



# 逢甲大學 *docker* 研習班

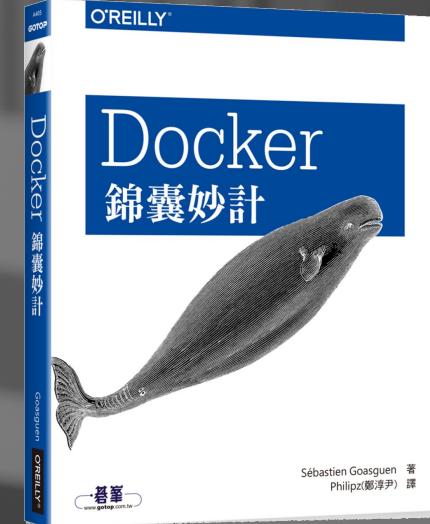
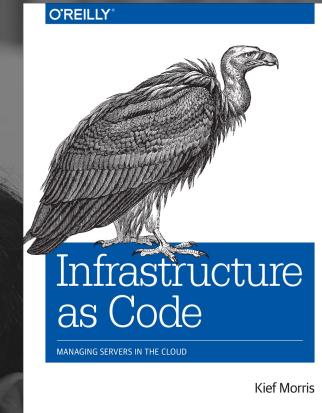
Docker.Taipei Philipz(鄭淳尹)  
2017-01-16

[https://github.com/philipz/workshop\\_fcu](https://github.com/philipz/workshop_fcu)

# Philipz (鄭淳尹)



Docker.Taipei 共同發起人



歐萊禮《Docker 錦囊妙計》譯者

碁峰《Docker入門與實戰》、

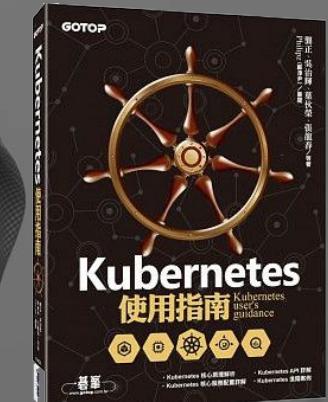
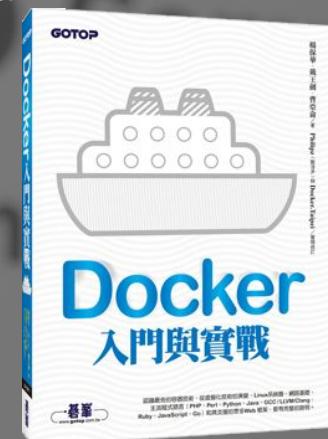
《Kubernetes使用指南》審譯者

2014 COSCUP/iThome Summit 講者

2015 Microsoft Azure 開發者大會 講者

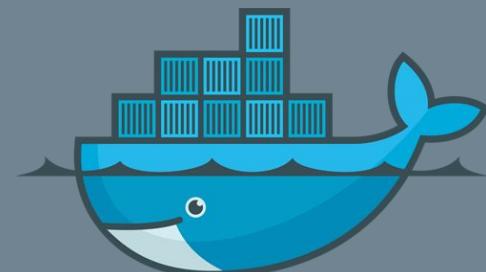
2016 COSCUP Docker 進階工作坊

2016 義守大學資工系 Docker 研習營



# Today Topics

1. Virtualization introduction
2. The differents between VMs and Container,  
Container lifecycle.
3. Docker ecosystem tools
4. Linux CLI, Docker CLI
5. Using Docker Engine
6. Docker image filesystem & how to build minimal  
Docker image
7. Using Docker & Qemu to emulation  
Raspberry Pi Raspbian

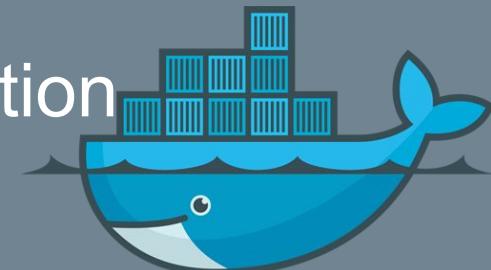


# 1. 虛擬化 Virtualization



# Virtualization History

- IBM zOS
- Virtual Hardware - VMware, KVM, Xen, VirtualBox
- Hardware-assisted virtualization
- Paravirtualization
- OS-level virtualization
  - a. OpenVZ
  - b. LXC
  - c. Docker
- IaaS, PaaS, SaaS - Snapshot, Migration



# HVM vs PV on AWS

Instance Family	HVM	HVM	PV	PV
	EBS-Backed 64-bit	Instance Store 64-bit	EBS-Backed 64-bit	Instance Store 64-bit
T2	✓			
M4	✓			
M3	✓	✓	✓	✓
C4	✓			
C3	✓	✓	✓	✓
R3	✓	✓		
G2	✓			
I2	✓	✓		
D2	✓	✓		



# Azure Regions

## Azure 地區

Azure 已在全球 30 個區域正式運作，也宣佈計畫增加 8 個區域。擴展地理位置對於 Azure 而言是首要目標，因為這樣會讓我們的客戶能達到更佳的效能，並支援資料位置相關的需求及喜好設定。

依區域探索產品 ►

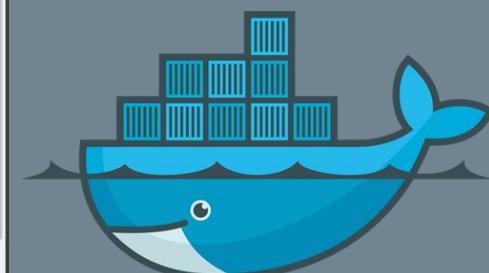


# Microsoft Azure

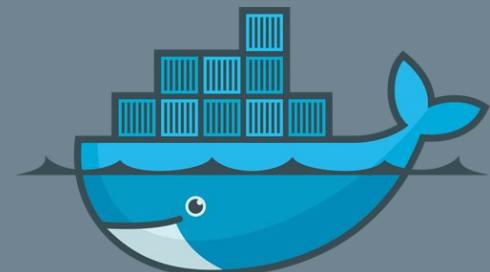
<https://portal.azure.com/>

The screenshot shows the Microsoft Azure portal interface. On the left, there's a sidebar with various service icons and labels: 計算 (Compute), 網路 (Network), Storage, Web + 行動 (Mobile + Web), Databases, Intelligence + analytics, 物聯網 (IoT), Enterprise Integration, 安全性 + 識別 (Security + Identity), Developer tools, and Monitoring + management. The main area has a title bar "新增 > 計算". Below it, there's a search bar "搜尋 Marketplace" and a "MARKETPLACE" section with a "查看全部" button. To the right, there's a "精選應用程式" (Selected Applications) section with three items:

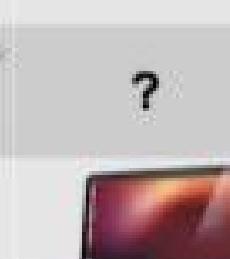
- Windows Server 2012 R2 Datacenter**  
Enterprise-class solutions that are simple to deploy, cost-effective,
- Windows Server 2016 Datacenter**  
Enterprise-class solutions that are simple to deploy, cost-effective,
- Red Hat Enterprise Linux 7.2**  
Red Hat Enterprise Linux 7 is the world's leading enterprise Linux platform built to meet the needs



## 2. Compare VM with Container



# The Martix of Hell

		?	?	?	?	?	?
		?	?	?	?	?	?
		?	?	?	?	?	?
		?	?	?	?	?	?
		?	?	?	?	?	?
	 cassandra	?	?	?	?	?	?
							

# A Brief History of Containers

1979: Unix V7

2000: FreeBSD Jails

2005: OpenVZ

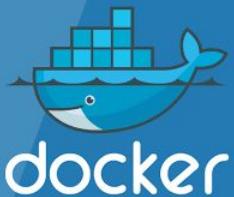
2008: LXC

2013: LMCTFY

2013: Docker

2016: Windows Container

From: [A Brief History of Containers: From 1970s chroot to Docker 2016](#)



# Build, Ship, Run, Any App Anywhere

From Dev



To Ops



Any App



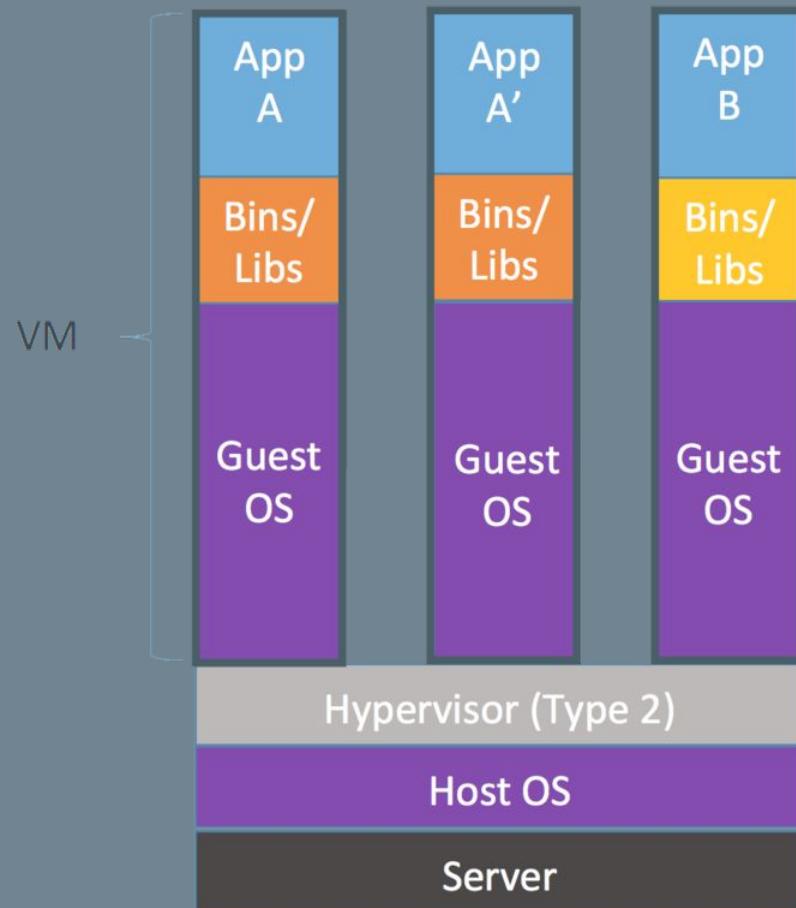
Any OS



Anywhere



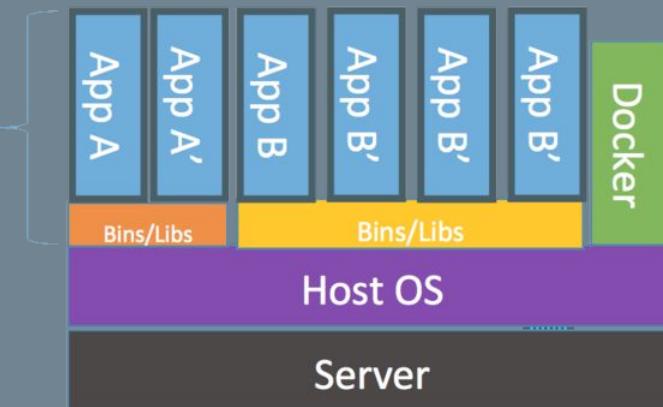
# Containers vs. VMs



Containers are isolated,  
but share OS and, where  
appropriate, bins/libraries

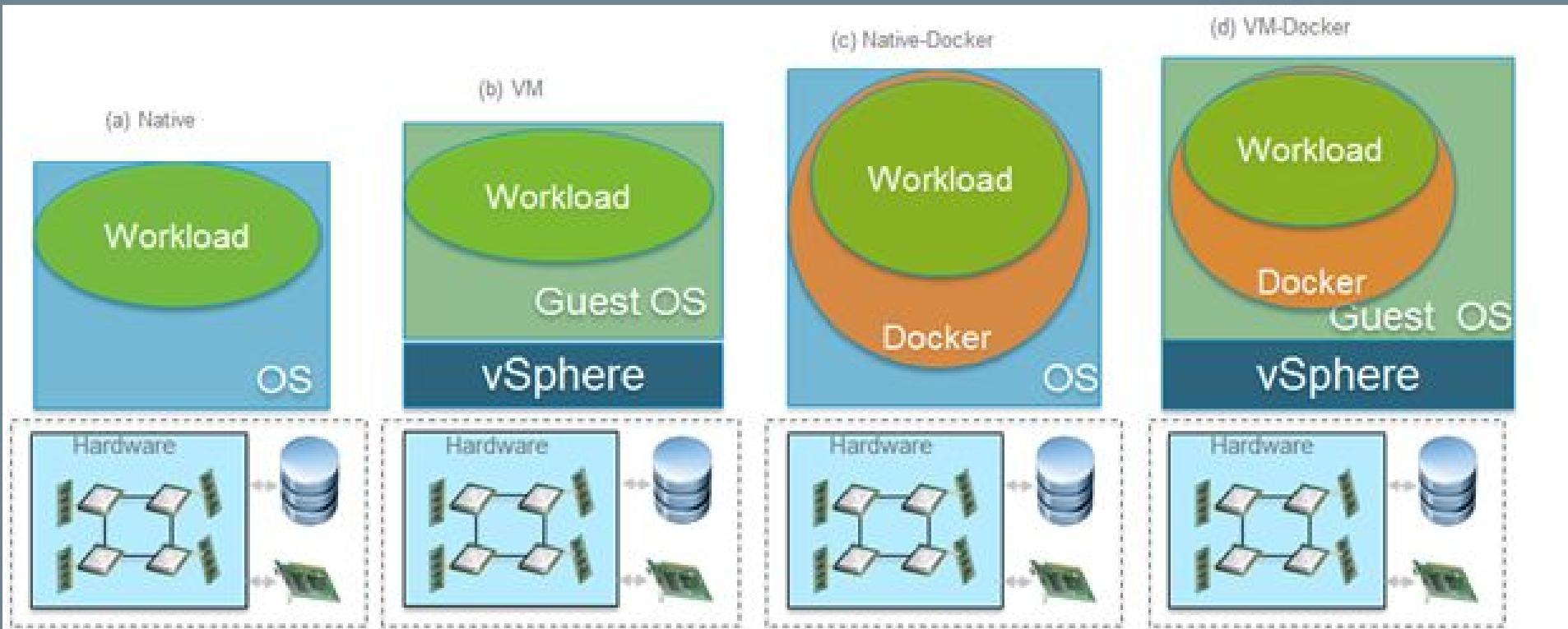
...result is significantly faster deployment,  
much less overhead, easier migration,  
faster restart

Container

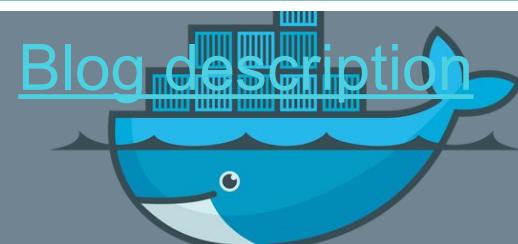
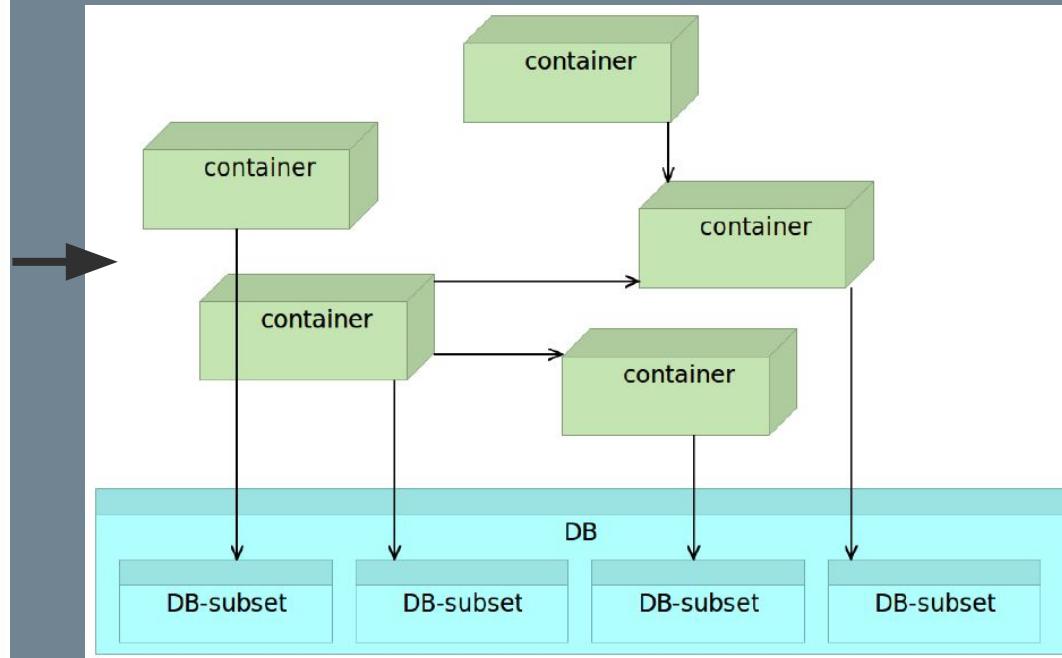
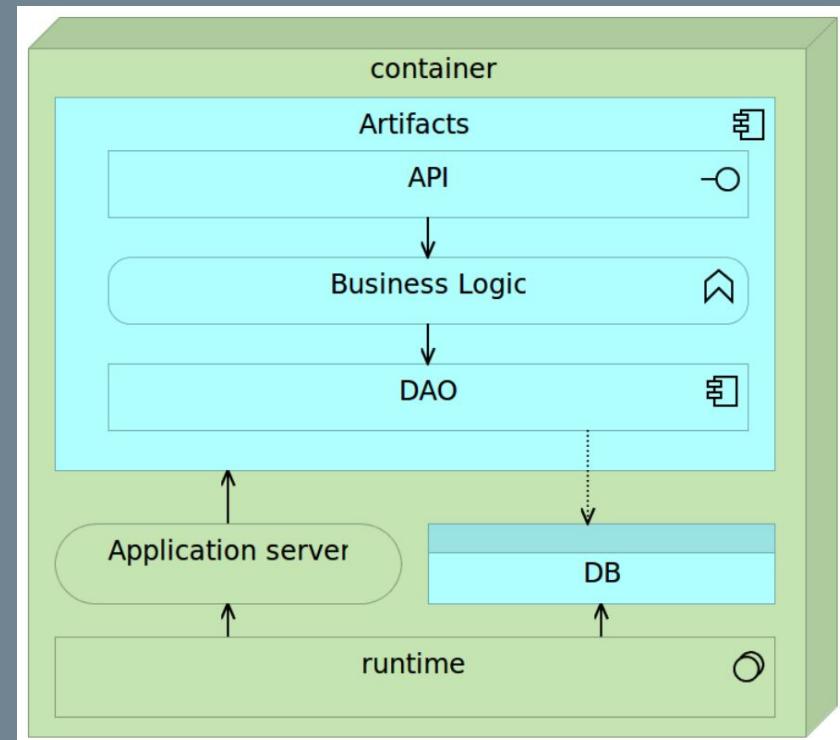


[Blog description](#)

# Containers vs. VMs



# Containers are not VMs



# Container Principle

Real Container

One Container

One Customer

One Commodity

Software Container

One Container

One Process

## The Box

How the Shipping Container Made the World Smaller and the World Economy Bigger



箱子 貨櫃造就的全球貿易與現代經濟生活

沒有它，就沒有全球化。沒有沃爾瑪，甚至沒有高科技。  
貨櫃船的運費降低後，意外生產變成最大贏家。  
它改變了我們的生活，也改變了世界。  
從世界各地為我們帶來各種無法想像的低價商品。

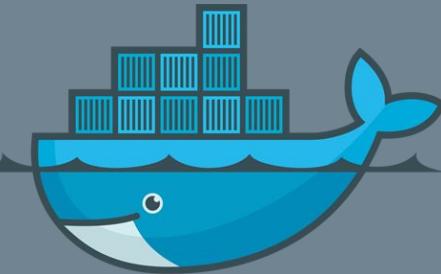
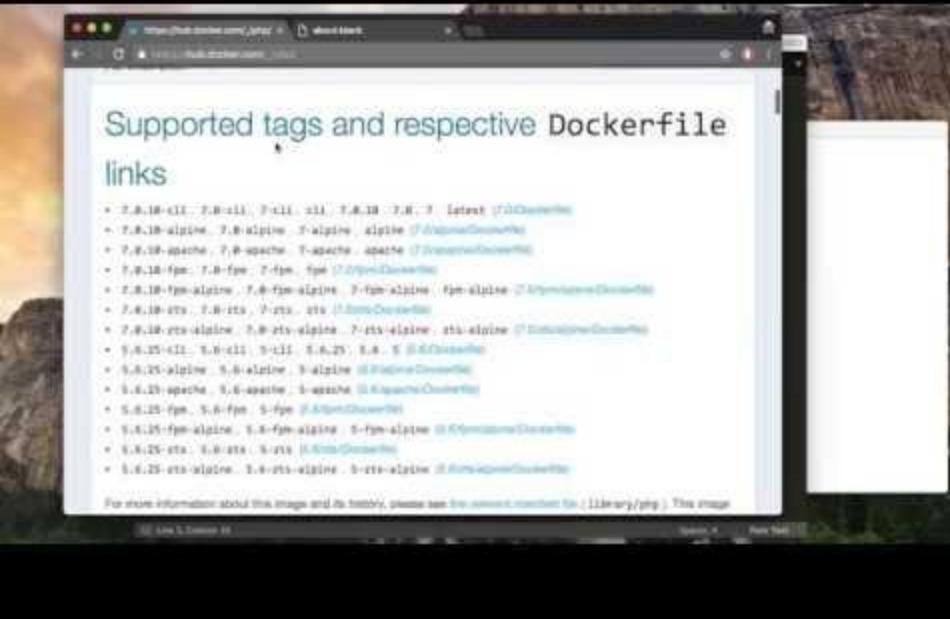
英國《金融時報》年度最佳選書

陳思寬 台大國企系教授 陳國棟 中央研究院人文社會科學研究中心

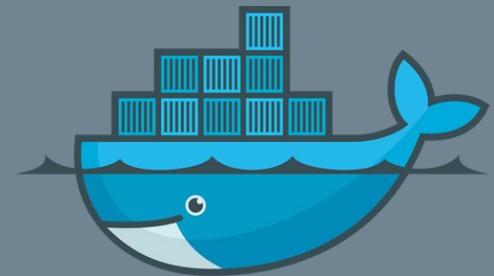
盧峯海 陽明海運董事長 陳柏廷 萬海航運董事長

專文導讀  
聯合推薦

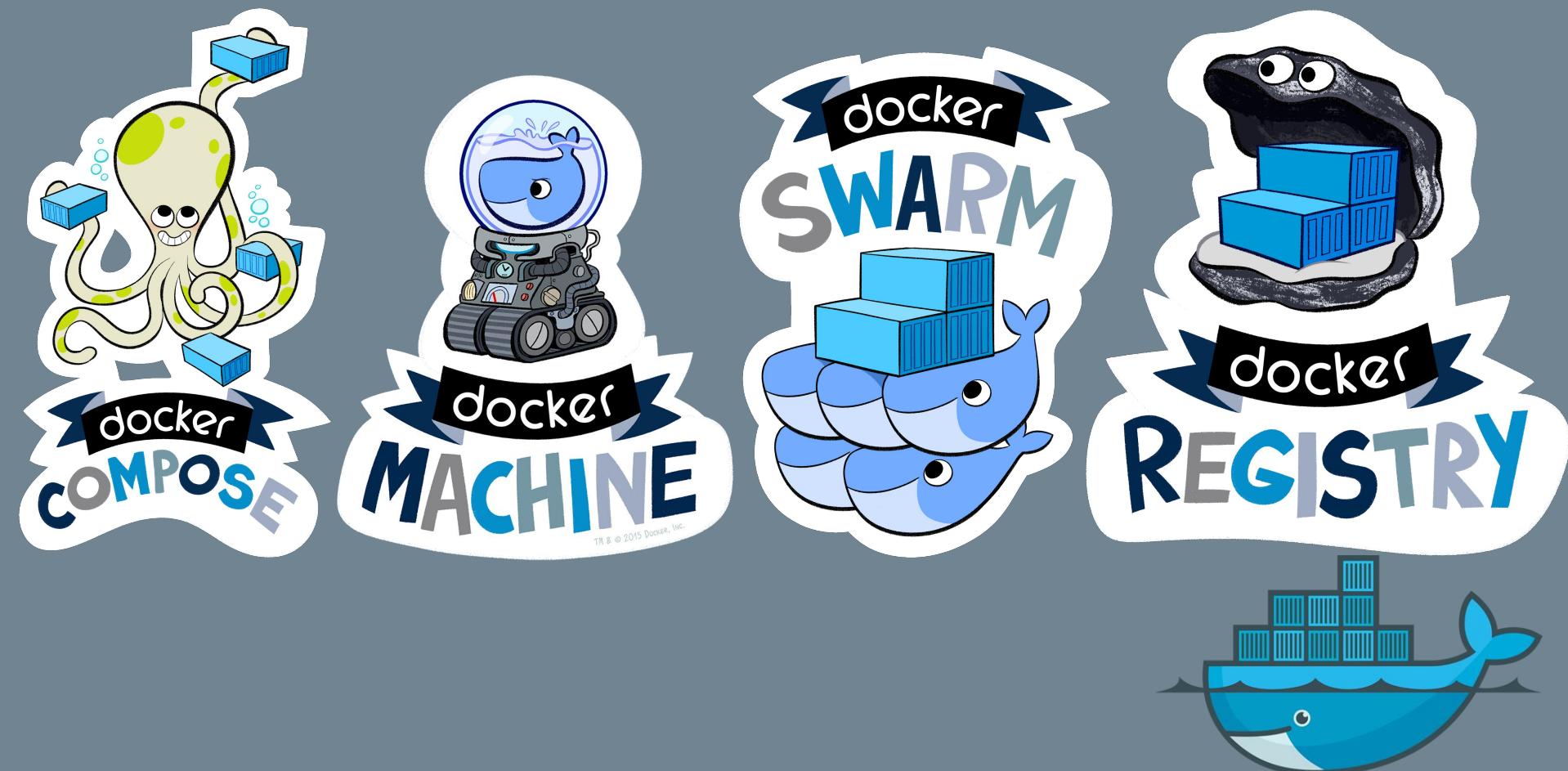




## 3.1 Docker ecosystem tools



# Docker Tools



# Still No Silver Bullet

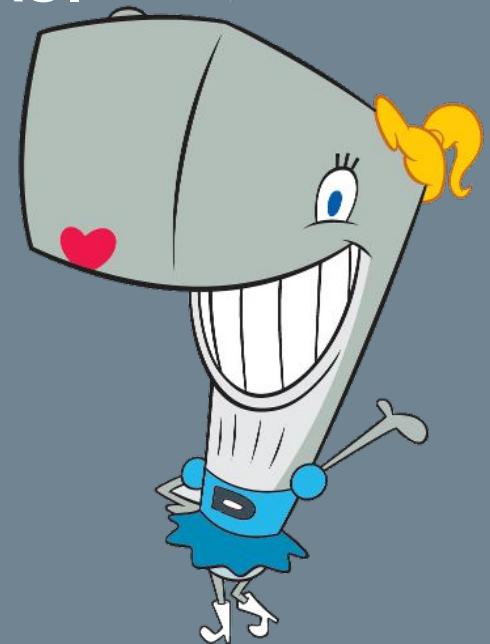
Container is one key element, not all.

DevOps pipeline process

Microservices, or other service stacks.

Infrastructure as Code

# Business model



# The Docker Stack

Commercial Product

Development Platform

Infrastructure

Standards Design



# The Docker Stack

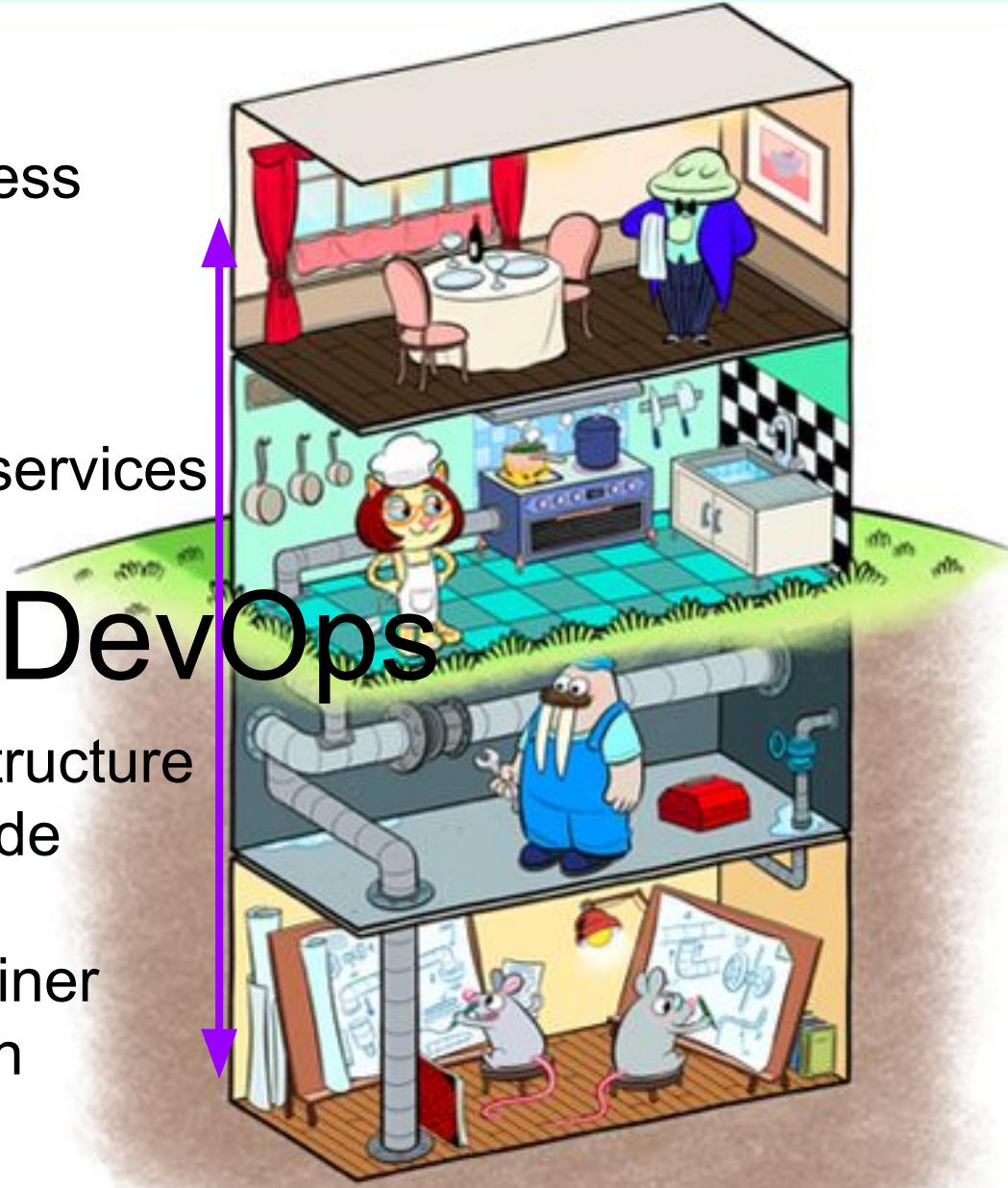
Business  
model

Microservices

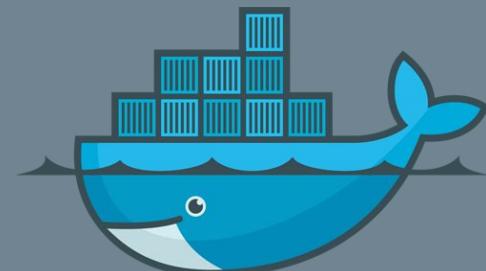
DevOps

Infrastructure  
as Code

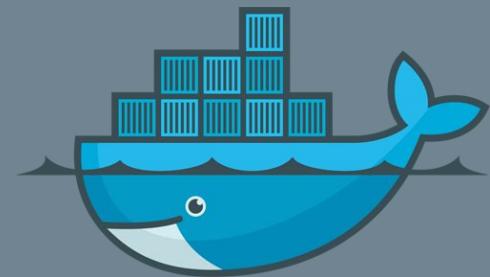
Container  
Design



# Docker Datacenter



# 4.1 Linux command-line





## FILE COMMANDS

- ⑥ ls - directory listing
- ⑥ ls -al - formatted listing with hidden files
- ⑥ cd dir - change directory to dir
- ⑥ cd - change to home
- ⑥ pwd - show current directory
- ⑥ mkdir dir - create a directory dir
- ⑥ rm file - delete file
- ⑥ rm -r dir - delete directory dir
- ⑥ rm -f file - force remove file
- ⑥ rm -rf dir - force remove directory dir \*
- ⑥ cp file1 file2 - copy file1 to file2
- ⑥ cp -r dir1 dir2 - copy dir1 to dir2; create dir2 if it doesn't exist
- ⑥ mv file1 file2 - rename or move file1 to file2  
if file2 is an existing directory, moves file1 into directory file2
- ⑥ ln -s file link - create symbolic link to file
- ⑥ touch file - create or update file
- ⑥ cat > file - places standard input into file
- ⑥ more file - output the contents of file
- ⑥ head file - output the first 10 lines of file
- ⑥ tail file - output the last 10 lines of file
- ⑥ tail -f file - output the contents of file as it grows, starting with the last 10 lines



## SHORTCUTS

- ⑥ Ctrl+C
- ⑥ Ctrl+Z
- fg in t
- ⑥ Ctrl+D
- ⑥ Ctrl+W
- ⑥ Ctrl+U
- ⑥ Ctrl+R
- ⑥ !! - re
- ⑥ exit -



## SYSTEM

- ⑥ date
- ⑥ cal -
- ⑥ uptime
- ⑥ w - d
- ⑥ whoami
- ⑥ finger
- ⑥ uname
- ⑥ cat /
- ⑥ cat /
- ⑥ man c
- ⑥ df -
- ⑥ du -
- ⑥ free

which



## SEARCHING

- ⑥ grep pattern files - search for pattern in files
- ⑥ grep -r pattern dir - search recursively for pattern in dir
- ⑥ command | grep pattern - search for pattern in the output of command



COMP



## PROCESS MANAGEMENT

- ⑥ ps - display your currently active processes
- ⑥ top - display all running processes
- ⑥ kill pid - kill process id pid
- ⑥ killall proc - kill all processes named proc  
(use with extreme caution)
- ⑥ bg - lists stopped or background jobs; resume a stopped job in the background
- ⑥ fg - brings the most recent job to foreground
- ⑥ fg n - brings job n to the foreground

⑥ tar  
file  
⑥ tar  
⑥ tar  
⑥ Gzip  
⑥ tar  
⑥ tar  
comp  
⑥ tar  
⑥ gzip  
file  
⑥ gzip  
file

- ⌚ !! - repeats the last command
- ⌚ exit - log out of current session

it



## SYSTEM INFO

- ⌚ date - show the current date and time
- ⌚ cal - show this month's calendar
- ⌚ uptime - show current uptime
- ⌚ w - display who is online
- ⌚ whoami - who you are logged in as
- ⌚ finger user - display information about user
- ⌚ uname -a - show kernel information
- ⌚ cat /proc/cpuinfo - cpu information
- ⌚ cat /proc/meminfo - memory information
- ⌚ man command - show the manual for command
- ⌚ df - show disk usage
- ⌚ du - show directory space usage
- ⌚ free - show memory and swap usage
- ⌚ whereis app - show possible locations of app
- ⌚ which app - show which app will be run by default



INSTA



Insta

./con

make

make



dpkg



rpm

Cli

① which app - show which app will be run by default

make  
make

① dpkg  
① rpm -

# cli commands



① chmod  
to change  
the file  
permissions

group  
● Example

● Example

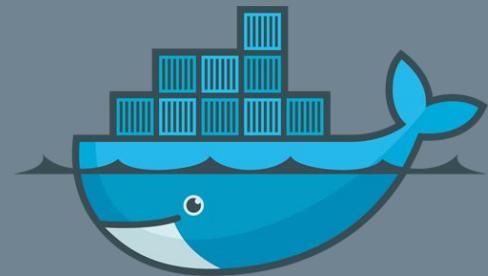
chmod  
chmod

For more

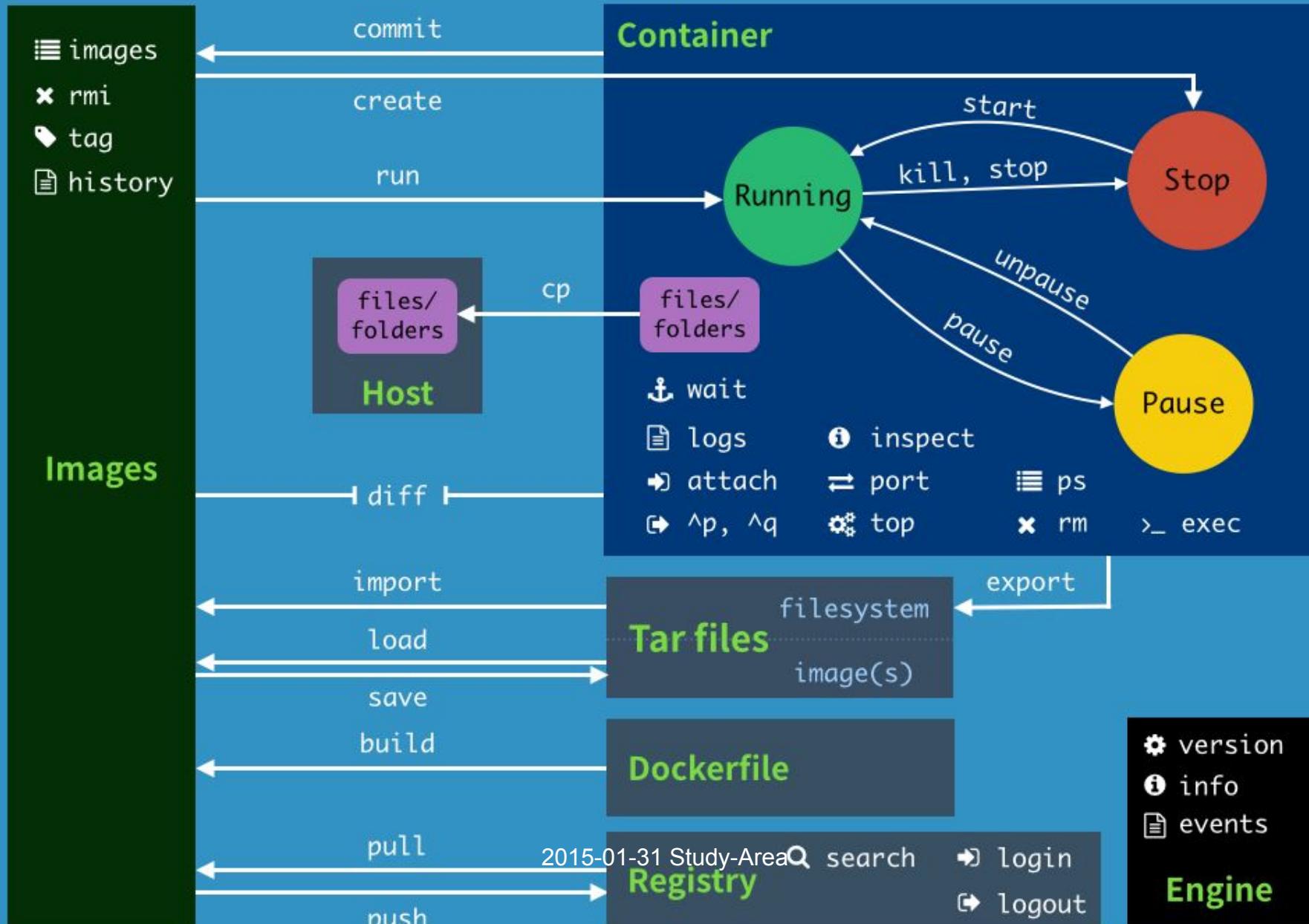
## ② COMPRESSION

- ① tar cf file.tar files - create a tar named file.tar containing files
- ① tar xf file.tar - extract the files from file.tar
- ① tar czf file.tar.gz files - create a tar with Gzip compression
- ① tar xzf file.tar.gz - extract a tar using Gzip
- ① tar cjf file.tar.bz2 - create a tar with Bzip2 compression
- ① tar xjf file.tar.bz2 - extract a tar using Bzip2
- ① gzip file - compresses file and renames it to file.gz
- ① gzip -d file.gz - decompresses file.gz back to file

## 4.2 Docker command-line

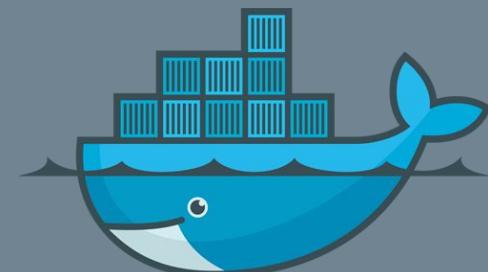


# Docker Commands Diagram



# Docker Management commands

Command	Description
<code>dockerd</code>	Launch the Docker daemon
<code>info</code>	Display system-wide information
<code>inspect</code>	Return low-level information on a container or image
<code>version</code>	Show the Docker version information

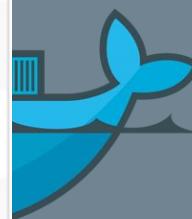


# Docker image commands

Command	Description
build	Build an image from a Dockerfile
commit	Create a new image from a container's changes
history	Show the history of an image
images	List images
import	Import the contents from a tarball to create a filesystem image
load	Load an image from a tar archive or STDIN
rmi	Remove one or more images
save	Save images to a tar archive
tag	Tag an image into a repository

# Docker container commands (1/2)

Command	Description
attach	Attach to a running container
cp	Copy files/folders from a container to a HOSTDIR or to STDOUT
create	Create a new container
diff	Inspect changes on a container's filesystem
events	Get real time events from the server
exec	Run a command in a running container
export	Export a container's filesystem as a tar archive
kill	Kill a running container
logs	Fetch the logs of a container
pause	Pause all processes within a container
port	List port mappings or a specific mapping for the container
ps	List containers

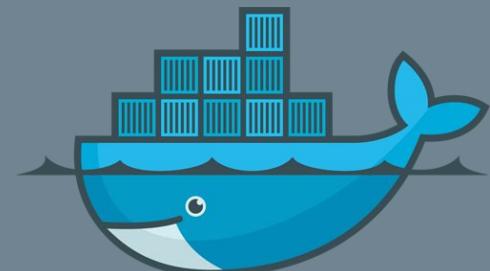


# Docker container commands (2/2)

Command	Description
rename	Rename a container
restart	Restart a running container
rm	Remove one or more containers
run	Run a command in a new container
start	Start one or more stopped containers
stats	Display a live stream of container(s) resource usage statistics
stop	Stop a running container
top	Display the running processes of a container
unpause	Unpause all processes within a container
update	Update configuration of one or more containers
wait	Block until a container stops, then print its exit code



# 5. Docker Engine Playground



# Install Docker

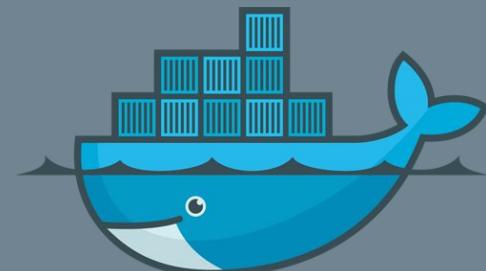
## Install Docker on Ubuntu

or

```
curl -sSL https://get.docker.com/ | sh
```

and

```
docker run hello-world
```



# Azure Firewall

docker run -d -p 80:80 nginx

優先順序	名稱	來源	目的地	服務	動作
1000	default-allow-ssh	Any	Any	SSH (TCP/22)	Allow
1010	web	Any	Any	HTTP (TCP/80)	Allow

docker run -ti --rm -p 80:80 nginx

docker run -ti --rm -p 80:80 nginx bash



# Azure DNS Setting

Microsoft Azure 資源群組 > workshop > docker0001-ip - 組態

重新整理 移動

訂用帳戶 ID: f54fb833-8281-4160-855e-aef64e241aa1  
位置: 東亞

類型	位置	操作
虛擬機器	東亞	...
網路介面	東亞	...
網路安全性群組	東亞	...
公用 IP 位址	東亞	...
虛擬網路	東亞	...
儲存體帳戶	東亞	...
儲存體帳戶	東亞	...

搜尋 (Ctrl+ /)

docker0001-ip - 組態

公用 IP 位址

儲存 捨棄

指派 動態 靜態

IP 位址: 13.75.113.166

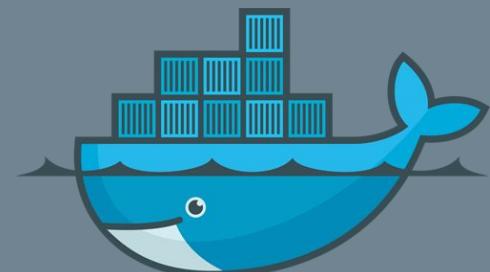
閒置逾時 (分鐘): 4

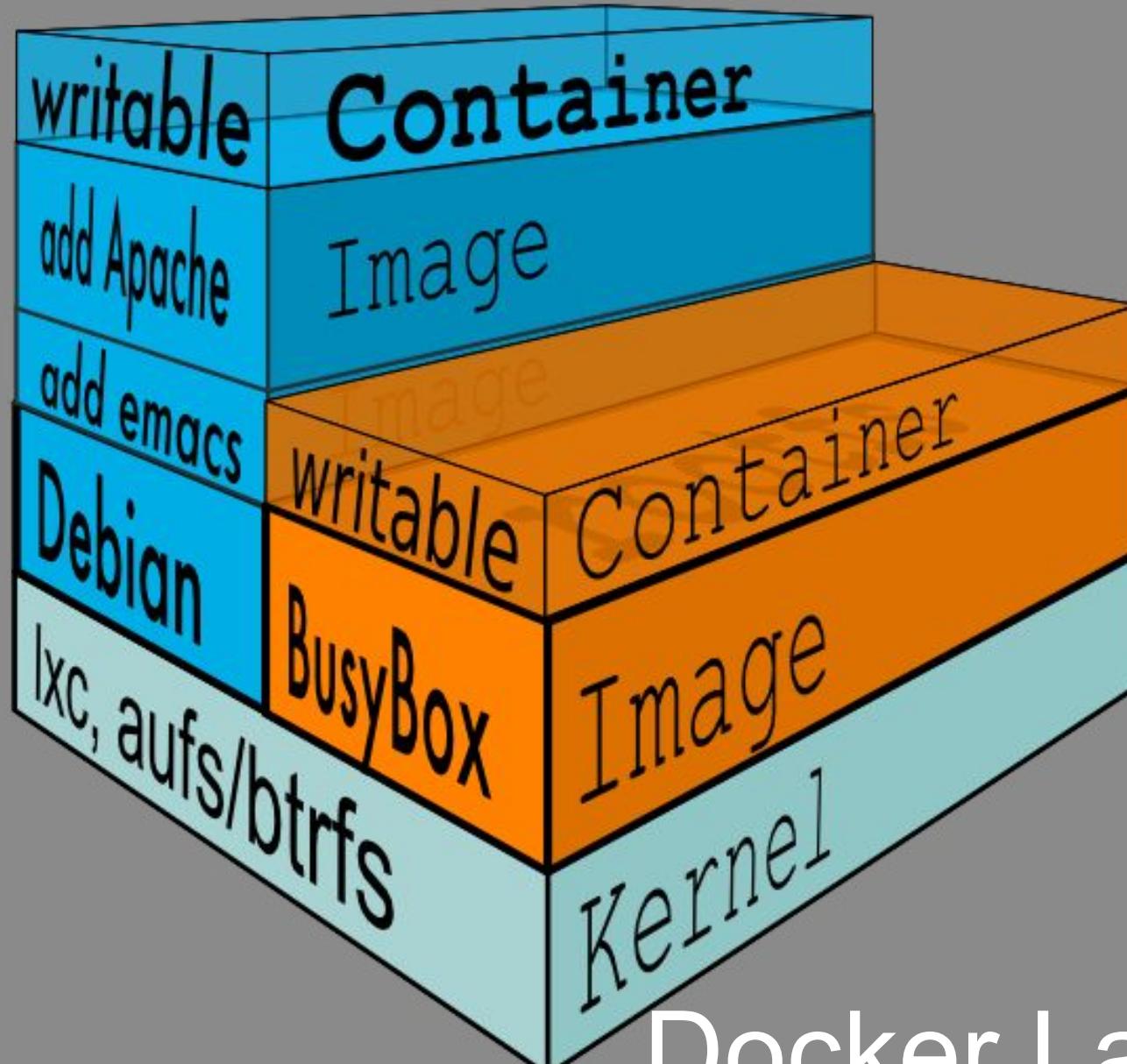
DNS 名稱標籤 (選用): docker0001  
.eastasia.cloudapp.azure.com

組態 屬性 鎖定 自動化範本

支援與疑難排解 新增支援要求

# 6.1 Docker image & Dockerfile





Docker Layers

# Create Docker image

1. Docker commit
2. Dockerfile - docker build
3. Docker Hub auto-build
4. FROM scratch
5. Based on others, ubuntu, alpine...

Example:

<https://github.com/docker/labs/tree/master/beginner/static-site>

```
docker save busybox > busybox.tar  
docker load < busybox.tar
```



# Dockerfile Reference

Same folder, docker build .

docker build -f /other/folder/file .

Add tag, docker build -t TAG\_NAME .

Sample:

```
FROM debian:jessie
```

```
MAINTAINER docker "docker@nginx.com"
```

```
RUN apt-get update && apt-get install -y nginx
```

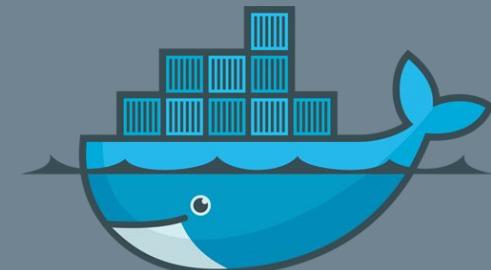
```
CMD ["nginx", "-g", "daemon off;"]
```

Healthcheck from 1.12

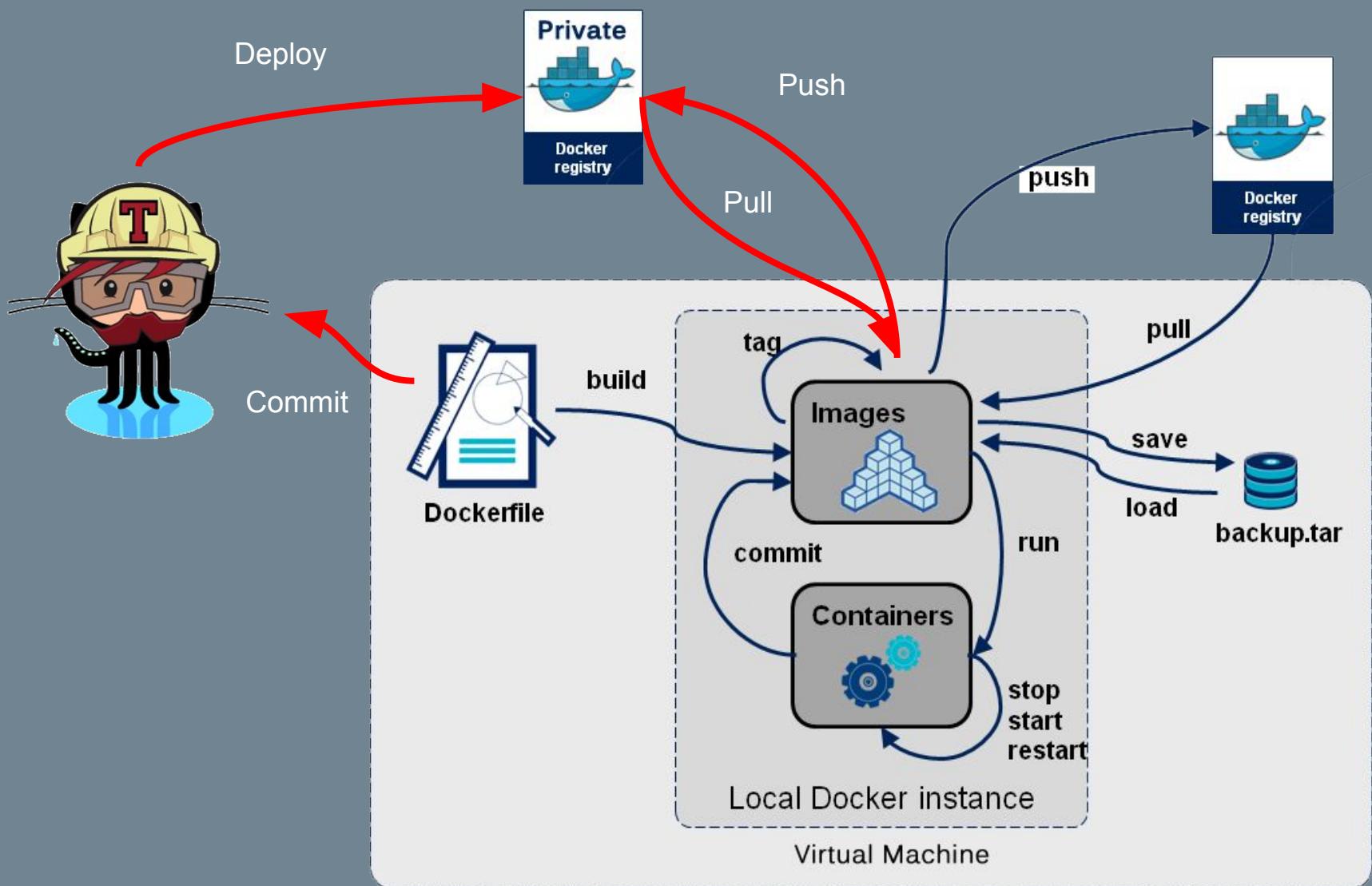


# Dockerfile Practice

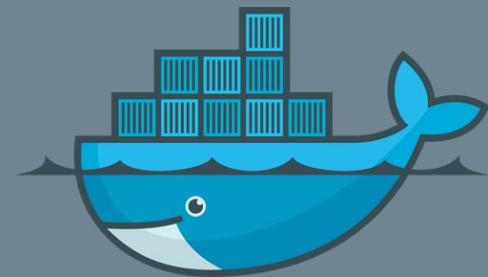
1. Must be “Dockerfile”.
2. Use a `.dockerignore` file, like `.gitignore`.
3. Minimize the number of layers
4. Sort multi-line arguments
5. ADD or COPY
6. CMD or ENTRYPOINT
7. ONBUILD
8. EXPOSE and USER
9. WORKDIR and ENV



# Use Scenario



## 6.2 Minimal Docker image



# HelloWorld!!

FROM scratch

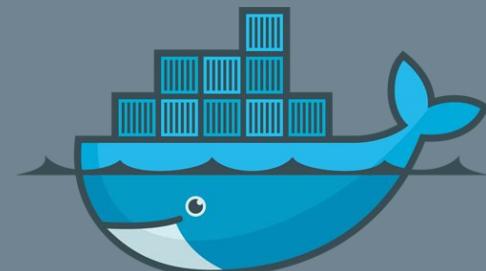
ADD ./libc.so.6 /lib/x86\_64-linux-gnu/libc.so.6

ADD ./ld-linux-x86-64.so.2 /lib64/ld-linux-x86-64.so.2

ADD ./echo /bin/echo

CMD ["echo", "HelloWorld!!"]

```
docker@docker0001:~$ docker images
REPOSITORY          TAG      IMAGE ID      CREATED       SIZE
philipz/minimal_echo  latest   fabcc6de8e86  6 seconds ago  2.059 MB
nginx               latest   05a60462f8ba  9 days ago    181.5 MB
philipz/rpi-raspbian latest   70b24b190431  12 weeks ago   121.5 MB
docker@docker0001:~$ docker run -ti --rm philipz/minimal_echo
HelloWorld!!
```



# Node.js Minimal Image

## Scratch Base Image

Docker image just a File System.

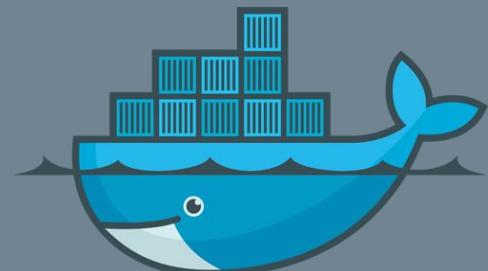
追求極簡化 Docker image 之路 by William Yeh

651.3 MB → 28.31 MB

1/23



# 7. Docker & Qemu & Raspberry Pi Raspbian



# RPi & Docker

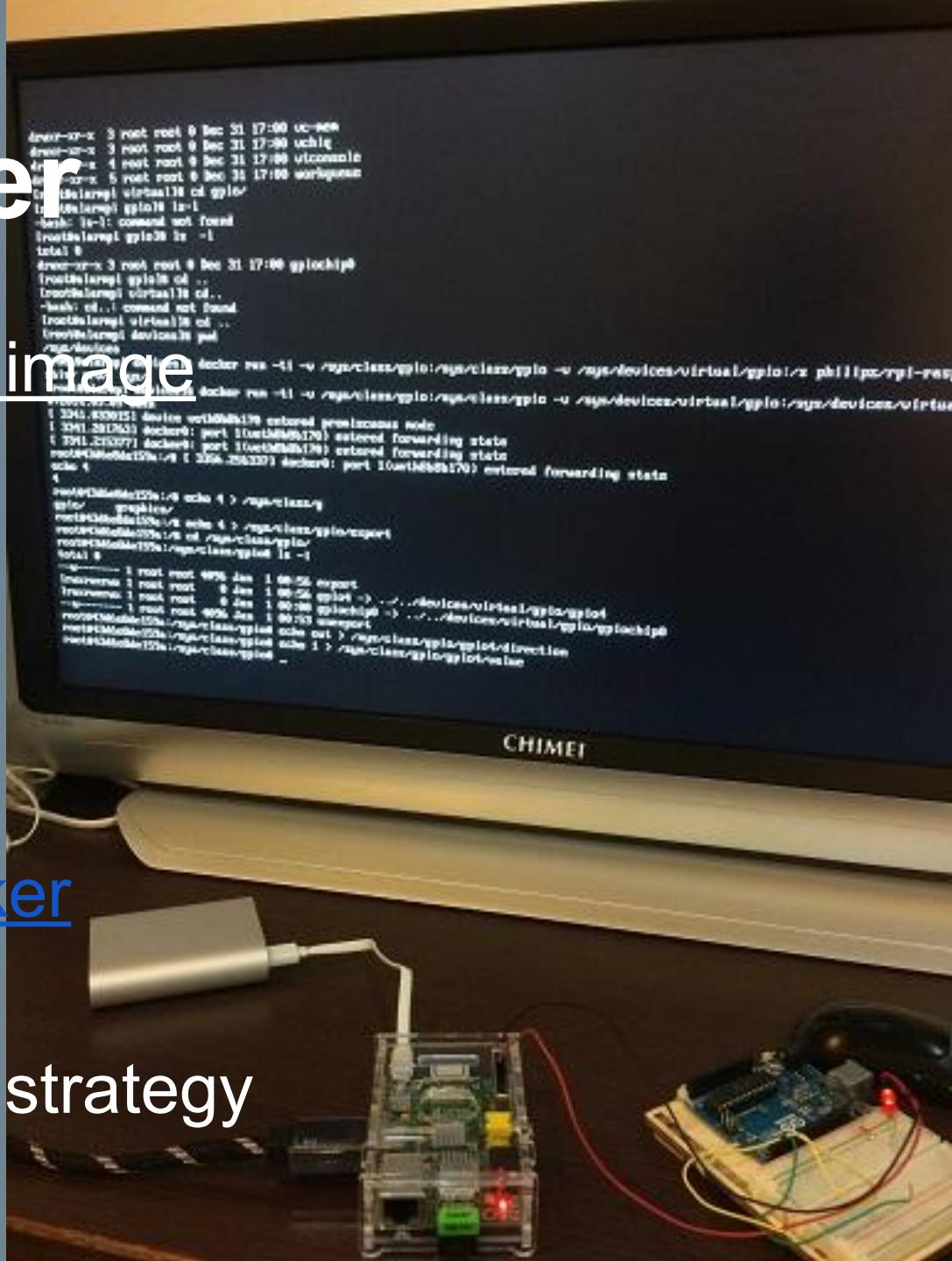
How to build a base image

Cross-compiler

1. Building ARM containers on x86 machine

2. Qemu-static-Docker IoT CI/CD

New thinking & new strategy



**JUST DO IT**



0  
(03:23)

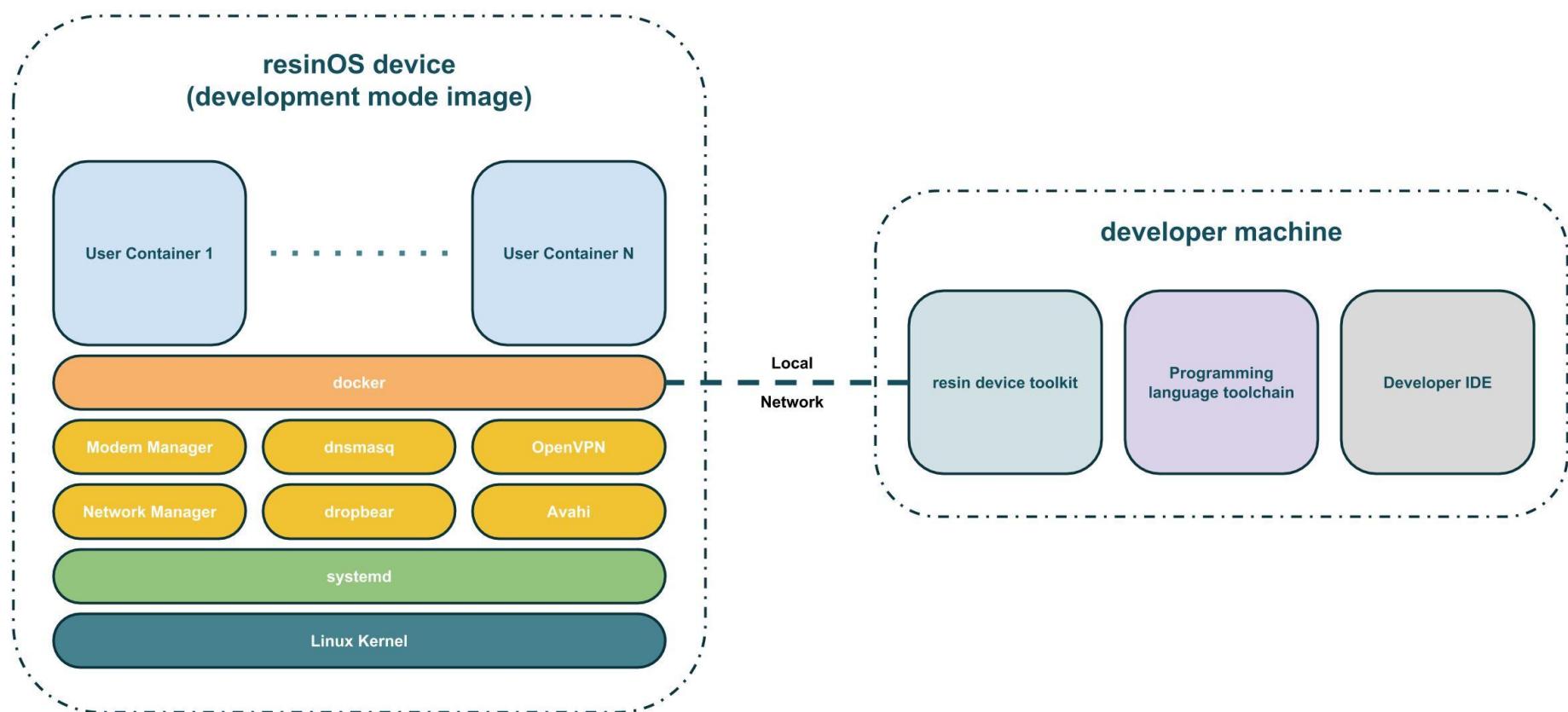
Add Containers +

```
Step 4 : COPY qemu/cross-build-end qemu/cross-build-start qemu/qemu-arm-static qemu/sh-shim /usr/bin/
--> 6b9181f32891
Error removing intermediate container c2702bd608f7: nosuchcontainer: No such container: c2702bd608f796
2e2939b88af88f15241ee45d5d003c81105890da670df6e203
Step 5 : RUN cross-build-start
--> Running in 1d0c6ff52fd3
--> a92560a622a5
Error removing intermediate container c2702bd608f7: nosuchcontainer: No such container: c2702bd608f796
2e2939b88af88f15241ee45d5d003c81105890da670df6e203
Step 6 : RUN apt-get update && apt-get install -y mosquitto-clients
--> Running in b94e9a36c402
Get:1 http://archive.raspbian.org jessie InRelease [14.9 kB]
Get:2 http://archive.raspbian.org jessie/main armhf Packages [12.5 MB]
Fetched 12.5 MB in 12s (1019 kB/s)
Reading package lists...
Reading package lists...
Building dependency tree...
The following extra packages will be installed:
  libc-ares2 libmosquitto1 libssl1.0.0
The following NEW packages will be installed:
  libc-ares2 libmosquitto1 libssl1.0.0 mosquitto-clients
0 upgraded, 4 newly installed, 0 to remove and 34 not upgraded.
Need to get 999 kB of archives.
After this operation, 2542 kB of additional disk space will be used.
Get:1 http://archive.raspbian.org/raspbian/ jessie/main libssl1.0.0 armhf 1.0.1t-1+deb8u2 [852 kB]
Get:2 http://archive.raspbian.org/raspbian/ jessie/main libc-ares2 armhf 1.10.0-2 [71.3 kB]
Get:3 http://archive.raspbian.org/raspbian/ jessie/main libmosquitto1 armhf 1.3.4-2 [36.3 kB]
Get:4 http://archive.raspbian.org/raspbian/ jessie/main mosquitto-clients armhf 1.3.4-2 [39.3 kB]
debconf: delaying package configuration, since apt-utils is not installed
Fetched 999 kB in 1s (621 kB/s)
Selecting previously unselected package libssl1.0.0:armhf.
(Reading database ... 7096 files and directories currently installed.)
```



# Why resinOS

<https://resinos.io/>

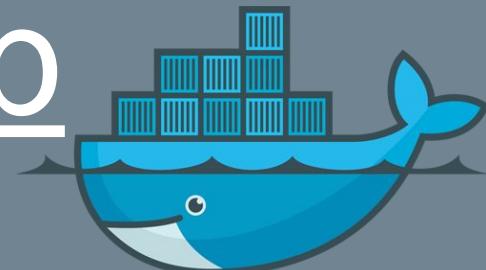


# Exercise & Self-learning

1. Docker Basic - Katacoda
2. Docker Trainning
3. Docker Mentor Week
4. Docker Tutorials and Labs

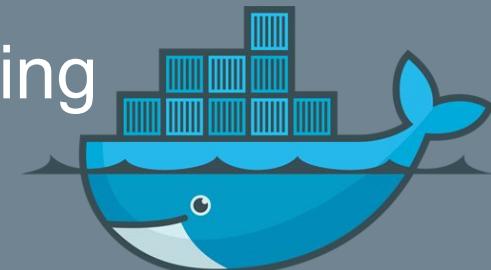
## Online Self-learning

## MS Win Online Lab



# Tomorrow Topics

1. Docker Hub introduction
2. Git CLI
3. Docker Hub Auto-build from **Github**
4. Docker Network CLI
5. Docker Volume CLI
6. Docker Compose CLI  
= **Multi**-Container on Single Host
7. Using Docker Compose & official voting application example





See You Next Week