如何以k8s替他國政府建立易維護容錯的數位化開放資料系統

22, Dec. 2021

Ivan Chiou

Kubernetes Summit '21

Kubernetes Summit 21

演講大綱

- 我做了什麼?
- Opendata system介紹
- 這個計劃中我們做了哪些?
- 這個專案的架構
- 如何設定k8s?
- 如何開始這個專案?
- Program the world
- Q&A

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我做了什麼?

- 2020/09~2021/09
- 國合會

TAIWAN ICDF 財團法人國際合作發展基金會 International Cooperation and Development Fund

- 2022/01~ TBD
- Program the world中華民國愛自造者學習協會

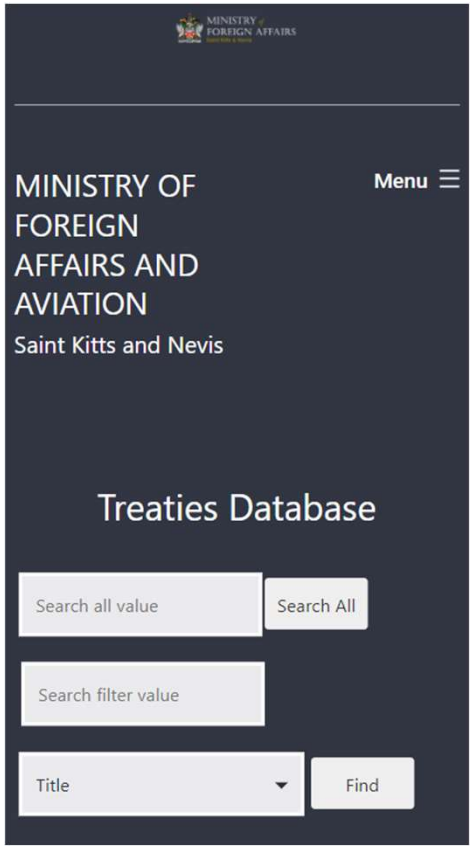
PROGRAM the WORLD

- 2020/07~ TBD
- AlphaCamp

ALPHAcamp

The Opendata system

- A public platform for people searching and browsing open data on website
  - Developed from an open-source system, **WordPress**
  - Deployed via **Docker** and **K8S** technology
  - Located on **AWS** (Amazon Web Services)
- People can access it on **desktop and mobile**
- The IT operator or technician can easily **customize it**

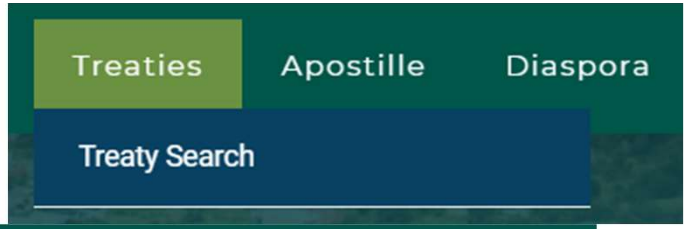


我(們)做了哪些 on Opendata?

- Implementation of Opendata system
  - Treaty Search
  - **Auto-crawl** Multilateral treaties from OAS website
  - Desk Assignment
  - Apostille Verified
  - Email Search
  - Leave application
  - Signature form
  - SKN Honorary Consuls
  - Page for MOFA template

Opendata system – Treaty Search

- https://www.foreign.gov.kn/treaty-search/

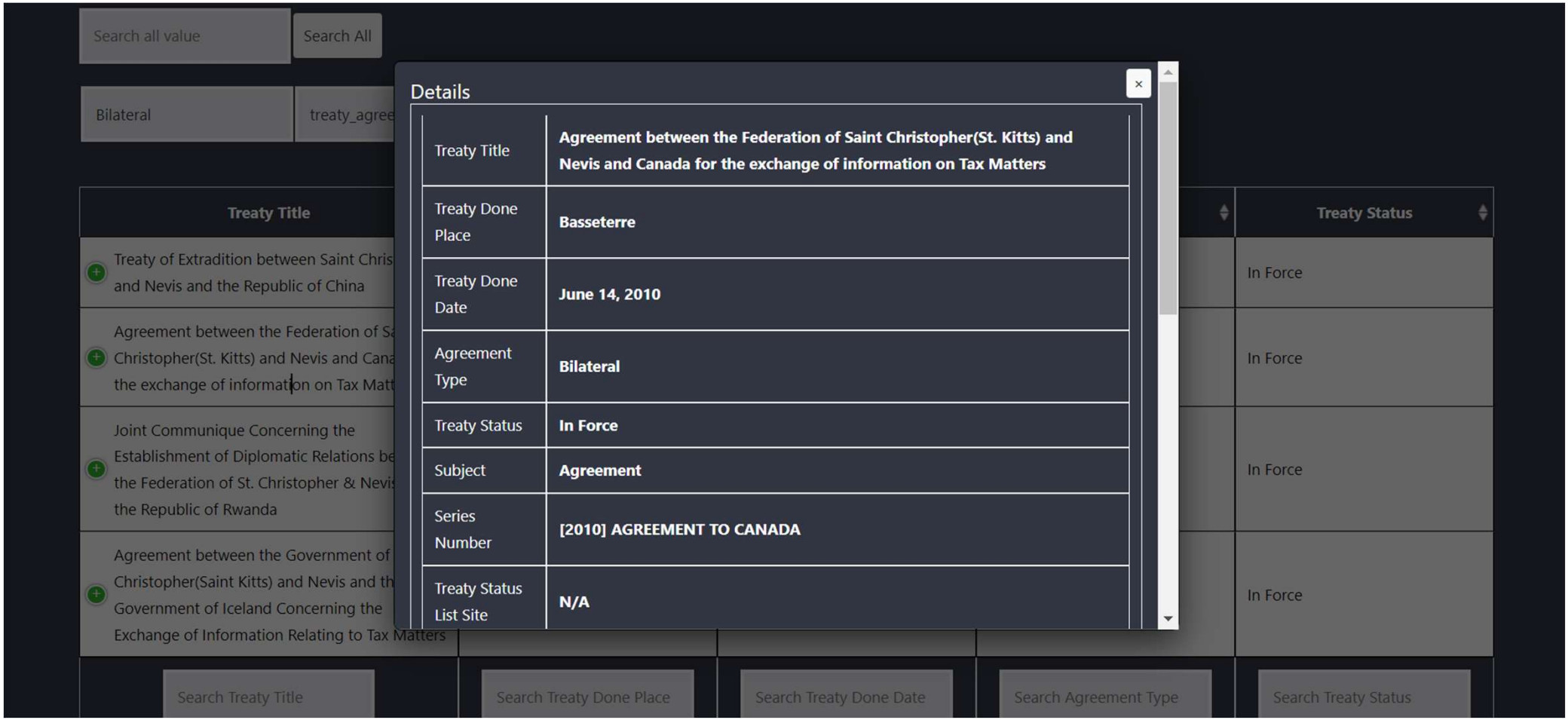


Treaties Database

Search all value | Search All

d | Title | Find

Title	Done Place	Done Date	Agreement Type	Upload File	Status
Convention on Diplomatic Asylum (A-46)	CARACAS, VENEZUELA	28 Mar, 1954	Multilateral		In Force
Convention to Prevent and Punish the Acts of Terrorism Taking the Forms of Crimes Against Persons and Related Extortion that are of International Significance (A-49)	WASHINGTON, D.C., UNITED STATES	2 Feb, 1971	Multilateral		In Force
Protocol of Amendment to the Charter of the Organization of American States "Protocol of Cartagena de Indias (A-50)	CARTAGENA DE INDIAS, COLOMBIA	5 Dec, 1985	Multilateral		In Force
Inter-American Convention to Prevent and Punish Torture (A-51)	CARTAGENA DE INDIAS, COLOMBIA	9 Dec, 1985	Multilateral		In Force



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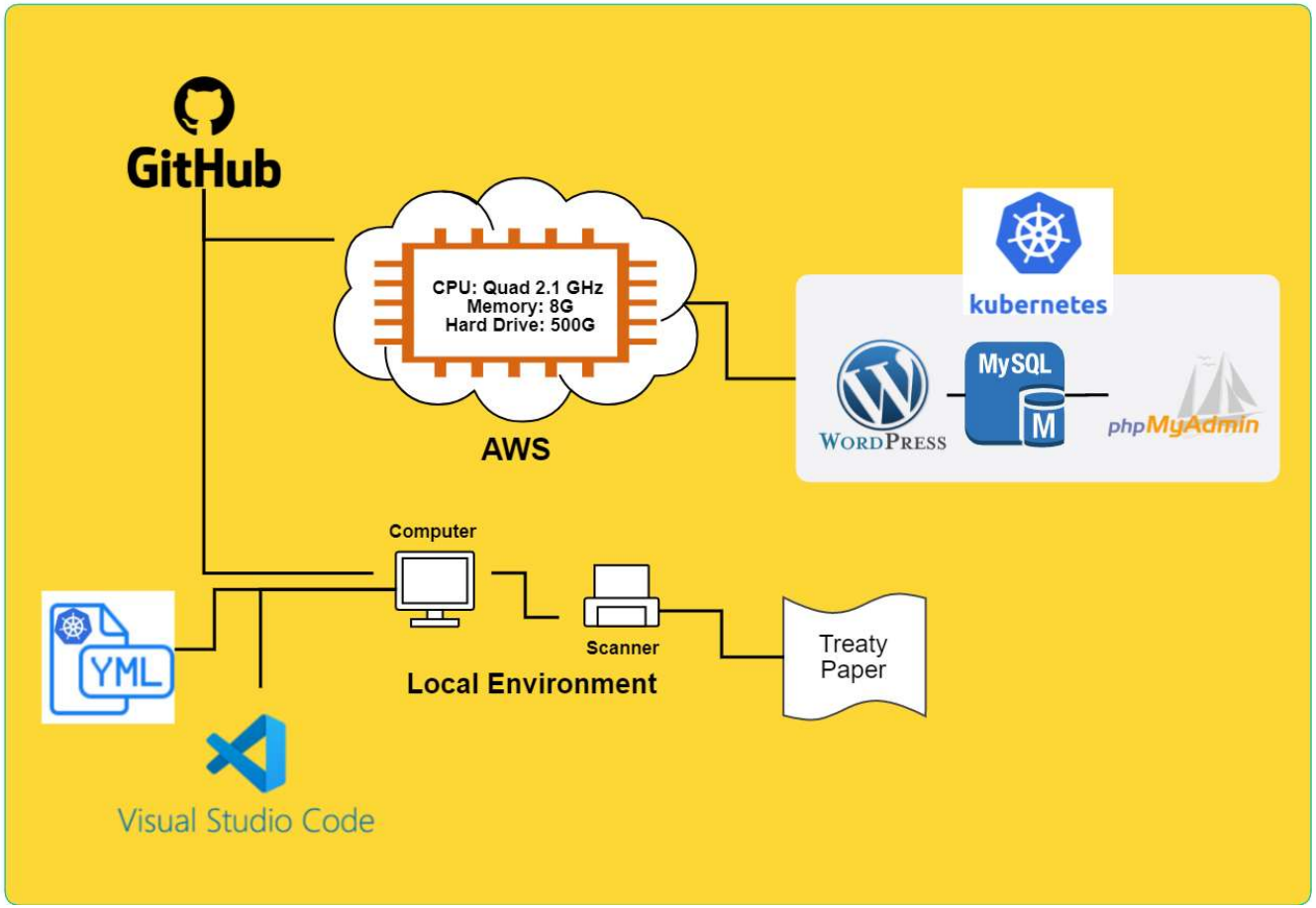
The Infrastructure

- Server(Hardware) Requirements
  - Domain name:
    - opendata.foreign.gov.kn
  - Machine:
    - CPU: Quad 2.1 GHz (minimize)
    - Memory: 8G (minimize)
    - Hard Drive: 500G (minimize)
  - OS: Linux(Ubuntu)
- Software Requirements
  - Kubernetes (free)
  - Wordpress (free)
  - Mysql (free)
  - Code base repository – github(free)
  - IDE tools – Visual Studio Code(free)

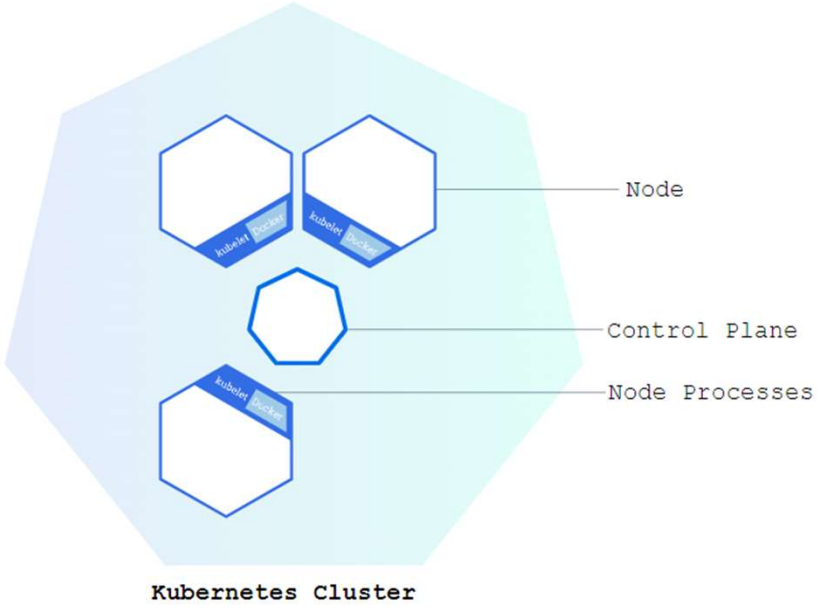
The Infrastructure on cloud



What is Kubernetes?

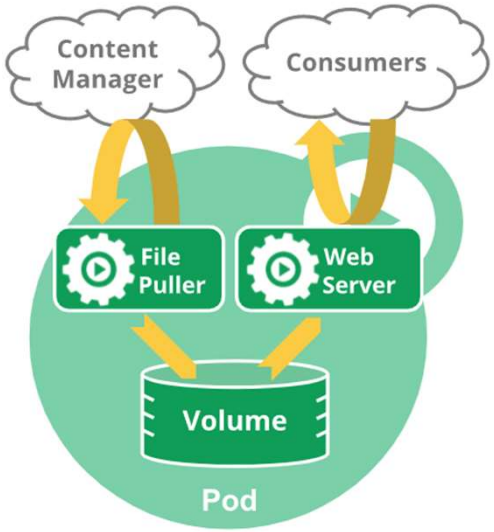
Cluster

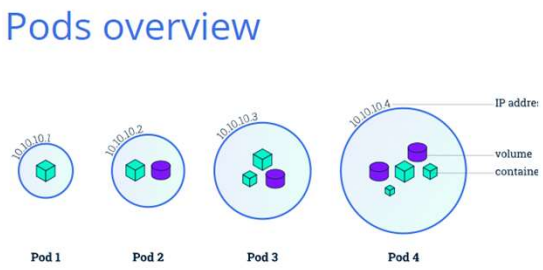
- Kubernetes is a portable, extensible, open-source platform for managing containerized workloads and services, that facilitates both declarative configuration and automation.

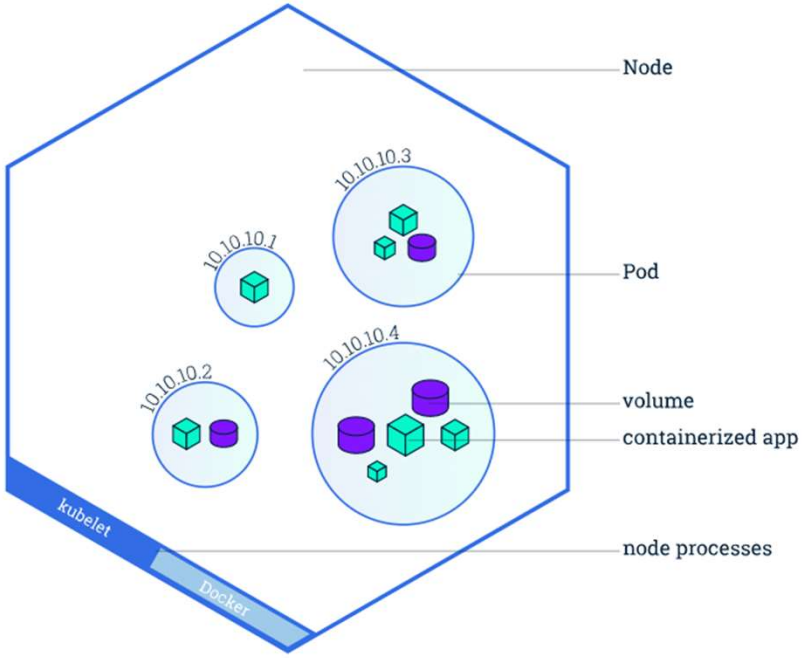


Pods & Nodes

- A Pod is a Kubernetes abstraction that represents a group of one or more application containers (such as Docker)



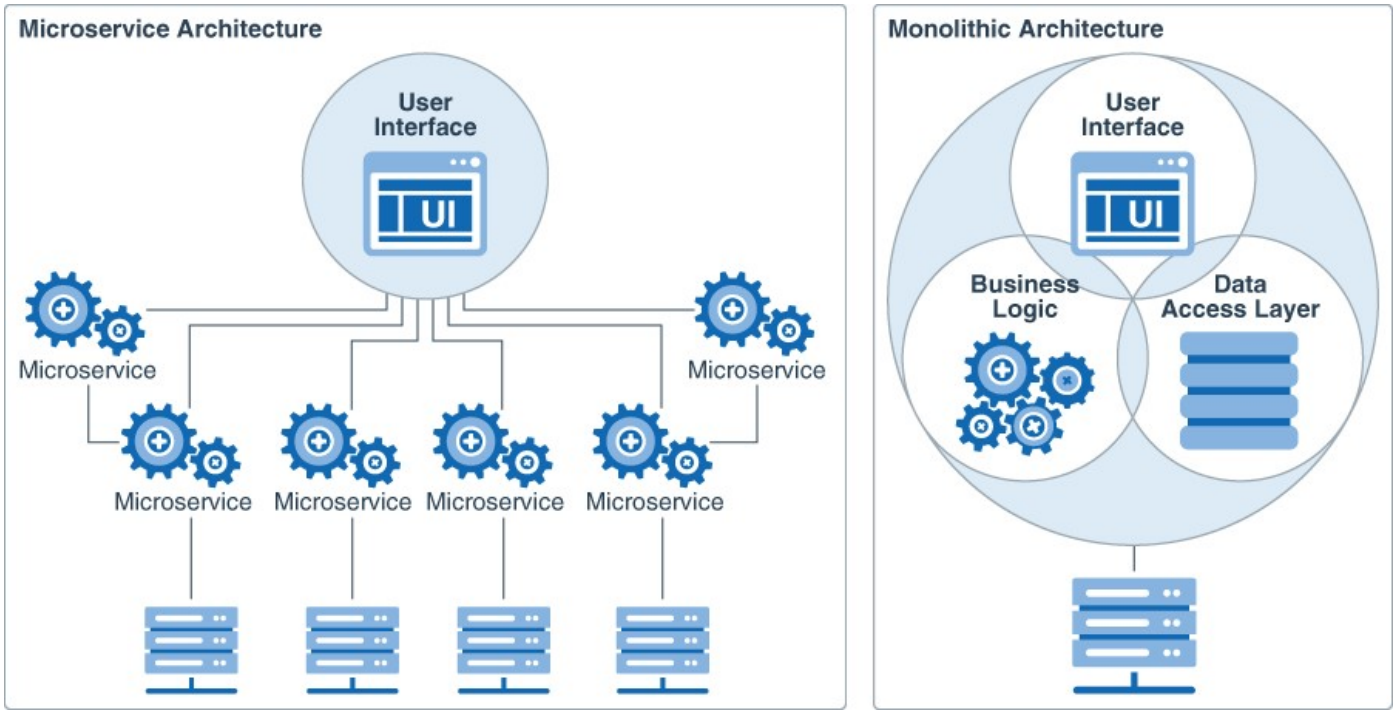




from https://kubernetes.io/

Opendata system with Kubernetes

- Wordpress / mysql / phpmyadmin are Microservices



from https://kubernetes.io/

Steps to deploy on cloud

- Deploying WordPress and MySQL
- Deploying loadbalancer to auto-reconnect pods of wordpress(service) when it is out of capacity
  - The Kubernetes load balancer sends connections to the first server in the pool until it is at capacity, and then sends new connections to the next available server. This algorithm is ideal where virtual machines incur a cost, such as in hosted environments.
- Deploying kubernetes dashboard

先使用docker-compose試一次

- docker-compose.yml

```yaml
version: '3.7'

services:

  ##
  # The web server container.
  ##
  wordpress-develop:
    image: nginx:alpine
    restart: always
    networks:
      - wpdevnet

    ports:
      - ${LOCAL_PORT-8889}:80

    environment:
      LOCAL_DIR: ${LOCAL_DIR-src}

    volumes:
      - ./tools/local-env/default.template:/etc/nginx/conf.d/default.template
      - ./:/var/www

    # Load our config file, substituting environment variables into the config.
    command: /bin/sh -c "envsubst '$$LOCAL_DIR' < /etc/nginx/conf.d/default.template > /etc/nginx/conf.d/default.conf && exec nginx -g 'daemon
    off;'"

    depends_on:
      - php
```

Install docker-compose

- sudo curl -L "https://github.com/docker/compose/releases/download/1.27.4/docker-compose-$(uname -s)-$(uname -m)" -o /usr/local/bin/docker-compose

- sudo chmod +x /usr/local/bin/docker-compose

Execute docker compose file

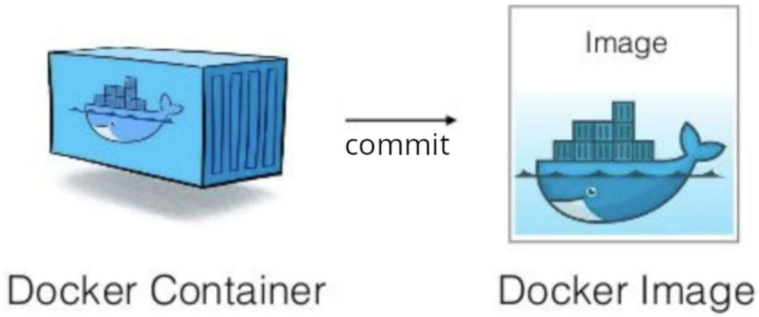
- sudo npm run env:start

or

- sudo docker-compose up -d

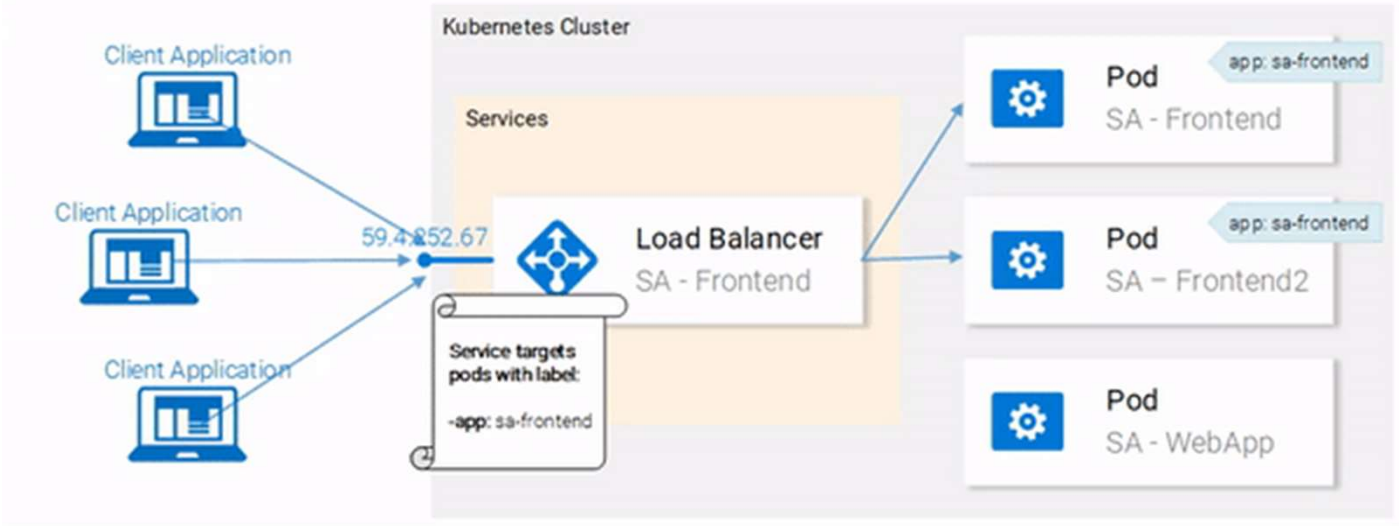
產生docker images給k8s使用

- docker commit [CONTAINER_ID] [new_image_name]



How to set kubernetes

- Use **Kubernetes(K8S)** to build up load balancer of our own system



from https://kubernetes.io/

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How to set kubernetes – apply yaml file

- kubectl apply -k ./

- It will do as follows
- kubectl apply -f wpdevnet-networkpolicy.yaml,wordpress-develop-service.yaml,wordpress-develop-deployment.yaml,phpunit-deployment.yaml,phpmyadmin-service.yaml,phpmyadmin-deployment.yaml,php-deployment.yaml,mysql-service.yaml,mysql-deployment.yaml,cli-deployment.yaml

wordpress-deployment.yaml

```yaml
apiVersion: v1
kind: Service
metadata:
  name: wordpress
  labels:
    app: wordpress
spec:
  ports:
    - port: 80
  selector:
    app: wordpress
    tier: frontend
  type: LoadBalancer
---
apiVersion: v1
kind: PersistentVolumeClaim
metadata:
  name: wp-pv-claim
  labels:
    app: wordpress
spec:
  accessModes:
    - ReadWriteOnce
  resources:
    requests:
      storage: 20Gi
---
```

How to set kubernetes

- kubectl port-forward service/wordpress 80:80
- Or
- kubectl expose deployment/my-nginx
- Then
- kubectl proxy
- wget http://localhost:8001/

Configuration of reverse proxy

- Let use domain name can access localhost

```
location [redacted]/ {
        proxy_set_header Host $host;
        proxy_pass https://localhost:8001/;
        proxy_set_header X-Forwarded-For $proxy_add_x_forwarded_for;
        proxy_set_header X-Forwarded-Proto https;
        proxy_set_header X-Forwarded-Port 443;
        proxy_redirect off;
}
```

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Create Kubernetes dashboard

Creating a Service Account

We are creating Service Account with the name `admin-user` in namespace `kubernetes-dashboard` first.

```
apiVersion: v1
kind: ServiceAccount
metadata:
  name: admin-user
  namespace: kubernetes-dashboard
```

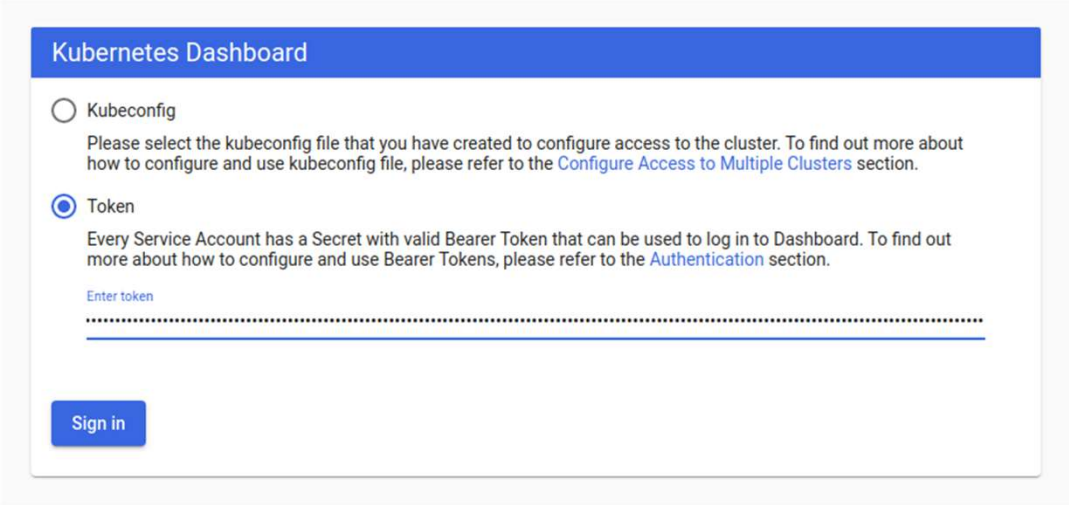
Creating a ClusterRoleBinding

In most cases after provisioning the cluster using `kops`, `kubeadm` or any other popular tool, the `ClusterRole` `cluster-admin` already exists in the cluster. We can use it and create only a `ClusterRoleBinding` for our `ServiceAccount`. If it does not exist then you need to create this role first and grant required privileges manually.

```
apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRoleBinding
metadata:
  name: admin-user
roleRef:
  apiGroup: rbac.authorization.k8s.io
  kind: ClusterRole
  name: cluster-admin
subjects:
- kind: ServiceAccount
  name: admin-user
  namespace: kubernetes-dashboard
```

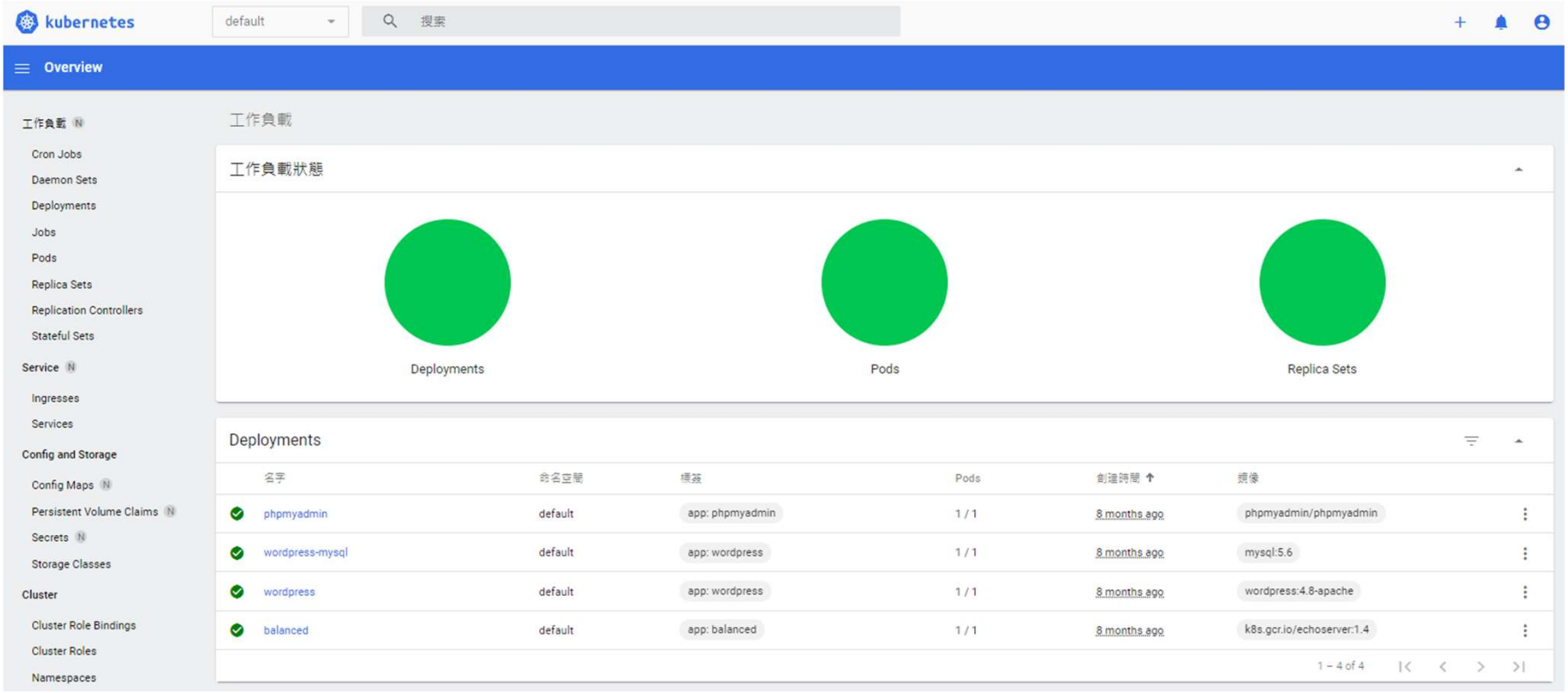
Create token

- kubectl -n kubernetes-dashboard get secret $(kubectl -n kubernetes-dashboard get sa/admin-user -o jsonpath="{.secrets[0].name}") -o go-template="{{.data.token | base64decode}}"



Dashboard

- kubectl proxy



Demo

Minikube

- Minikube 是由Google 發布的一個輕量級工具。 讓開發者可以在本機上輕易架設**一個**Kubernetes Cluster，快速上手Kubernetes 的指令與環境。
  - *minikube start*
  - *minikube dashboard*
  - *minikube service wordpress --url*
  - *minikube stop*
- Alternative solutions: Microk8s, k3s

Pros and Cons of k8s

- Pros
  - Improve your workflow of deployment
  - Make your website more stable
  - Free solution to coordinate your containers well
- Cons
  - Too powerful for simple website
  - Too complex and hard to learn
  - More heavily dependence on k8s technology

But how to start on real project?

How to start the project

- Plans in 3-phase
  - Short-term: use freeware (Ragic)
  - Middle-term: we create our own system (Opendata system)
  - Long-term: let our customers use it

How to start the project

- Three principles of cooperation
  - *Make more **close connection and good relationship** with your supervisors and stakeholders.*
  - ***Attend all activities with staff** whatever it is related to the project or not. For example, I went to the church every week because my colleagues were there event thought I am not Christian*
  - *You should **co-work with them on other business** like teaching them Mandarin and helping them solve issues of computer*

How to start the project

- Solid technical skills
- Experienced soft skills — always smile :)
- Patient, patient and more patient

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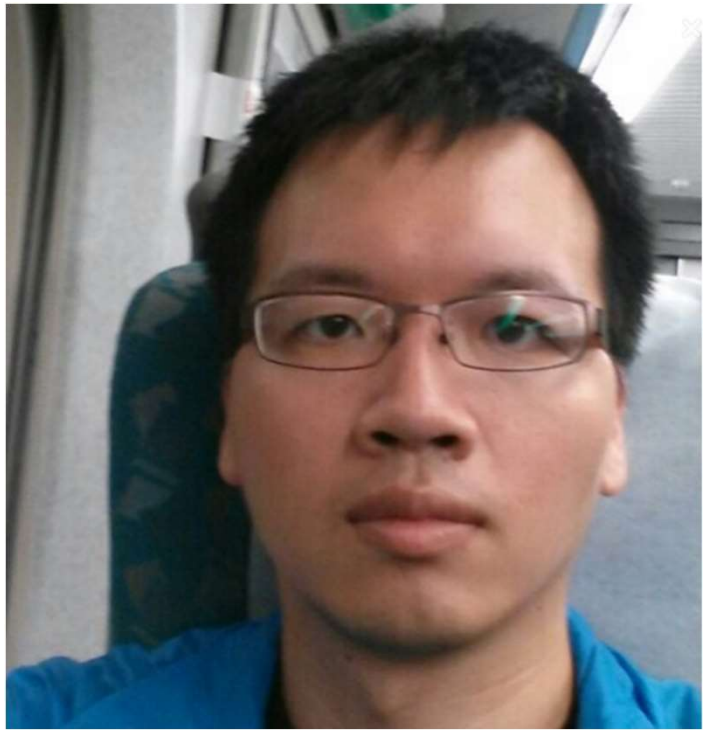
特別感謝 - 專案期間指導

- 熙哥 – 專案指導

- Tony Ko – K8S指導



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- 社團法人中華民國愛自造者學習協會 – 蘇文鈺 教授

PAIA – AI Game Learning platform

- https://www.paia-arena.com/

PAIA

Q&A