



智慧製造專題與實作報告

Edge computing implementation with Docker 以Docker實作邊緣運算系統

指導老師：周哲維

109005510 簡光正

2022.05.07



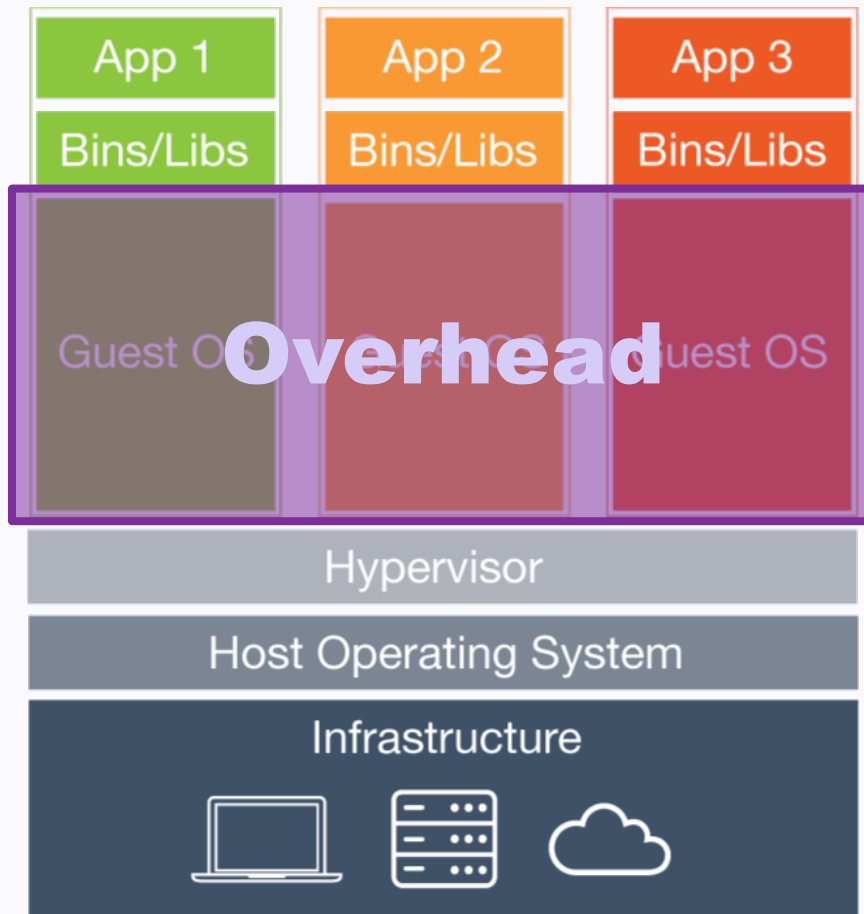
人工智慧製造系統研究中心
AIMS, Taiwan, R.O.C.
Artificial Intelligence for Intelligent Manufacturing Systems Research Center

大綱

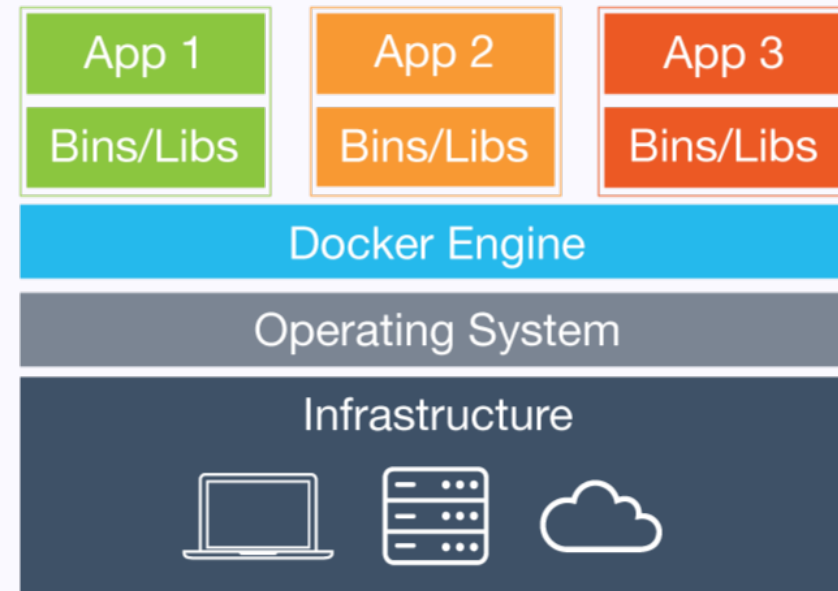
- What is Container / Docker? (5 mins)
- Why Docker? (5 mins)
- Docker Hands-On (20 mins)

Docker Explained

Docker Explained



Virtual machines



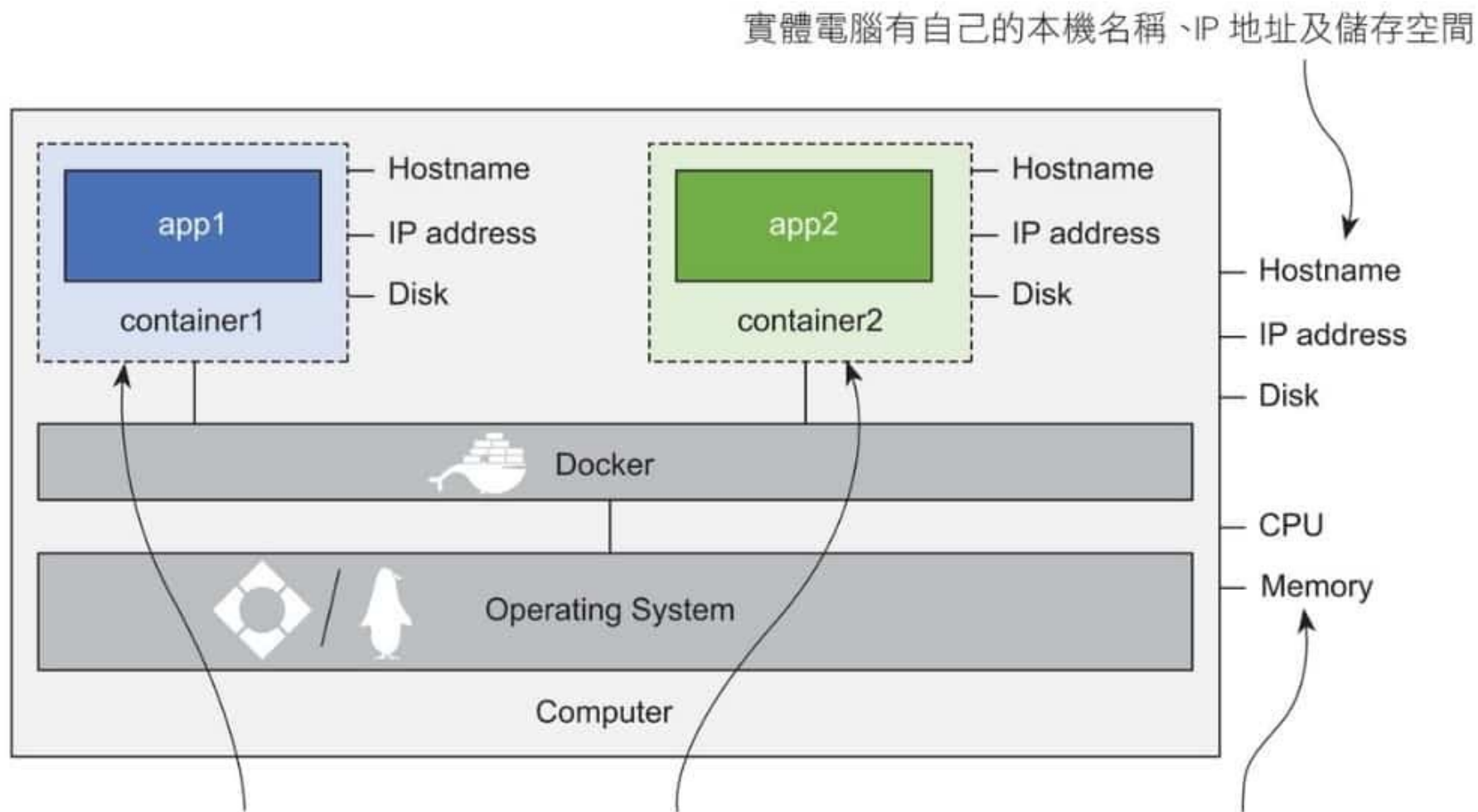
Containers

Docker Explained



容器有自己的作業系統，Docker
負責管理每個容器環境的資源

Docker Explained



每個容器有自己的本機名稱、IP 地址及磁碟

每個容器共用實體電腦的作業系統、CPU 以及記憶體

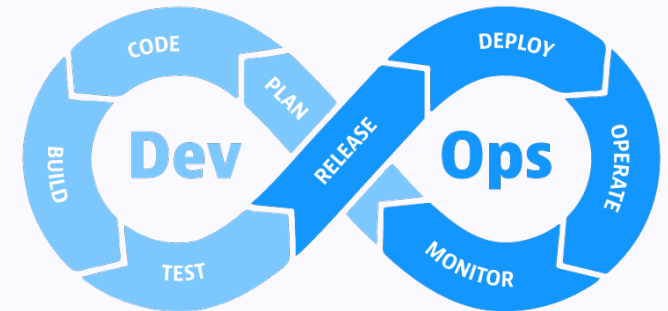
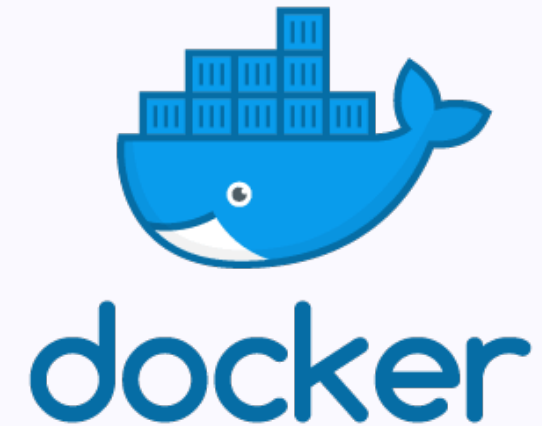
Docker key use cases

- #1 部署應用程式到雲端服務
- #2 微服務架構 Microservices
- #3 原生雲端應用程式 Cloud Native
- #4 Serverless架構
- #5 DevOps數位轉型

Why Docker?

Advantages of Docker

- Portability
- Performance
- Agility
- Isolation
- Scalability
- Security

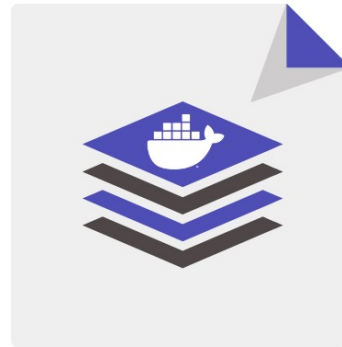


Docker Hands-On in 20mins

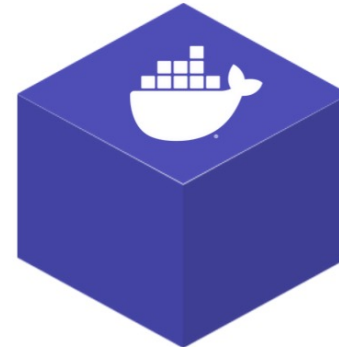
Docker Flow



Dockerfile



Docker Image



Docker Container

Usual docker commands (Part I)

docker run 執行容器

```
> docker run --name webserver -p 5000:80 nginx
```

執行一個Nginx的Web伺服器，並將電腦上的 5000 port 導到容器的 80 port

docker stop 停止容器運行

```
> docker container stop webserver
```

docker start 運行已停止的容器

```
> docker container start webserver
```

docker rm 刪除容器

```
> docker rm webserver
```

Usual docker commands (Part II)

docker container ls 列出容器清單 (等同 **docker ps -a**)

```
> docker container ls -a
```

docker image ls 列出映像清單

```
> docker image ls
```

docker start 運行已停止的容器

```
> docker container start webserver
```

docker rm 刪除容器

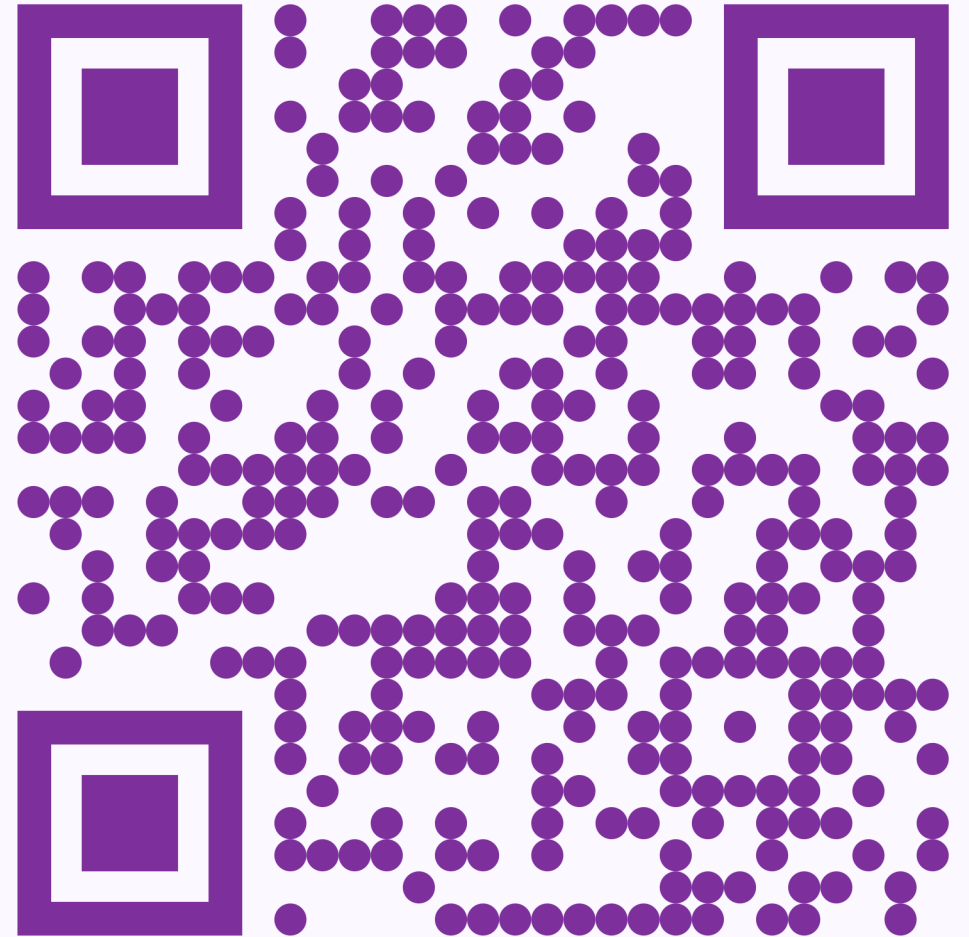
```
> docker rm webserver
```

#1 Hello World!

Before we start

Quick Notes

<https://hackmd.io/@kcchien/HyZXzXzlc>



Before we start

> Play with Docker

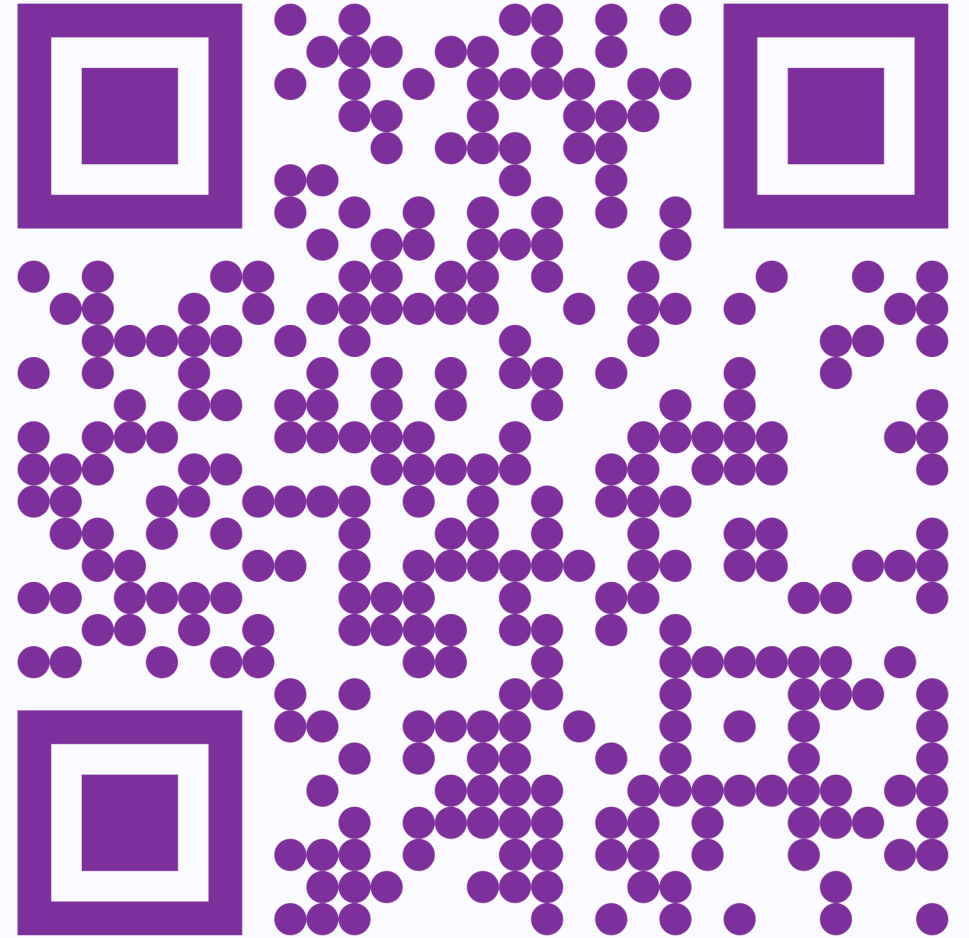
<https://labs.play-with-docker.com/>



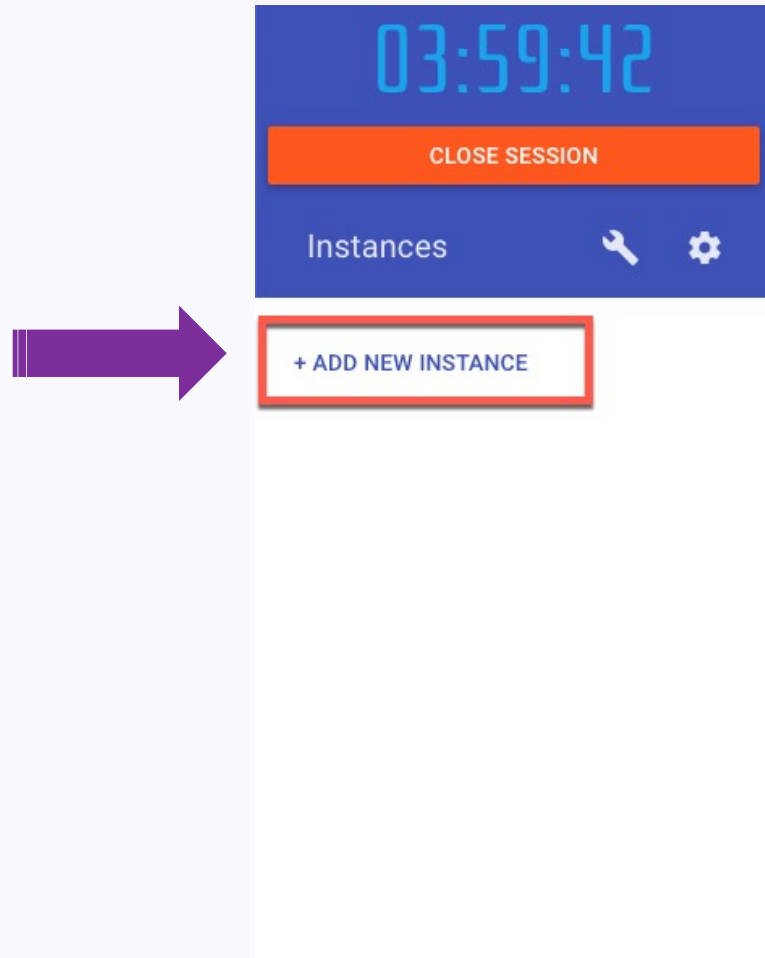
aims001



aims12345



Before we start



Add instances to your playground.

Sessions and all their instances are deleted after 03:59:42 hours.

Command list

docker run 執行容器

```
> docker run hello-world
```

docker stop 停止容器運行

```
> docker container stop hello-world
```

docker start 運行已停止的容器

```
> docker container start hello-world
```

docker rm 刪除容器

```
> docker rm hello-world
```

Hello World!

> docker run hello-world

docker hub即時下載名稱為

“hello-world” 的映像檔，並立即生成
一個container執行，執行內容很簡單，
就是印出一篇文字訊息

```
#####  
#                               WARNING!!!!                               #  
# This is a sandbox environment. Using personal credentials             #  
# is HIGHLY! discouraged. Any consequences of doing so are              #  
# completely the user's responsibilities.                                #  
#                                                                           #  
# The PWD team.                                                           #  
#####  
[nodel] (local) root@192.168.0.18 ~  
$ docker run hello-world  
Unable to find image 'hello-world:latest' locally  
latest: Pulling from library/hello-world  
2db29710123e: Pull complete  
Digest: sha256:10d7d58d5ebd2a652f4d93fdd86da8f265f5318c6a73cc5b6a9798ff6d2b2e67  
Status: Downloaded newer image for hello-world:latest  
  
Hello from Docker!  
This message shows that your installation appears to be working correctly.  
  
To generate this message, Docker took the following steps:  
1. The Docker client contacted the Docker daemon.  
2. The Docker daemon pulled the "hello-world" image from the Docker Hub.  
   (amd64)  
3. The Docker daemon created a new container from that image which runs the  
   executable that produces the output you are currently reading.  
4. The Docker daemon streamed that output to the Docker client, which sent it  
   to your terminal.  
  
To try something more ambitious, you can run an Ubuntu container with:  
$ docker run -it ubuntu bash  
  
Share images, automate workflows, and more with a free Docker ID:  
https://hub.docker.com/  
  
For more examples and ideas, visit:  
https://docs.docker.com/get-started/  
  
[nodel] (local) root@192.168.0.18 ~  
$
```

#2 Web Server

Command list

docker run 執行容器

```
> docker run --name webserver -p 5000:80 nginx
```

執行一個Nginx的Web伺服器，並將電腦上的 5000 port 導到容器的 80 port

docker stop 停止容器運行

```
> docker container stop webserver
```

docker start 運行已停止的容器

```
> docker container start webserver
```

docker rm 刪除容器

```
> docker rm webserver
```

#3 Node-RED

Deploy Node-RED

從 Node-RED 官方 docker hub 下載映像部署

```
> docker run -it -p 1880:1880 -v node_red_data:/data --name mynodered nodered/node-red
```



進階運用 docker-compose

#3 Node-RED

+

Grafana

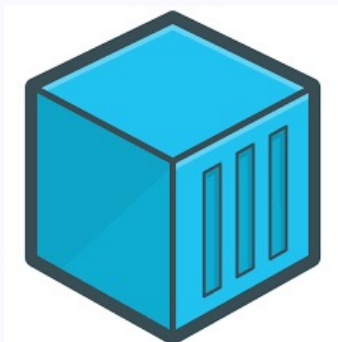
+

InfluxDB

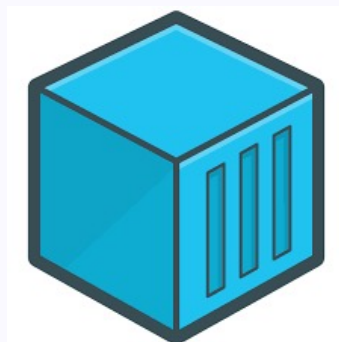
Deploy Node-RED

下載docker-compose.yaml

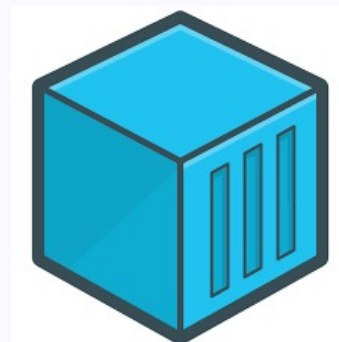
```
> wget https://github.com/kcchien/aims-docker-lab/raw/main/docker-compose.yaml
```



nodered
port 1880



grafana
port 3000



influxDB
port 8086

```
1 version: "3"
2 services:
3   nodered:
4     image: nodered/node-red:latest
5     container_name: nodered
6     restart: always
7     ports:
8       - "1880:1880"
9     networks:
10      - grafana_network
11     volumes:
12      - nodered_data:/data
13     environment:
14      - TZ=Asia/Taipei
15     depends_on:
16      - grafana
17
18   grafana:
19     image: grafana/grafana
20     container_name: grafana
21     restart: always
22     ports:
23       - 3000:3000
24     networks:
25      - grafana_network
26     volumes:
27      - grafana_data:/var/lib/grafana
28     environment:
29      - GF_SECURITY_ADMIN_USER=admin
30      - GF_SECURITY_ADMIN_PASSWORD=password
31     depends_on:
32      - influxdb
33
34   influxdb:
35     image: influxdb/latest
36     container_name: influxdb
37     restart: always
38     ports:
39       - 8086:8086
40     networks:
41      - grafana_network
42     volumes:
43      - influxdb_data:/var/lib/influxdb
44     environment:
45      - INFLUXDB_DB=grafana
46      - INFLUXDB_USER=admin
47      - INFLUXDB_USER_PASSWORD=password
48      - INFLUXDB_ADMIN_ENABLED=true
49      - INFLUXDB_ADMIN_USER=admin
50      - INFLUXDB_ADMIN_PASSWORD=password
51
52   networks:
53     grafana_network:
54
55   volumes:
56     nodered_data:
57     grafana_data:
58     influxdb_data:
```

Command list

啟動所有容器

```
> docker-compose up -d
```

-d 參數代表要執行在背景的方式

停止所有容器運行

```
> docker-compose stop
```

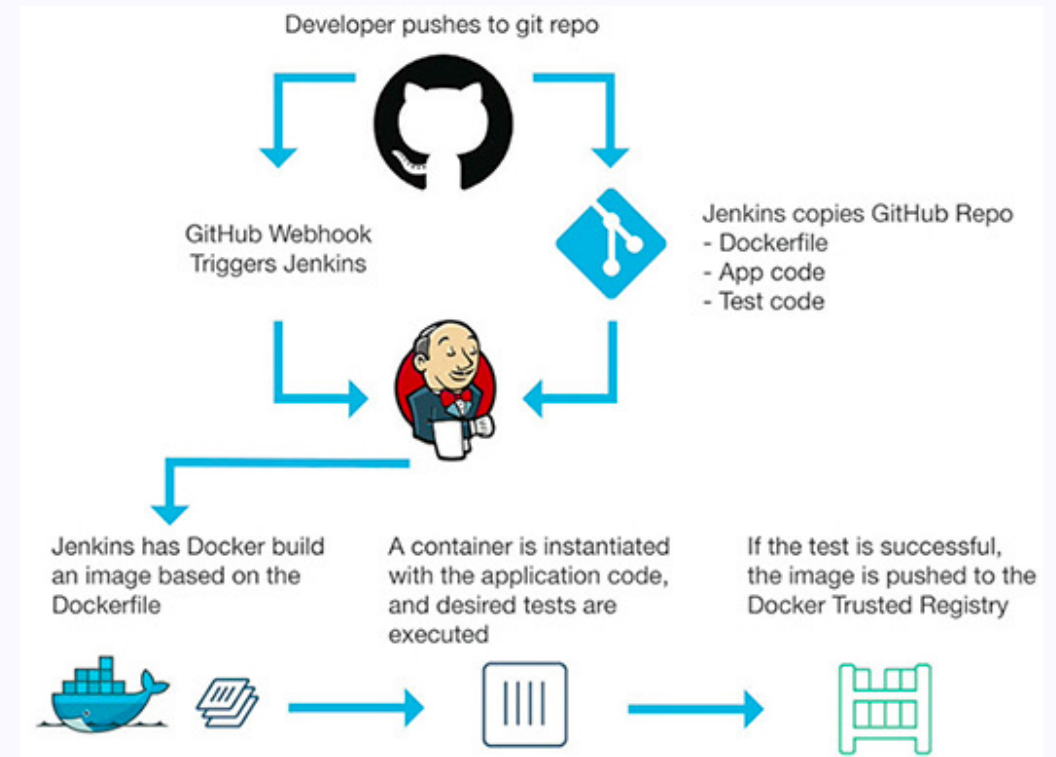
刪除所有已停止的容器

```
> docker-compose rm
```

Summary

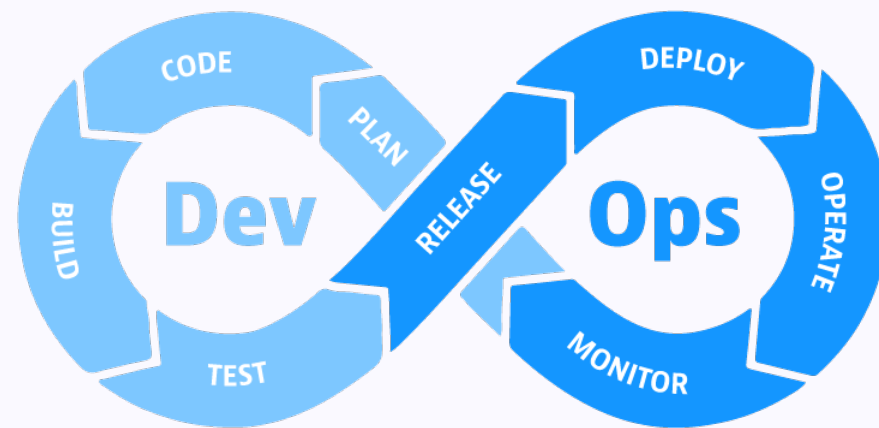
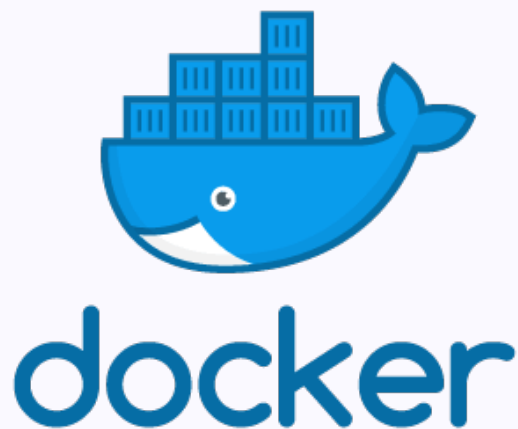
Benefit from using docker in IoT deployment

- Portability
- Lightweight
- Easy application upgrades
- Simplicity and faster configuration
- Reuse
- Security



Summary

透過這些現代化開發方法與技術，可以讓工廠的機聯網系統，可以讓工廠擁有更具彈性、可擴充彈性，在影響最小的情況下，進行新的功能更新與部署，也同時可以提高機聯網網路的安全性，讓工廠可以隨著科技技術的更新，同步成長。



Resources

- **docker official site**

- <https://www.docker.com/>

- **docker hub**

- <https://hub.docker.com/>

- **Play with Docker**

- <https://labs.play-with-docker.com/>

- **Tensorflow with Docker**

- <https://www.tensorflow.org/install/docker/>

**Thank
You**