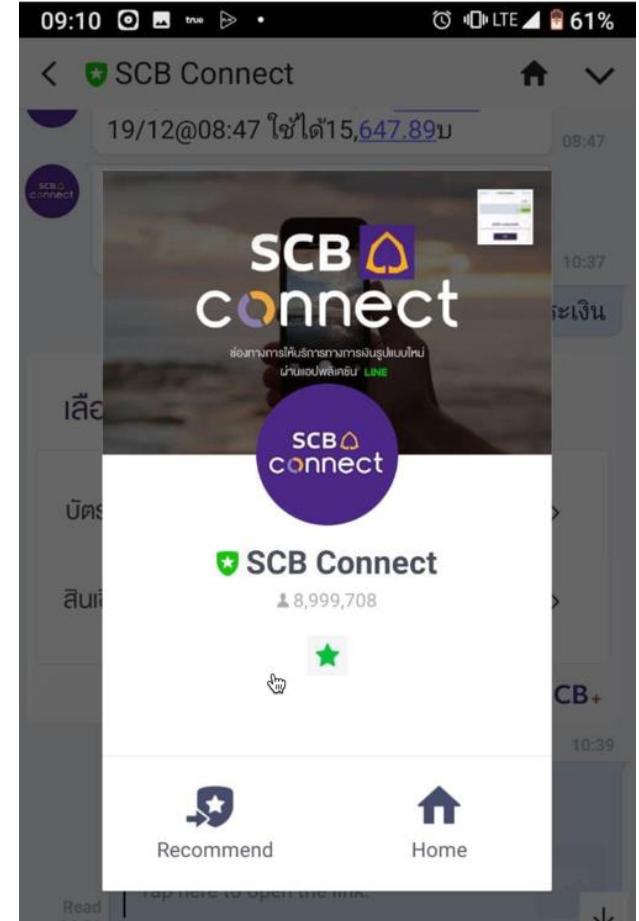
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Zippyzippys Chantaban

21 mins ·

มีความภูมิใจกับ kubernetes ที่ทำกันมาสามารถรองรับ user ได้มาก many ตีโจງๆๆ



kubernetes  
by Google

# 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.

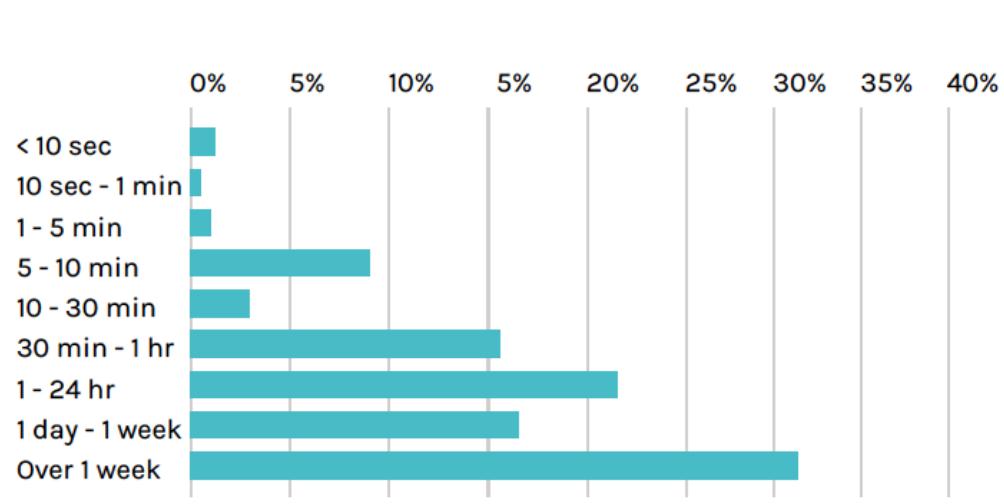
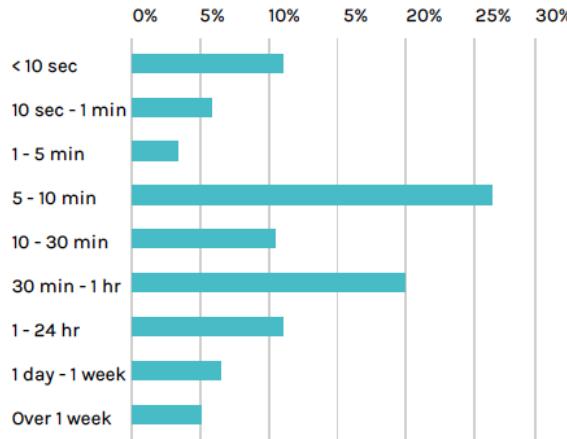
2. Docker Enterprise Edition, featuring the Universal Control Plane (UCP) has simplified many operational aspects of getting started with Swarm. Since Docker's Kubernetes tie-in came late in 2017, any change in adoption in our customer base from Swarm to Kubernetes might be still forthcoming.



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

# Ultimate goals is application

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

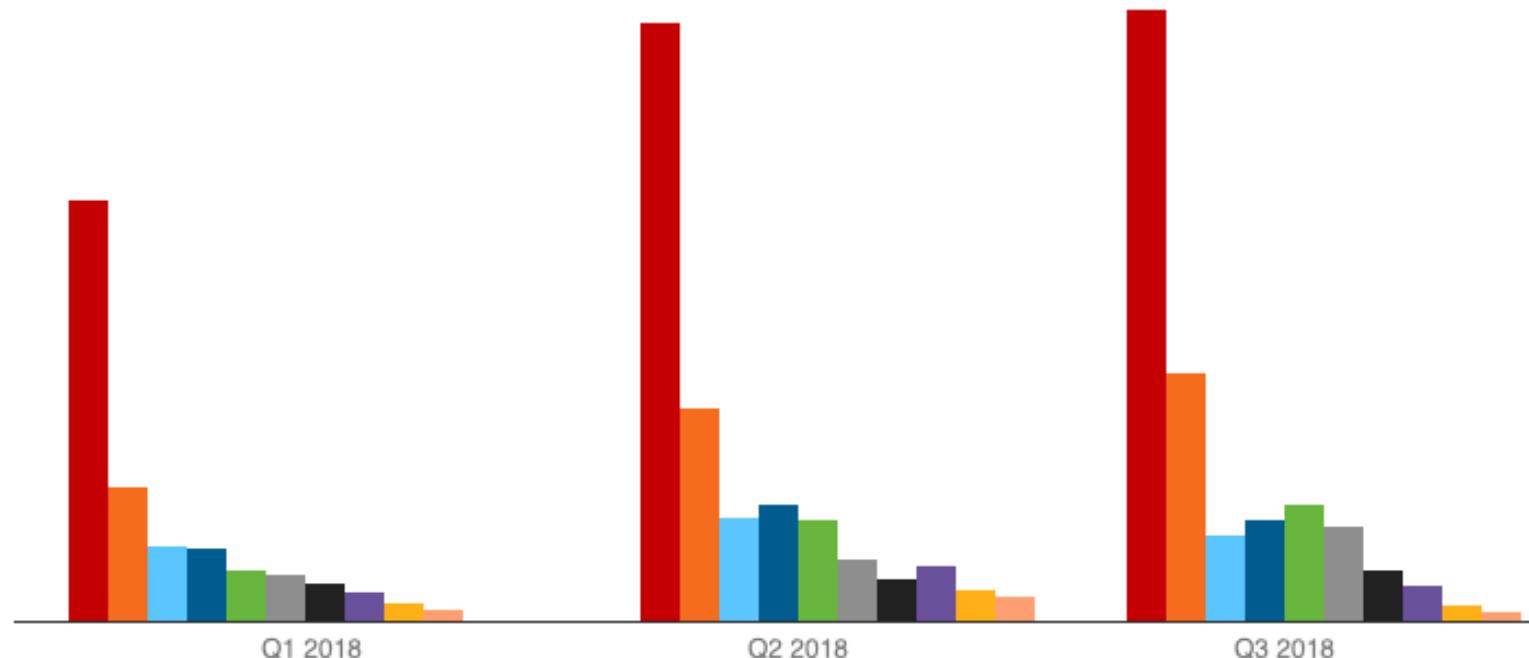


# Landscape of the world now

## 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%



# Container Principle

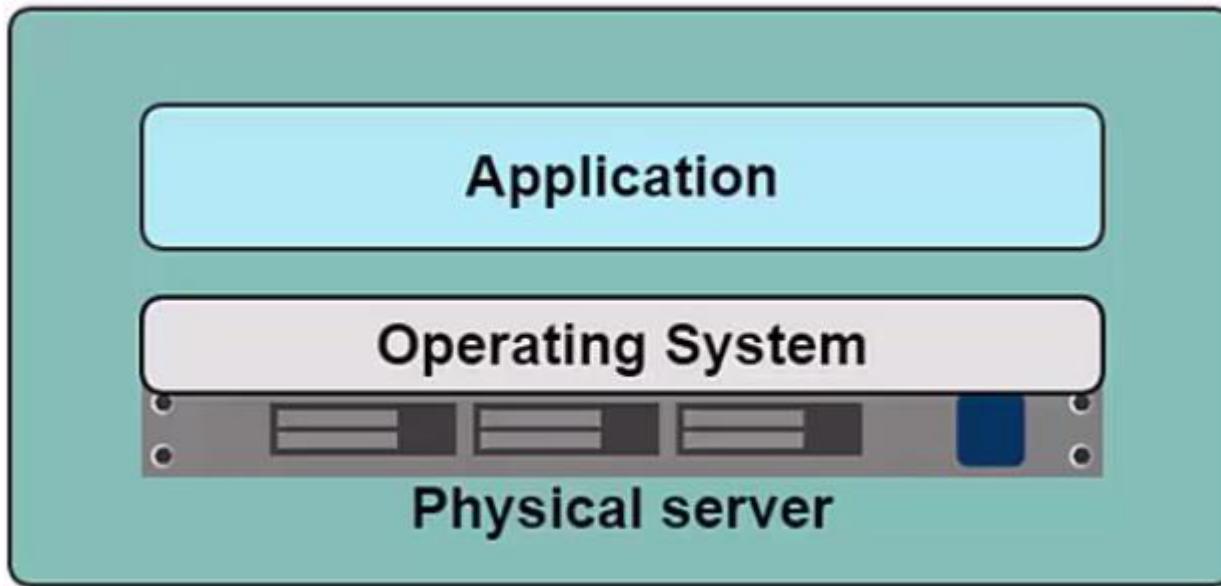


Kubernetes: Production Workload Orchestration



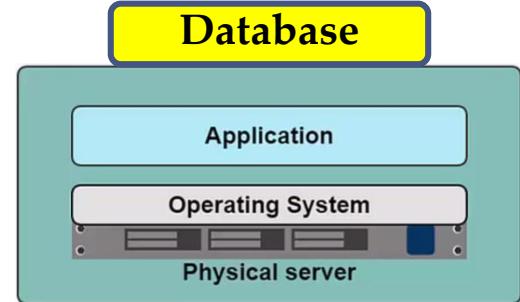
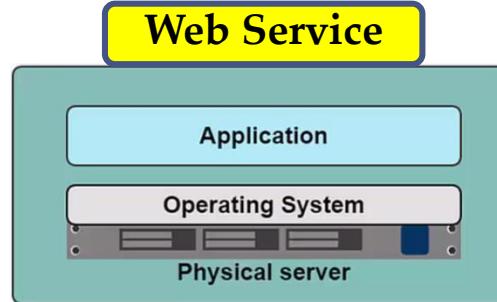
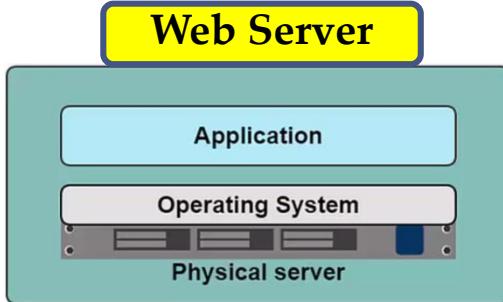
**kubernetes**  
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# Container Principle



# Existing Technology

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



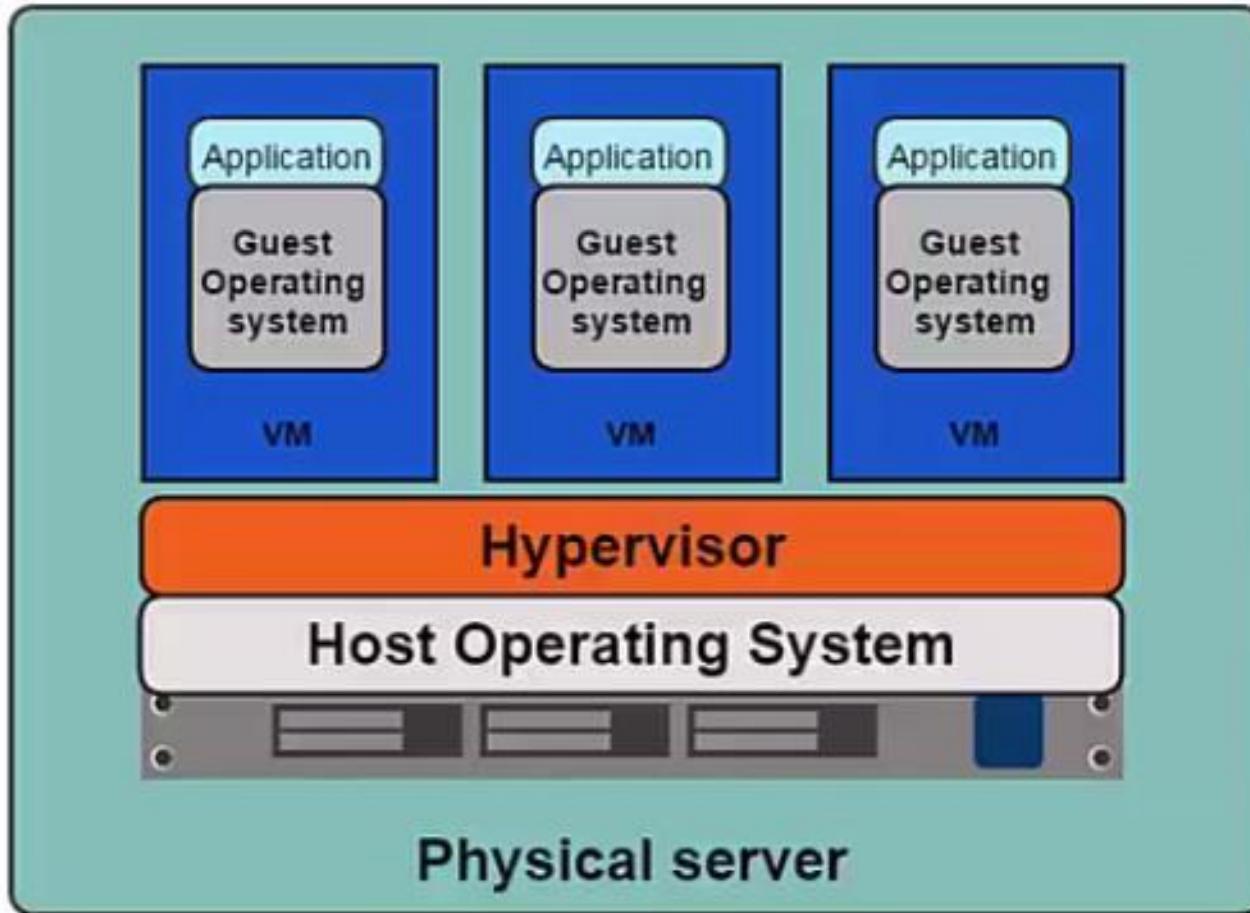
- Apache 2.20 Web Server
- PHP 5.5 Engine
- Laravel 4.1 Framework

- 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



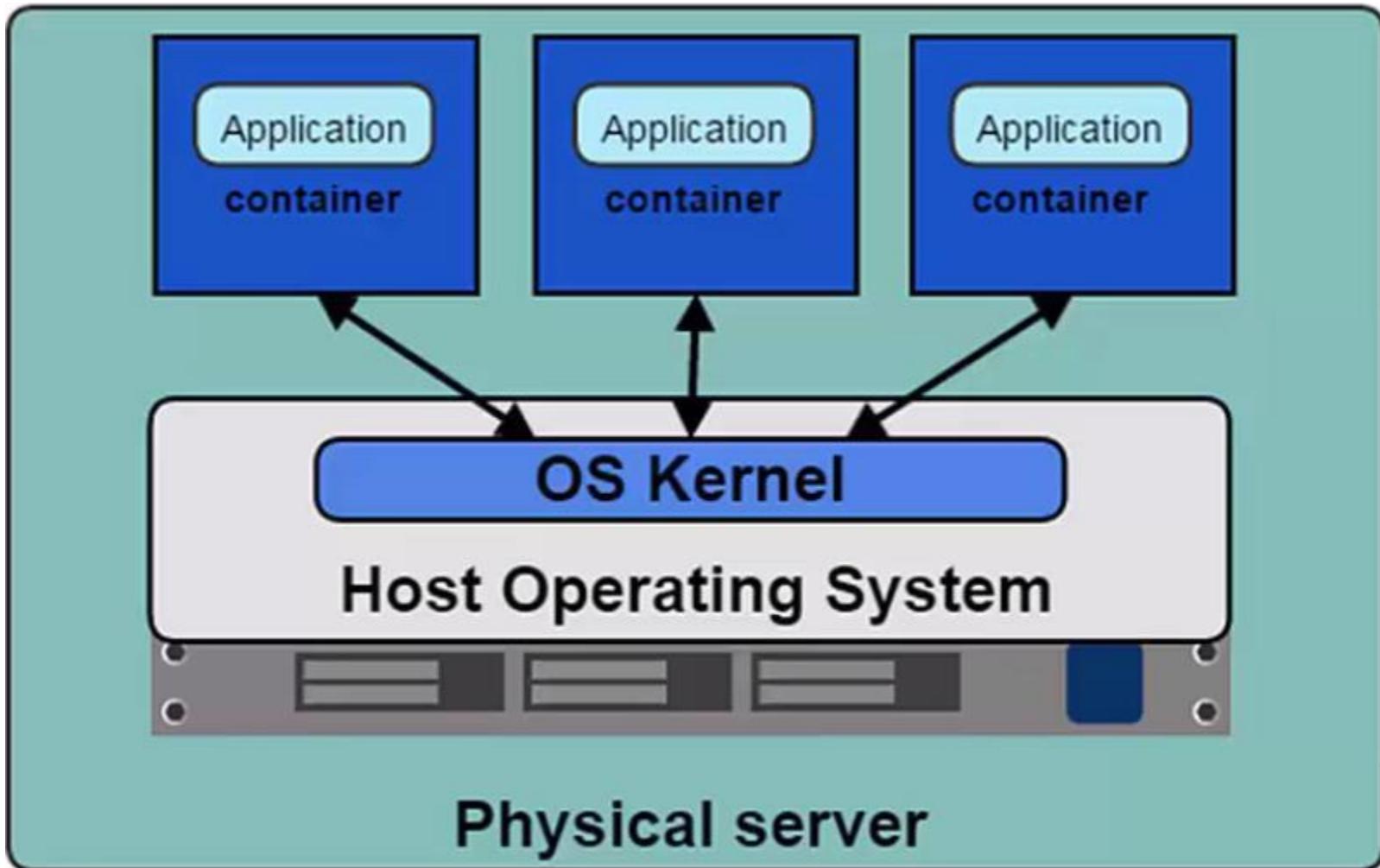
- Apache 2.20 Web Server
- PHP 5.5 Engine
- Laravel 4.1 Framework

- 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

The screenshot shows the official website for rkt. At the top is a dark blue header with the rkt logo and the text "A security-minded, standards-based container engine". Below the header are three navigation links: "Overview" (selected), "Documentation", and "GitHub Project". The main content area has a light gray background. On the left, there's a section titled "Overview" with text about rkt's purpose and architecture. To the right, there's a sidebar with "THE LATEST ON RKT" containing two bullet points, 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 landing page with a large blue Kubernetes logo and the text "Play with Kubernetes". It includes a "Login" button and a note about the project being a sandbox environment. On the right is a session details page for a session named "b9moh1td\_b9moh35duh0g00e4ugeg". It displays session statistics: IP 192.168.0.18, Memory 0.77% (30.64MiB / 3.906GiB), and GPU 0.19%. Below this is a terminal window showing a "WARNING!!!!" message about using personal credentials in a sandbox. It then provides instructions for bootstrapping a cluster, including commands like "kubeadm init --apiserver-advertise-address \$(hostname -i)" and "kubectl apply -n kube-system -f \ "https://cloud.weave.works/k8s/net?k8s-version=\$(kubectl version | base64 | tr -d '\n')\"", followed by an optional nginx deployment command.



# 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 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

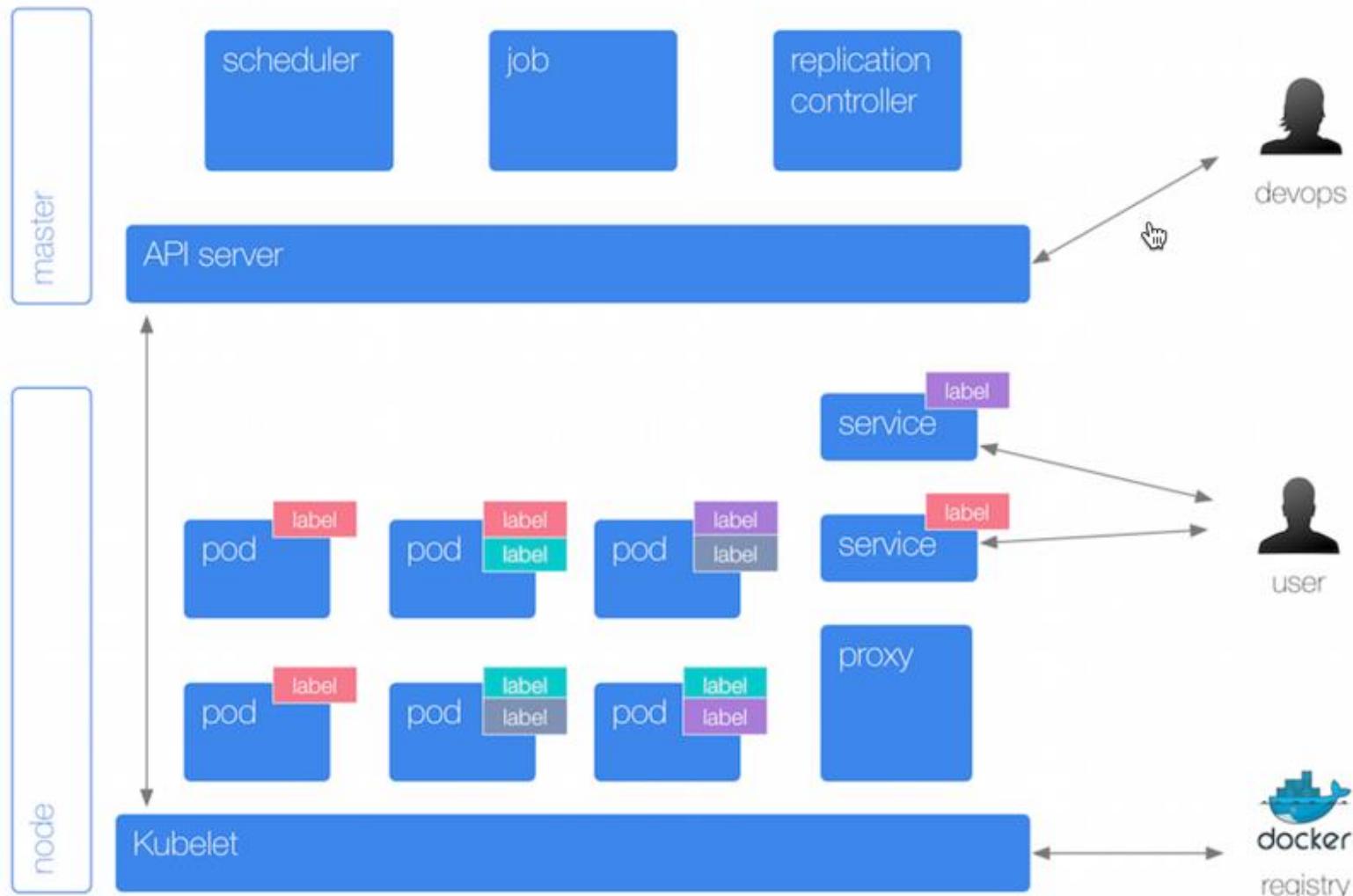


Kubernetes: Production Workload Orchestration



**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%)

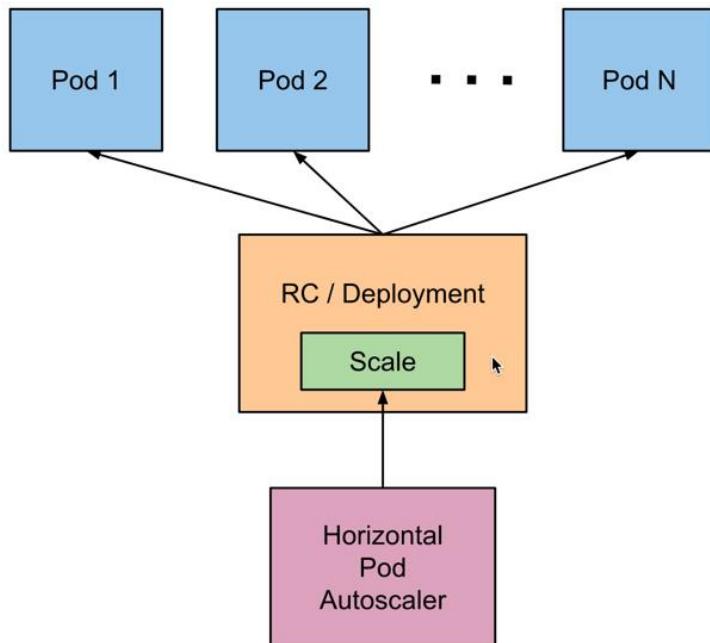
  

Allocated resources:					
(Total limits may be over 100 percent, i.e., overcommitted.)					
CPU Requests	CPU Limits	Memory Requests	Memory Limits		
265m (13%)	0 (0%)	160Mi (8%)	170Mi (8%)		
Events:	<none>				



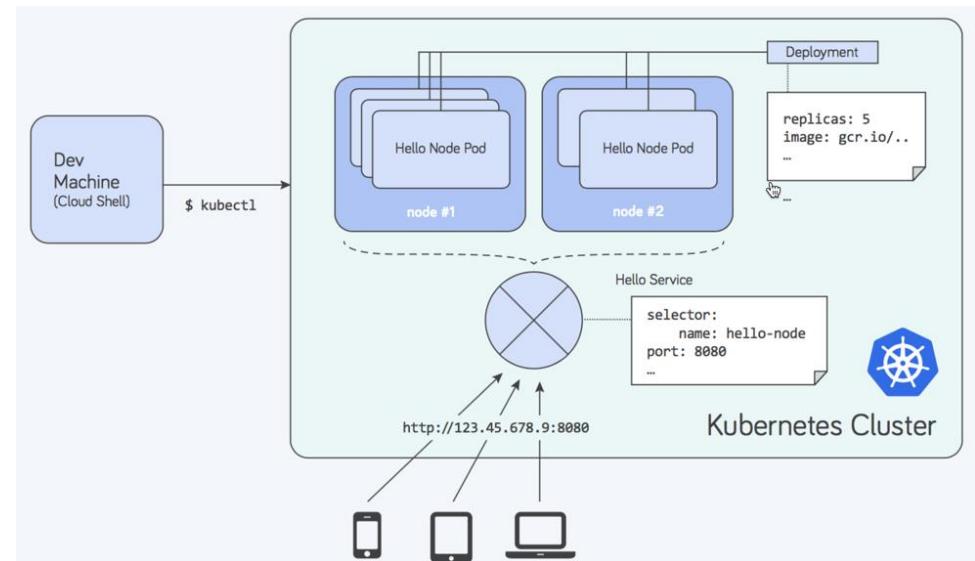
# Introduction to Kubernetes

- 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)



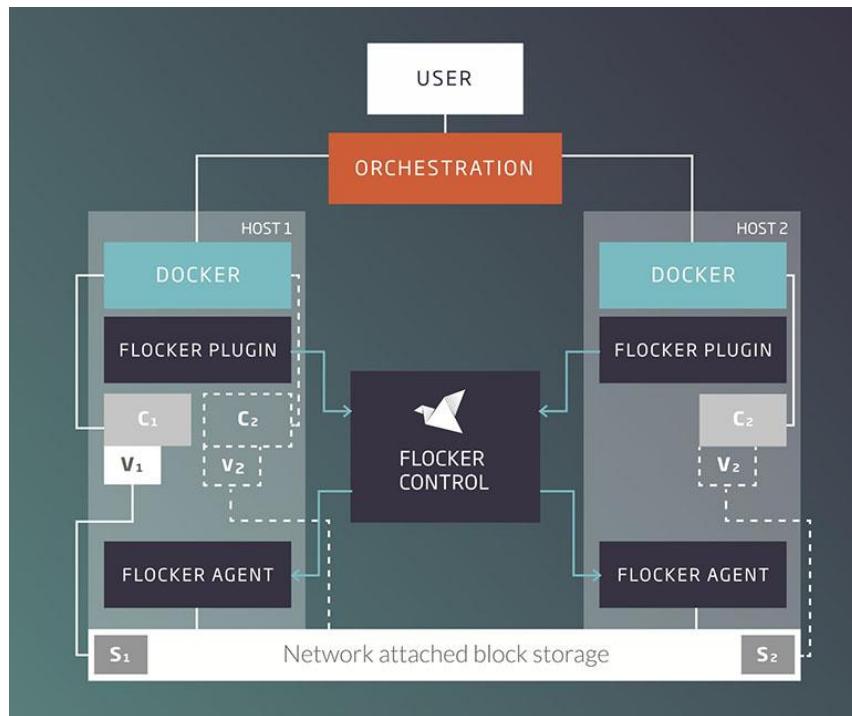
# Introduction to Kubernetes

- 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)



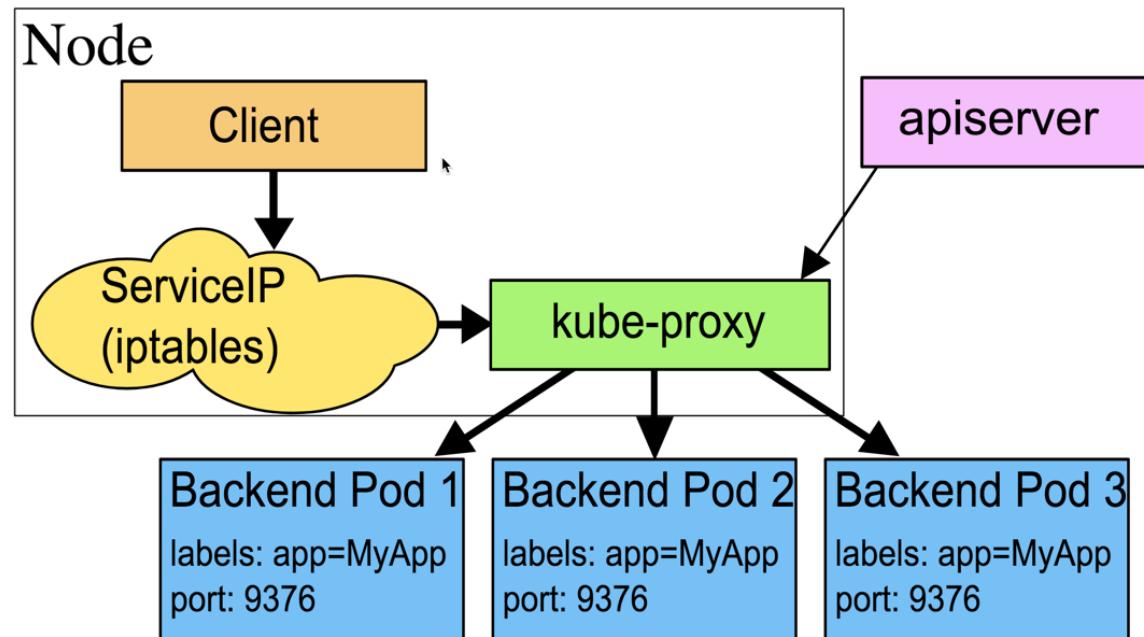
# Introduction to Kubernetes

- 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>

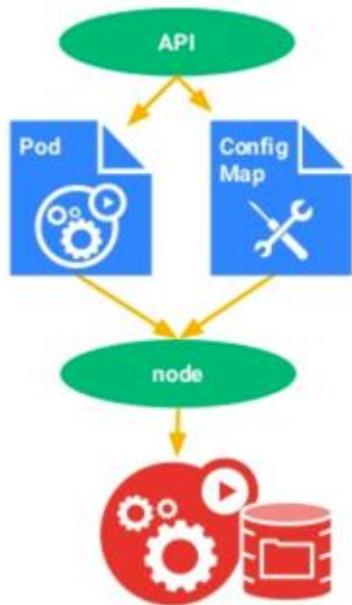
Type:         Opaque

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

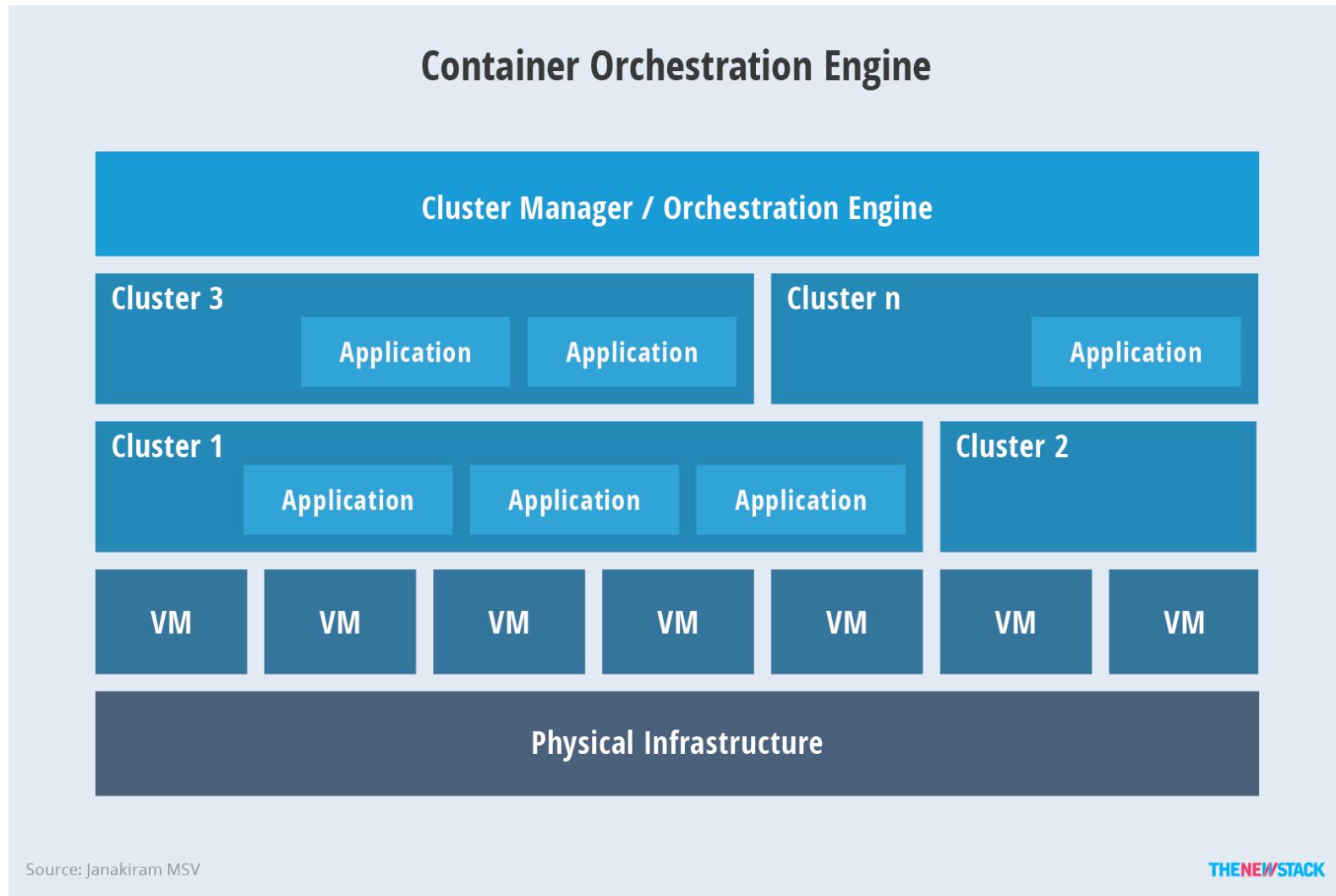


Kubernetes: Production Workload Orchestration



**kubernetes**  
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# System Architecture



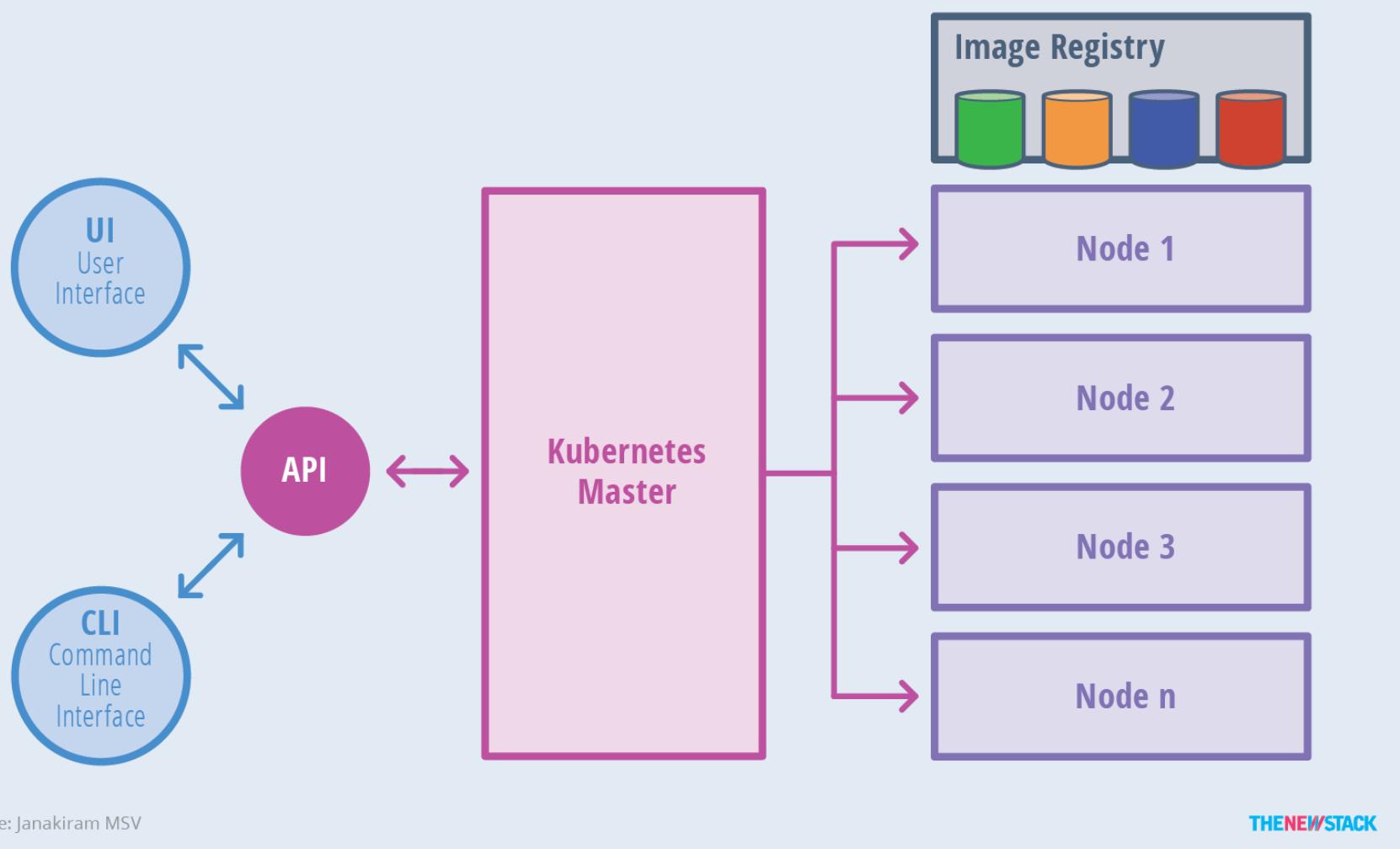
Ref: [https://cdn.thenewstack.io/media/2016/11/Chart\\_02\\_Kubernetes-Architecture.png](https://cdn.thenewstack.io/media/2016/11/Chart_02_Kubernetes-Architecture.png)

Kubernetes: Production Workload Orchestration



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# System Architecture



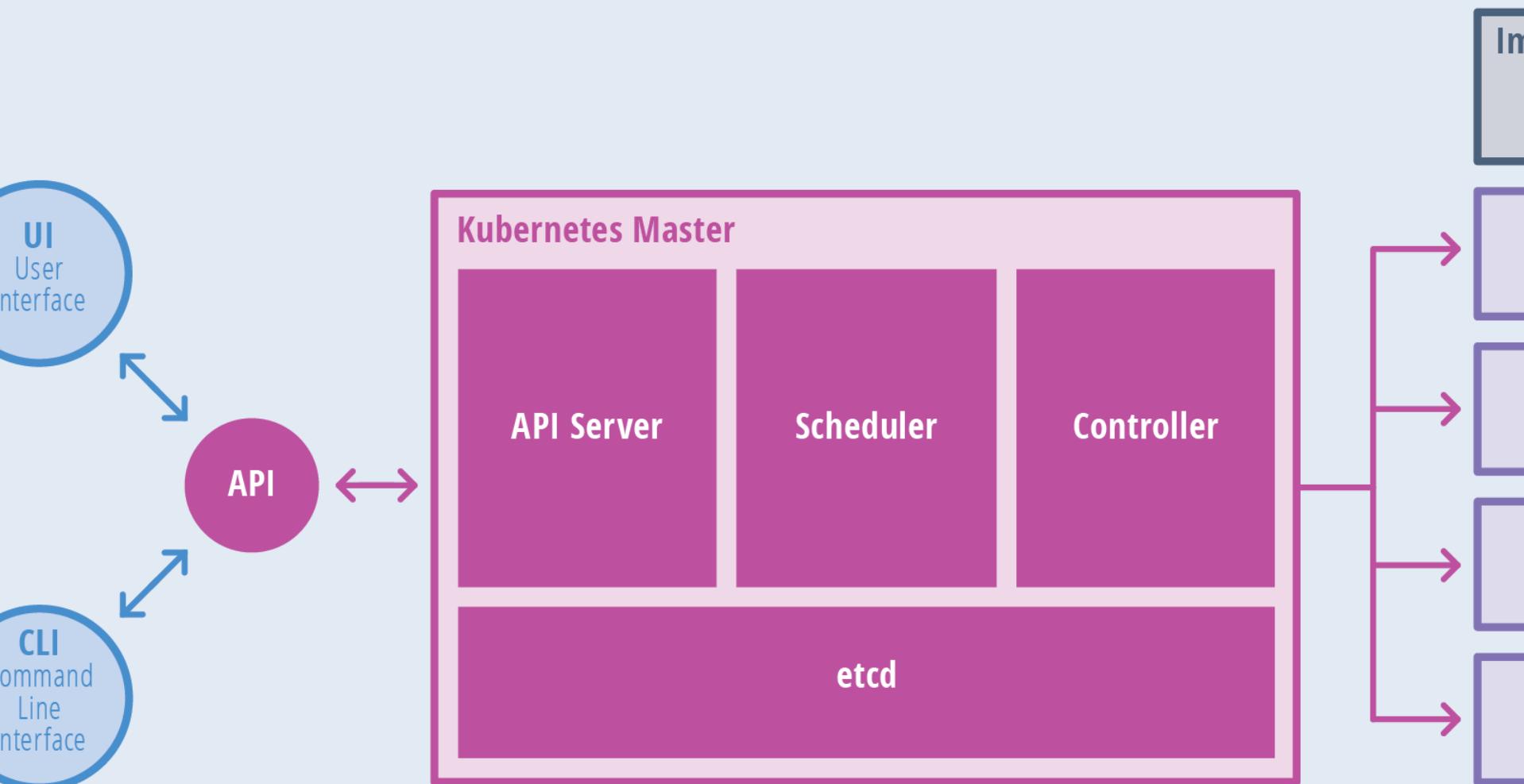
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Kubernetes: Production Workload Orchestration



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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



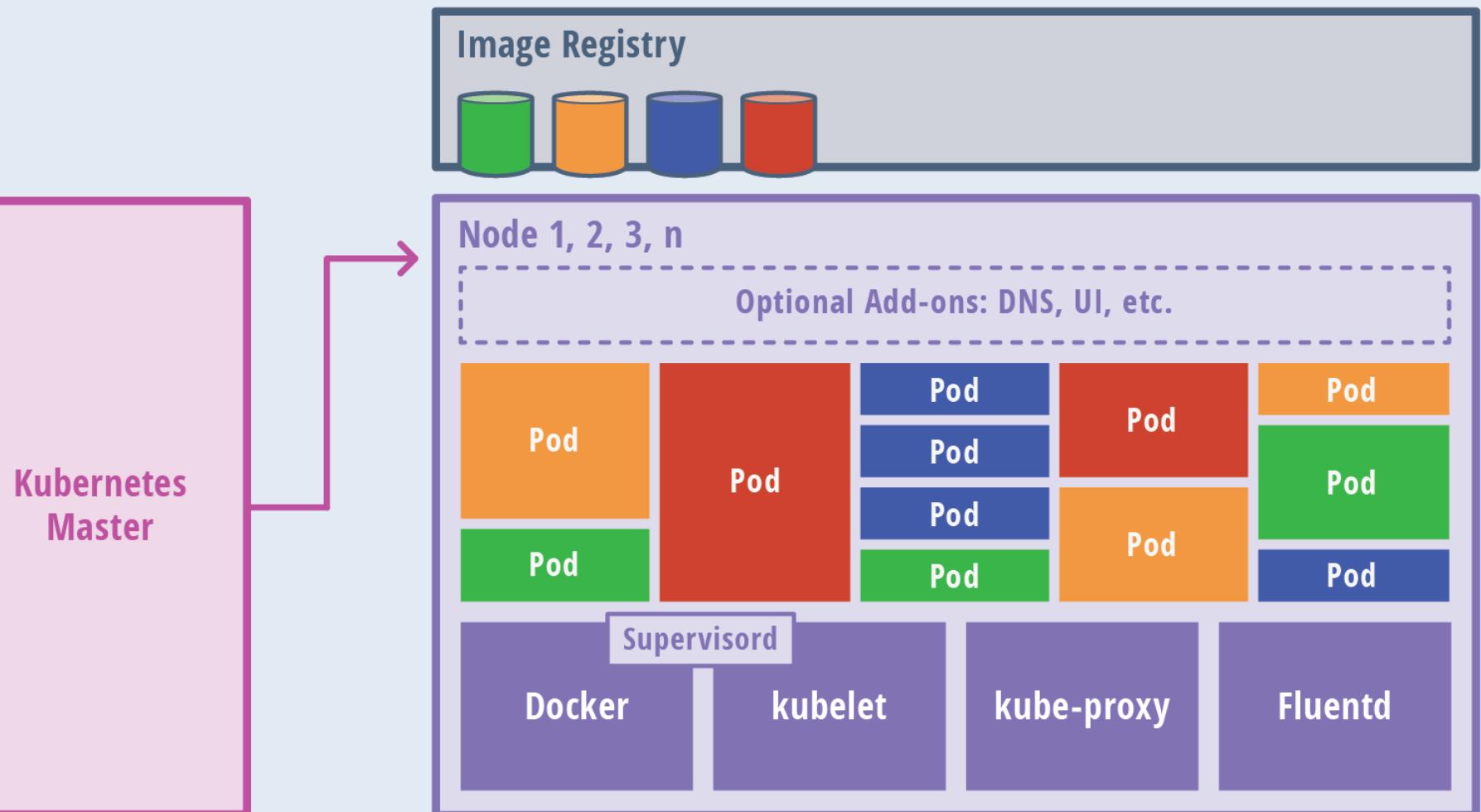
kubernetes  
by Google

# 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



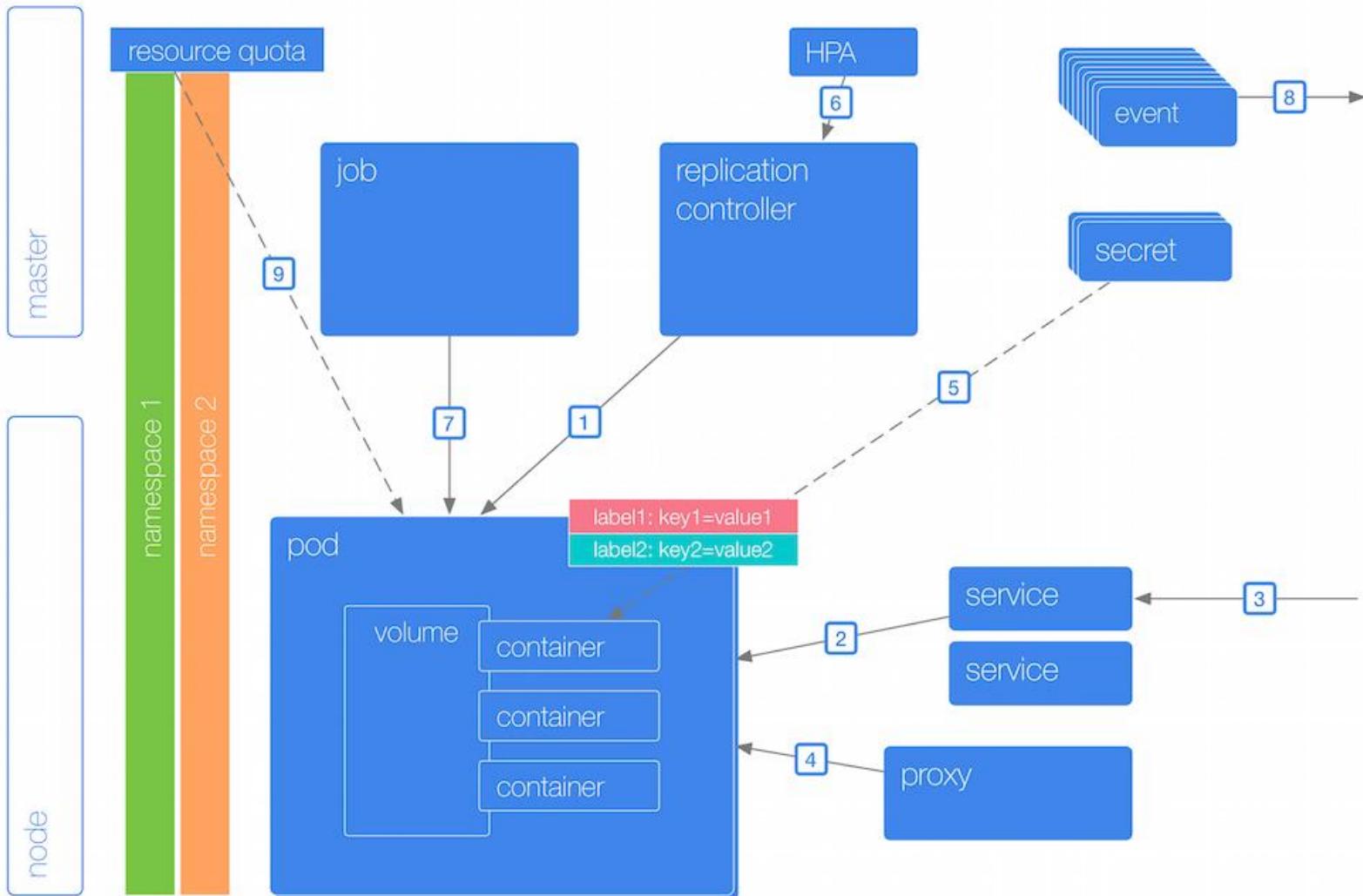
**kubernetes**  
by Google

# 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



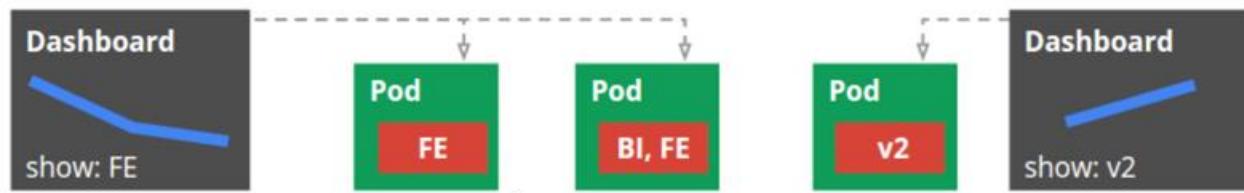
Ref: <http://k8s.info/cs.html>

Kubernetes: Production Workload Orchestration



**kubernetes**  
by Google

# 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



**kubernetes**  
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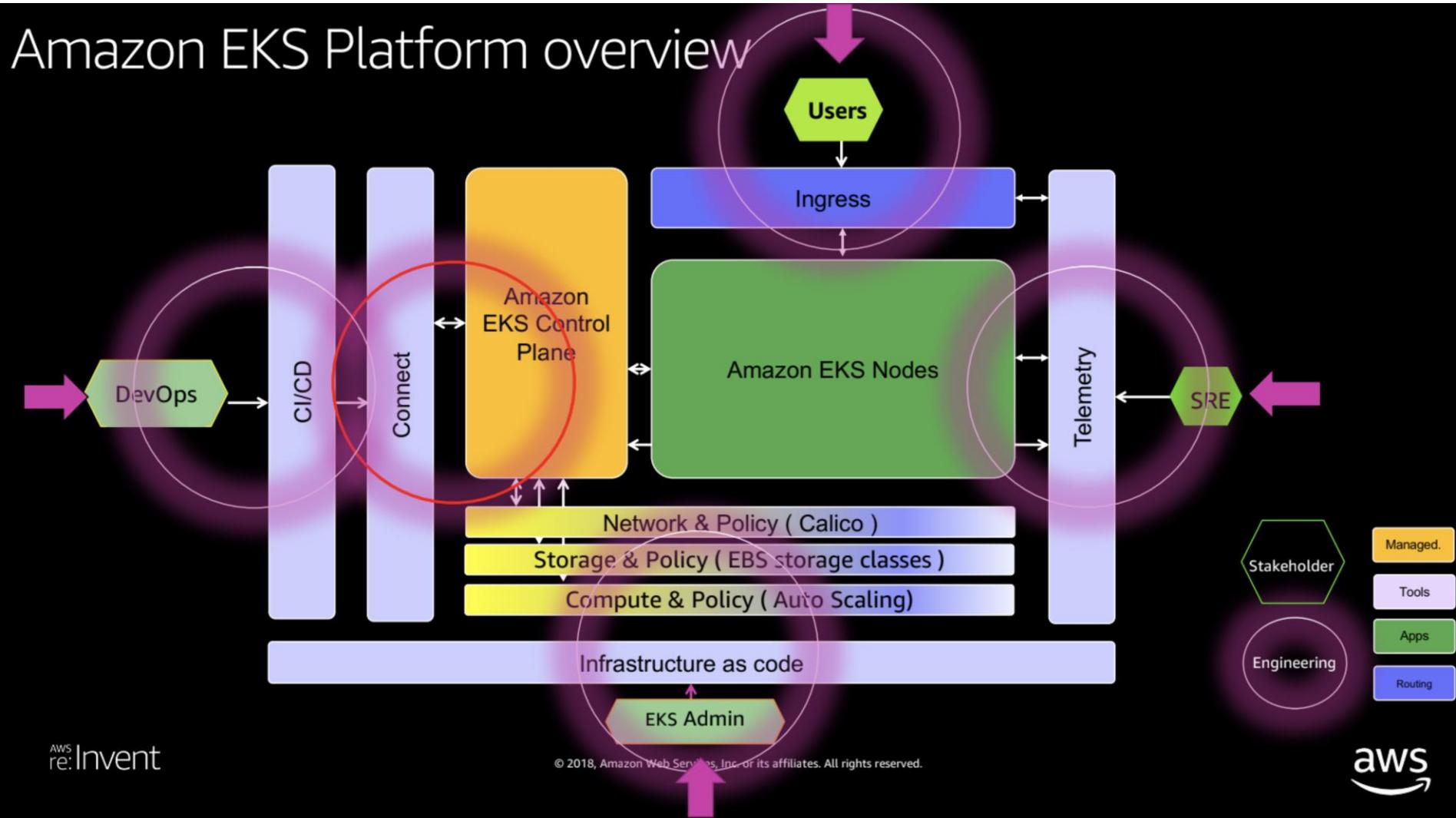
# System Architecture

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

## Amazon EKS Platform overview



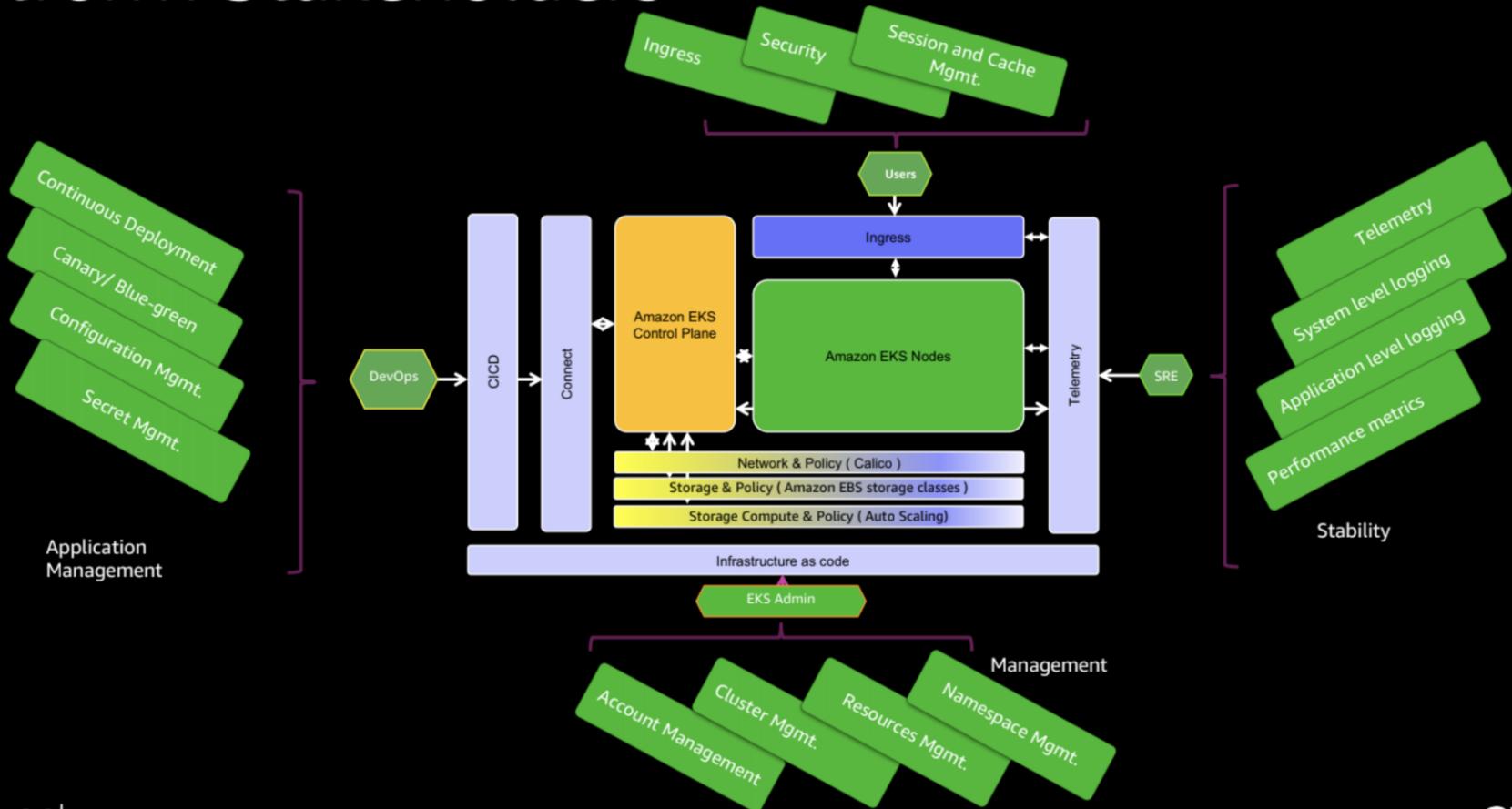
# Kubernetes: Production Workload Orchestration



kubernetes  
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# System Architecture

## Platform Stakeholders



aws re:Invent



Kubernetes: Production Workload Orchestration



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# System Architecture



The screenshot shows the DevOps.com homepage. At the top is a red header with the DevOps.com logo and the tagline "WHERE THE WORLD MEETS DEVOPS". Below the header is a navigation bar with links for LATEST, CHAT, WEBINARS, LIBRARY, EVENTS, RELATED SITES, and categories like AI, CLOUD, CONTINUOUS DELIVERY, CONTINUOUS TESTING, DEVSECOPS, LEADERSHIP SUITE, and PRACTICE. A sidebar on the right features a brain graphic and the text "Take th Join the".

[Home](#) » [Blogs](#) » [ROELBOB](#) » Mastering Kubernetes



## Mastering Kubernetes

 BY ROELBOB ON MAY 3, 2019 — 0 COMMENTS

Kubernetes: Production Workload Orchestration



**kubernetes**  
by Google

# Fundamental of Kubernetes



Kubernetes: Production Workload Orchestration



**kubernetes**  
by Google

# Pods, Container and Services



Kubernetes: Production Workload Orchestration



**kubernetes**  
by Google

# 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



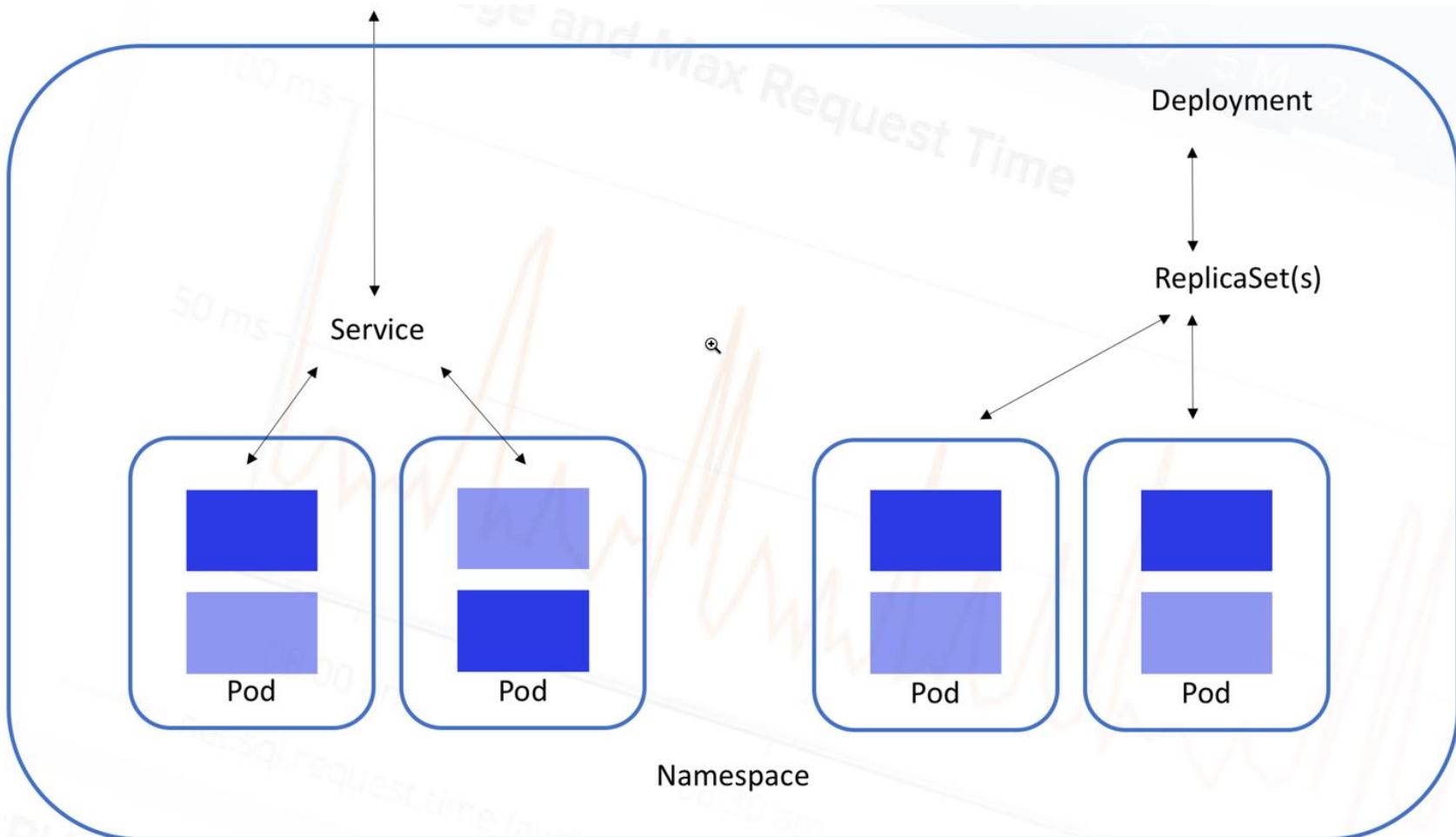
# Pods, Container and Services

- 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>
```

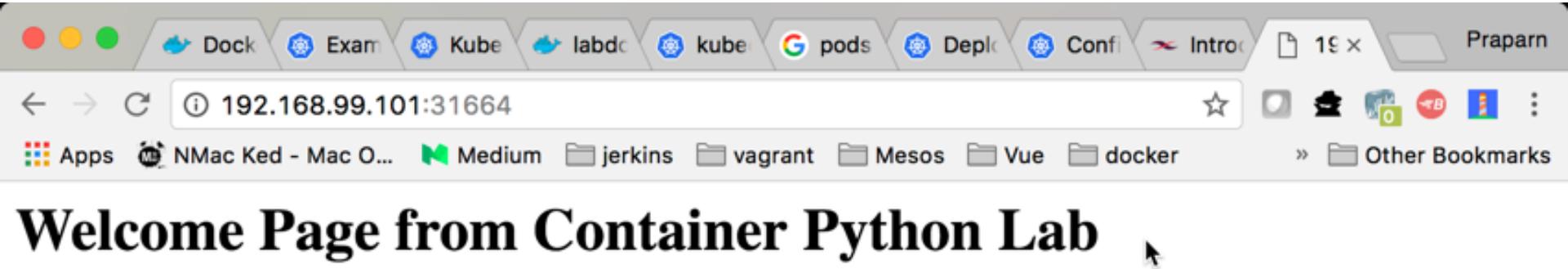
- Option:

- --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

The screenshot shows the Code Beautify YAML Converter interface. On the left, the "YAML Input" section displays a YAML configuration for a Pod named "webtest". The configuration includes metadata like name, labels, owner, version, module, and environment, along with a specification for a container named "webtest" using the image "labdocker/cluster:webservicelite" and exposing port 5000 TCP. A node selector is also defined. In the center, there are conversion buttons for "YAML TO JSON", "YAML TO XML", "YAML TO CSV", and "Validate". Below these buttons is a small advertisement banner with options "Seen this ad multiple times" and "Not interested in this ad". On the right, the "Result : YAML TO JSON" section shows the converted JSON code, which is identical to the YAML input but in JSON syntax.

```
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
```

```
{"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



## Kube YAML

Validating kubernetes objects since 2018

### How to use this webpage

Paste your Kubernetes YAML in the text area below and see which versions it is valid for.

⚠ Please only enter one YAML document at a time, this will not split YAML documents with `---` correctly.

Example 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
```

Validate

1.14 Errors	1.13 Errors	1.12 Errors	1.11 Errors
✓ No errors			



# Pods, Container and Services

- Imperative object configuration

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

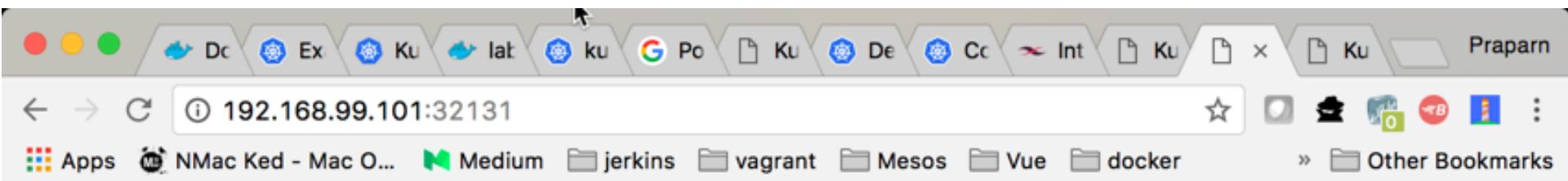
```
praparns-MacBook-Pro:WorkShop_1.2_Pods_Service_Deployment praparn$ ls -lh
total 24
-rw-r--r--@ 1 praparn  staff  550B Jul  2 09:29 instruction.txt
-rw-r--r--@ 1 praparn  staff  321B Jul  2 12:52 webtest_pod.yml
-rw-r--r--@ 1 praparn  staff  393B Jul  2 12:52 webtest_svc.yml
praparns-MacBook-Pro:WorkShop_1.2_Pods_Service_Deployment 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.



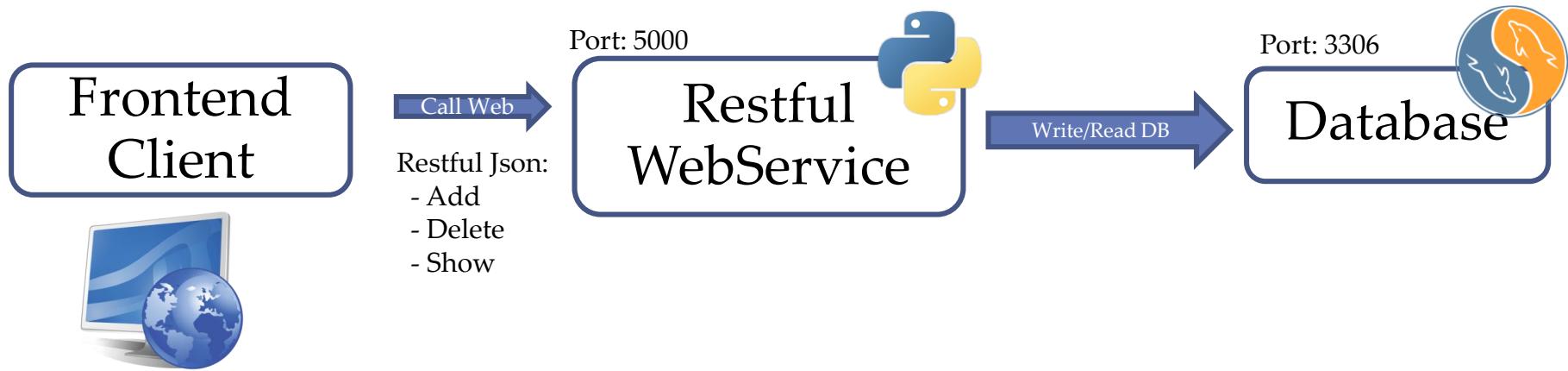
# Workshop 1.2: Pods & Service

- Part 1: Deploy simple web pods with single container



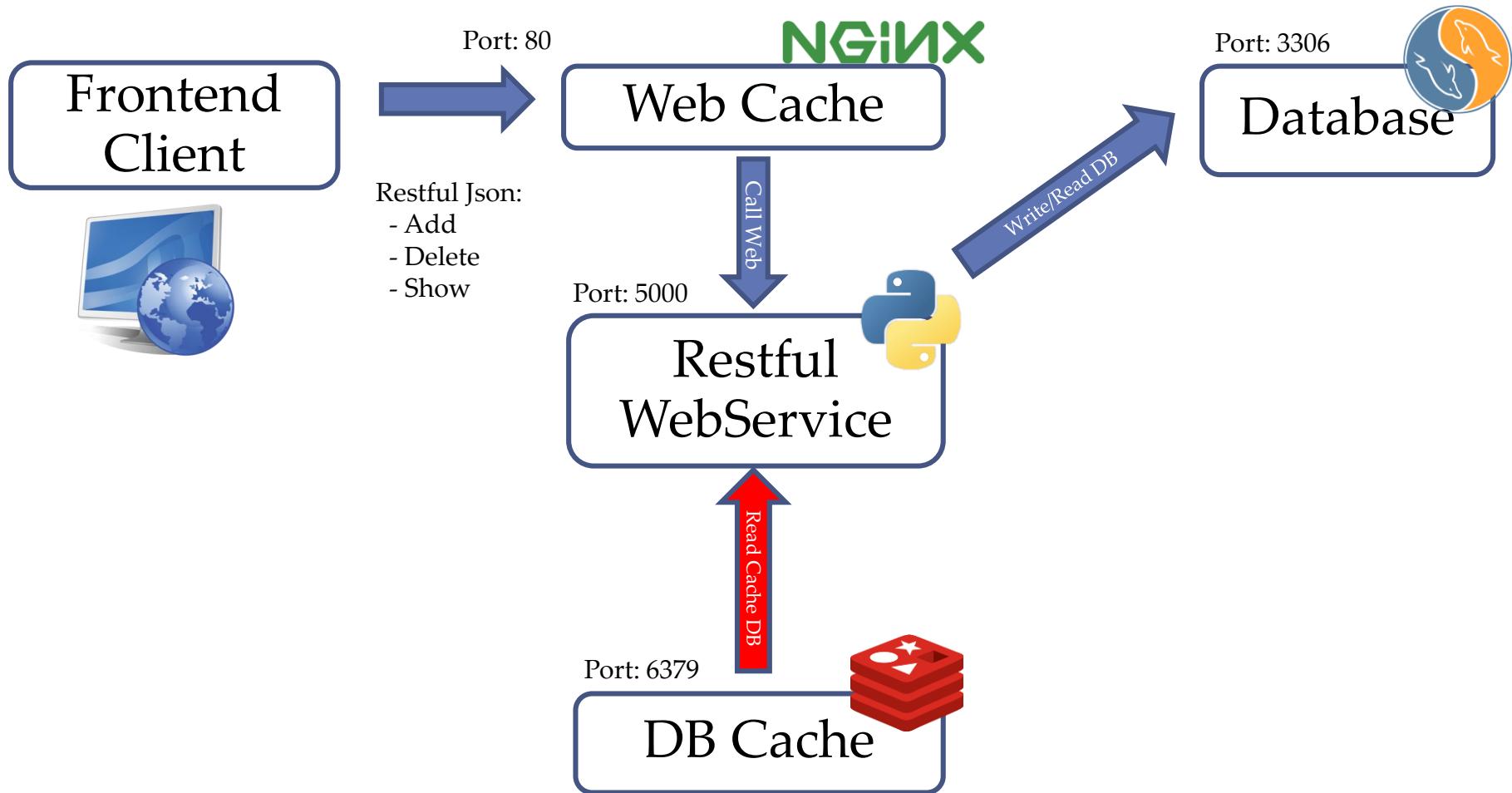
# Pods, Container and Service

- 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

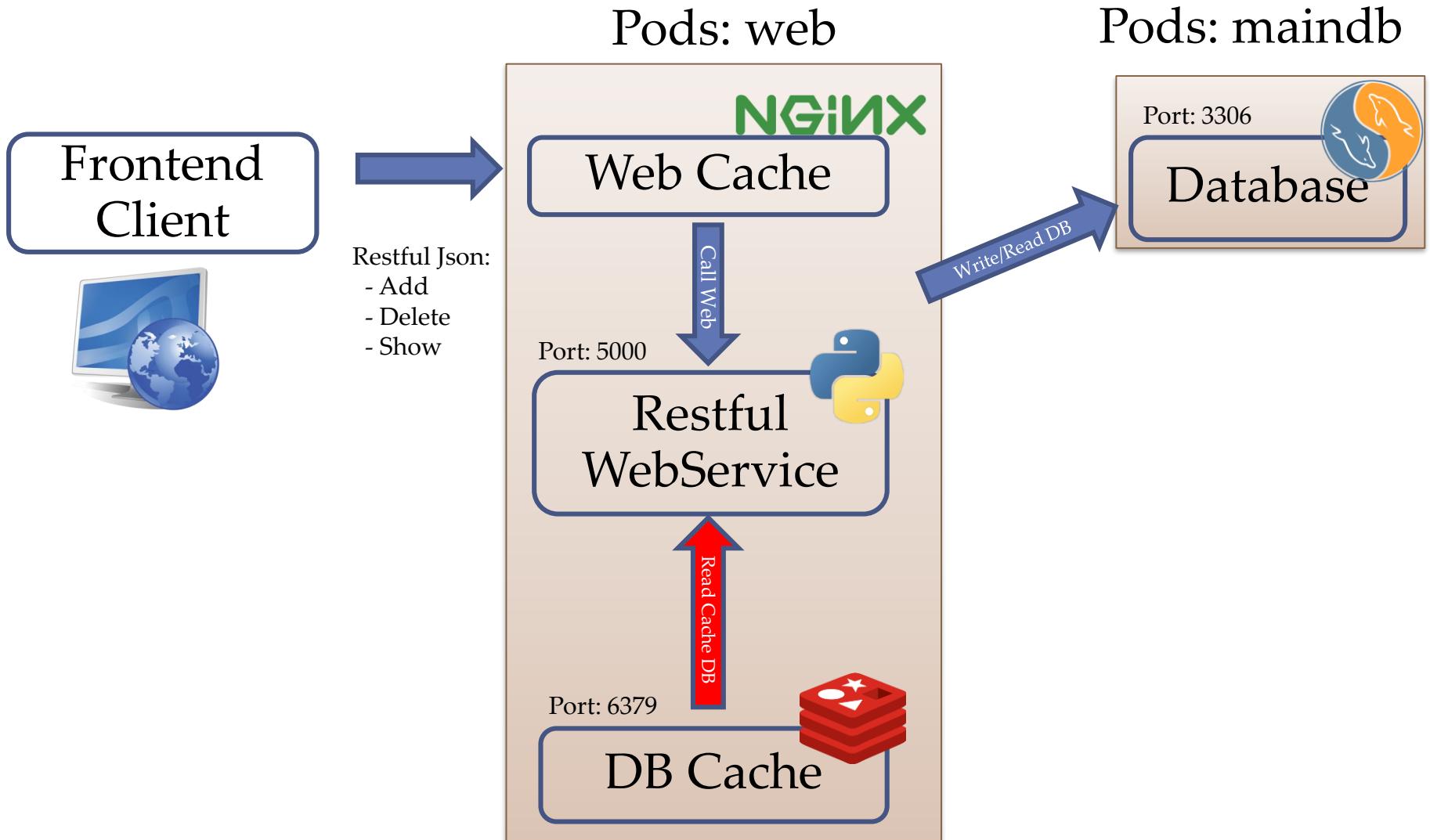
```
praparns-MacBook-Pro:~ paparn$ curl http://$Server_IP:$Server_Port/users/1
Praparn Luangphoonlappraparns-MacBook-Pro:~ paparn$
praparns-MacBook-Pro:~ paparn$ curl http://$Server_IP:$Server_Port/users/1
Praparn Luangphoonlap(Database Cache)praparns-MacBook-Pro:~ paparn$
```

- Delete database

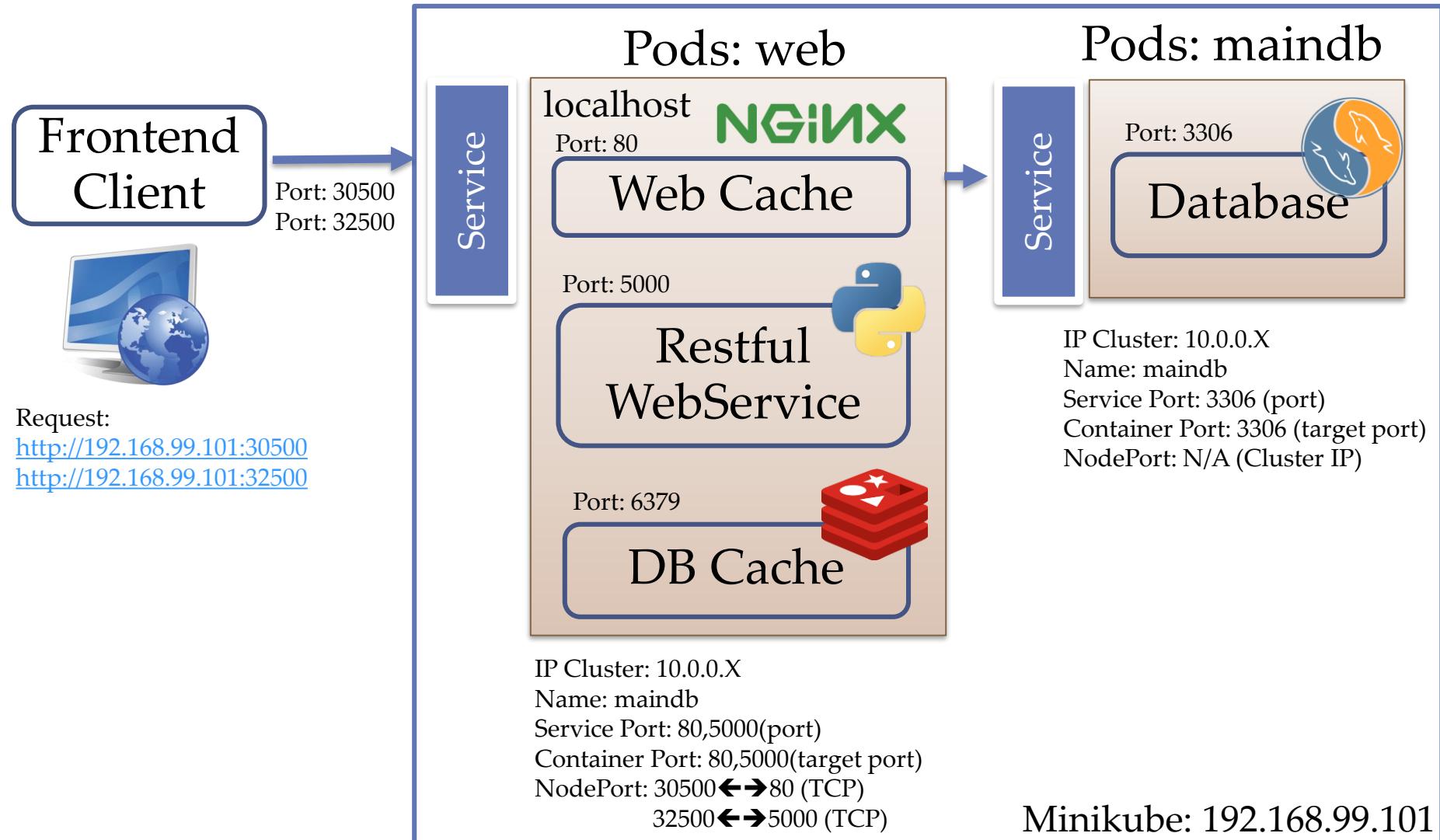
```
praparns-MacBook-Pro:~ paparn$ curl http://$Server_IP:$Server_Port/users/removeuser/1
##### Record was deleted (Both Database Cache) #####praparns-MacBook-Pro:~ paparn$
praparns-MacBook-Pro:~ paparn$ curl http://$Server_IP:$Server_Port/users/removeuser/2
##### Record was deleted #####praparns-MacBook-Pro:~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



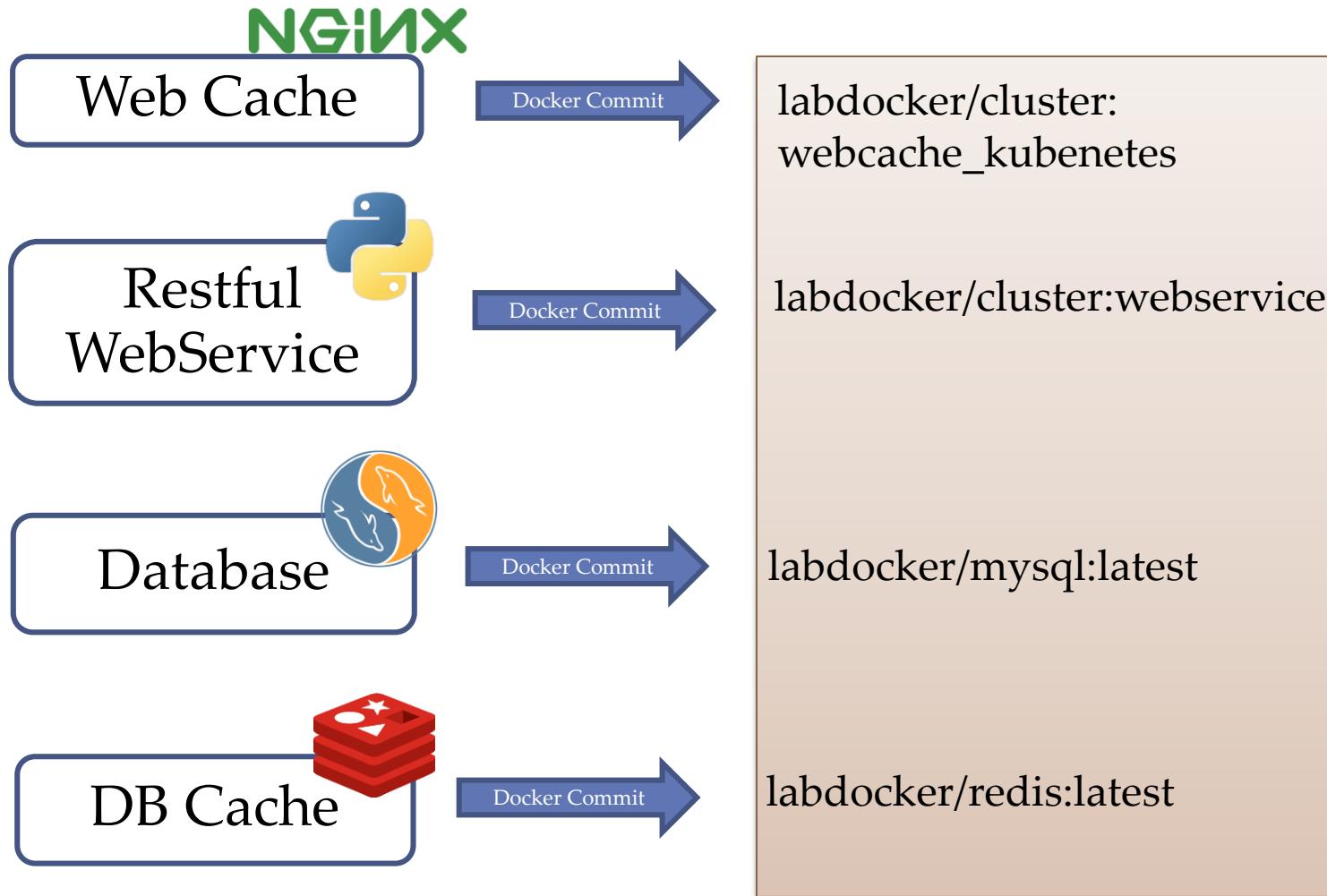
# Pods, Container and Service



# 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"
22
```

- 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"
21
```



# 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
12  spec:
13    containers:
14      - name: cachedb
15        image: labdocker/redis:latest
16        ports:
17          - containerPort: 6379
18            protocol: TCP
19      - name: webservice
20        image: labdocker/cluster:webservicev2
21        env:
22          - name: "REDIS_HOST"
23            value: "localhost"
24        ports:
25          - containerPort: 5000
26            protocol: TCP
27      - name: webcache
28        image: labdocker/cluster:webcache_kubernetes
29        ports:
30          - containerPort: 80
31            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
12  spec:
13    selector:
14      name: "web"
15      owner: "Praparn_L"
16      version: "1.0"
17      module: "web"
18      environment: "development"
19    type: NodePort
20    ports:
21      - port: 5000
22        name: webservice
23        targetPort: 5000
24        protocol: TCP
25        nodePort: 32500
26      - port: 80
27        name: webcache
28        targetPort: 80
29        protocol: TCP
30        nodePort: 30500
```



# Pods, Container and Service

- Create "maindb" Pods and service

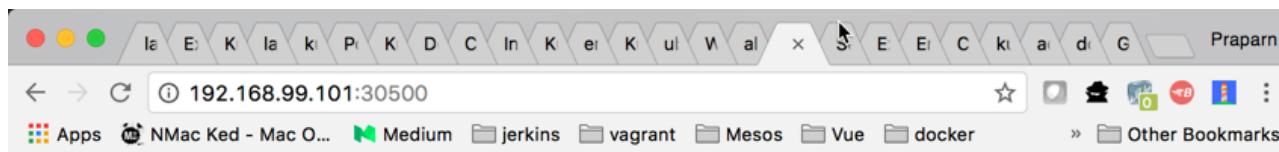
```
[praparns-MacBook-Pro:multicontainer praparn$ kubectl get pods
No resources found.
[praparns-MacBook-Pro:multicontainer praparn$ kubectl get svc
NAME      CLUSTER-IP  EXTERNAL-IP  PORT(S)  AGE
kubernetes  10.0.0.1    <none>        443/TCP  4d
[praparns-MacBook-Pro:multicontainer praparn$ kubectl 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

- Check how to operate with component on Kubernetes via “Kubectl explain xxx”

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

```
kubectl api-versions
```

```
ubuntu@ip-10-0-1-239:~$ kubectl explain pods
KIND:     Pod
VERSION:  v1

DESCRIPTION:
  Pod is a collection of containers that can run on a host. This resource is
  created by clients and scheduled onto hosts.

FIELDS:
  apiVersion  <string>
    APIVersion defines the versioned schema of this representation of an
    object. Servers should convert recognized schemas to the latest internal
    value, and may reject unrecognized values. More info:
    https://git.k8s.io/community/contributors/devel/api-conventions.md#resources

  kind <string>
    Kind is a string value representing the REST resource this object
    represents. Servers may infer this from the endpoint the client submits
    requests to. Cannot be updated. In CamelCase. More info:
    https://git.k8s.io/community/contributors/devel/api-conventions.md#types-kinds

  metadata    <Object>
    Standard object's metadata. More info:
    https://git.k8s.io/community/contributors/devel/api-conventions.md#metadata

  spec <Object>
    Specification of the desired behavior of the pod. More info:
    https://git.k8s.io/community/contributors/devel/api-conventions.md#spec-and-status

  status      <Object>
    Most recently observed status of the pod. This data may not be up to date.
    Populated by the system. Read-only. More info:
    https://git.k8s.io/community/contributors/devel/api-conventions.md#spec-and-status

ubuntu@ip-10-0-1-239:~$
```

```
ubuntu@ip-10-0-1-239:~$ kubectl api-versions
admissionregistration.k8s.io/v1beta1
apiextensions.k8s.io/v1beta1
apiregistration.k8s.io/v1
apiregistration.k8s.io/v1beta1
apps/v1
apps/v1beta1
apps/v1beta2
authentication.k8s.io/v1
authentication.k8s.io/v1beta1
authorization.k8s.io/v1
authorization.k8s.io/v1beta1
autoscaling/v1
autoscaling/v2beta1
autoscaling/v2beta2
batch/v1
batch/v1beta1
certificates.k8s.io/v1beta1
coordination.k8s.io/v1
coordination.k8s.io/v1beta1
crd.projectcalico.org/v1
events.k8s.io/v1beta1
extensions/v1beta1
networking.k8s.io/v1
networking.k8s.io/v1beta1
node.k8s.io/v1beta1
policy/v1beta1
rbac.authorization.k8s.io/v1
rbac.authorization.k8s.io/v1beta1
scheduling.k8s.io/v1
scheduling.k8s.io/v1beta1
storage.k8s.io/v1
storage.k8s.io/v1beta1
v1
ubuntu@ip-10-0-1-239:~$
```



# Pods, Container and Services

- For check all component on K8S version

```
kubectl api-resources --o wide
```

NAME	SHORTNAMES	APIGROUP	NAMESPACED	KIND	VERBS
bindings			true	Binding	[create] [get list]
componentstatuses	cs		false	ComponentStatus	[create delete deletecollection get list patch update watch]
configmaps	cm		true	ConfigMap	[create delete deletecollection get list patch update watch]
endpoints	ep		true	Endpoints	[create delete deletecollection get list patch update watch]
events	ev		true	Event	[create delete deletecollection get list patch update watch]
limitranges	limits		true	LimitRange	[create delete deletecollection get list patch update watch]
namespaces	ns		false	Namespace	[create delete get list patch update watch]
nodes	no		false	Node	[create delete deletecollection get list patch update watch]
persistentvolumeclaims	pvc		true	PersistentVolumeClaim	[create delete deletecollection get list patch update watch]
persistentvolumes	pv		false	PersistentVolume	[create delete deletecollection get list patch update watch]
pods	po		true	Pod	[create delete deletecollection get list patch update watch]
podtemplates			true	PodTemplate	[create delete deletecollection get list patch update watch]
replicationcontrollers	rc		true	ReplicationController	[create delete deletecollection get list patch update watch]
resourcequotas	quota		true	ResourceQuota	[create delete deletecollection get list patch update watch]
secrets			true	Secret	[create delete deletecollection get list patch update watch]
serviceaccounts	sa		true	ServiceAccount	[create delete deletecollection get list patch update watch]
services	svc		true	Service	[create delete get list patch update watch]
mutatingwebhookconfigurations		admissionregistration.k8s.io	false	MutatingWebhookConfiguration	[create delete deletecollection get list patch update watch]
validatingwebhookconfigurations		admissionregistration.k8s.io	false	ValidatingWebhookConfiguration	[create delete deletecollection get list patch update watch]
customresourcedefinitions	crd,crds	apiextensions.k8s.io	false	CustomResourceDefinition	[create delete deletecollection get list patch update watch]
apiservices		apiregistration.k8s.io	false	APIService	[create delete deletecollection get list patch update watch]
controllerrevisions		apps	true	ControllerRevision	[create delete deletecollection get list patch update watch]
daemonsets	ds	apps	true	DaemonSet	[create delete deletecollection get list patch update watch]
deployments	deploy	apps	true	Deployment	[create delete deletecollection get list patch update watch]
replicasets	rs	apps	true	ReplicaSet	[create delete deletecollection get list patch update watch]
statefulsets	sts	apps	true	StatefulSet	[create delete deletecollection get list patch update watch]
tokenreviews		authentication.k8s.io	false	TokenReview	[create]
localsubjectaccessreviews		authorization.k8s.io	true	LocalSubjectAccessReview	[create]
selfsubjectaccesstokenreviews		authorization.k8s.io	false	SelfSubjectAccessReview	[create]
selfsubjectaccesstokenreviews		authorization.k8s.io	false	SelfSubjectRulesReview	[create]
subjectaccesstokenreviews		authorization.k8s.io	false	SubjectAccessReview	[create]
horizontalpodautoscalers	hpa	autoscaling	true	HorizontalPodAutoscaler	[create delete deletecollection get list patch update watch]
cronjobs	cj	batch	true	CronJob	[create delete deletecollection get list patch update watch]
jobs		batch	true	Job	[create delete deletecollection get list patch update watch]
certificatesigningrequests	csr	certificates.k8s.io	false	CertificateSigningRequest	[create delete deletecollection get list patch update watch]
leases		coordination.k8s.io	true	Lease	[create delete deletecollection get list patch update watch]
bgpconfigurations		crd.projectcalico.org	false	BGPConfiguration	[delete deletecollection get list patch create update watch]
bgppeers		crd.projectcalico.org	false	BGPPeer	[delete deletecollection get list patch create update watch]
blockaffinities		crd.projectcalico.org	false	BlockAffinity	[delete deletecollection get list patch create update watch]
clusterinformations		crd.projectcalico.org	false	ClusterInformation	[delete deletecollection get list patch create update watch]
felixconfigurations		crd.projectcalico.org	false	FelixConfiguration	[delete deletecollection get list patch create update watch]
globalnetworkpolicies		crd.projectcalico.org	false	GlobalNetworkPolicy	[delete deletecollection get list patch create update watch]
globalnetworksets		crd.projectcalico.org	false	GlobalNetworkSet	[delete deletecollection get list patch create update watch]
hostendpoints		crd.projectcalico.org	false	HostEndpoint	[delete deletecollection get list patch create update watch]
ipamblocks		crd.projectcalico.org	false	IPAMBlock	[delete deletecollection get list patch create update watch]
ipamconfigs		crd.projectcalico.org	false	IPAMConfig	[delete deletecollection get list patch create update watch]
ipamhandles		crd.projectcalico.org	false	IPAMHandle	[delete deletecollection get list patch create update watch]
ippools		crd.projectcalico.org	false	IPPool	[delete deletecollection get list patch create update watch]
networkpolicies		crd.projectcalico.org	true	NetworkPolicy	[delete deletecollection get list patch create update watch]
networksets		crd.projectcalico.org	true	NetworkSet	[delete deletecollection get list patch create update watch]
events	ev	events.k8s.io	true	Event	[create delete deletecollection get list patch update watch]
daemonsets	ds	extensions	true	DaemonSet	[create delete deletecollection get list patch update watch]
deployments	deploy	extensions	true	Deployment	[create delete deletecollection get list patch update watch]
ingresses	ing	extensions	true	Ingress	[create delete deletecollection get list patch update watch]
networkpolicies	netpol	extensions	true	NetworkPolicy	[create delete deletecollection get list patch update watch]
podsecuritypolicies	psp	extensions	false	PodSecurityPolicy	[create delete deletecollection get list patch update watch]
replicasets	rs	extensions	true	ReplicaSet	[create delete deletecollection get list patch update watch]
ingresses...	ing	networking.k8s.io	true	Ingress	[create delete deletecollection get list patch update watch]



# Pods, Container and Services

## Overview

### WORKLOADS APIS

Container v1 core

CronJob v1beta1 batch

DaemonSet v1 apps

Deployment v1 apps

Job v1 batch

Pod v1 core

ReplicaSet v1 apps

ReplicationController v1 core

StatefulSet v1 apps

### SERVICE APIS

Endpoints v1 core

Ingress v1beta1 networking.k8s.io

Service v1 core

### CONFIG AND STORAGE APIS

ConfigMap v1 core

CSI Driver v1beta1 storage.k8s.io

CSINode v1beta1 storage.k8s.io

Secret v1 core

PersistentVolumeClaim v1 core

StorageClass v1 storage.k8s.io

Volume v1 core

VolumeAttachment v1 storage.k8s.io

### METADATA APIS

ControllerRevision v1 apps

CustomResourceDefinition v1beta1 apiextensions.k8s.io

Event v1 core

LimitRange v1 core

HorizontalPodAutoscaler v1 autoscaling

## API OVERVIEW

Welcome to the Kubernetes API. You can use the Kubernetes API to read and write Kubernetes resource objects via a Kubernetes API endpoint.

### Resource Categories

This is a high-level overview of the basic types of resources provided by the Kubernetes API and their primary functions.

**Workloads** are objects you use to manage and run your containers on the cluster.

**Discovery & LB** resources are objects you use to "stitch" your workloads together into an externally accessible, load-balanced Service.

**Config & Storage** resources are objects you use to inject initialization data into your applications, and to persist data that is external to your container.

**Cluster** resources define how the cluster itself is configured; these are typically used only by cluster operators.

**Metadata** resources are objects you use to configure the behavior of other resources within the cluster, such as `HorizontalPodAutoscaler` for scaling workloads.

### Resource Objects

Resource objects typically have 3 components:

- **Resource ObjectMeta:** This is metadata about the resource, such as its name, type, API version, annotations, and labels. This contains fields that may be updated both by the end user and the system (e.g. annotations).
- **ResourceSpec:** This is defined by the user and describes the desired state of the system. Fill this in when creating or updating an object.
- **ResourceStatus:** This is filled in by the server and reports the current state of the system. In most cases, users don't need to change this.

Ref: <https://kubernetes.io/docs/reference/generated/kubernetes-api/v1.15/#-strong-api-overview-strong->

Kubernetes: Production Workload Orchestration



kubernetes  
by Google

# 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
12  spec:
13    containers:
14      - name: cachedb
15        image: labdocker/redis:latest
16        ports:
17          - containerPort: 6379
18            protocol: TCP
19      - name: webservice
20        image: labdocker/cluster:webservicev2
21        env:
22          - name: "REDIS_HOST"
23            value: "localhost"
24        ports:
25          - containerPort: 5000
26            protocol: TCP
27      - name: webcache
28        image: labdocker/cluster:webcache_kubernetes
29        ports:
30          - containerPort: 80
31            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
12  spec:
13    containers:
14      - name: cachedb
15        image: labdocker/redis:latest
16        ports:
17          - containerPort: 6379
18            protocol: TCP
19      - name: webservice
20        image: labdocker/cluster:webservicev2set2
21        env:
22          - name: "REDIS_HOST"
23            value: "localhost"
24        ports:
25          - containerPort: 5000
26            protocol: TCP
27      - name: webcache
28        image: labdocker/cluster:webcache_kubernetes
29        ports:
30          - containerPort: 80
31            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
12  spec:
13    selector:
14      name: "web"
15      owner: "Praparn_L"
16      version: "1.0"
17      module: "web"
18      environment: "development"
19    type: NodePort
20    ports:
21      - port: 5000
22        name: webservice
23        targetPort: 5000
24        protocol: TCP
25        nodePort: 32500
26      - port: 80
27        name: webcache
28        targetPort: 80
29        protocol: TCP
30        nodePort: 30500
```

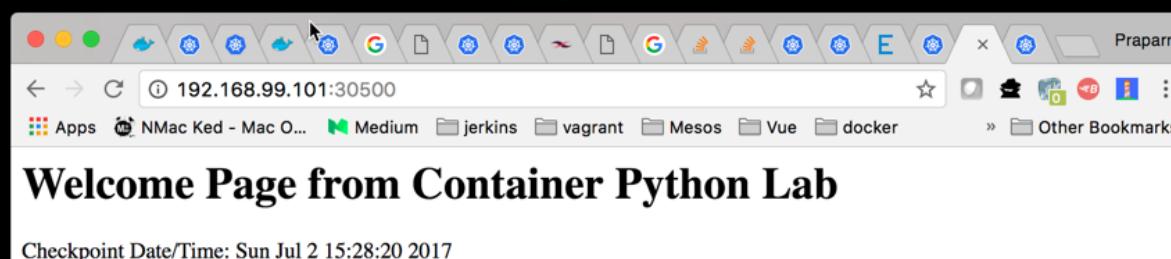


# Pods, Container and Services

- Services

- Existing Pods “web”

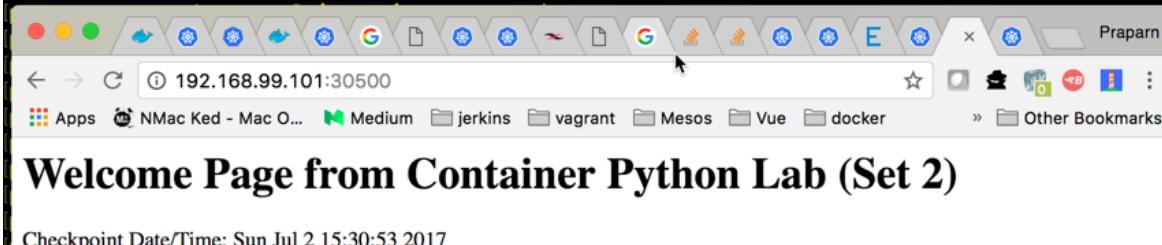
```
praparns-MacBook-Pro:multicontainer praparn$ kubectl get pods
NAME          READY   STATUS    RESTARTS   AGE
curl-1580724602-gjihq   0/1     CrashLoopBackOff  27      1h
maindb        1/1     Running   0          56m
web           3/3     Running   0          7m
praparns-MacBook-Pro:multicontainer 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"

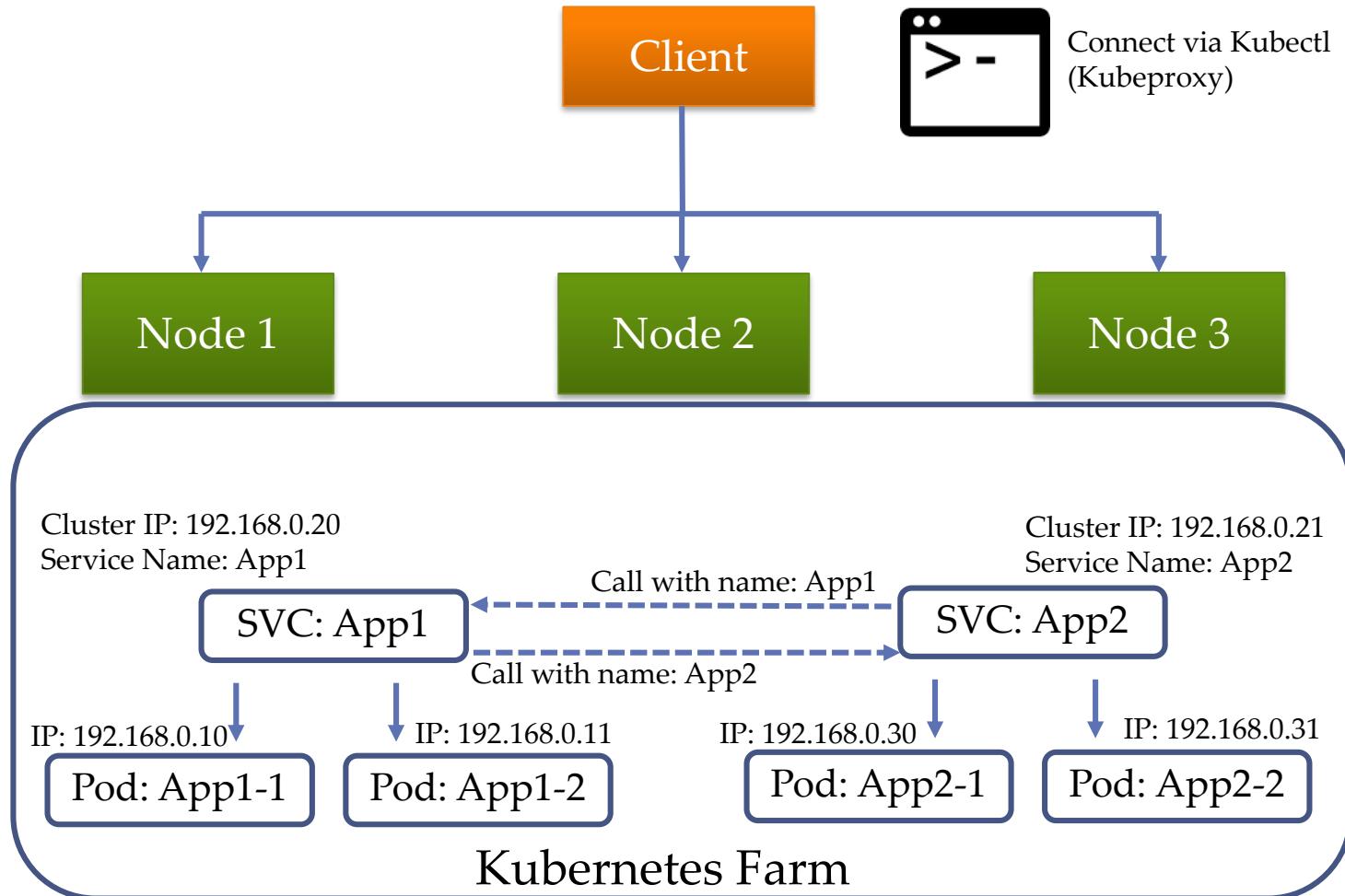
```
18 type: NodePort
19 ports:
20 - port: 5000
21   name: webservice
22   targetPort: 5000
23   protocol: TCP
24   nodePort: 32500
25 - port: 80
26   name: webcache
27   targetPort: 80
28   protocol: TCP
29   nodePort: 30500
```

```
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$ █
```



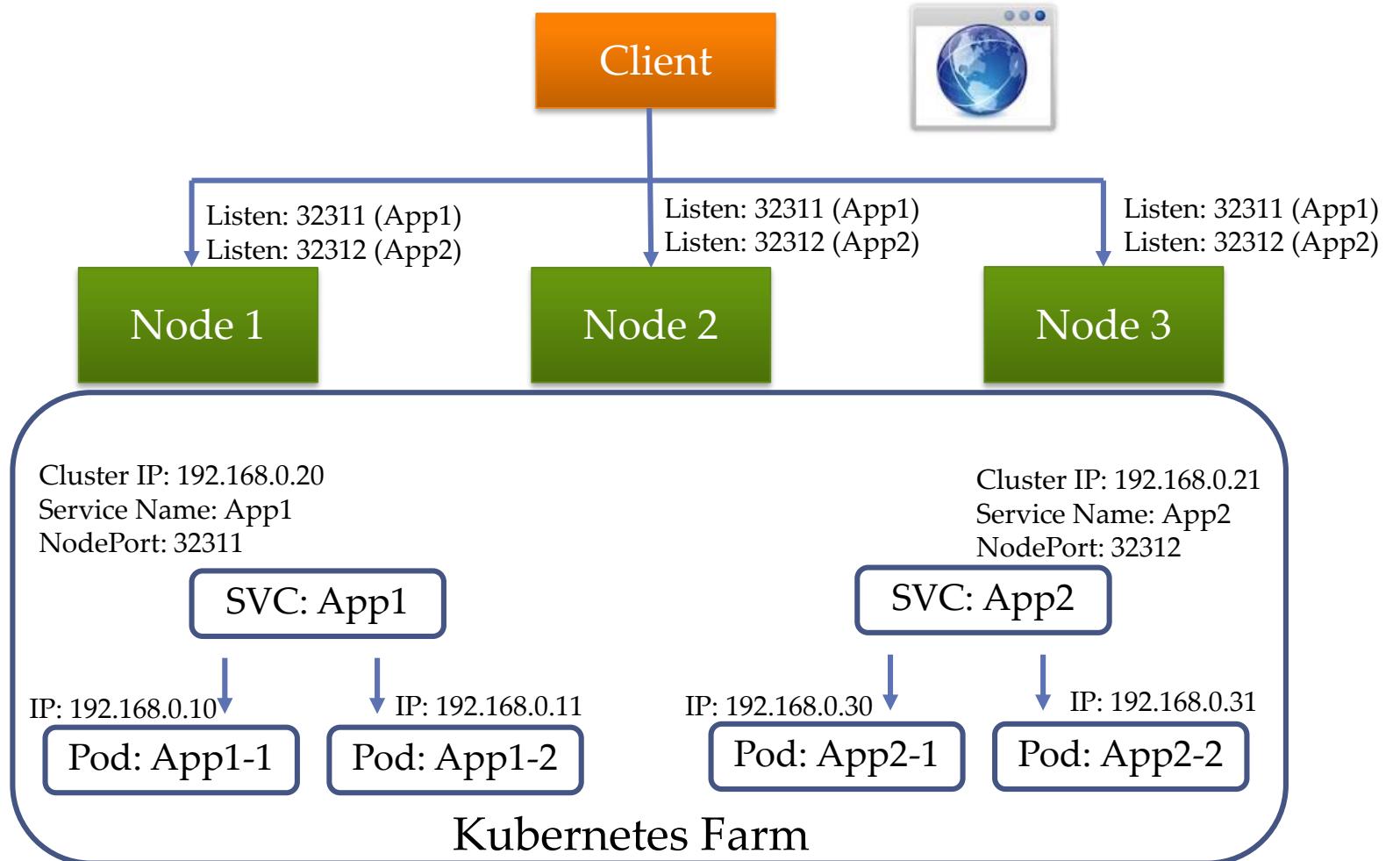
# Pods, Container and Services

- Services: ClusterIP



# Pods, Container and Services

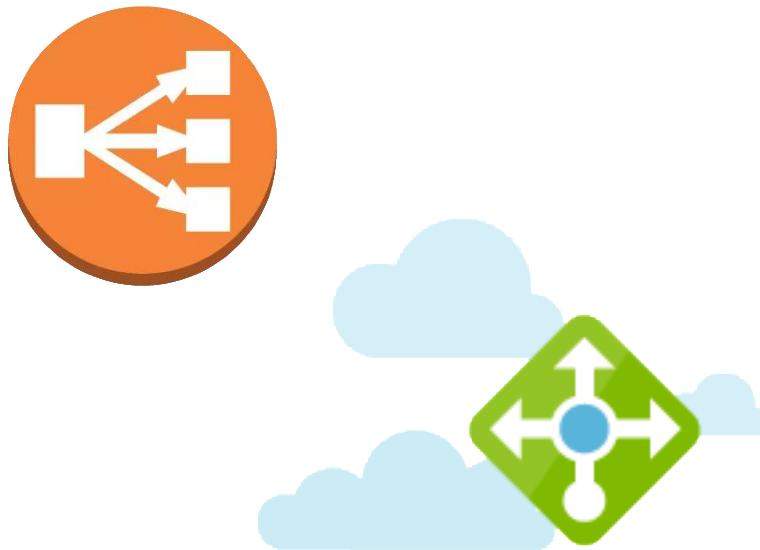
- Services: NodePort



# Pods, Container and Services

- Services

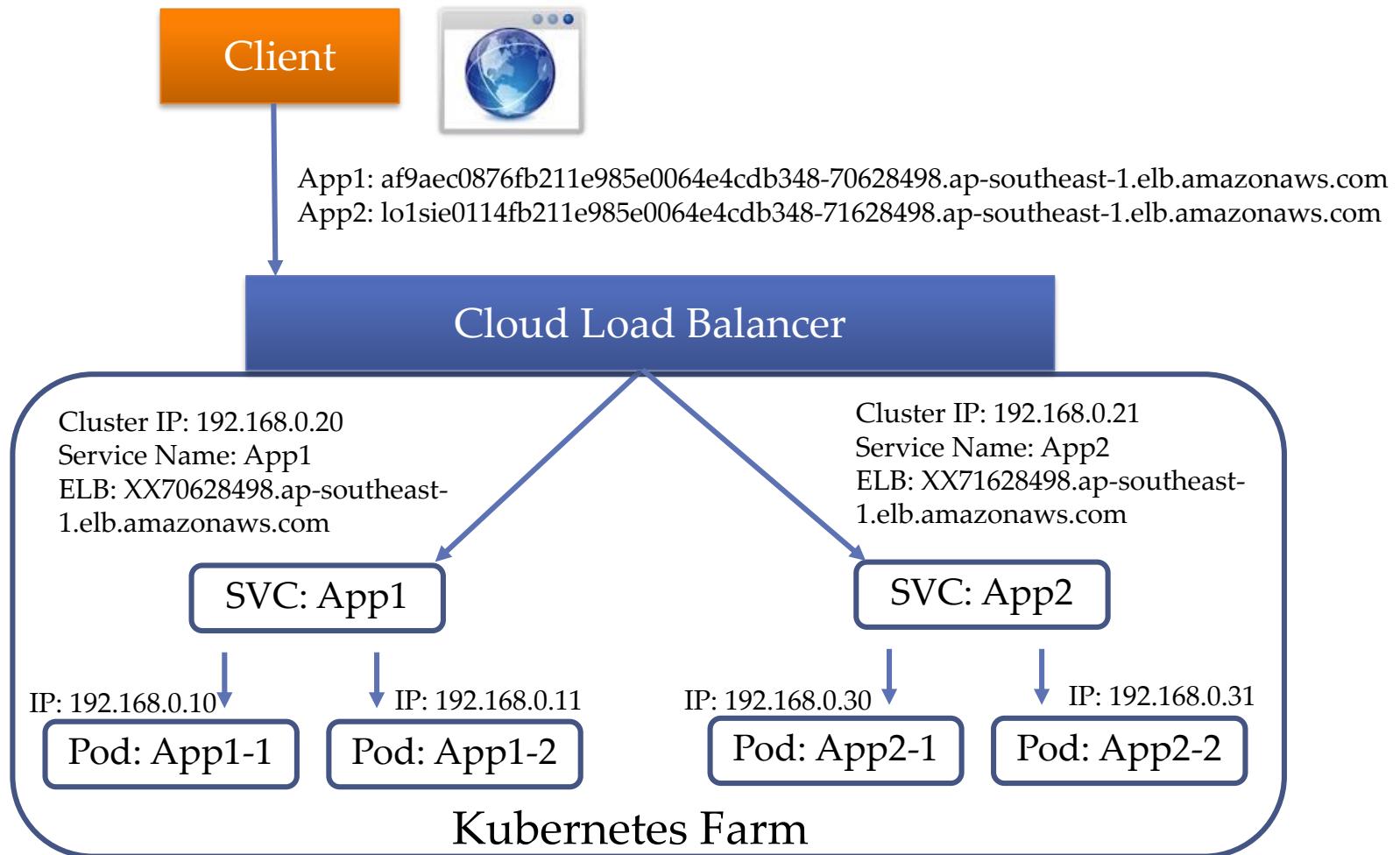
- Publish Service Type:
  - LoadBalance:
    - Use load balancer from external cloud provider for intercept traffic
    - Manage by Kubernetes Itself
    - Flexible for use facilities on cloud



```
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: Load Balancer



# Pods, Container and Services

- Services:

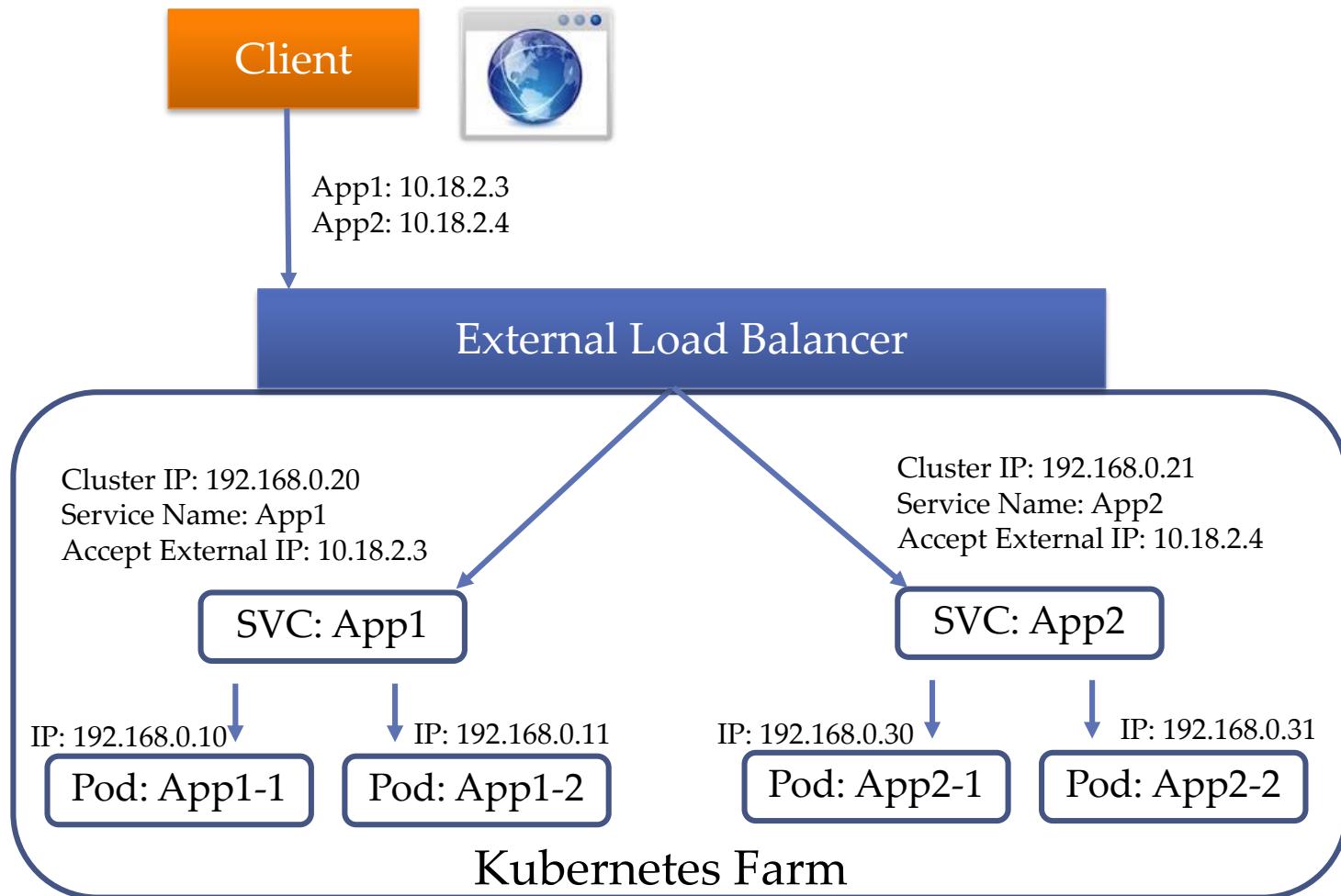
- Publish Service Type:
  - ExternalIP:
    - Similar with Load Balancer
    - Reference to external load balance by IP Address
    - Not manage by kubernetes itself

```
1 kind: Service
2 apiVersion: v1
3 metadata:
4   name: my-service
5 spec:
6   selector:
7     app: MyApp
8   ports:
9     - name: http
10    protocol: TCP
11    port: 80
12    targetPort: 9376
13   externalIPs:
14     - 80.11.12.10
```



# Pods, Container and Services

- Services: External IP



# Pods, Container and Services

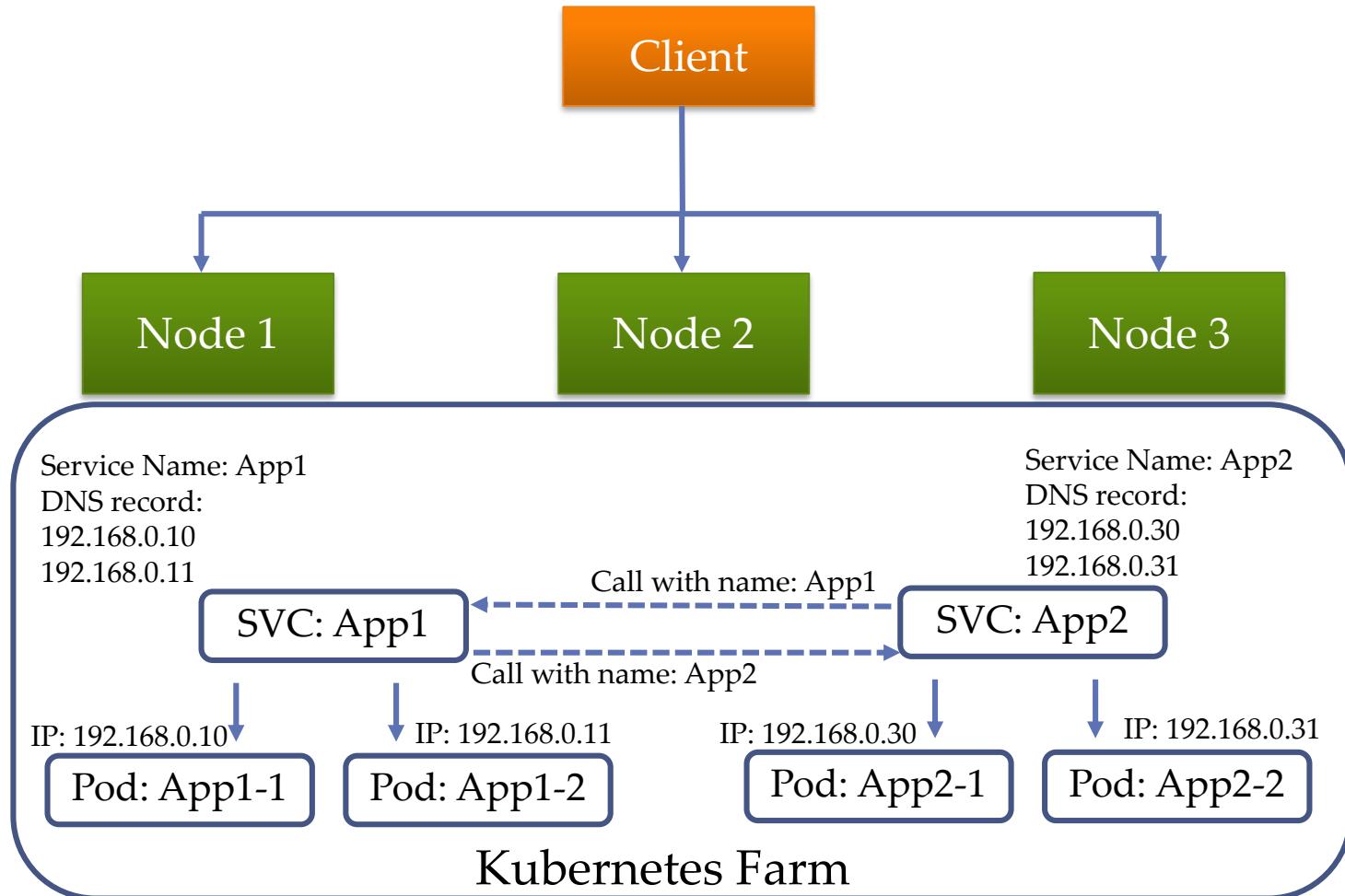
- Services
  - Publish Service Type:
    - Headless Service (StatefulSet): service will just dns round-robin for all statefulset pods's ip address

```
! 20dns.yml ✘
1 # A headless service to create DNS records
2 ---
3 apiVersion: v1
4 kind: Service
5 metadata:
6   name: kafka
7   namespace: sansiri-unityapi
8 spec:
9   ports:
10   - port: 9092
11     # [podname].broker.kafka.svc.cluster.local
12     clusterIP: None
13   selector:
14     app: kafka
15
```



# Pods, Container and Services

- Services: Headless



# Pods, Container and Services

- Services

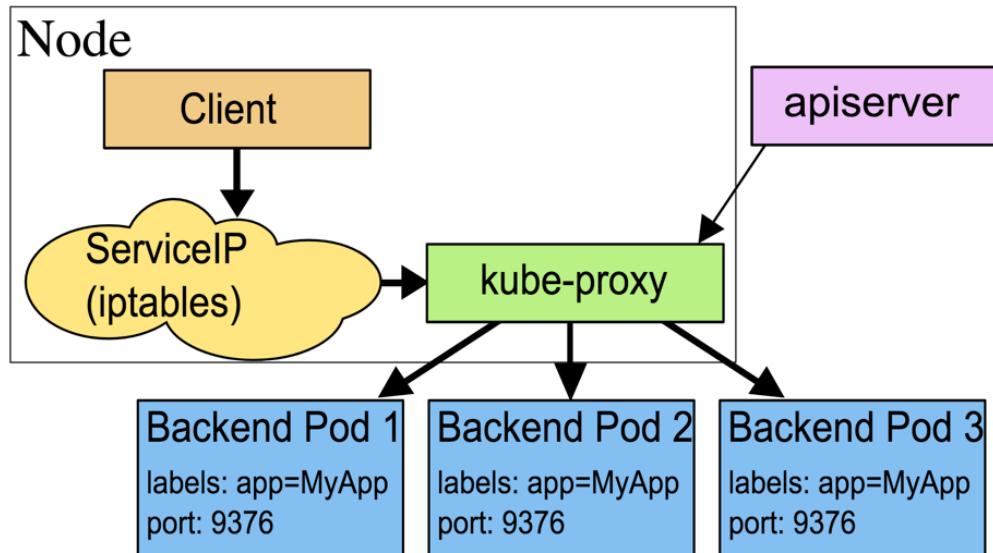
- Publish Service Type:
  - ExternalName:
    - No selector / No define pods / No endpoints
    - Use for return CNAME record for DNS-Load Balance
    - Work with kube-dns (Kubernetes V1.7 or higher)

```
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"

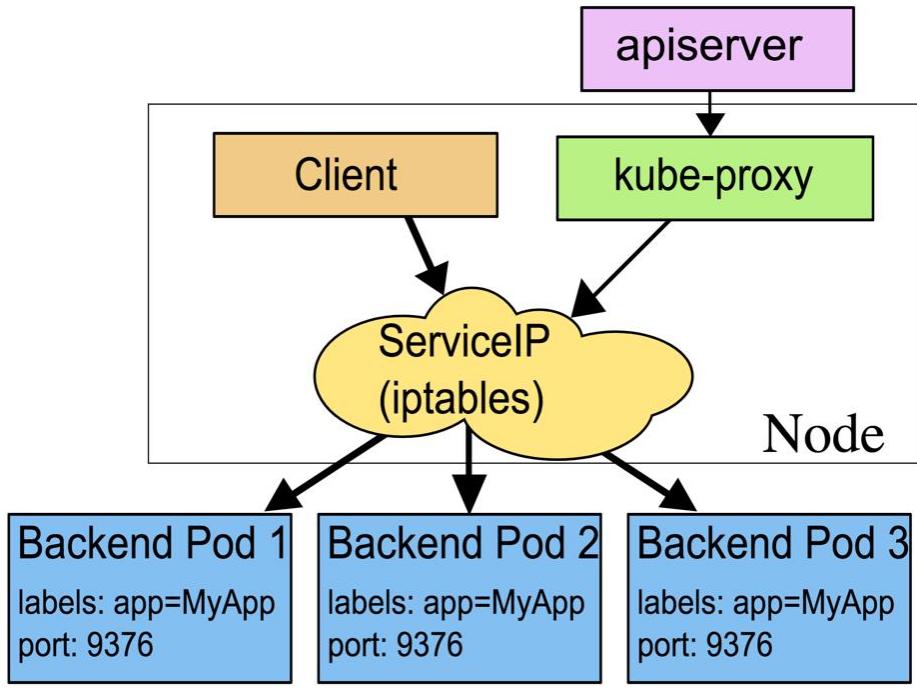
# Pods, Container and Services

- 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



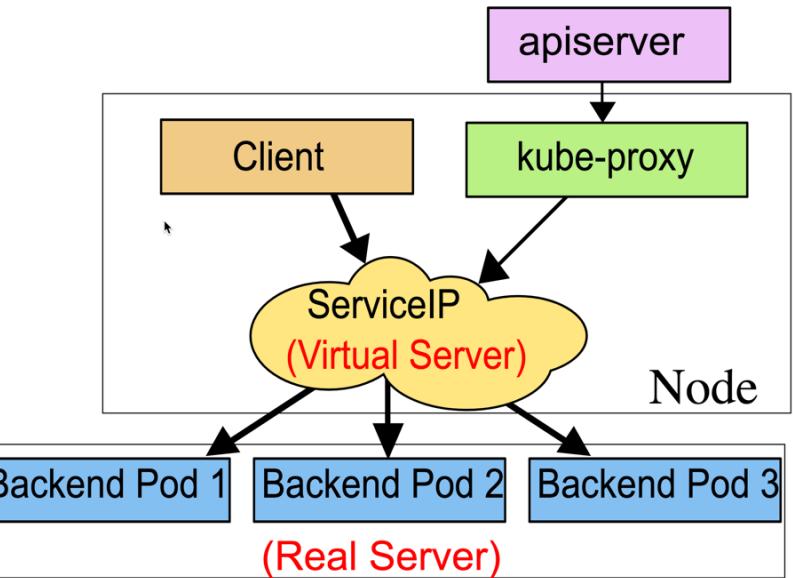
# Pods, Container and Services

- kube-proxy (proxy-mode)
  - Proxy-mode: iptables (default on kubernetes v1.8)
    - 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>

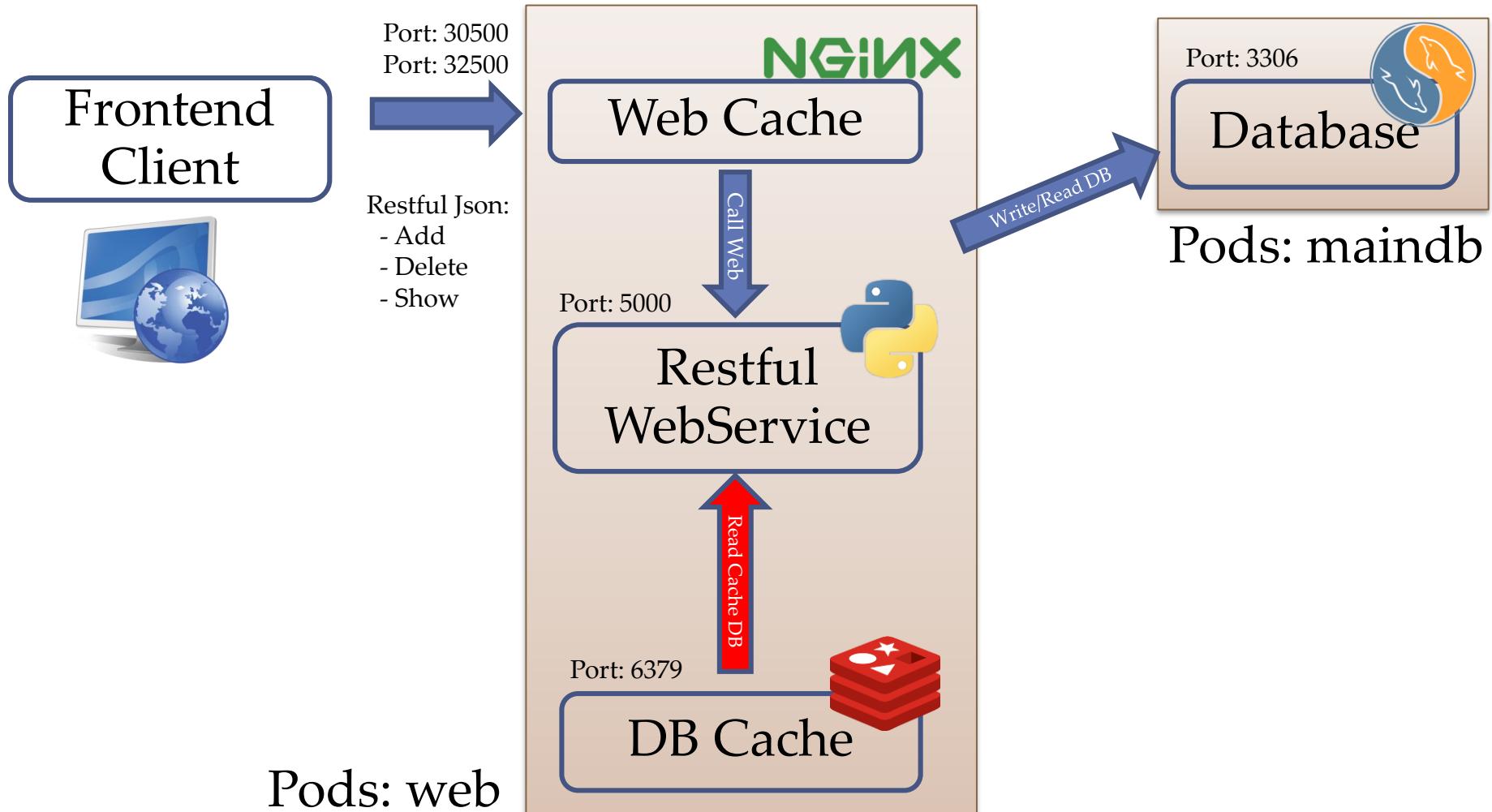
Kubernetes: Production Workload Orchestration



**kubernetes**  
by Google

# Workshop 1.2: Pods & Service

- Part 2: Deploy web pods with multi container



# Pods, Container and Services

- Pods Priority and Preemption
  - Give the priority create for pods. When resource is insufficient kubernetes will consider to run higher priority pods first and evict the lower priority pods.
  - Priority will effective only when pods was “created”
  - Disable feature of “Preemption” is not recommend

```
1 apiVersion: componentconfig/v1alpha1
2 kind: KubeSchedulerConfiguration
3 algorithmSource:
4   provider: DefaultProvider
5
6 ...
7
8 disablePreemption: true
```



# Pods, Container and Services

- Pods Priority and Preemption
  - Kubernetes will use value on object “PriorityClass” for consideration. Pods will reference this for define

```
1 apiVersion: scheduling.k8s.io/v1
2 kind: PriorityClass
3 metadata:
4   name: high-priority
5 value: 1000000
6 globalDefault: false
7 description: "This priority class for highest pods."
8
9 ---
10
11 apiVersion: scheduling.k8s.io/v1
12 kind: PriorityClass
13 metadata:
14   name: medium-priority
15 value: 1000
16 globalDefault: true
17 description: "This priority class for default pods."
18
19 ---
20
21 apiVersion: scheduling.k8s.io/v1
22 kind: PriorityClass
23 metadata:
24   name: low-priority
25 value: 100
26 globalDefault: false
27 description: "This priority class for lowest pods."
28
```

```
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   priorityClassName: high-priority
```



# Daemon Set and RC

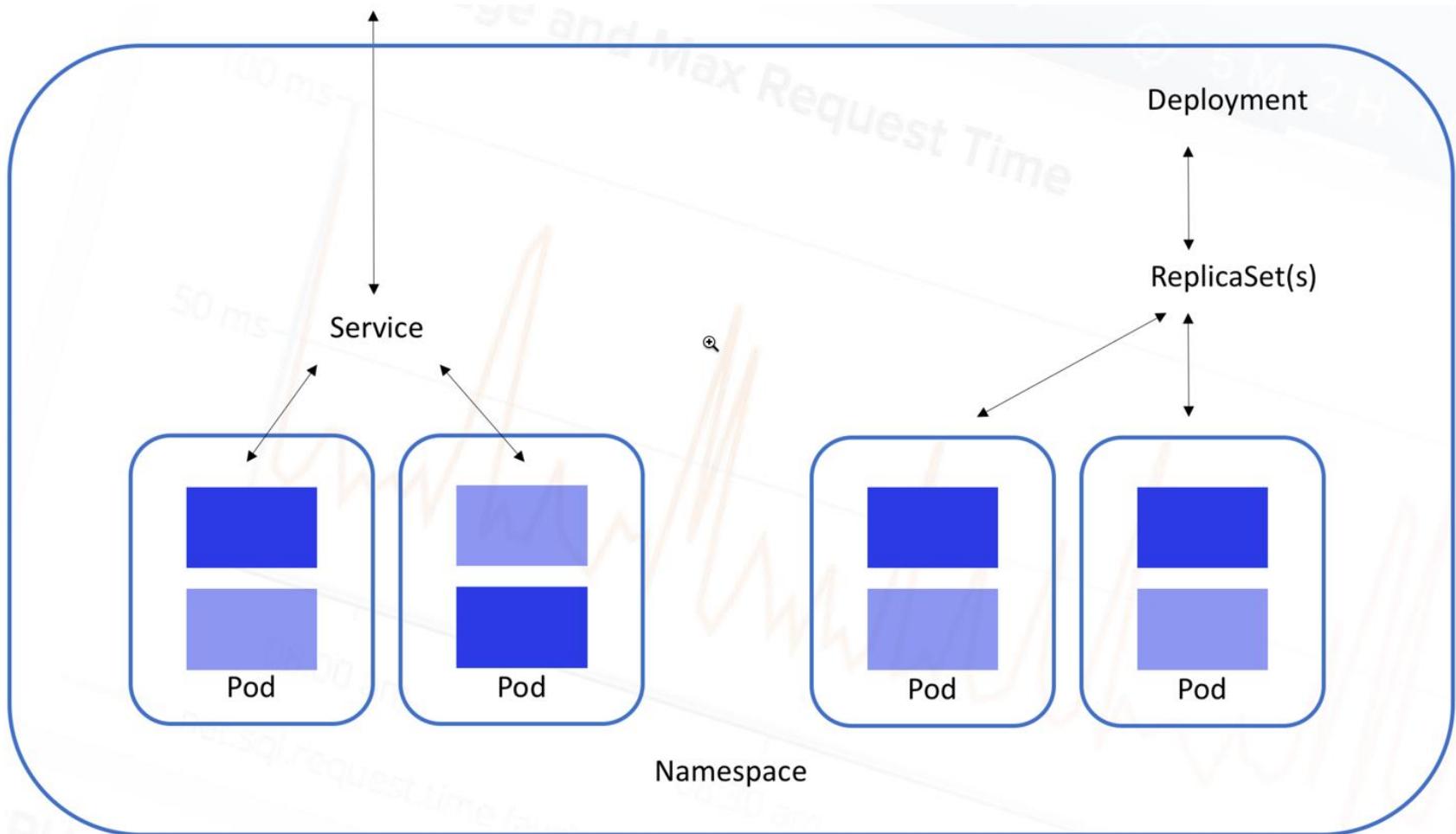


Kubernetes: Production Workload Orchestration



**kubernetes**  
by Google

# 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$ ]
```



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# 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$
```



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# 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$
```



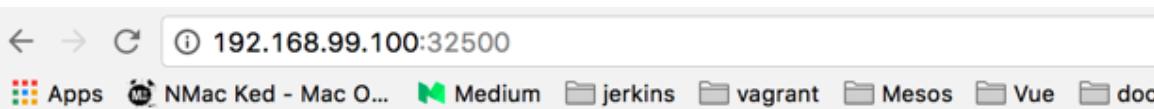
# Replication Controller

- 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$ █
```



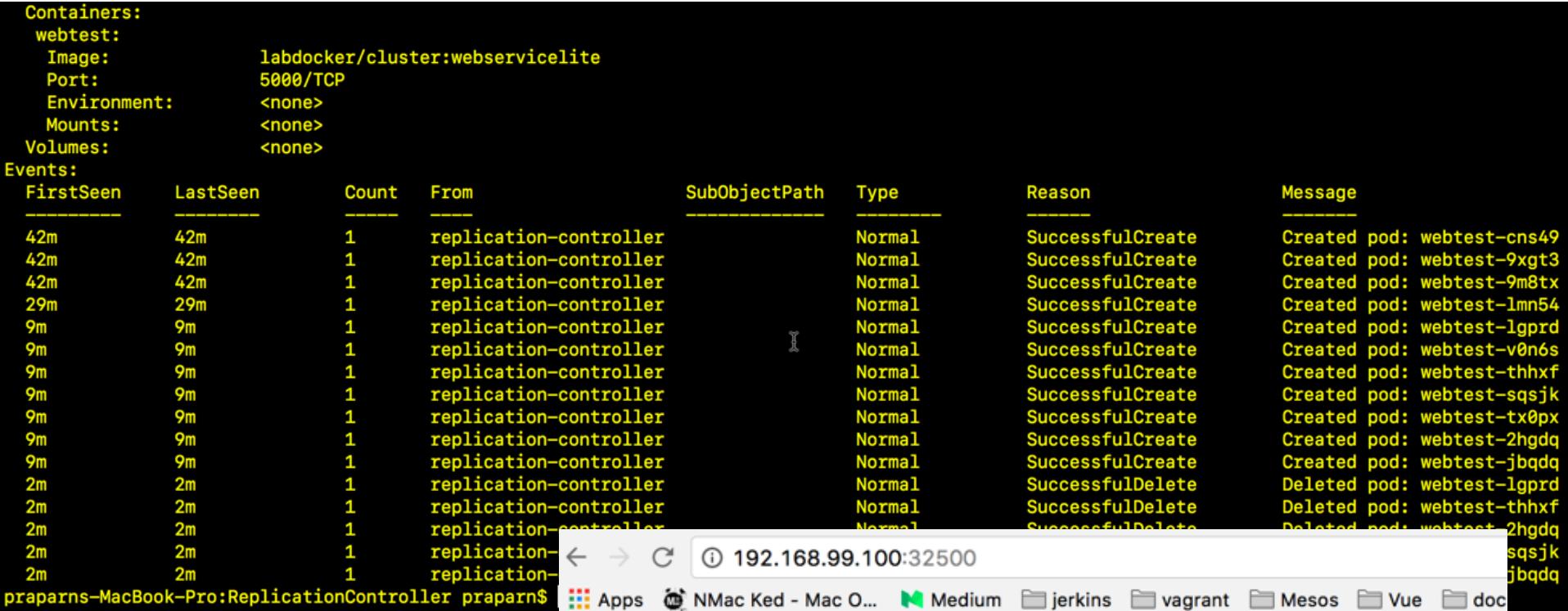
# Workshop 1.3: RC

- 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  sqsjk
  2m            2m         1      replication-          Normal   SuccessfulDelete  jbqqd
praparns-MacBook-Pro:ReplicationController praparn$
```

192.168.99.100:32500



Welcome Page from Container Python Lab

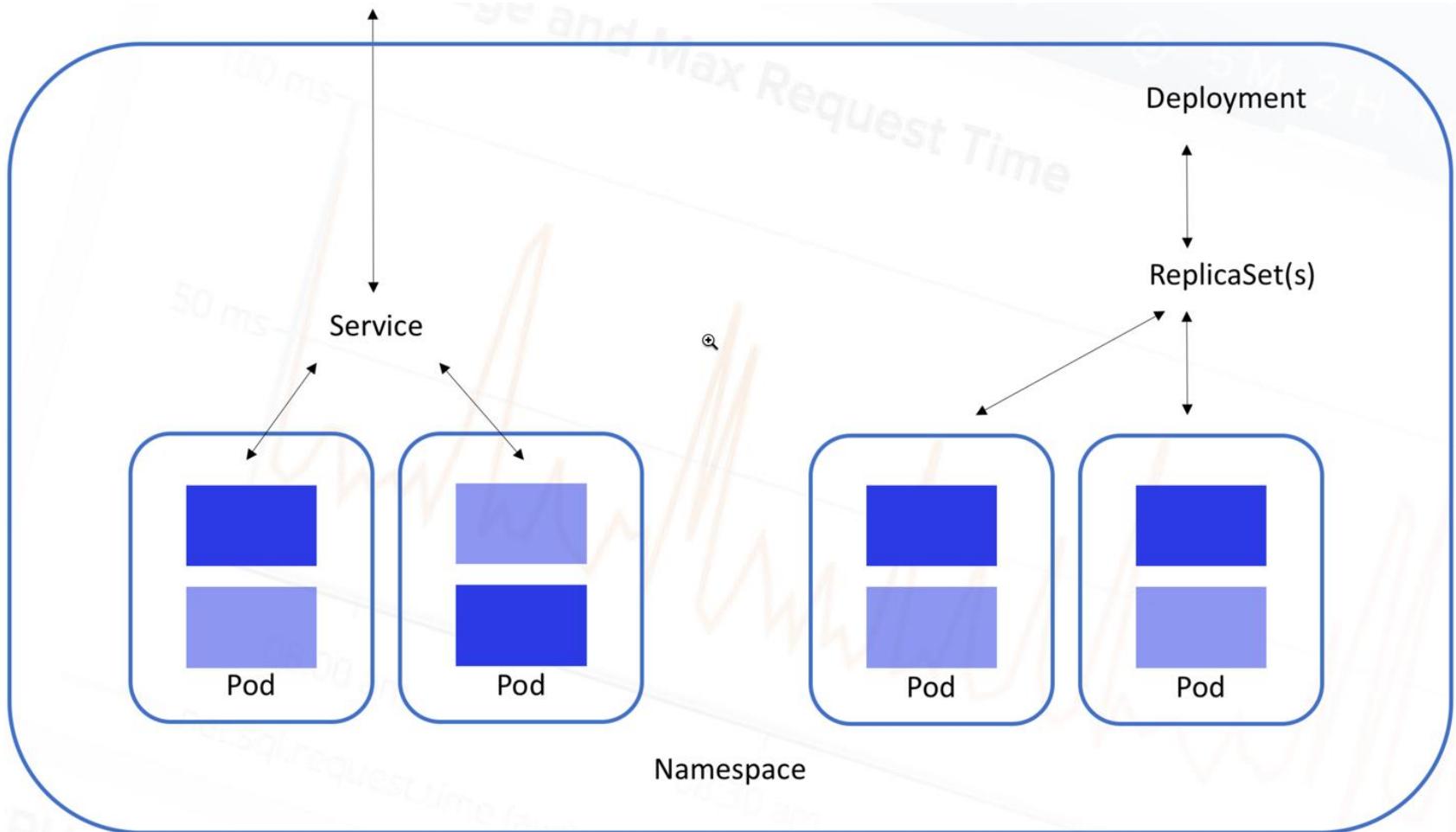
Checkpoint Date/Time: Wed Jul 5 15:55:31 2017



# 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”

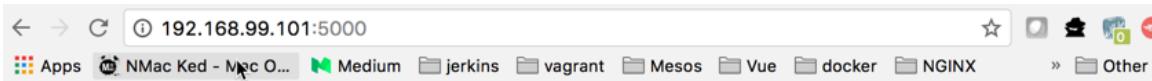
```
selector:  
  matchLabels:  
    environment: development  
  matchExpressions:  
    - {key: environment, operator: In, values: [development]}
```



# 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 (RollingUpdate)
  - 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
```

- Step for produce update (rollout) with Each Change (Default)
  - Create new RS for template change
  - Scale down existing RS to 1 (1 max unavailable)
  - Scale new RS as designed (No more than design +1: 1 max surge)
  - Delete existing RS
- Default deployment will allow 25% for lack (maxUnavailable) and 25% for over design (maxSurge)



# Deployment/RS and Update

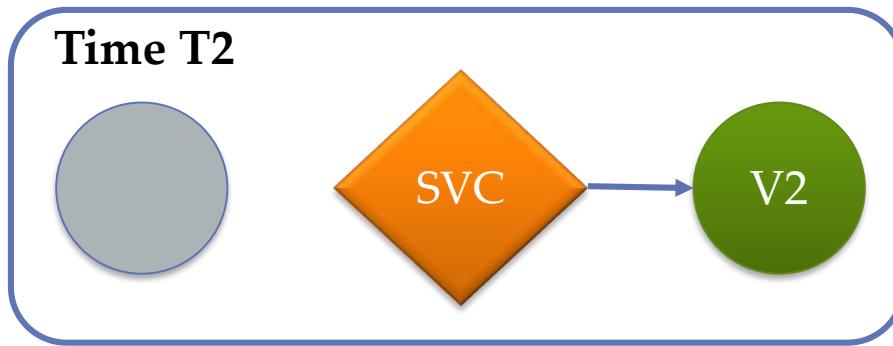
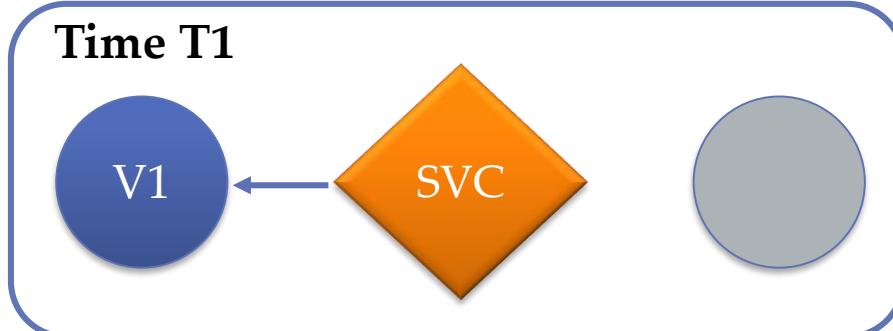
- Let's Talk about deployment's strategies !!!
  - On deployment we have many procedure for apply rollout strategy with deployment
  - Recreate (For Development): Destroy all pods and recreate it again.
  - RollingUpdate (Default): Create new version of pods and wait for it ready before terminate existing version
  - Blue/Green: Create new deployment for "green" version and reconfigure service for point to new deployment
  - Canary: Create new deployment with same "Label" but less replicas in begin and increase as need
  - A/B: Create new deployment and let's use service mesh for select some traffic to new deployment

Ref: <https://container-solutions.com/kubernetes-deployment-strategies/?fbclid=IwAR1T3mdkK46Hmj7ckla6iEjtAuKKnijLWRcsrK3Jetzb5BOB21akiYBgm5Y>



# Deployment/RS and Update

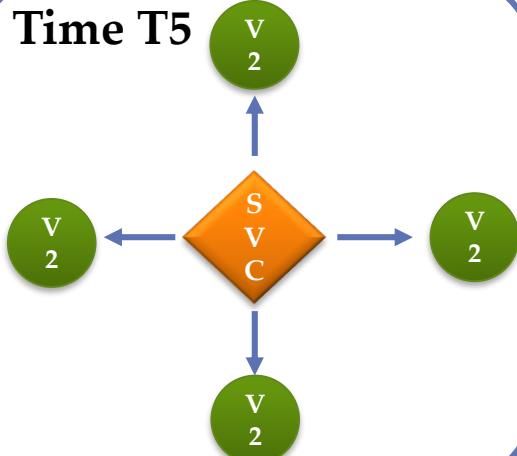
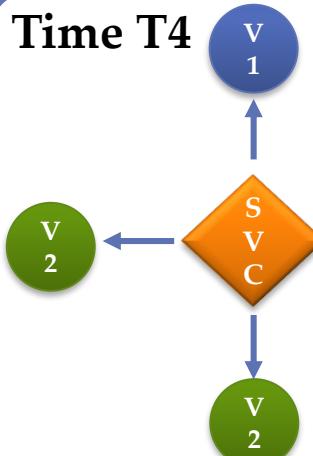
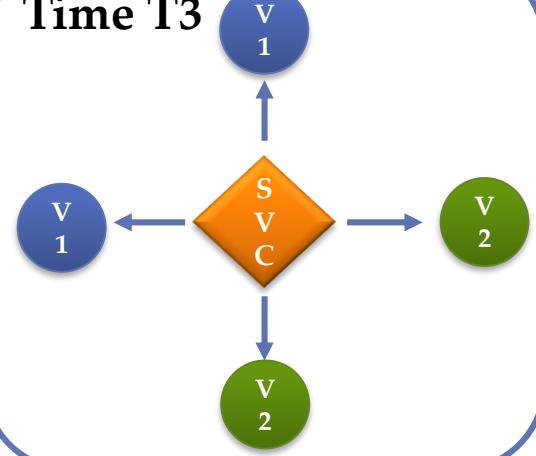
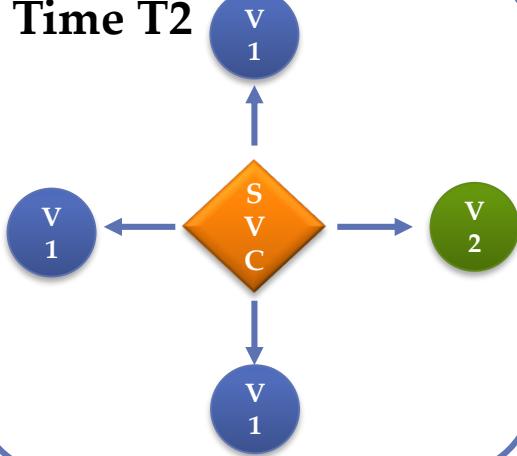
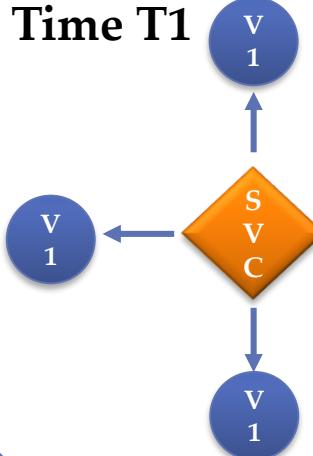
- Recreate (For Development)



```
! webtest_deploy.yml •  
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    strategy:  
15      type: Recreate  
16    selector:  
17      matchLabels:  
18        name: web  
        owner: Praparn_L
```

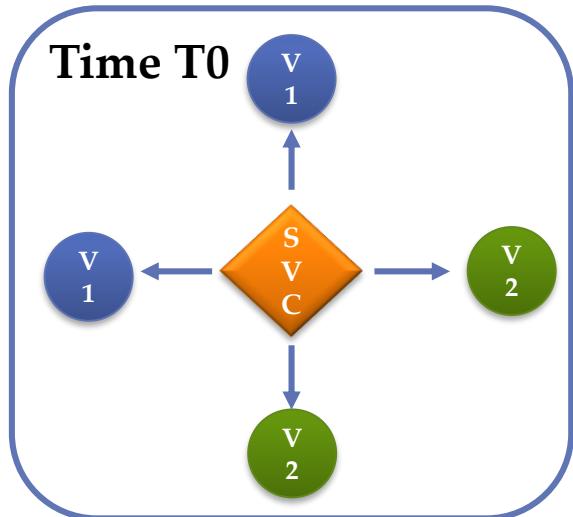
# Deployment/RS and Update

- RollingUpdate (Default)



# Deployment/RS and Update

- RollingUpdate (Default)



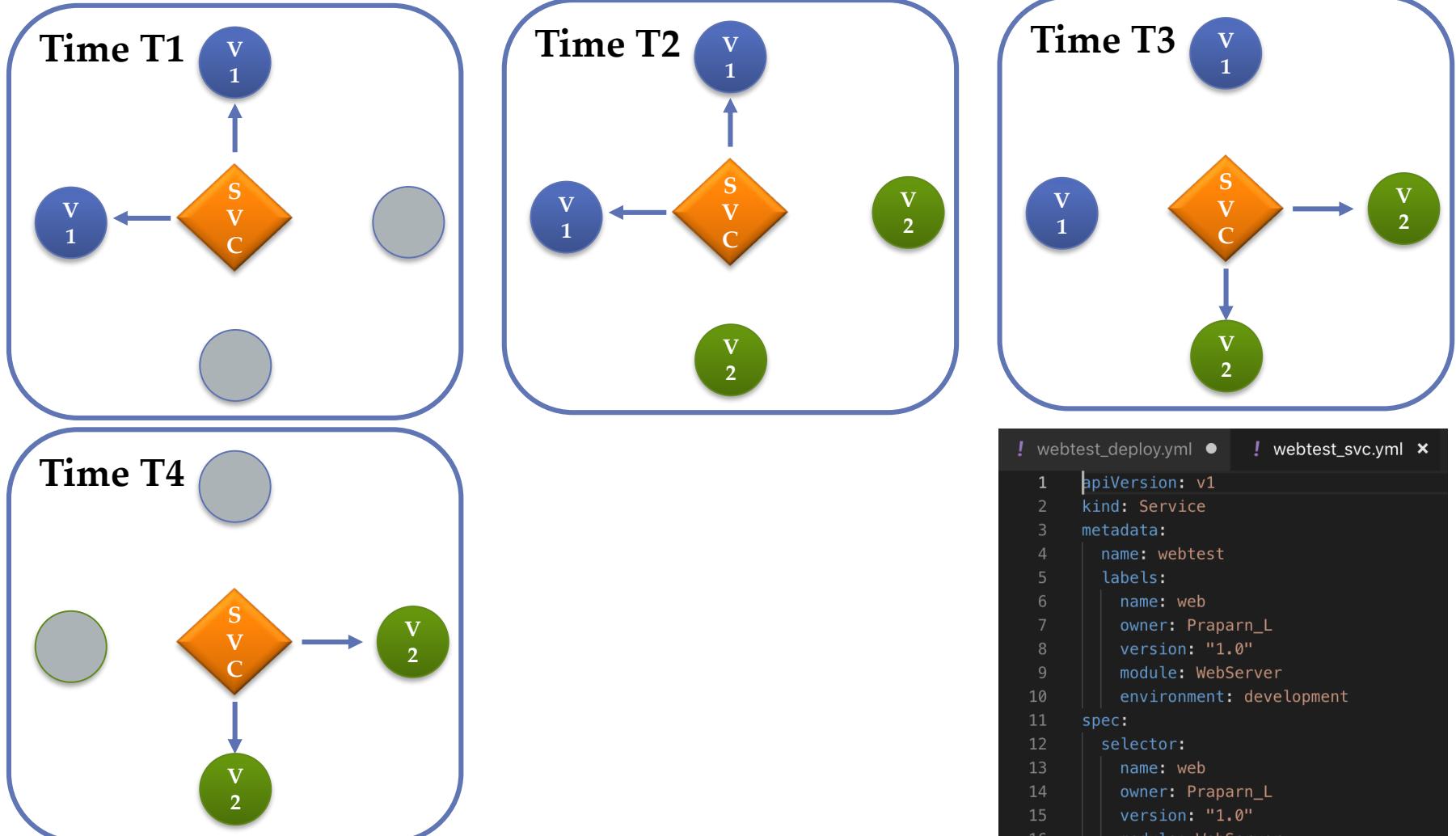
```
! webtest_deploy.yml •  
1 apiVersion: apps/v1  
2 kind: Deployment  
3 metadata:  
4   name: webtest  
5   labels:  
6     name: web  
7     owner: Praparn_L  
8   version: "1.0"  
9   module: WebServer  
10  environment: development  
11 spec:  
12   replicas: 4  
13   strategy:  
14     type: RollingUpdate  
15     rollingUpdate:  
16       maxUnavailable: 1  
17       maxSurge: 1  
18   selector:  
19     matchLabels:  
20       name: web  
21       owner: Praparn_L
```



kubernetes  
by Google

# Deployment/RS and Update

- Blue/Green



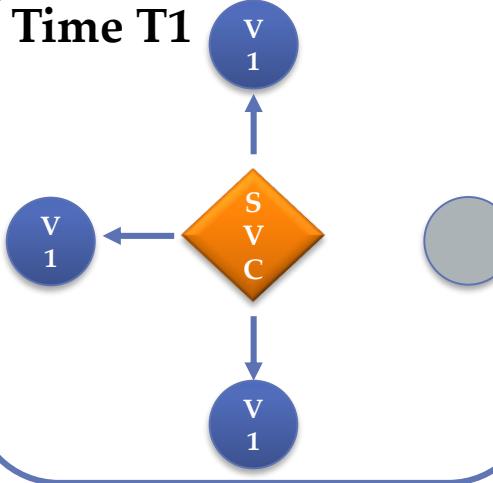
Kubernetes: Production Workload Orchestration

```
! webtest_deploy.yml • ! webtest_svc.yml x
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
```

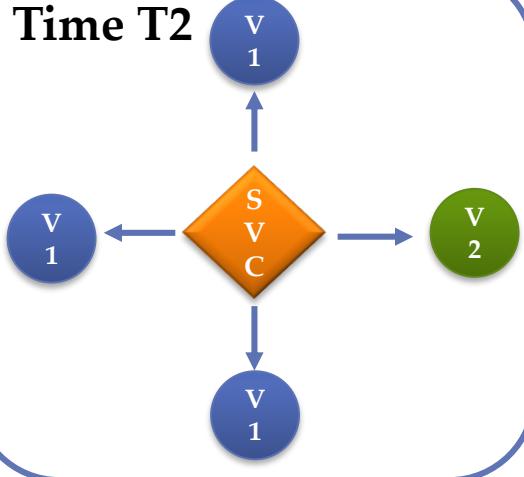
# Deployment/RS and Update

- Canary: (2 Deployment same label)

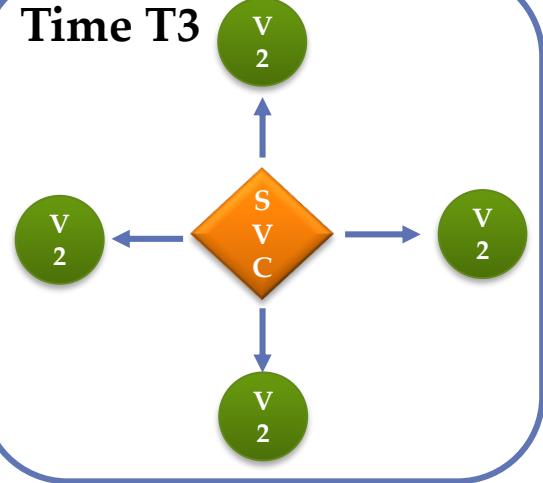
Time T1



Time T2



Time T3



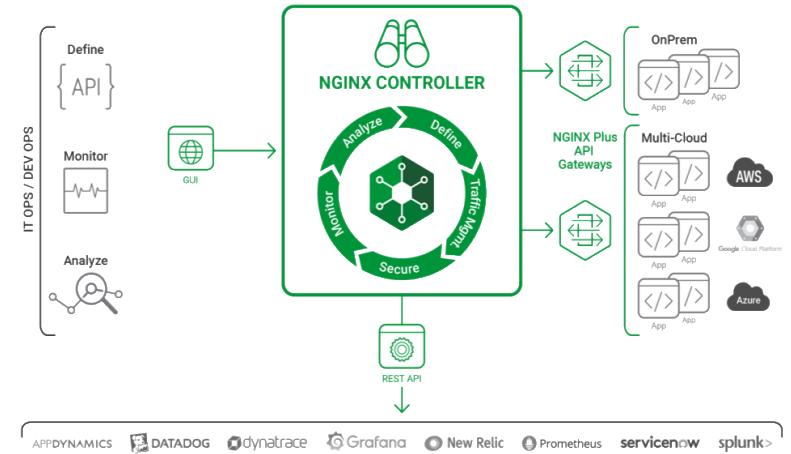
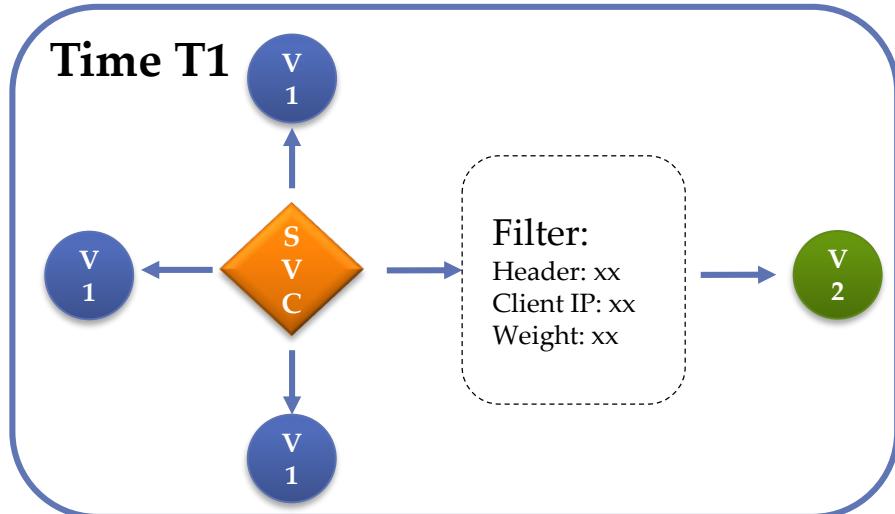
```
1 apiVersion: apps/v1
2 kind: Deployment
3 metadata:
4   name: webtest_V1
5   labels:
6     name: web
7     owner: Praparn_L
8     version: "1.0"
9     module: WebServer
10    environment: development
11 spec:
12   replicas: 3
```

```
1 apiVersion: apps/v1
2 kind: Deployment
3 metadata:
4   name: webtest_V2
5   labels:
6     name: web
7     owner: Praparn_L
8     version: "1.0"
9     module: WebServer
10    environment: development
11 spec:
12   replicas: 1
```

```
! webtest_deploy.yml ● ! webtest_svc.yml ✘
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
```

# Deployment/RS and Update

- A/B: (2 Deployment with Service Mesh)



# Istio

Connect, secure, control, and observe services.

Kubernetes: Production Workload Orchestration

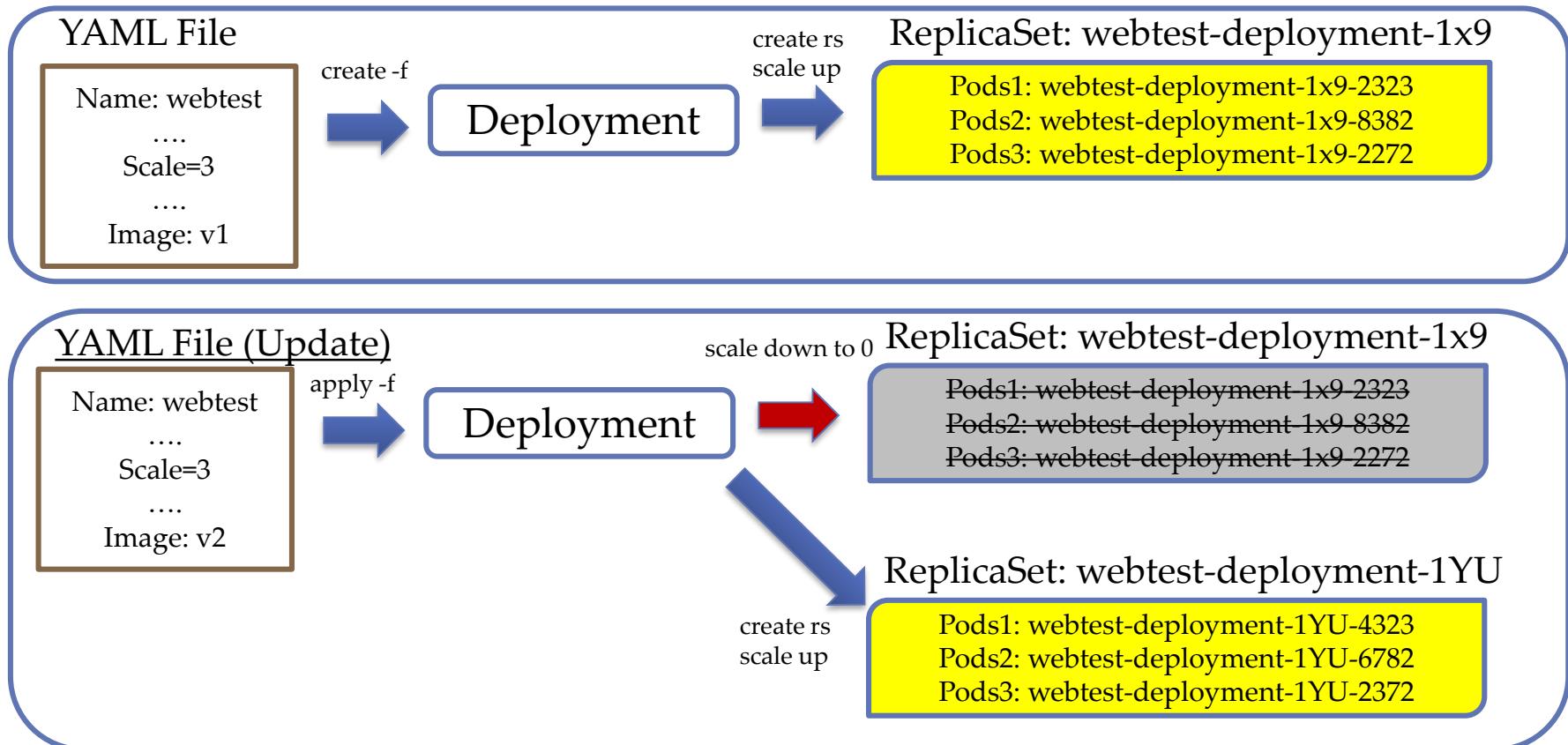
vamp



kubernetes  
by Google

# Deployment/RS and Update

- Deployment update strategy (RollingUpdate)



# 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 coding for set readiness fail when get "SIGTERM"
- Setup "readinessGates" for additional healthcheck for external hookback before start open pods

# 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:~$ ]
```



# 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

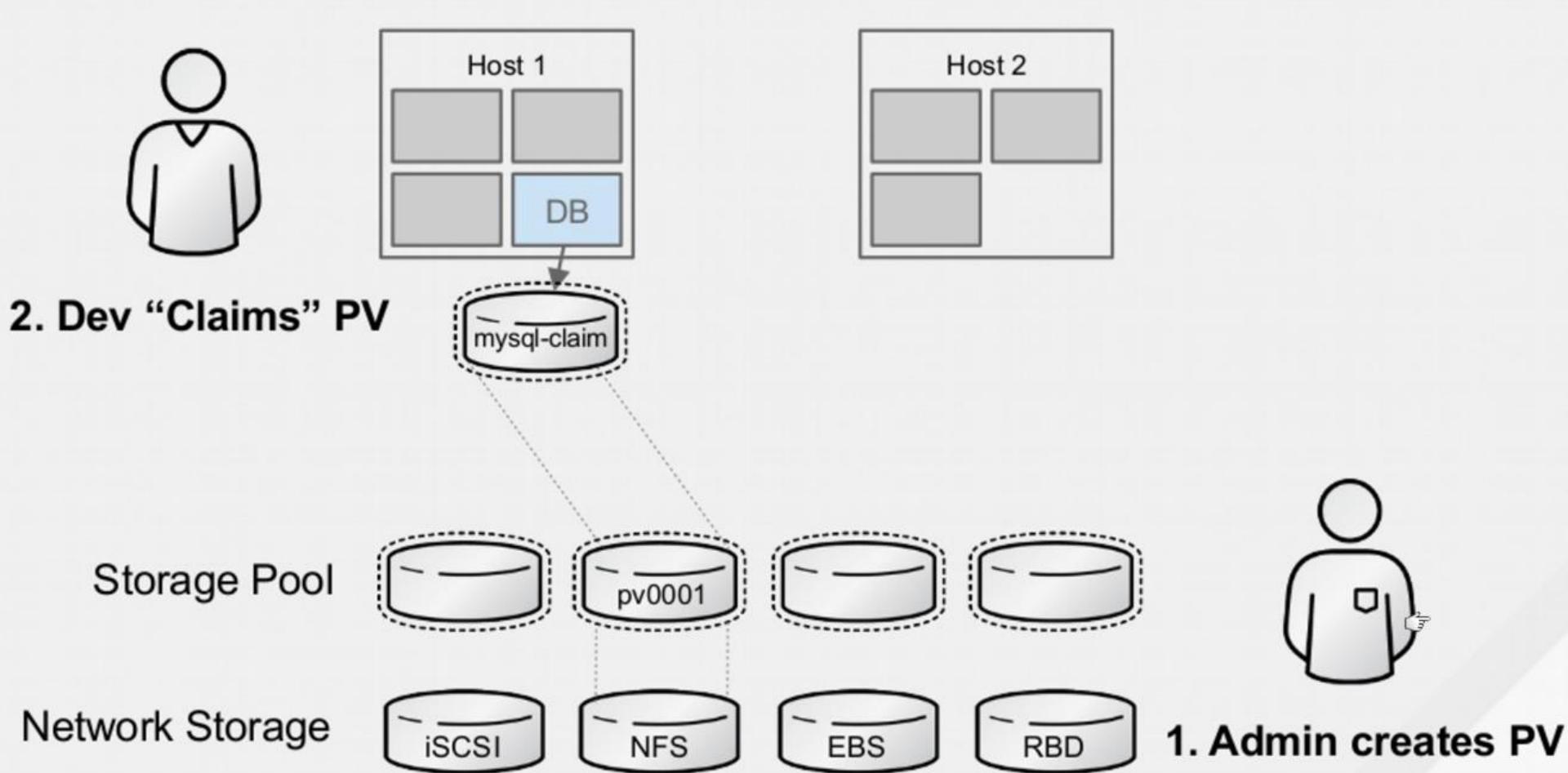
Docker Containers

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 Phase (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



**kubernetes**  
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/>

Kubernetes: Production Workload Orchestration



**kubernetes**  
by Google

# 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/>

Kubernetes: Production Workload Orchestration



**kubernetes**  
by Google

# Liveness and Readiness Probe

- ExecAction:

```
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
29   spec:
30     containers:
31       - name: webtest
32         image: labdocker/cluster:webservicelite_v1
33         ports:
34           - containerPort: 5000
35             protocol: TCP
36         readinessProbe:
37           exec:
38             command:
39               - cat
40               - /usr/src/app/main.py
41             initialDelaySeconds: 15
42             periodSeconds: 5
43         livenessProbe:
44           exec:
45             command:
46               - cat
47               - /usr/src/app/main.py
48             initialDelaySeconds: 15
49             periodSeconds: 15
```

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

Kubernetes: Production Workload Orchestration

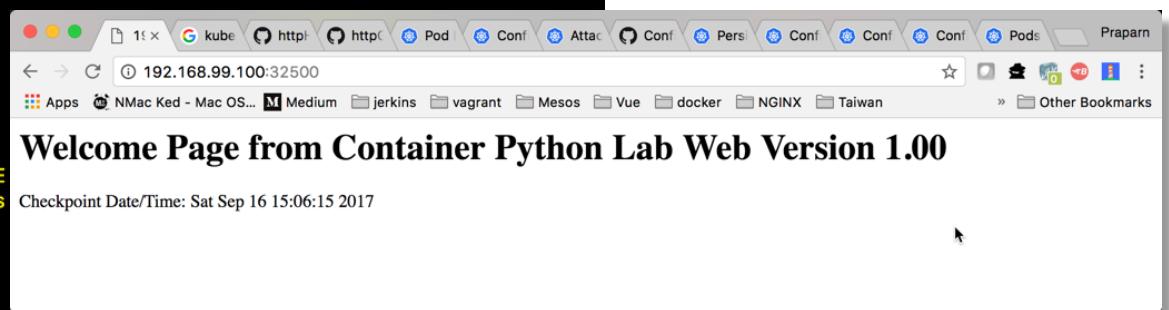


**kubernetes**  
by Google

# 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/>

Kubernetes: Production Workload Orchestration



kubernetes  
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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/>

Kubernetes: Production Workload Orchestration



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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 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:webservicelite_v1
32         ports:
33           - name: webservice
34             containerPort: 5000
35             protocol: TCP
36         readinessProbe:
37           tcpSocket:
38             port: 5000
39           initialDelaySeconds: 15
40           periodSeconds: 5
41         livenessProbe:
42           tcpSocket:
43             port: 5000
44           initialDelaySeconds: 15
45           periodSeconds: 15
```

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

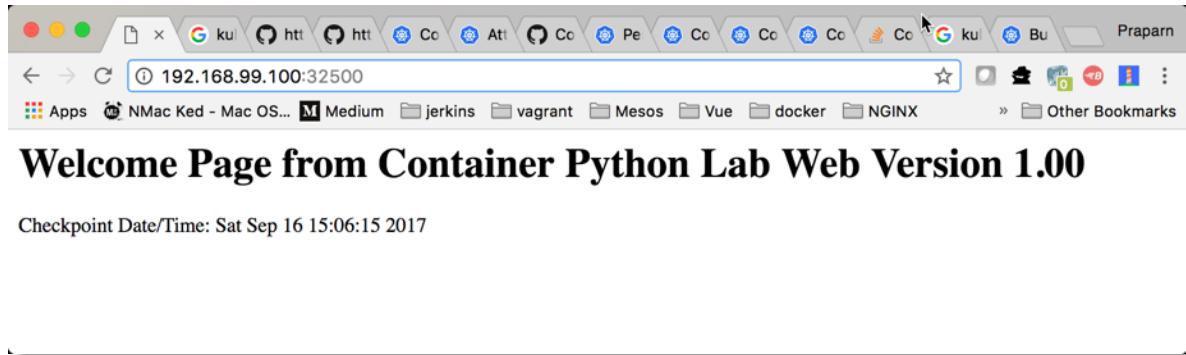
Kubernetes: Production Workload Orchestration



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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.yaml  
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"}...
```



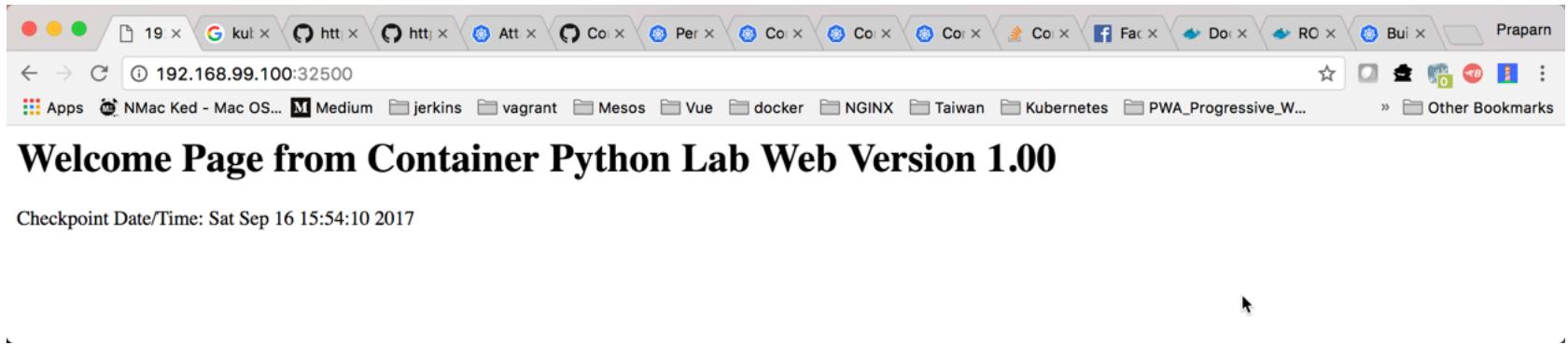
# Liveness and Readiness Probe

- 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:



# 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
29   spec:
30     containers:
31       - name: webtest
32         image: labdocker/cluster:webservicelite_v1
33         ports:
34           - name: webservice
35             containerPort: 5000
36             protocol: TCP
37         readinessProbe:
38           httpGet:
39             # Optional "host: my-host" for set specific ip of Pods
40             # Optional "scheme: HTTPS"
41             #schema: HTTPS
42             path: /
43             port: webservice
44             initialDelaySeconds: 15
45             periodSeconds: 5
46             timeoutSeconds: 10
47             successThreshold: 1
48             failureThreshold: 3
49
50         livenessProbe:
51           httpGet:
52             # Optional "host: my-host" for set specific ip of Pods
53             # Optional "scheme: HTTPS"
54             #schema: HTTPS
55             path: /
56             port: webservice
57             initialDelaySeconds: 15
58             periodSeconds: 10
59             timeoutSeconds: 15
60             successThreshold: 1
61             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
-tmpalte-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 "labdockey/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%								

# Liveness and Readiness Probe

- ReadinessGate: (New feature 1.14)

```
1  apiVersion: apps/v1
2  kind: Deployment
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      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          readinessGates:
32            - conditionType: webtest1.kuberneteslabthailand.com/python1
33          containers:
34            - name: webtest
35              image: labdocker/cluster:webservicelite_v1.51rc
36              ports:
37                - containerPort: 5000
38                  protocol: TCP
39              readinessProbe:
40                exec:
41                  command:
42                    - cat
43                    - /usr/src/app/main.py
44                initialDelaySeconds: 15
45                periodSeconds: 5
```

```
1  Kind: Pod
2  ...
3  spec:
4    readinessGates:
5      - webtest1.kuberneteslabthailand.com/python1
6  ...
7  status:
8    conditions:
9      - lastProbeTime: null
10     lastTransitionTime: 2019-04-13T00:00:00Z
11     status: "False"
12     type: Ready
13      - lastProbeTime: null
14     lastTransitionTime: 2019-04-13T00:00:00Z
15     status: "False"
16     type: webtest1.kuberneteslabthailand.com/python1
17   containerStatuses:
18     - containerID: docker://xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
19     ready : true
20 ...
```



# Workshop 1.6: Liveness and Readiness

The screenshot shows a web browser window with the URL `http://192.168.99.100:32500`. The page title is "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". To the right of the browser, a larger window of the Postman application is open. The Postman interface shows a list of API requests under the "History" tab. One specific request is highlighted: a GET request to `http://192.168.99.100:32500`. The "Headers" tab for this request shows the following headers:

Header	Value
content-length	113
content-type	text/html; charset=utf-8
date	Sat, 16 Sep 2017 15:56:21 GMT
server	Werkzeug/0.12.2 Python/2.7.13

The Postman interface also includes tabs for "Authorization", "Headers", "Body", "Pre-request Script", and "Tests". The "Authorization" tab is currently selected, showing "No Auth". The "Body" tab is also visible.



# Resource Management and HPA

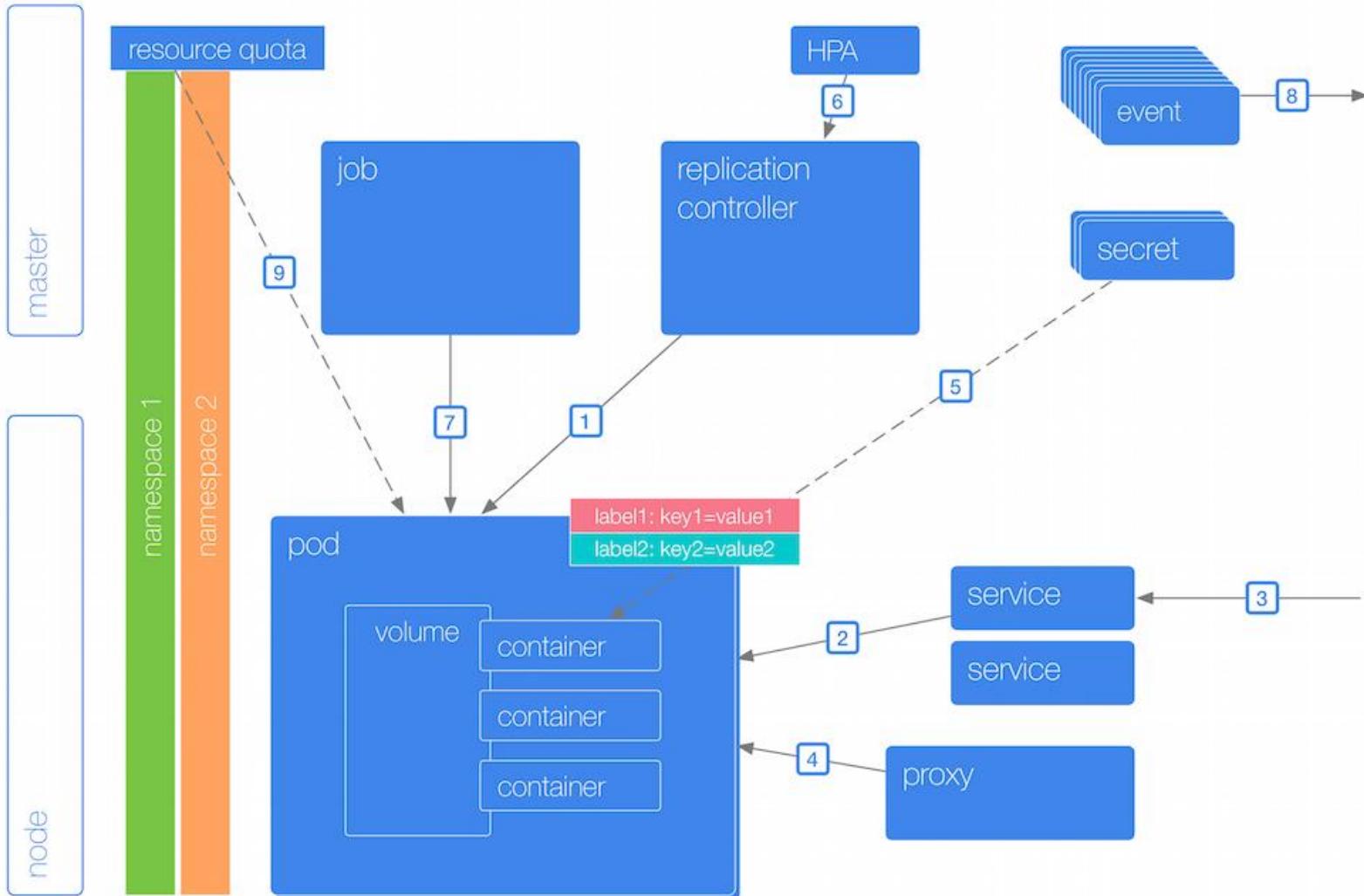


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# Resource Management and HPA



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
    - 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>

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# 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-tqh51	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[███████████]  
%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

- 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  
by Google

# 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



**kubernetes**  
by Google

# 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
38    spec:
39      replicas: 1
40      template:
41        metadata:
42          labels:
43            name: web
44            owner: Praparn_L
45            version: "1.0"
46            module: WebServer
47            environment: development
48
49      spec:
50        containers:
51          - name: webtest
52            image: labdocker/cluster:webservicelite_v1
53            ports:
54              - containerPort: 5000
55                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

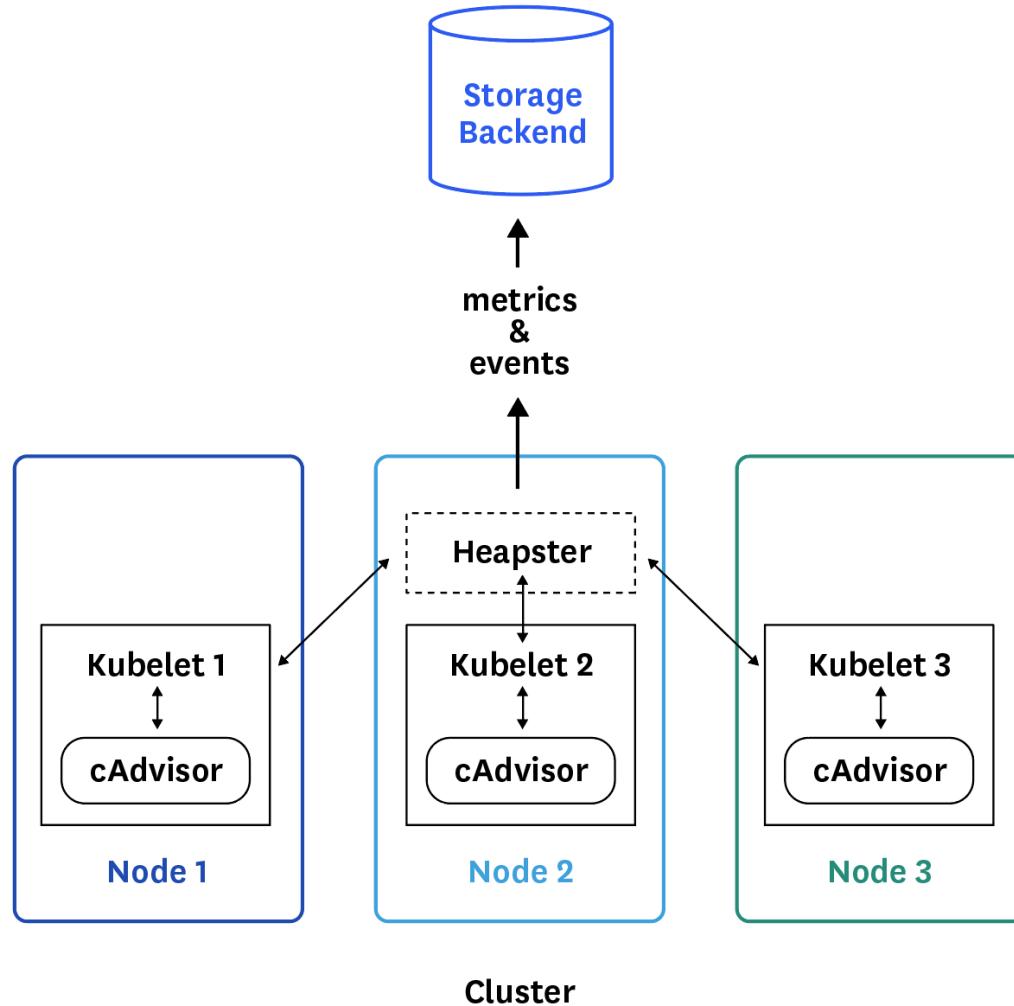
- Horizontal Pod Autoscaling (HPA)
  - The scale is easy to operate with "kubectl scale --replicas=XXX deployment/<name>" with single command
  - But..
    - How can you scale meet up/down actual required ?
  - HPA will response for monitor workload on Pods (Now base on CPU) and automatic trigger deployment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

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

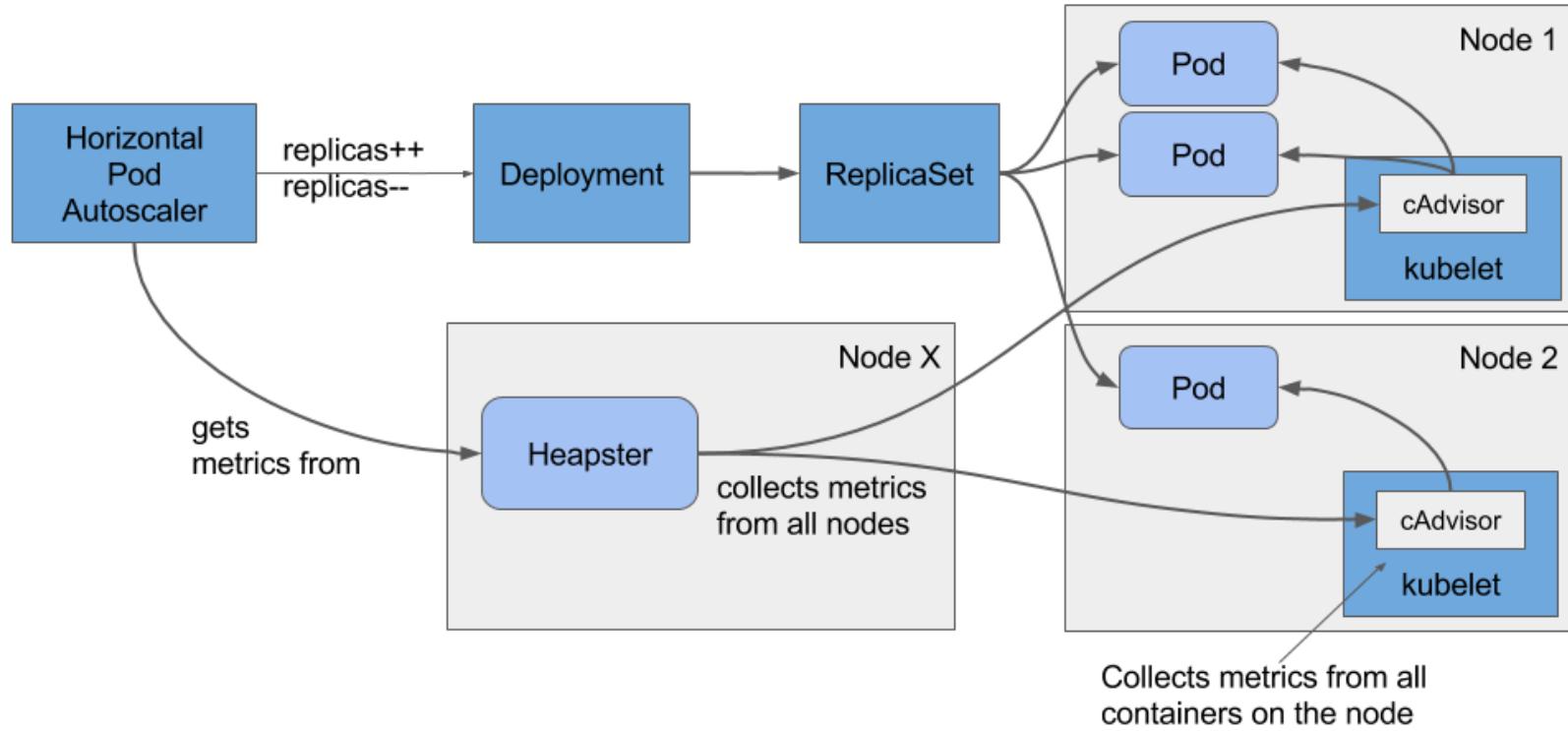
- Ex: kubectl autoscale deployment/webtest --min=1--max=10 --cpu-percent=80



# Resource Management and HPA



# Resource Management and HPA



# Resource Management and HPA

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.

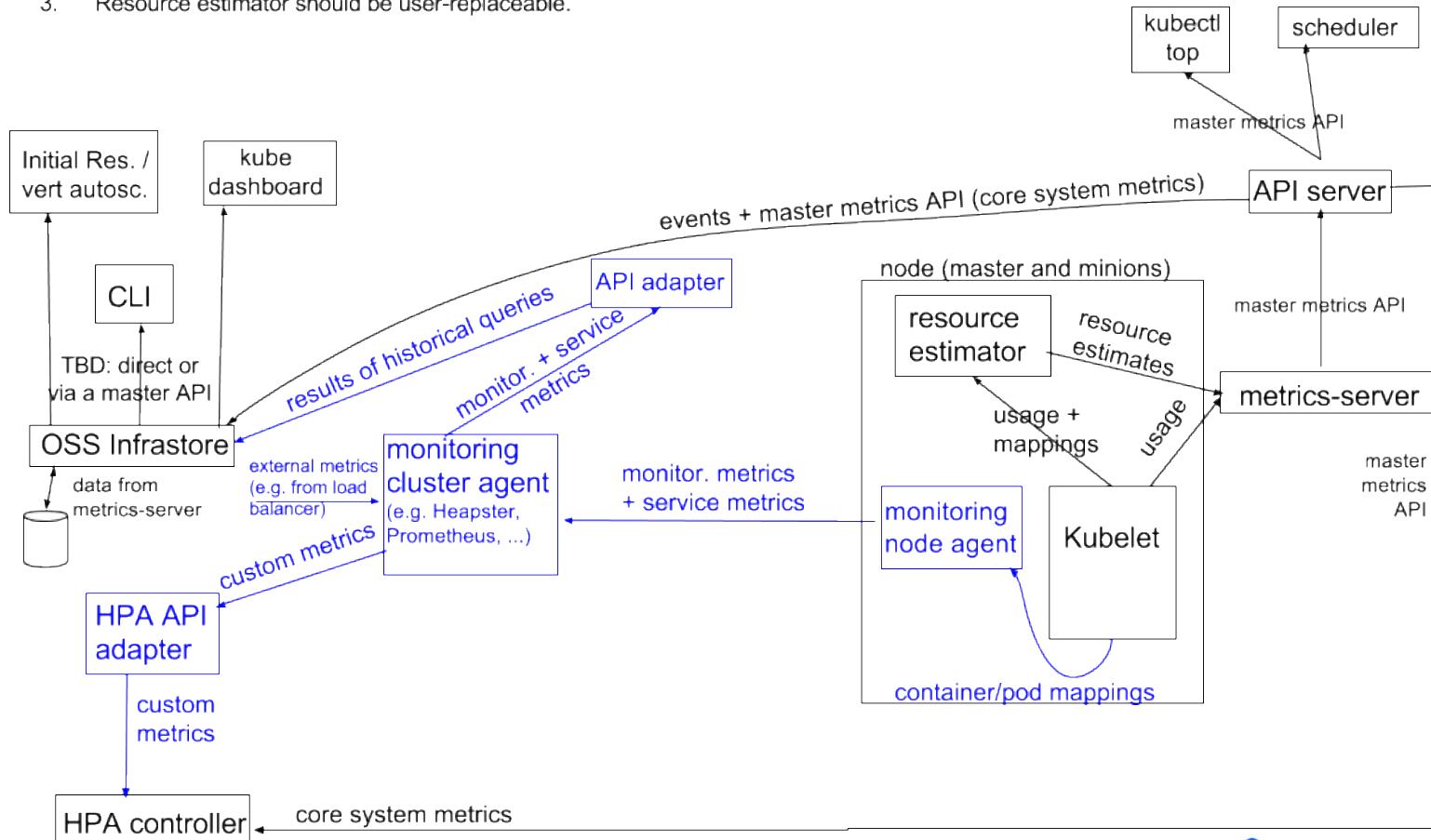


# Resource Management and HPA

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

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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](#)

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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

## Algorithm Details

From the most basic perspective, the Horizontal Pod Autoscaler controller operates on the ratio between desired metric value and current metric value:

```
desiredReplicas = ceil[currentReplicas * ( currentMetricValue / desiredMetricValue )]
```

For example, if the current metric value is `200m`, and the desired value is `100m`, the number of replicas will be doubled, since `200.0 / 100.0 == 2.0`. If the current value is instead `50m`, we'll halve the number of replicas, since `50.0 / 100.0 == 0.5`. We'll skip scaling if the ratio is sufficiently close to 1.0 (within a globally-configurable tolerance, from the `--horizontal-pod-autoscaler-tolerance` flag, which defaults to 0.1).

### --horizontal-pod-autoscaler-initial-readiness-delay

- Default 30 seconds

### --horizontal-pod-autoscaler-cpu-initialization-period

- Default 300 seconds

### --horizontal-pod-autoscaler-downscale-stabilization

- Default 300 seconds

# 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
```

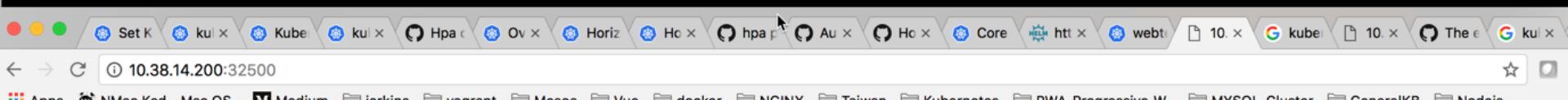
```
27  apiVersion: apps/v1
28  kind: Deployment
29  metadata:
30    name: webtest
31    labels:
32      name: web
33      owner: Praparn_L
34      version: "1.0"
35      module: WebServer
36      environment: development
37  spec:
38    replicas: 1
39    selector:
40      matchLabels:
41        name: 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:~$
```



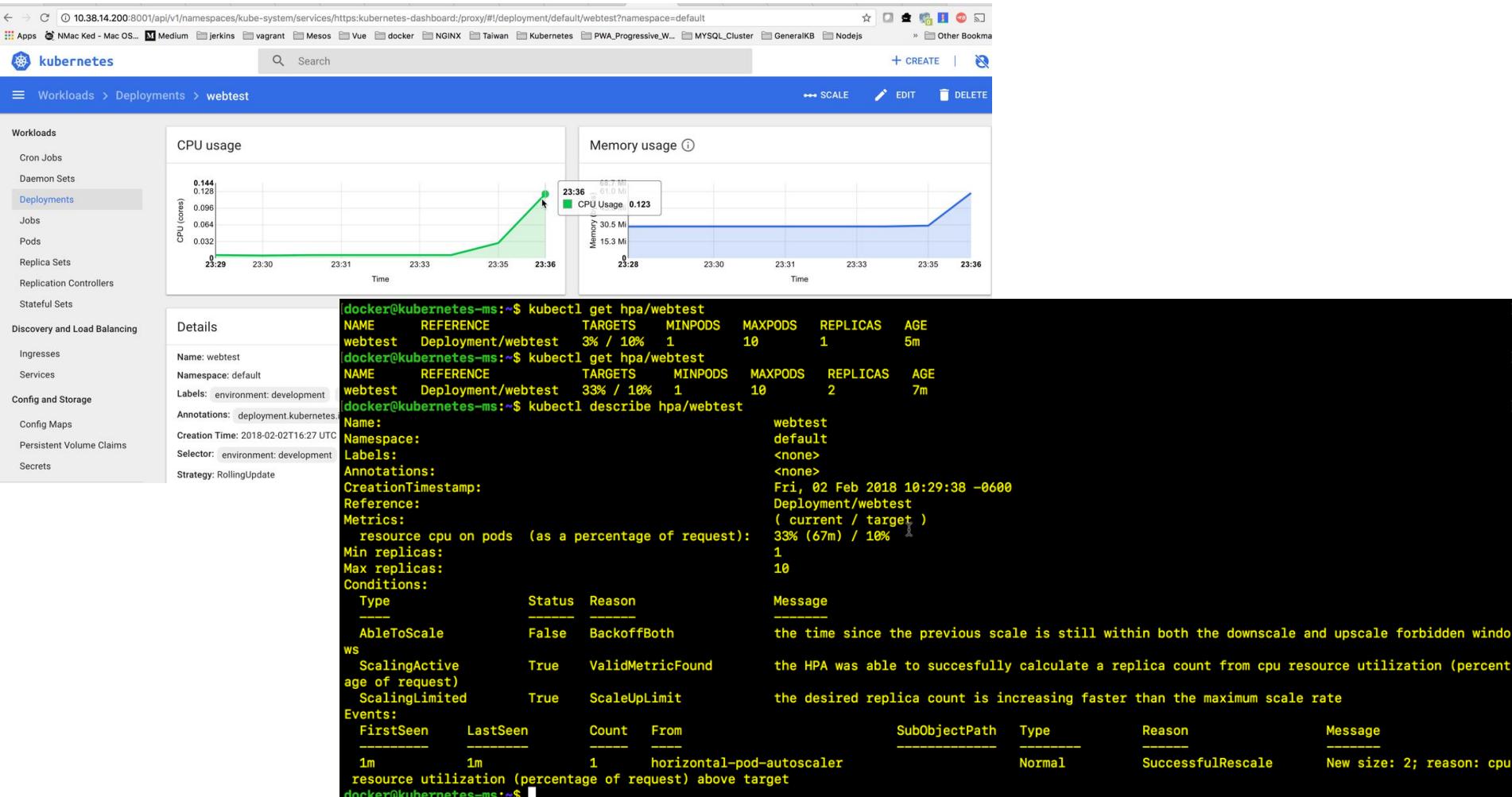
# Resource Management and HPA

- 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)



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# 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
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# Outline Day 2

- Fundamental of Kubernetes
  - ConfigMap Secret
  - Job and CronJob
  - Log and Monitoring
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- 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



# 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>
```

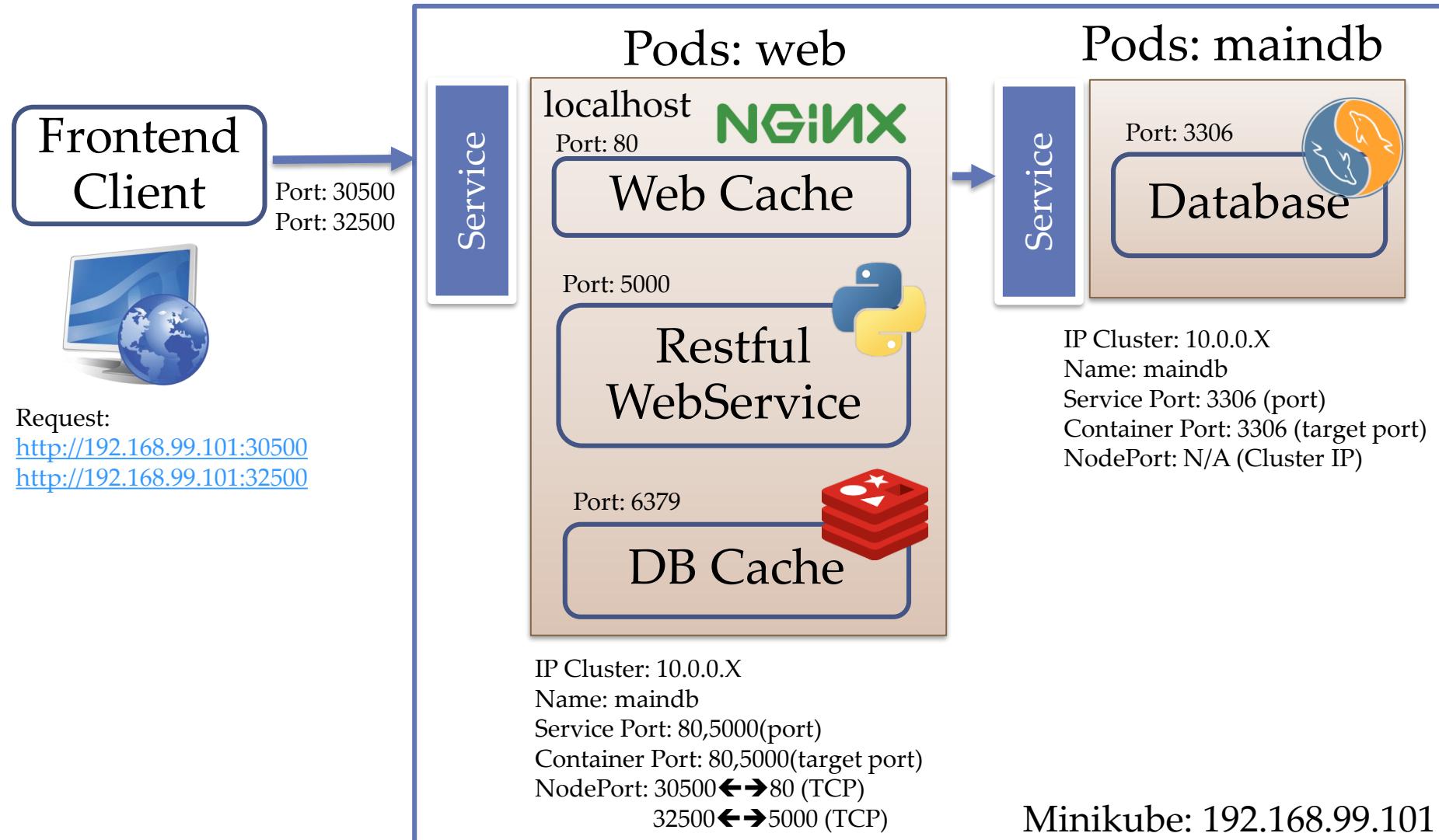
- Ex: “kubectl create secret generic databasemodule\_secret --from-file=./username.txt --from-file=./password.txt”
- Ex: “kubectl create -f databasemodule\_secret.yml”

```
|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:

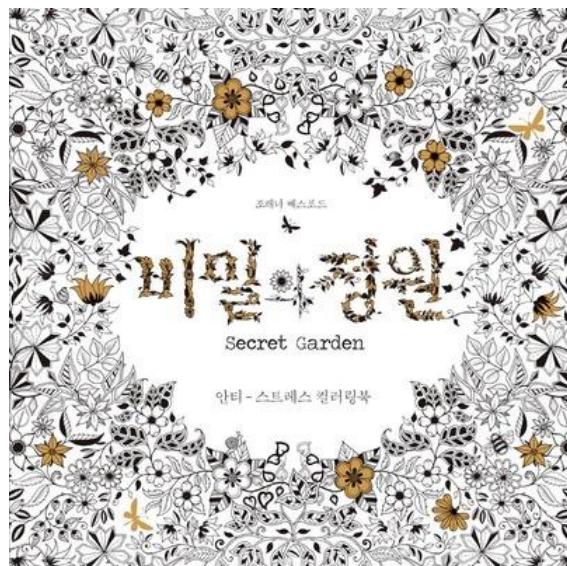
webmodule\_configmap.yaml

```
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

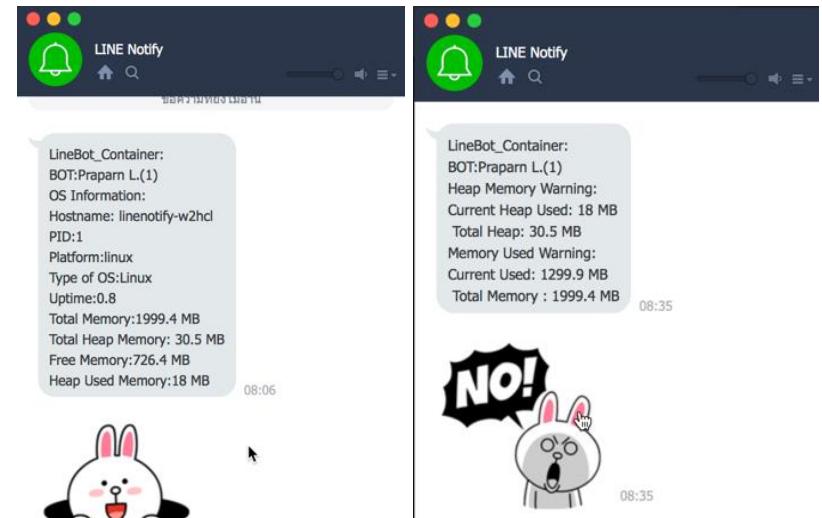


# Job and Cron Job

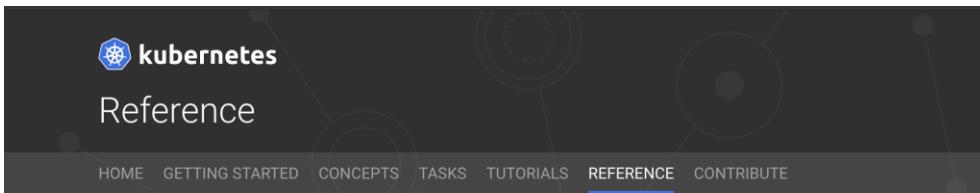
Job.yml:

```
WorkShop_2.2_Job_CronJob ▶ ! 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 spec:
12   ttlSecondsAfterFinished: 30
13   activeDeadlineSeconds: 60
14   template:
15     metadata:
16       name: linenotify
17     spec:
18       containers:
19         - name: linenotify
20           image: labdocker/linenotify:onetime
21           env:
22             - name: TITLE
23               value: "BOT:Praparn_L."
24             - name: INTERVAL
25               value: "10000"
26             - name: HEAP_HIGH
27               value: "20"
28             - name: MEM_HIGH
29               value: "20"
30             - name: SH_OS
31               value: "Y"
32             - name: TOKEN
33               value: "E1eqyllzkzpaCo1R0rebZTcGbIyzDZHp0jcd0t6CX"
34   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>
```



# Job and Cron Job



The header of the Kubernetes Reference documentation. It features the Kubernetes logo (a blue hexagon with a white star) and the word "kubernetes" in lowercase. Below the logo is the word "Reference". A navigation bar below the header includes links for "HOME", "GETTING STARTED", "CONCEPTS", "TASKS", "TUTORIALS", "REFERENCE" (which is underlined to indicate it's the current page), and "CONTRIBUTE".

## Reference

### Standardized Glossary

- ▶ Kubernetes Issues and Security
  - ▶ Using the Kubernetes API
  - ▶ Accessing the API
  - ▶ API Reference
  - ▼ Setup tools reference
    - ▶ Kubeadm
- Overview of kubeadm
- kubeadm init
- kubeadm join

## Options

```
--apiserver-advertise-address string      The IP address the API Server will advertise it's listening on. If not set the default netw
--apiserver-bind-port int32                Port for the API Server to bind to. (default 6443)
--apiserver-cert-extra-sans strings       Optional extra Subject Alternative Names (SANs) to use for the API Server serving certifica
--cert-dir string                         The path where to save and store the certificates. (default "/etc/kubernetes/pki")
--certificate-key string                  Key used to encrypt the control-plane certificates in the kubeadm-certs Secret.
--config string                           Path to a kubeadm configuration file.
--cri-socket string                      Path to the CRI socket to connect. If empty kubeadm will try to auto-detect this value; use
--dry-run                                Don't apply any changes; just output what would be done.
--feature-gates string                   A set of key-value pairs that describe feature gates for various features. No feature gates
--help                                     help for init
--ignore-preflight-errors strings        A list of checks whose errors will be shown as warnings. Example: 'IsPrivilegedUser,Swap'.
--image-repository string                Choose a container registry to pull control plane images from (default "k8s.gcr.io")
--kubernetes-version string             Choose a specific Kubernetes version for the control plane. (default "stable-1")
--node-name string                       Specify the node name.
--pod-network-cidr string               Specify range of IP addresses for the pod network. If set, the control plane will automatic
--service-cidr string                   Use alternative range of IP address for service VIPs. (default "10.96.0.0/12")
--service-dns-domain string            Use alternative domain for services, e.g. "myorg.internal". (default "cluster.local")
--skip-certificate-key-print           Don't print the key used to encrypt the control-plane certificates.
--skip-phases strings                  List of phases to be skipped
--skip-token-print                     Skip printing of the default bootstrap token generated by 'kubeadm init'.
--token string                          The token to use for establishing bidirectional trust between nodes and control-plane nodes
--token-ttl duration                  The duration before the token is automatically deleted (e.g. 1s, 2m, 3h). If set to '0', th
--upload-certs                         Upload control-plane certificates to the kubeadm-certs Secret.
```

## kubeadm init



This command initializes a Kubernetes control-plane node.

### What's next

Run this command in order to set up the Kubernetes control plane

## Synopsis

Run this command in order to set up the Kubernetes control plane

The "init" command executes the following phases:

savitaashture commented on Dec 13, 2018

Author + 3 ...

Thanks a lot.

Its working now.

Earlier i haven't set --feature-gates=TTLAfterFinished=true in controller yaml thats the reason it was not working.

3

## TTL Mechanism for Finished Jobs

FEATURE STATE: Kubernetes v1.12 alpha

Another way to clean up finished Jobs (either **Complete** or **Failed**) automatically is to use a TTL mechanism provided by a [TTL controller](#) for finished resources, by specifying the `.spec.ttlSecondsAfterFinished` field of the Job.

When the TTL controller cleans up the Job, it will delete the Job cascadingly, i.e. delete its dependent objects, such as Pods, together with the Job. Note that when the Job is deleted, its lifecycle guarantees, such as finalizers, will be honored.

For example:

```
apiVersion: batch/v1
kind: Job
metadata:
  name: pi-with-ttl
spec:
  ttlSecondsAfterFinished: 100
  template:
    spec:
      containers:
        - name: pi
          image: perl
          command: ["perl", "-Mbignum=bpi", "-wle", "print bpi(2000)"]
          restartPolicy: Never
```

The Job `pi-with-ttl` will be eligible to be automatically deleted, **100** seconds after it finishes.

<https://kubernetes.io/docs/reference/setup-tools/kubeadm/kubeadm-init/>

<https://github.com/kubernetes/kubernetes/issues/71993>

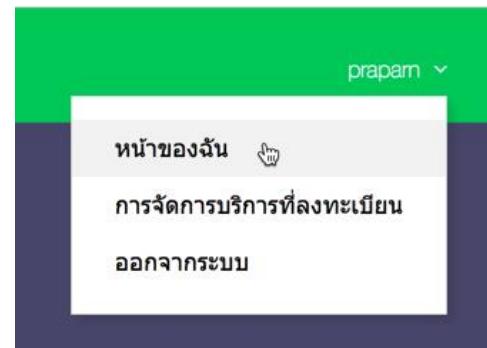
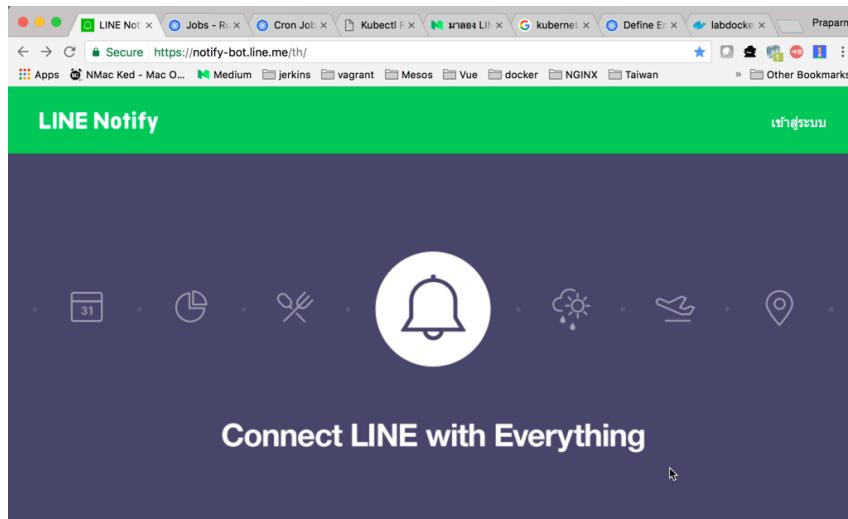
Kubernetes: Production Workload Orchestration



**kubernetes**  
by Google

# 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

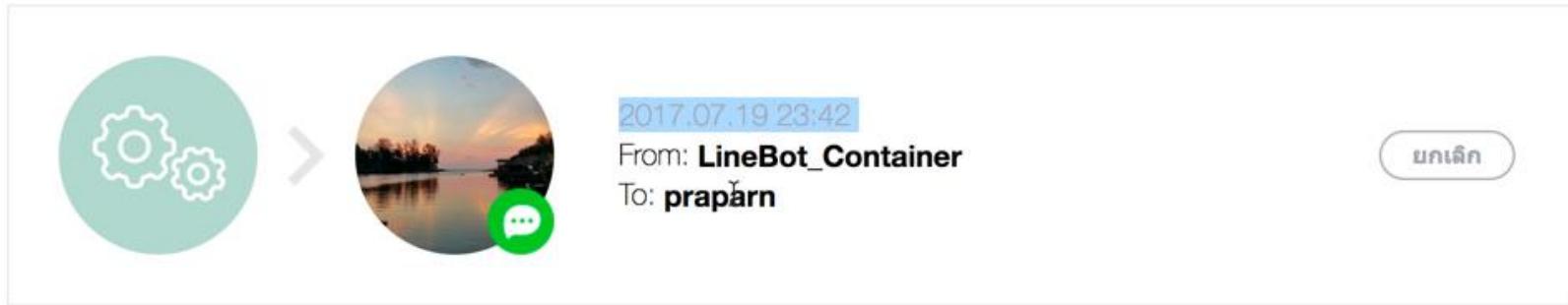
 **รับการแจ้งเตือนแบบตัวต่อตัวจาก LINE Notify**

**Token ที่ออก**

**zHOlcJCcpIIS8mEedn** 

ถ้าออกจากหน้านี้ ระบบจะไม่แสดง Token ที่ออกใหม่ถ้าต่อไป โปรดล็อก Token ก่อนออกจากหน้านี้

**ดูผล**  **ปิด**



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



# 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
lwolf committed 26 days ago go fmt, update README, more flexible makefile	go fmt, update README, more flexible makefile	Latest commit 1183f6f 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	Feautre/makefile (#10)	26 days ago
Dockerfile	Feautre/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:

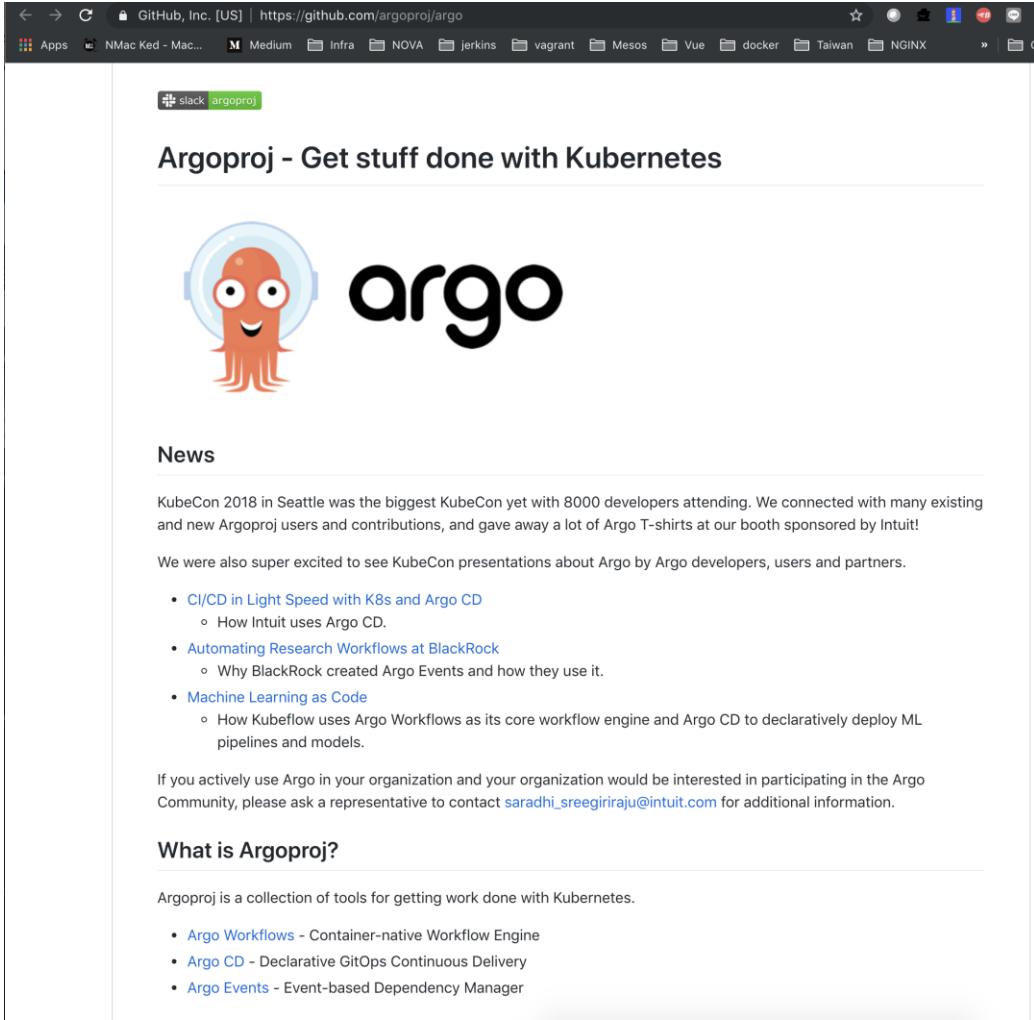
- All Namespaces are monitored by default
- Only Pods created by Jobs are monitored

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



# Job and Cron Job

- WorkFlow Job



The screenshot shows the GitHub repository page for `argoproj/argo`. The page features a large orange octopus logo with a space helmet, labeled "argo". Below the logo is a "News" section. The news items mention KubeCon 2018 in Seattle, Argo CD presentations at KubeCon, and Argo's use in organizations like BlackRock and Intuit. There is also a section about Argo Events. At the bottom, there is a "What is Argo?" section and a list of related projects.

**Argoproj - Get stuff done with Kubernetes**

**News**

KubeCon 2018 in Seattle was the biggest KubeCon yet with 8000 developers attending. We connected with many existing and new Argoproj users and contributions, and gave away a lot of Argo T-shirts at our booth sponsored by Intuit!

We were also super excited to see KubeCon presentations about Argo by Argo developers, users and partners.

- [CI/CD in Light Speed with K8s and Argo CD](#)
  - How Intuit uses Argo CD.
- [Automating Research Workflows at BlackRock](#)
  - Why BlackRock created Argo Events and how they use it.
- [Machine Learning as Code](#)
  - How Kubeflow uses Argo Workflows as its core workflow engine and Argo CD to declaratively deploy ML pipelines and models.

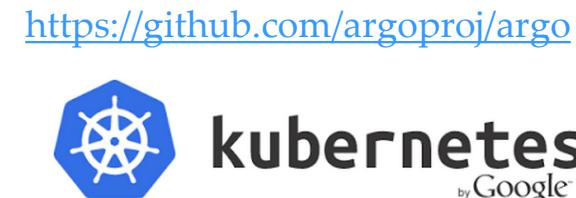
If you actively use Argo in your organization and your organization would be interested in participating in the Argo Community, please ask a representative to contact [saradhi\\_sreegiriraju@intuit.com](mailto:saradhi_sreegiriraju@intuit.com) for additional information.

**What is Argo?**

Argoproj is a collection of tools for getting work done with Kubernetes.

- [Argo Workflows](#) - Container-native Workflow Engine
- [Argo CD](#) - Declarative GitOps Continuous Delivery
- [Argo Events](#) - Event-based Dependency Manager

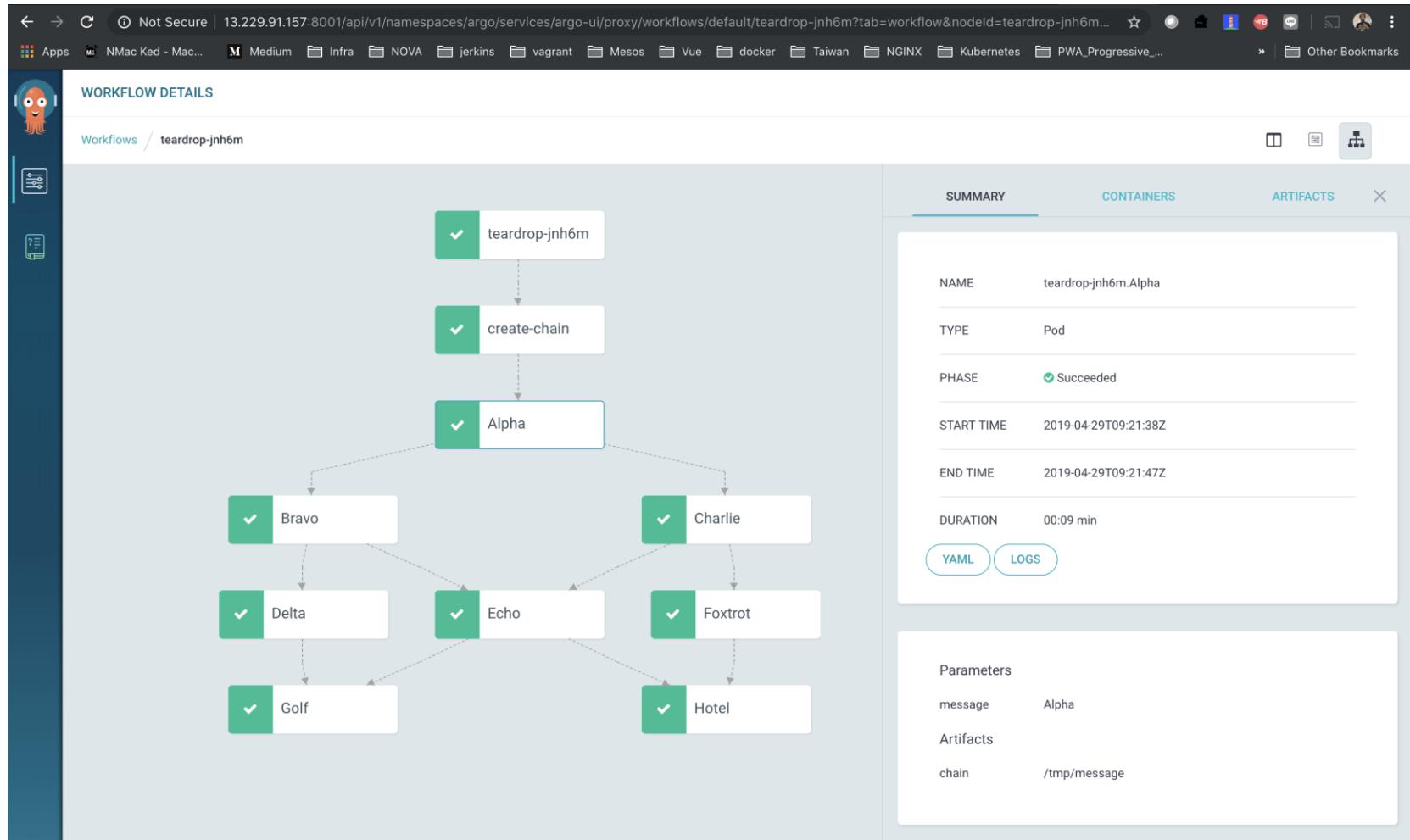
Kubernetes: Production Workload Orchestration



<https://github.com/argoproj/argo>

# Job and Cron Job

- WorkFlow Job



<https://github.com/argoproj/argo>

# Kubernetes: Production Workload Orchestration



**kubernetes**  
by Google

# 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

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...

Name	Labels	Pods	Age	Images
maindb-1334333237	environment: development module: maindb	1 / 1	48 seconds	labdocker/mysql:latest
	pod-template-hash: 1334...			
	show all labels			
	environment: development module: maindb			

```
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]
```



# Workshop 2.3: Log and Monitoring



# Ingress Network



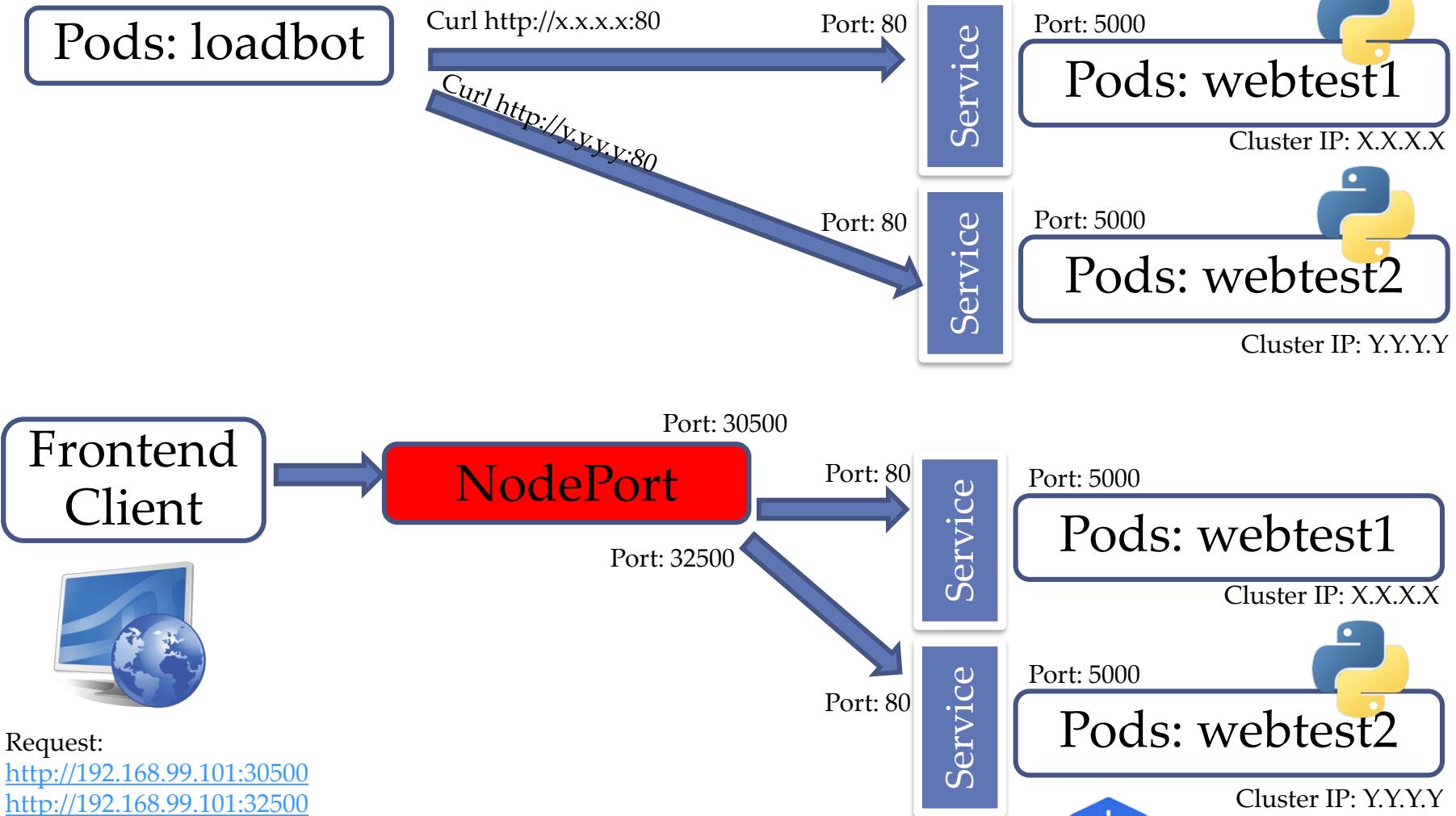
# Ingress Network

- 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

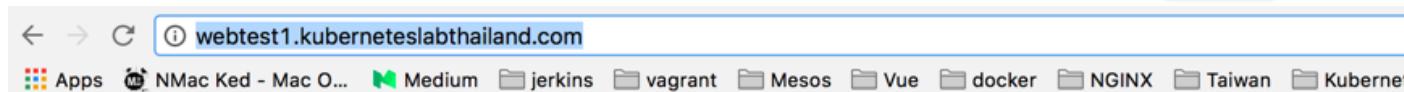
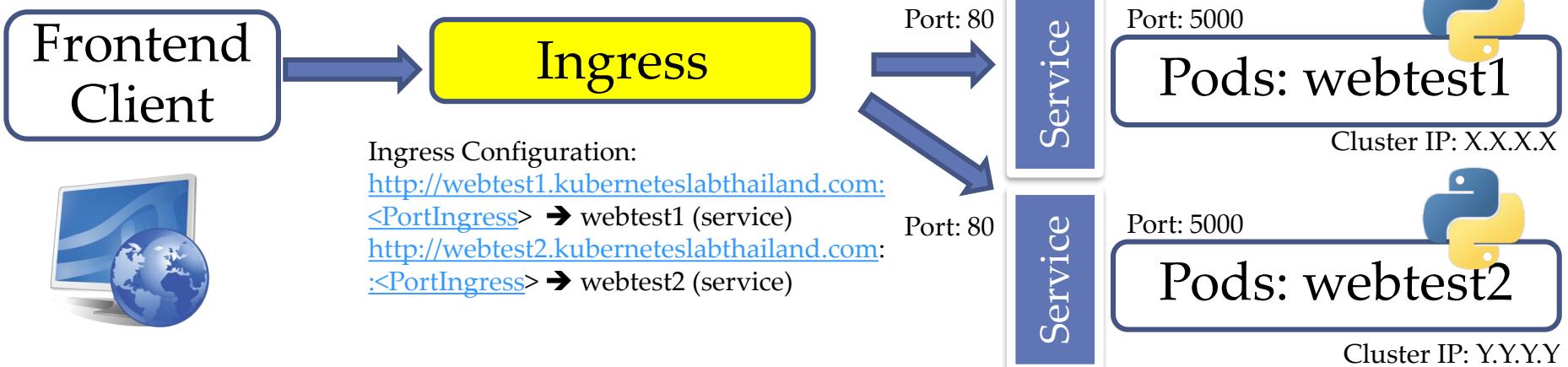
# Ingress Network

- Service:



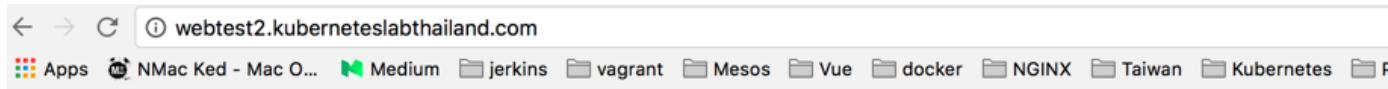
# Ingress Network

- 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
```

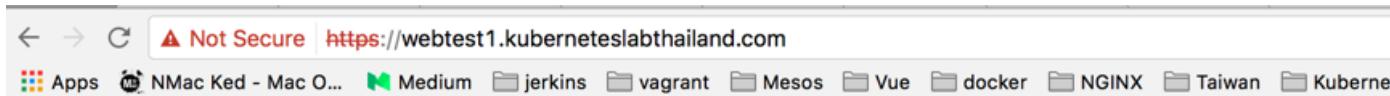
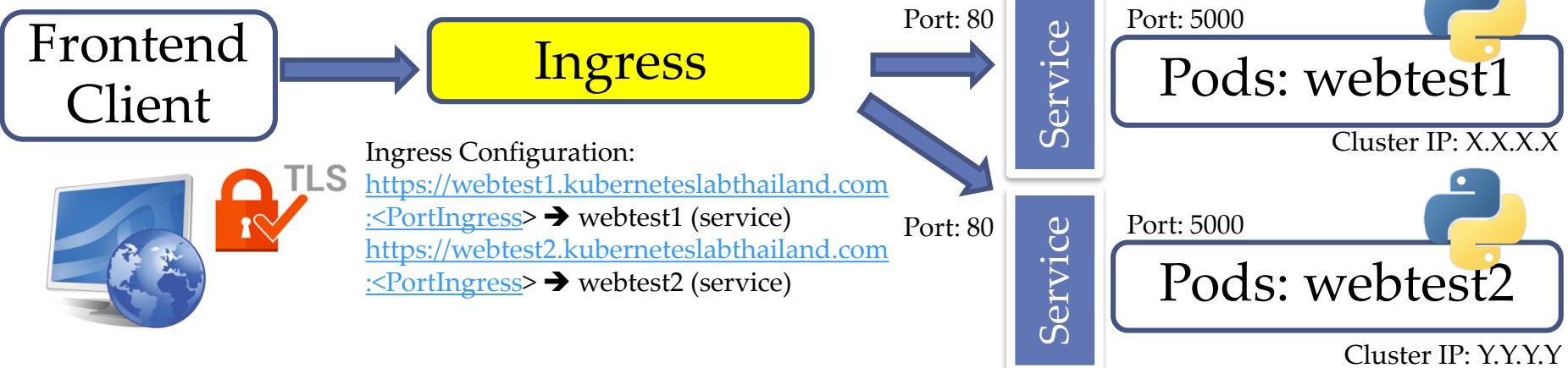
Ingress: ingresswebtest

```
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
```



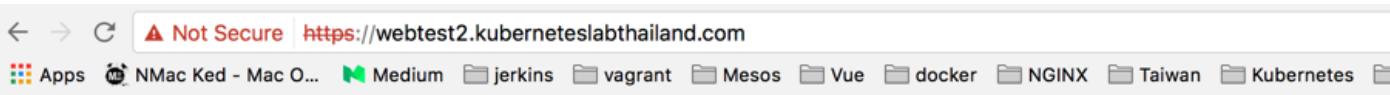
# Ingress Network

- 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
26
```

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
```

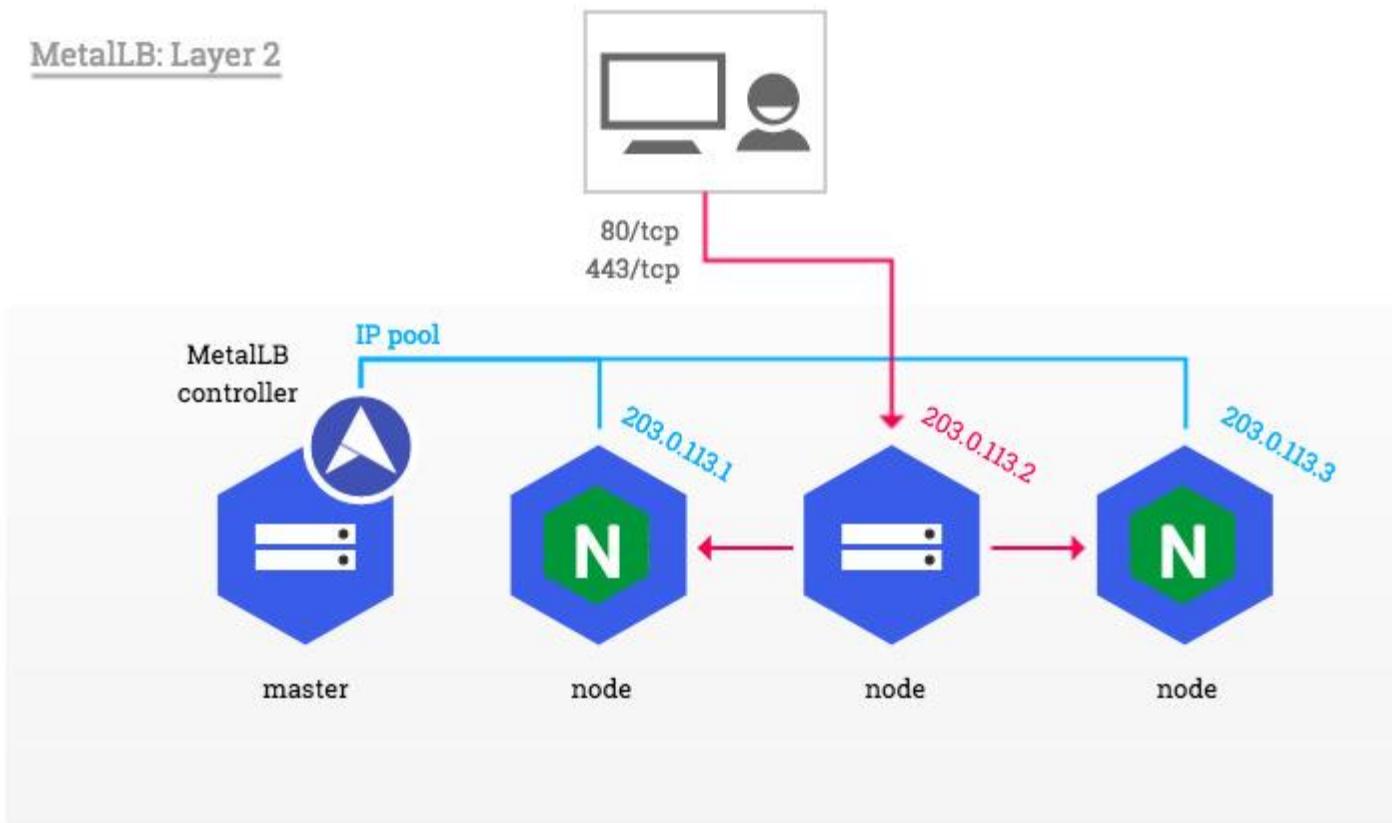
Secret: webtest2

```
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
```



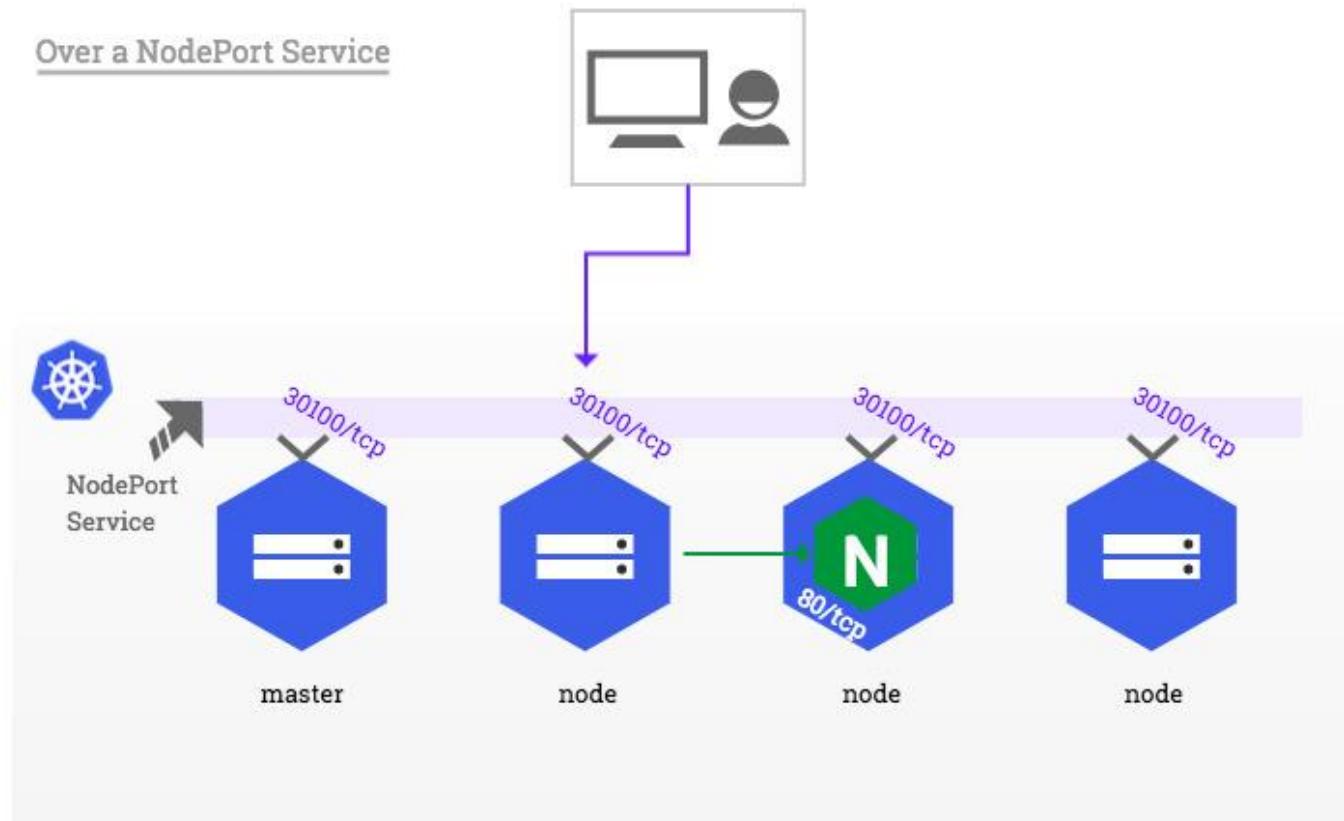
# Ingress Network

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



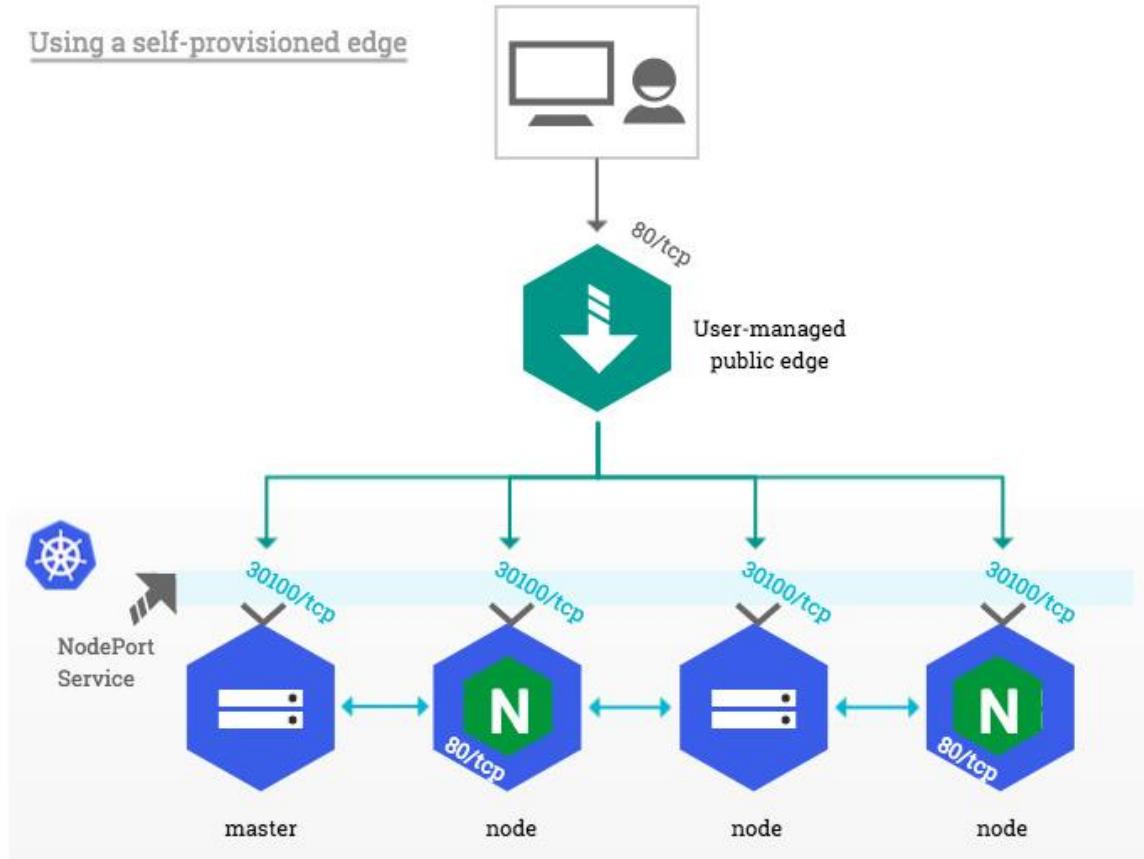
# Ingress Network

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



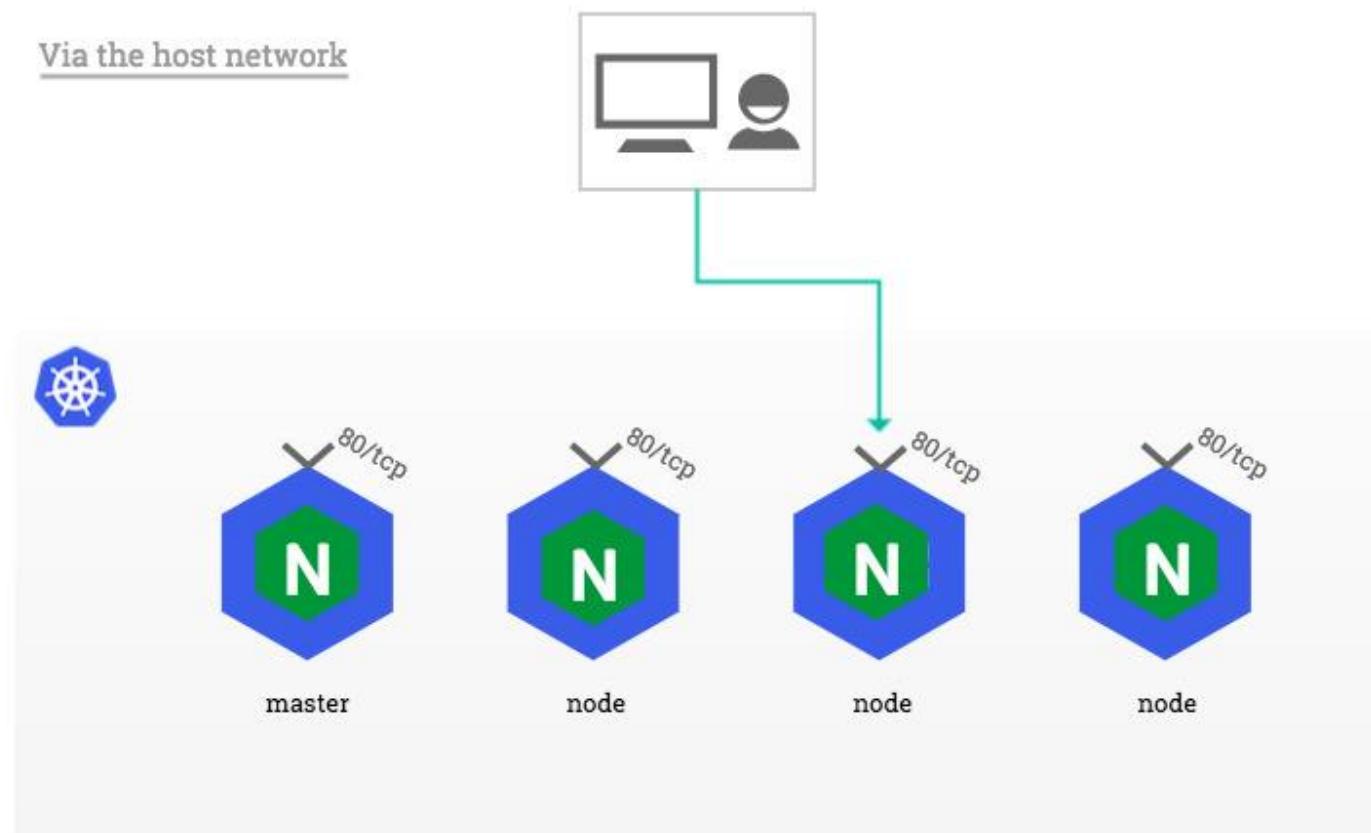
# Ingress Network

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



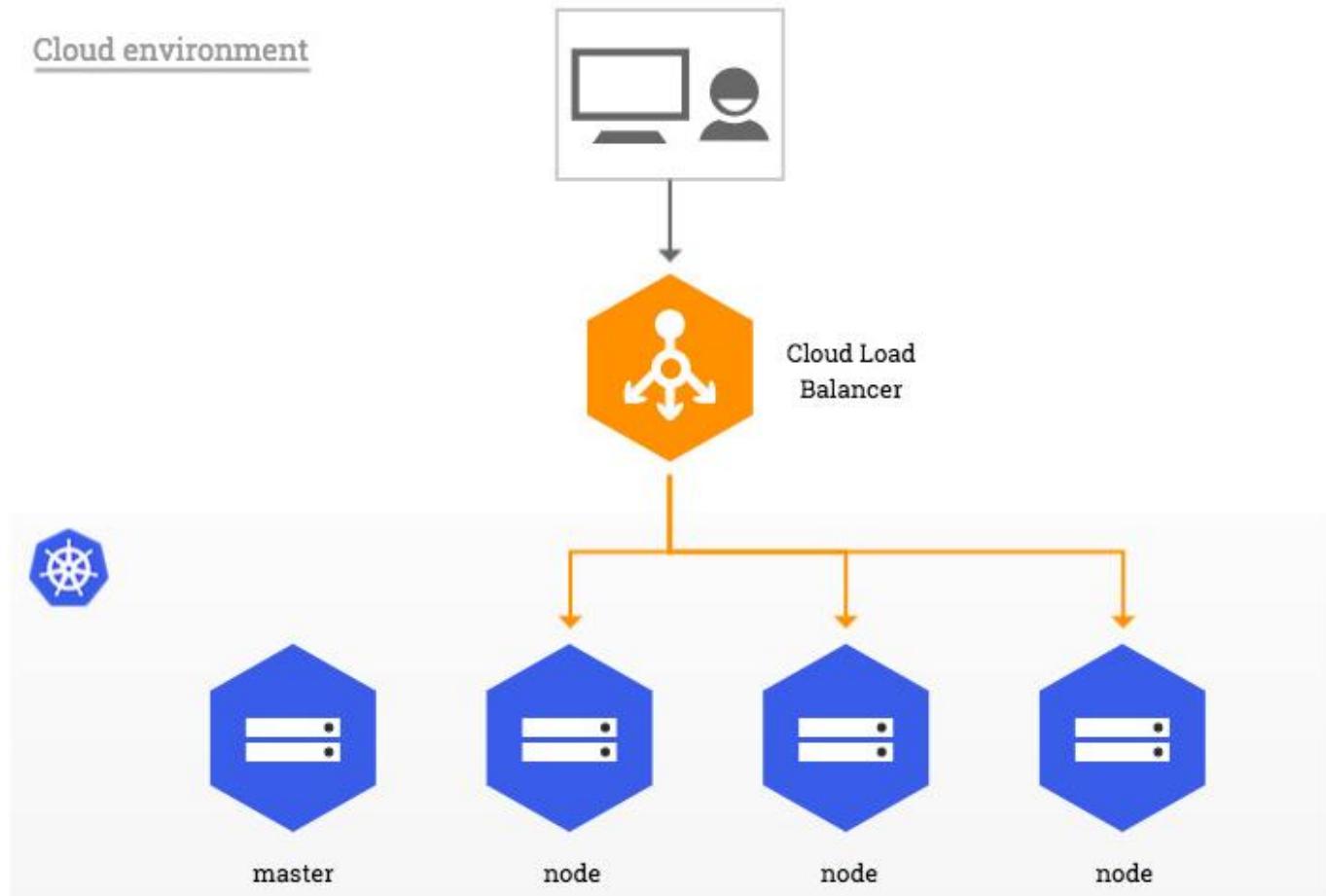
# Ingress Network

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



# Ingress Network

- Ingress for Cloud strategy



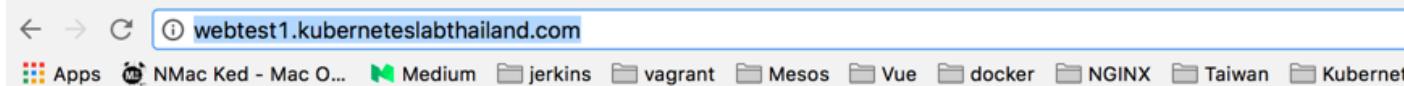
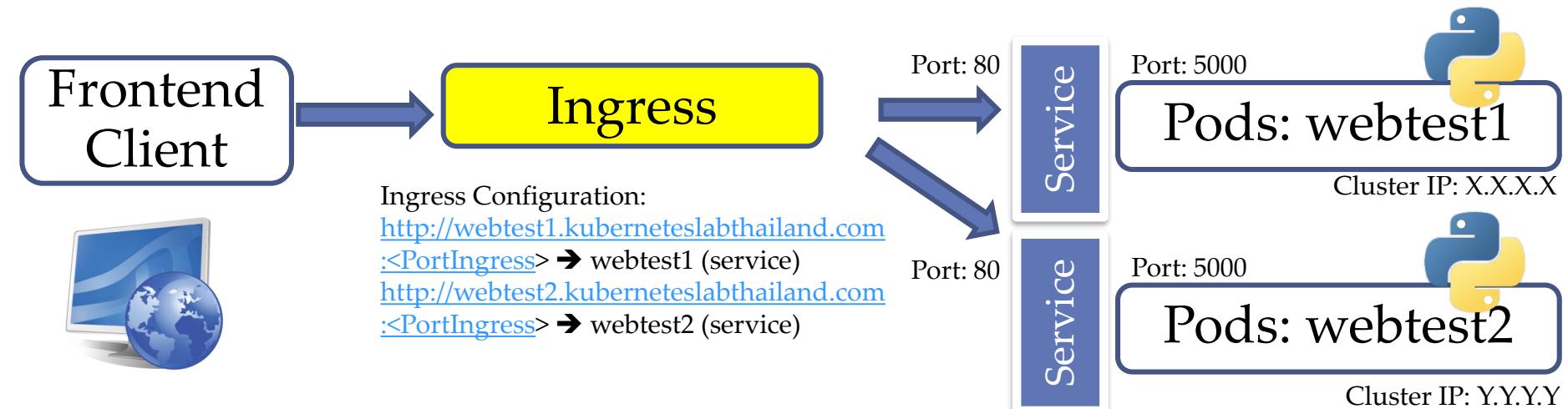
# Ingress Network

- 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/TrainingAdvanceDockerwithK8SStudentG5	me	Show Column



# Workshop 2.4: Ingress Network



# Kubernetes in real world



Kubernetes: Production Workload Orchestration



**kubernetes**  
by Google

# 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
    - Kube-Router
    - Etc
  - Phase 4: Join node to cluster system
    - `kubeadm join <option>`



# Kubernetes in real world

kubeadm maturity

Area	Maturity Level
Command line UX	GA
Implementation	GA
Config file API	Beta
CoreDNS	GA
kubeadm alpha subcommands	Alpha
High availability	Beta
DynamicKubeletConfig	Alpha

kubeadm's overall feature state is **GA**. Some sub-features, like the configuration file API are still under active development. The implementation of creating the cluster may change slightly as the tool evolves, but the overall implementation should be pretty stable. Any commands under `kubeadm alpha` are by definition, supported on an alpha level.

## Support timeframes

Kubernetes releases are generally supported for nine months, and during that period a patch release may be issued from the release branch if a severe bug or security issue is found. Here are the latest Kubernetes releases and the support timeframe; which also applies to `kubeadm`.

Kubernetes version	Release month	End-of-life-month
v1.6.x	March 2017	December 2017
v1.7.x	June 2017	March 2018
v1.8.x	September 2017	June 2018
v1.9.x	December 2017	September 2018
v1.10.x	March 2018	December 2018
v1.11.x	June 2018	March 2019
v1.12.x	September 2018	June 2019
v1.13.x	December 2018	September 2019
v1.14.x	March 2019	December 2019
v1.15.x	June 2019	March 2020

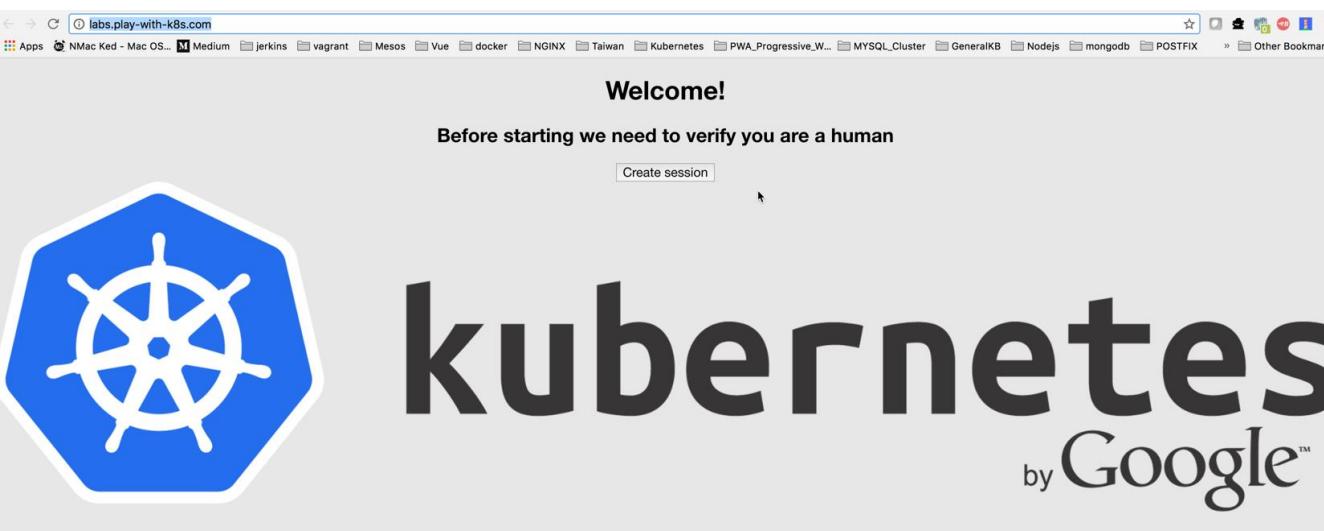
Ref: <https://kubernetes.io/docs/setup/independent/create-cluster-kubeadm/>

Kubernetes: Production Workload Orchestration



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# 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

CNI	EASY	AUTO - MTU	CORRECTION
Calico	😊	😐	ConfigMap
Canal	😊	😐	ConfigMap
Cilium	😢	😊	External ETCD
Flannel	😊	😊	✓
Kube-router	😊	😐	ConfigMap
Romana	😐	😊	Tolerations
WeaveNet	😊	😐	ENV var

Summary of setup benchmark result

CNI	ENCRYPTION	NETWORK POLICIES
Calico	😐	No 😊 Ingress + Egress
Canal	😐	No 😊 Ingress + Egress
Cilium	😐	No 😊 Ingress + Egress
Flannel	😐	No 😐 No
Kube-router	😐	No 😊 Ingress
Romana	😐	😢 Doc=yes, Reality=no
WeaveNet	😊 Yes	😊 Ingress

Summary of security benchmark result

<https://itnext.io/benchmark-results-of-kubernetes-network-plugins-cni-over-10gbit-s-network-36475925a560>

Kubernetes: Production Workload Orchestration

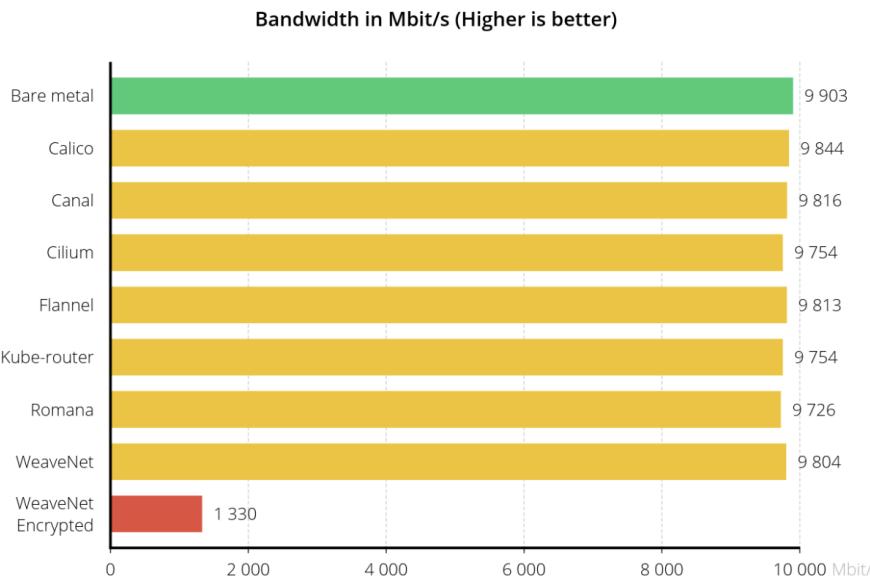


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# Kubernetes in real world

- Network Optional

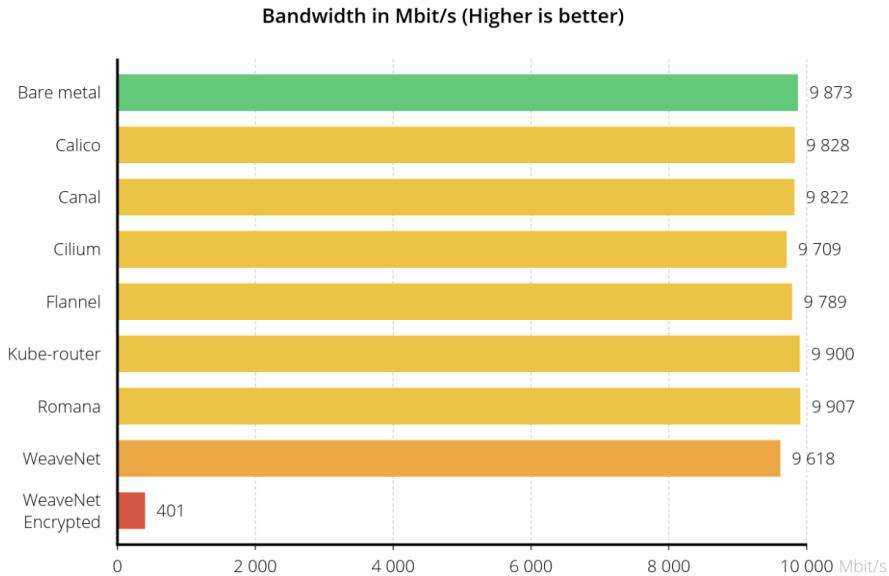
**Kubernetes CNI benchmark - 10Gbit network - TCP**



2018-11-15 - DEVOPS D-DAY 2018 - Alexis Ducastel - <https://infrabuilder.com> - Benchmark tool : iperf3

TCP performance

**Kubernetes CNI benchmark - 10Gbit network - UDP**



2018-11-15 - DEVOPS D-DAY 2018 - Alexis Ducastel - <https://infrabuilder.com> - Benchmark tool : iperf3

<https://itnext.io/benchmark-results-of-kubernetes-network-plugins-cni-over-10gbit-s-network-36475925a560>

Kubernetes: Production Workload Orchestration

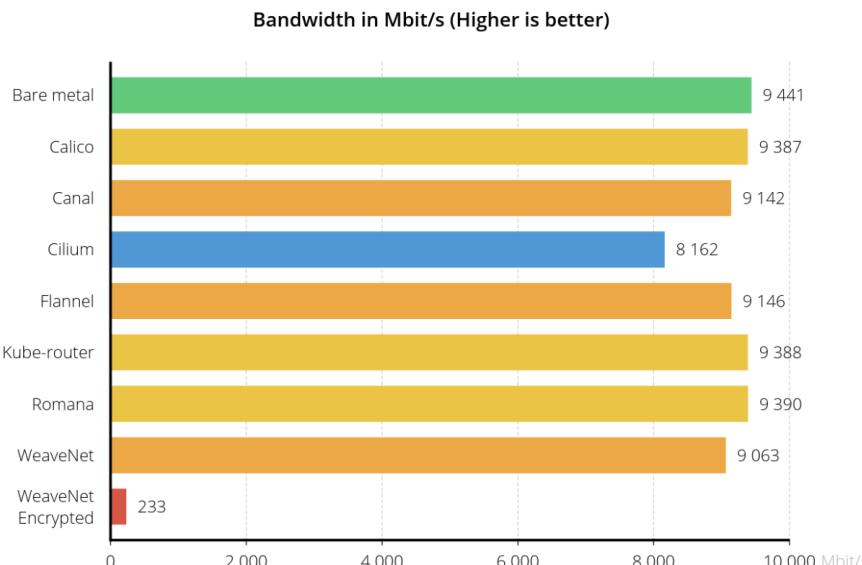


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# Kubernetes in real world

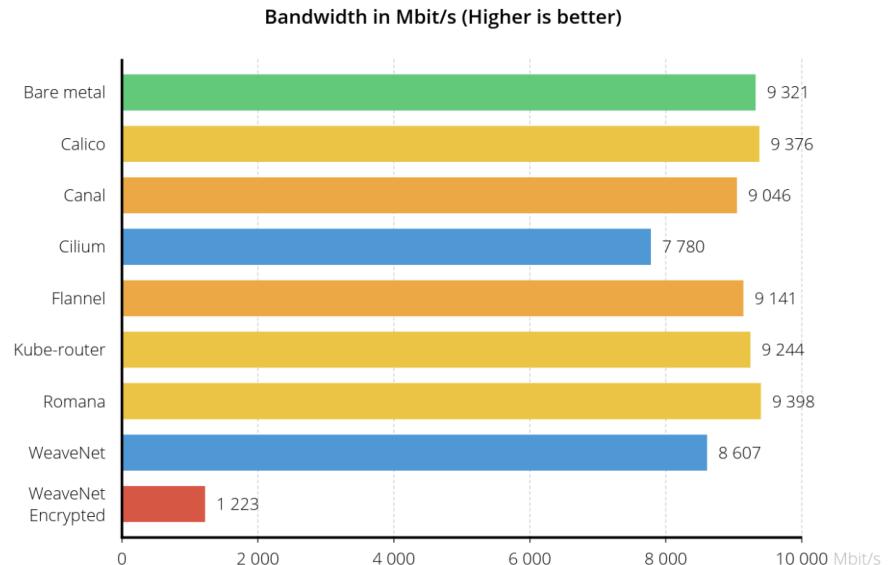
- Network Optional

**Kubernetes CNI benchmark - 10Gbit network - HTTP**



2018-11-15 - DEVOPS D-DAY 2018 - Alexis Ducastel - <https://infrabuilder.com> - Benchmark tool : nginx + curl

**Kubernetes CNI benchmark - 10Gbit network - FTP**



2018-11-15 - DEVOPS D-DAY 2018 - Alexis Ducastel - <https://infrabuilder.com> - Benchmark tool : vsftpd + curl

<https://itnext.io/benchmark-results-of-kubernetes-network-plugins-cni-over-10gbit-s-network-36475925a560>

Kubernetes: Production Workload Orchestration

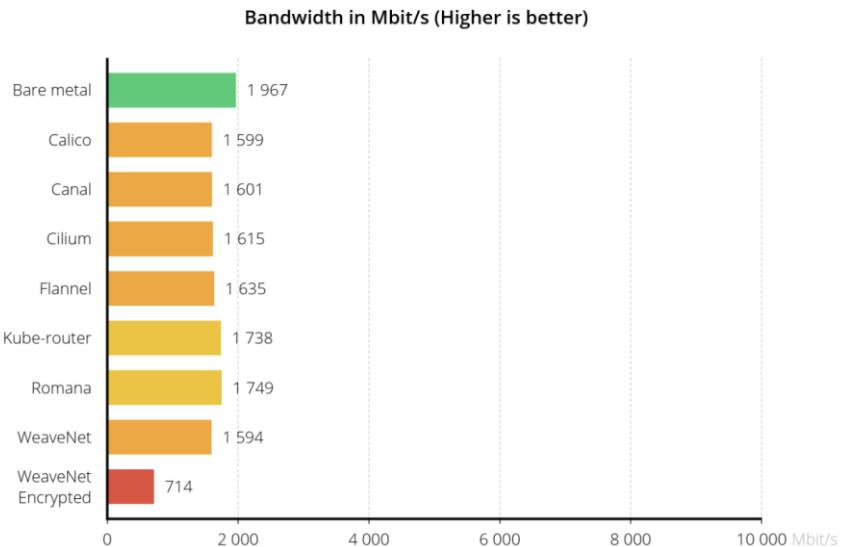


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# Kubernetes in real world

- Network Optional

## Kubernetes CNI benchmark - 10Gbit network - SCP



CNI	RAM	CPU
Calico	😊	😊
Canal	😊	😐
Cilium	😢	😢
Flannel	😊	😊
Kube-router	😊	😊
Romana	😊	😊
WeaveNet	😐	😐
WeaveNet Crypt	😐	😢

Resource consumption summary

<https://itnext.io/benchmark-results-of-kubernetes-network-plugins-cni-over-10gbit-s-network-36475925a560>

Kubernetes: Production Workload Orchestration



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# Kubernetes in real world

- Network Optional

CNI	INSTALL	SECURITY	PERFS	RESOURCES
Calico	😊	😊	😁	😊
Canal	😊	😊	😊	😐
Cilium	😢	😊	😐	😢
Flannel	😊	😢	😊	😁
Kube-router	😊	😐	😊	😊
Romana	😊	😢	😊	😊
WeaveNet	😊	😐	😊	😐
WeaveNet Crypt	😊	😁	😢	😢

<https://itnext.io/benchmark-results-of-kubernetes-network-plugins-cni-over-10gbit-s-network-36475925a560>

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/docker.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



**kubernetes**  
by Google

# 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



**kubernetes**  
by Google

# 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:~# ]
```

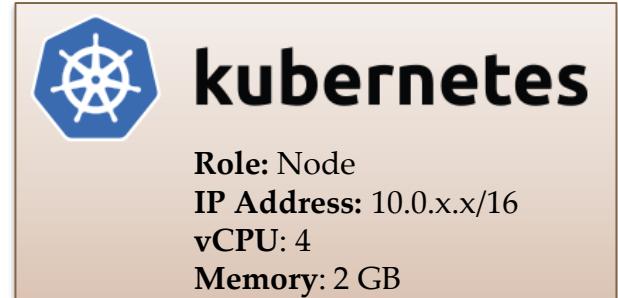
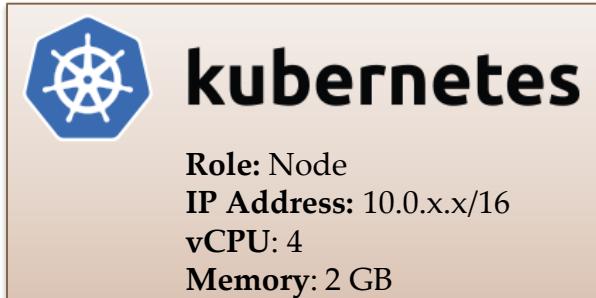
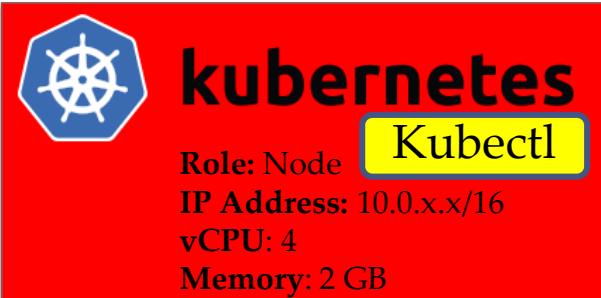
```
[praparn@kubernetes-ms:~$ kubectl get node
NAME        STATUS    AGE      VERSION
kubernetes-1  Ready    5m       v1.7.0
kubernetes-2  Ready    4m       v1.7.0
kubernetes-ms Ready   11m      v1.7.0
praparn@kubernetes-ms:~$ ]
```



# 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' link points 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
cheduled      Successfully assigned webtest to kubernetes-ms
12m          12m          1     kubelet, kubernetes-ms
uccesfulMountVolume  MountVolume.SetUp succeeded for volume "default-token-1ltqv"
12m          12m          1     kubelet, kubernetes-ms spec.containers{webtest}
ulling       pulling image "labdocker/cluster:webservicelite"
11m          11m          1     kubelet, kubernetes-ms spec.containers{webtest}
ulled       Successfully pulled image "labdocker/cluster:webservicelite"
11m          11m          1     kubelet, kubernetes-ms spec.containers{webtest}
reated      Created container
11m          11m          1     kubelet, kubernetes-ms spec.containers{webtest}
arted       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                topologyKey: storage
35
36      containers:
37        - name: webtest2
38          image: labdocker/cluster:webservicelite
39          ports:
40            - 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
- Value for Taint
  - PreferNoSchedule
  - NoSchedule
  - NoExecute



# Taint and Tolerations

Taint on Node:

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

Pods YAML File:

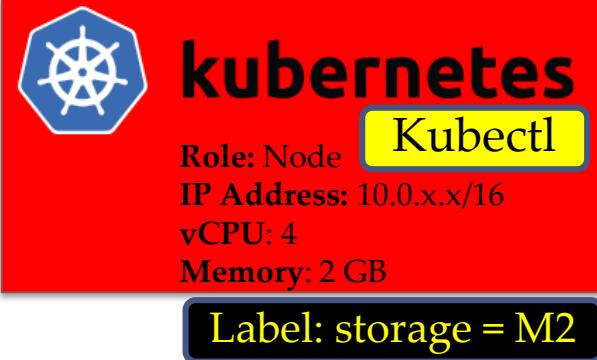
```
1  apiVersion: "v1"
2  kind: Pod
3  metadata:
4    name: webtest
5    labels:
6      name: web
7      owner: Praparn_L
8      version: "1.0"
9      module: WebServer
10     environment: development
11 spec:
12   containers:
13     - name: webtest
14       image: labdocker/cluster:webservicelite
15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

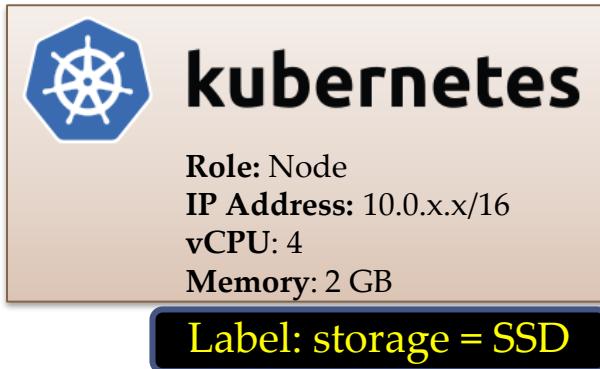


# Workshop 2.6: Orchestrator Assignment

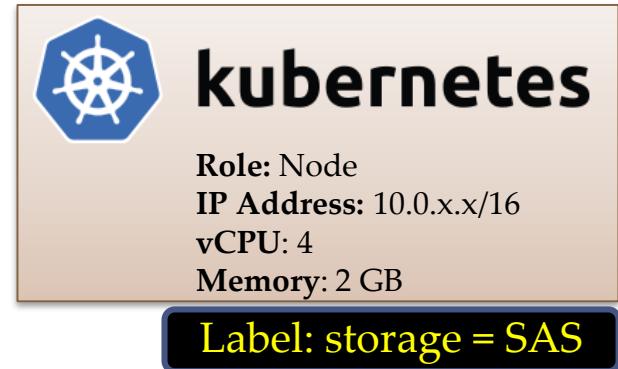
Machine: Kubernetes\_MS



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**  
by Google

# Stateful Application Deployment



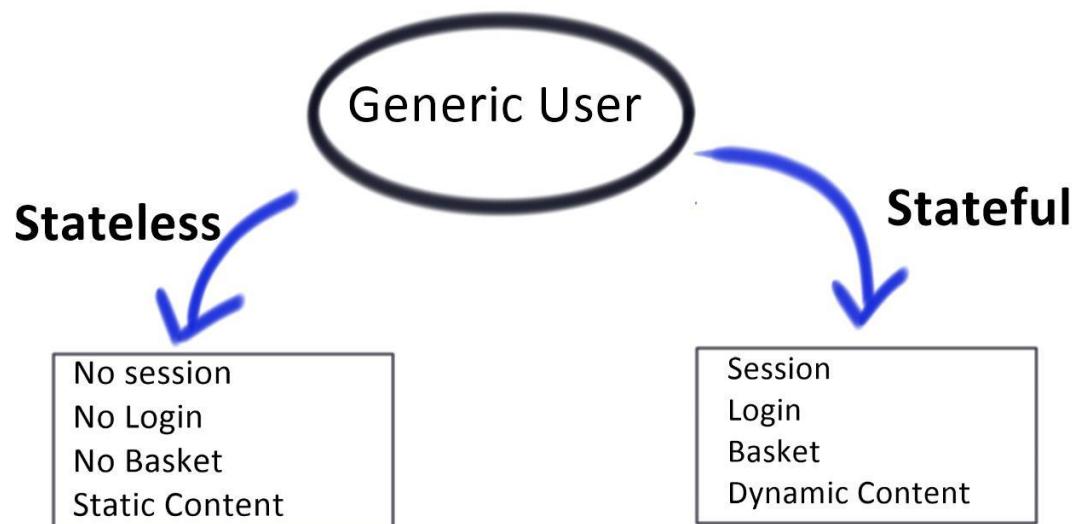
Kubernetes: Production Workload Orchestration



**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

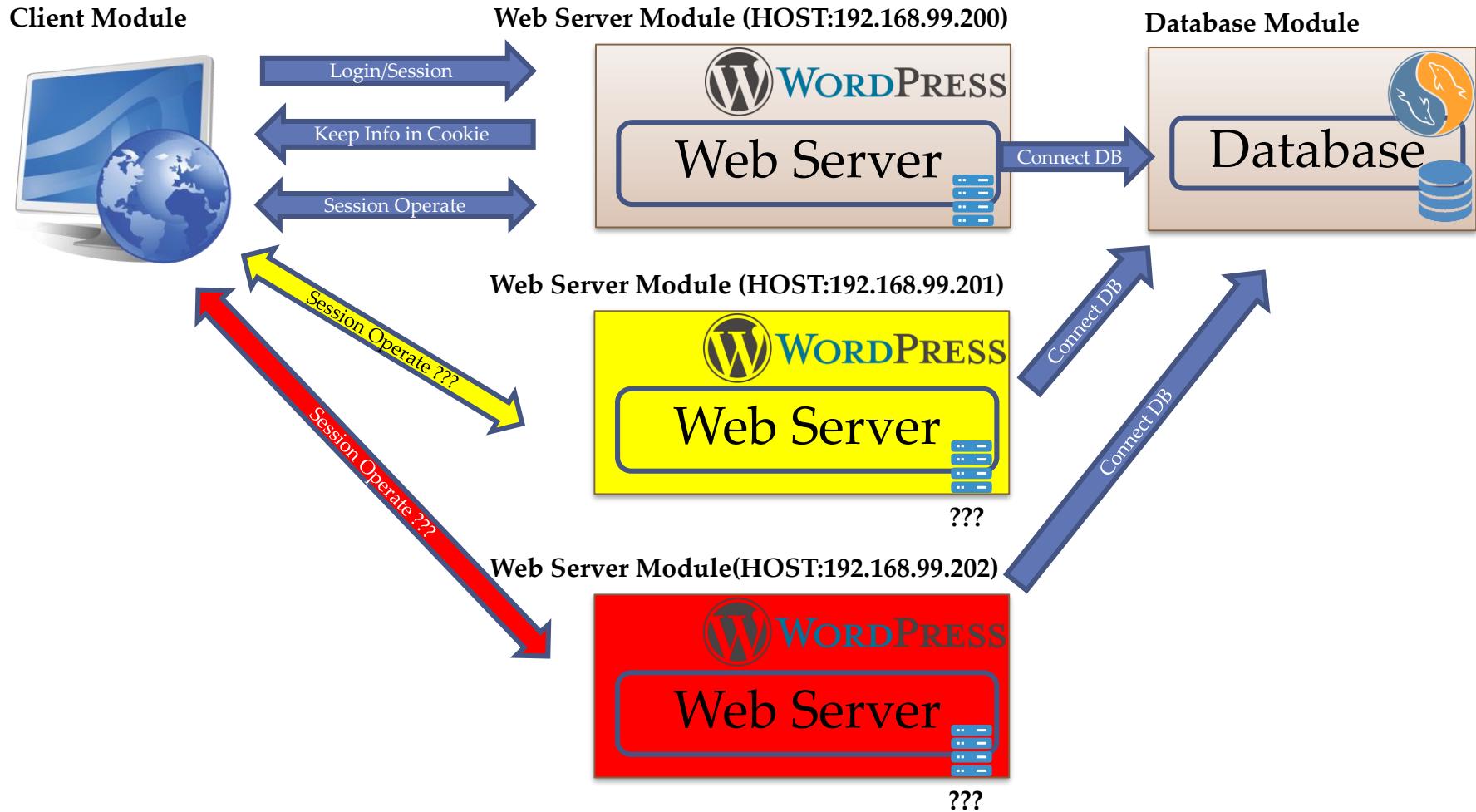


# Stateful Application Deployment

- 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



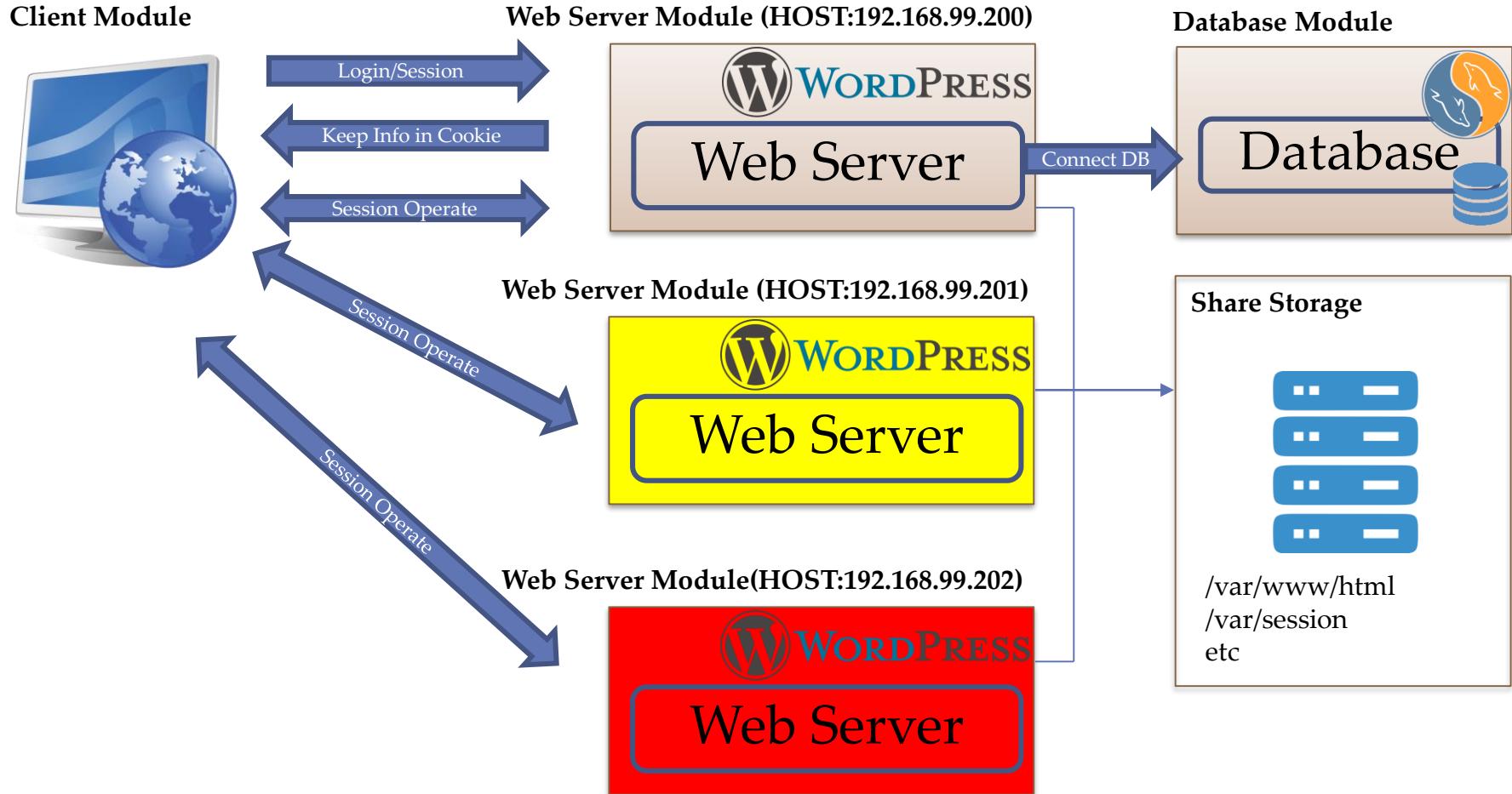
# Stateful Application Deployment



# 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

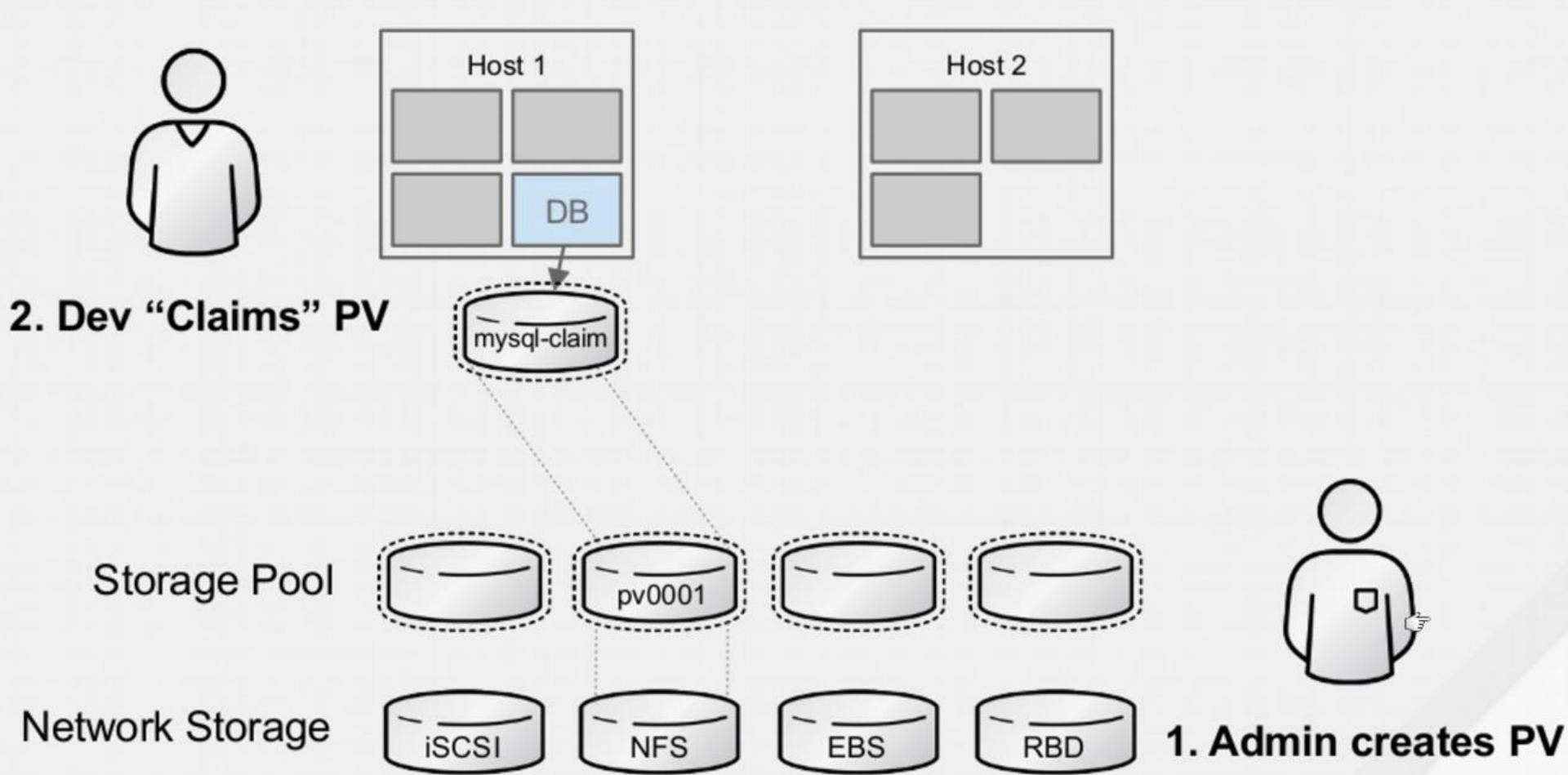
# Stateful Application Deployment



# Persistent Volume



# Persistent Volume



# Persistent Volume

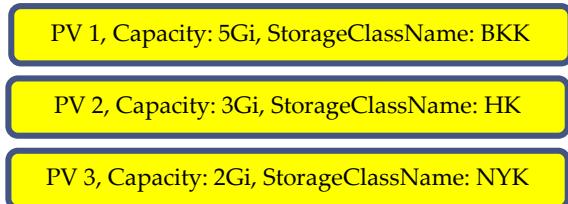
- Persistent Volume (PV)
  - Resource in cluster system
  - Act like pieces of storage (Independence from Pods)
  - Lifecycle was depended on Pods who used PV via PVC(Persistent Volume Claim)
  - Multiple type of PV as plugin support
- Persistent Volume Claim (PVC)
  - Similar Pod, That create for request 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

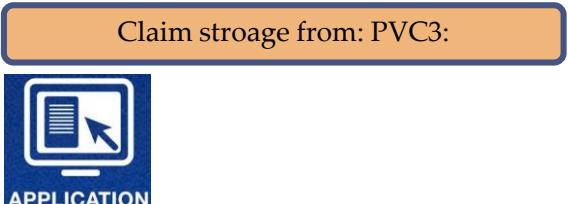
## PV Pool



## PVC Request



## Pods for Application



Static Provision

## Provision

Phase: Available/Fail

Match PV/PVC

## Binding

Phase: Bound

Pod use

## Using

Dynamic Provision

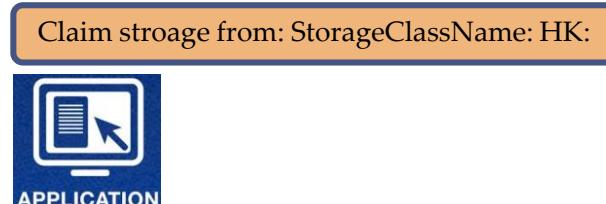
Phase: Release

## Reclaim

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

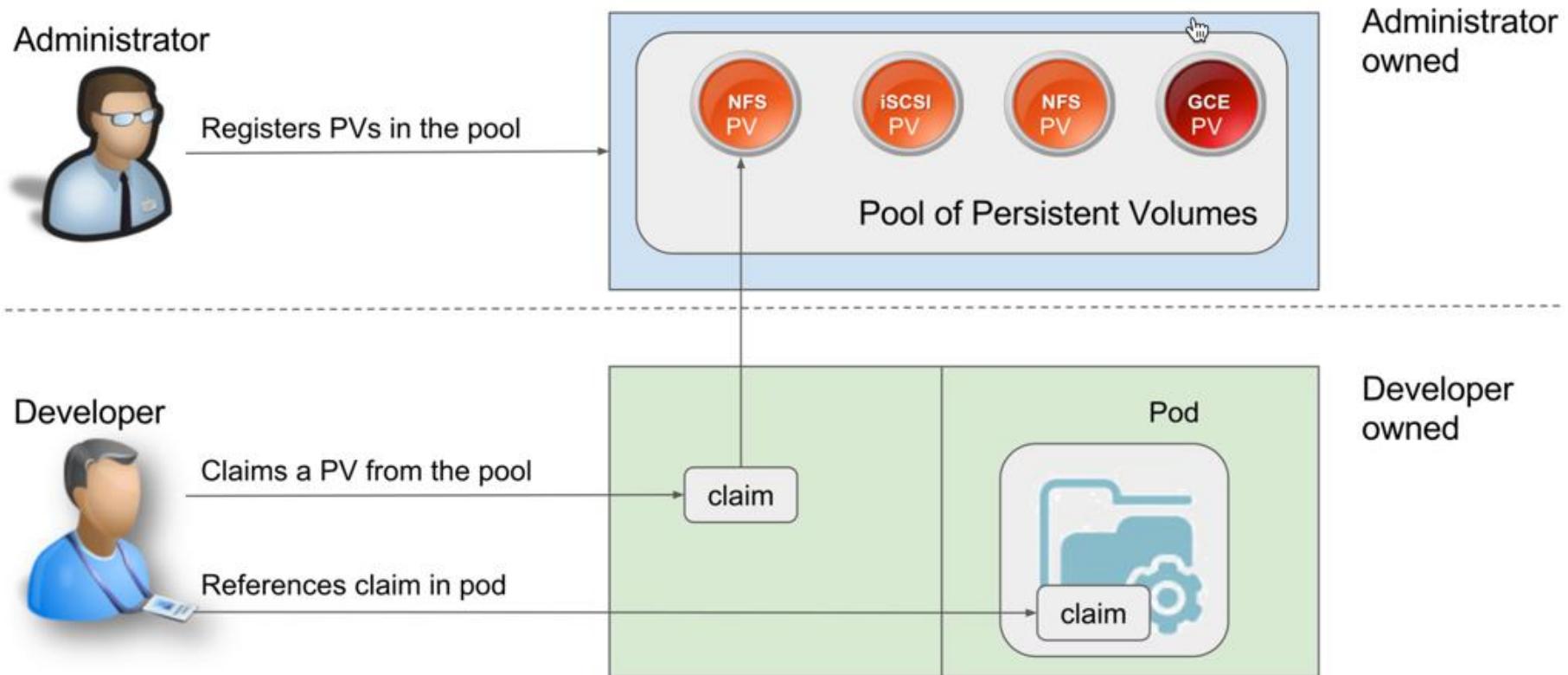
End of Use

## Pods for Application



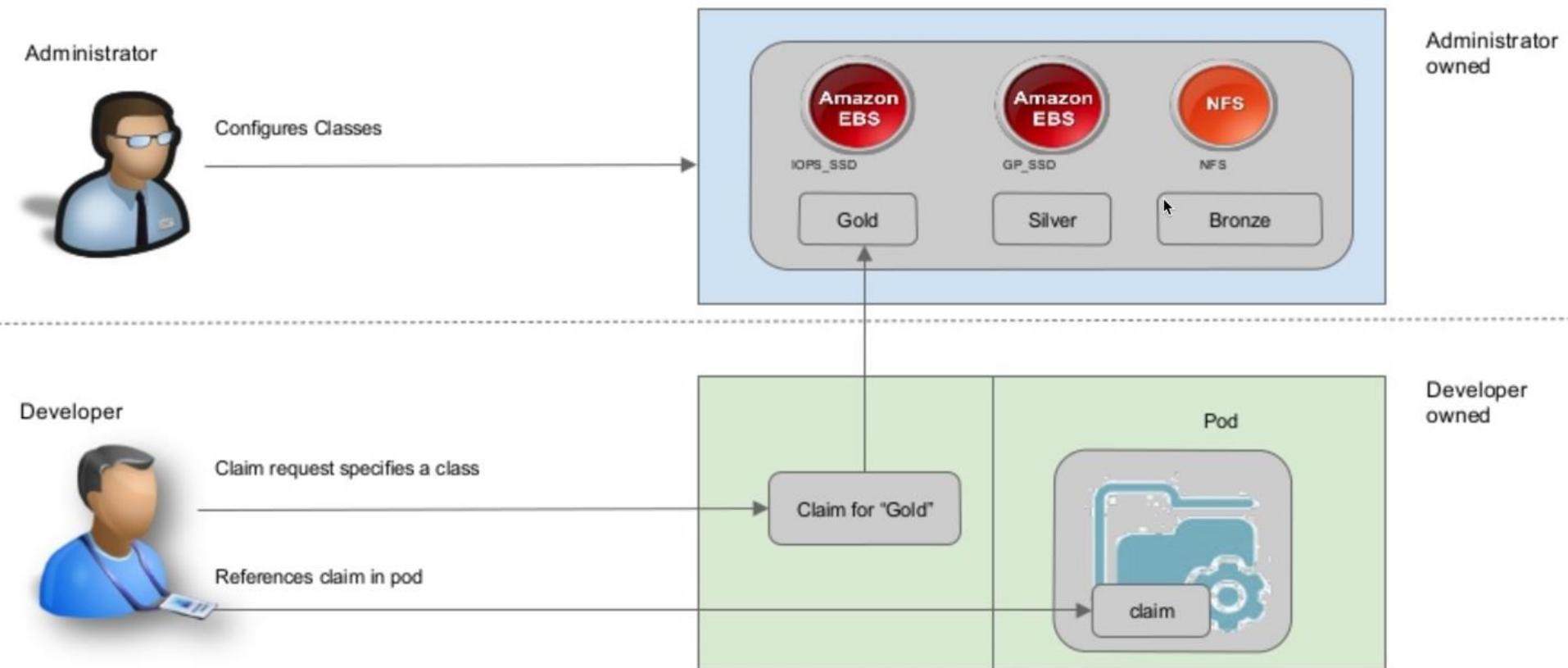
# Persistent Volume

- 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 10:30:00 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	⋮
<input checked="" type="checkbox"/> pvc-0a14702e-4...	5Gi	ReadWriteOnce	Delete	Bound	default/aws-ebs-...	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

```
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_deployment.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:          node.kubelet.csi.v1alpha1.CSIStorageAttach 701 800s
Events:
  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 features a large, bold heading: "Welcome Page from Container Python Lab". Below the heading, a timestamp is shown: "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

Kubernetes

Search

+ CREATE | EDIT DELETE

Workloads > Pods > webtest-6f4bdd5f6b-kj4jn

Cluster

Namespaces

Nodes

Persistent Volumes

Roles

Storage Classes

Namespace

default

Overview

Workloads

Cron Jobs

Daemon Sets

Deployments

Jobs

**Pods**

Replica Sets

Replication Controllers

Stateful Sets

Discovery and Load Balancing

Ingresses

Services

Config and Storage

Config Maps

**Details**

Name: webtest-6f4bdd5f6b-kj4jn

Namespace: default

Labels:

- environment: development
- module: WebServer
- name: web
- owner: Praparn\_L
- pod-template-hash: 6f4bdd5f6b

Annotations:

- cni.projectcalico.org/podIP: 192.168.1.40/32

Creation Time: 2019-03-09T16:05 UTC

Status: Running

QoS Class: BestEffort

**Network**

Node: ip-10-0-1-165.ap-southeast-1.compute.internal

IP: 192.168.1.40

**Containers**

**webtest**

Image: labdocker/cluster:webservicelite\_v1

Environment variables: -

Commands: -

Args: -

**Init Containers**

**download**

Image: labdocker/alpineweb:latest

Environment variables: -

Commands:

```
wget
-O
/source/mainlite.py
https://raw.githubusercontent.com/praparn/kubernetes_201904/master/WorkShop_2.7_Persistent_Storage/mainlite.py
```

Args: -

# Persistent Volume

- Create Deployment

The screenshot shows the Kubernetes UI for managing workloads. On the left, a sidebar navigation bar lists various resources: 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 a pod named `webtest-6f4bdd5f6b-kj4jn` which is part of a replicaset named `replicaset`. The pod has a status of `1 / 1`, was created 7 minutes ago, and is owned by `Paparn_L`. The pod template hash is `6f4bdd5f6b`. The pod is running the image `labdocker/cluster:webserviceelite_v1`.

The `Events` table provides a log of the pod's lifecycle:

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:webserviceelite_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

The `Persistent Volume Claims` table shows a single EBS PVC named `aws-ebs-pvc` is currently `Bound` to the pod. The volume is `pvc-e7988ede-4284-11e9-9e8e-02d2ffaea91a`, has a capacity of `5Gi`, uses `ReadWriteOnce` access mode, and is associated with the storage class `-`. It was created 9 minutes ago.



# 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

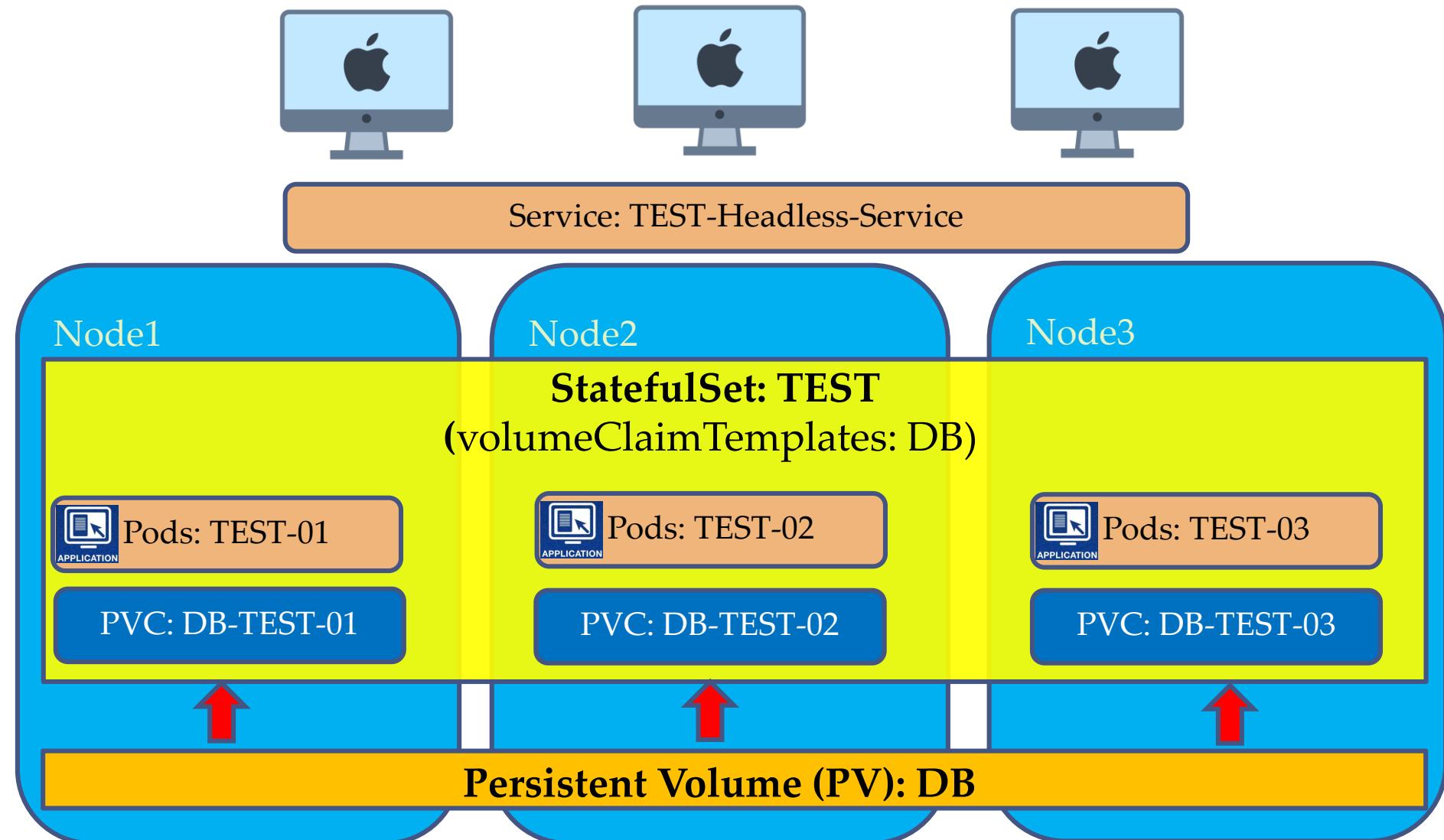


**kubernetes**  
by Google

# 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
```



# 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

