

Docker & K8s

MGL7320 - Ingénierie logicielle des systèmes d'IA

Introduction

Hello World in Python

Do you want to `print("Hello World!")`?

To do so, you have to have access to a Python interpreter...

- Install a version on your PC? Or through a Web interface?
- Wrong version? Conflicting versions?
- Missing libraries?
- What about also using another language?
- What about OS specificities ["/" (Linux) vs. "\" (Windows)]?
- ...

With Docker...

```
$ docker run -it python python
Python 3.8.5 (default, Jul 22 2020, 12:28:11)
[GCC 8.3.0] on linux
>>> print(" Hello World!")
This line will be printed.
>>> quit()
```

... and even more!

To call (in parallel) another version of Python:

```
$ docker run -it python:2.7.7 python
```

To call Python with the SciPy library:

```
$ docker run -it alectolytic/scipy python
```

To compile Java Code:

```
$ docker run --rm -v "$PWD":/usr/src/myapp -w /usr/src/myapp openjdk:7  
javac Main.java
```

Ok, but how does it work?

Let's start with the (simplified) basics

My own
application

Engine (Python, Java) +
libraries

Operating System (MacOs, Linux, Windows)

Hardware

The Virtual Machine Approach

My own
application

Engine (Python, Java) +
libraries

Linux VM (Virtual Machine)

Windows VM

Host Operating System + Hypervisor (Software de creation et gestion de VM)

Hardware Infrastructure

*What, a full Linux VM required to
run a single Python Interpreter?*

The Containers Approach

*With this “Containers” Approach,
no more need for multiple OS*

My own
application

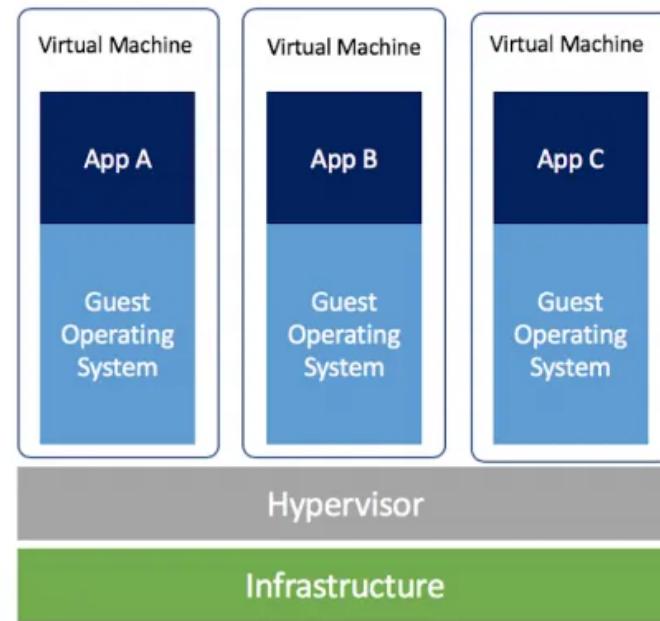
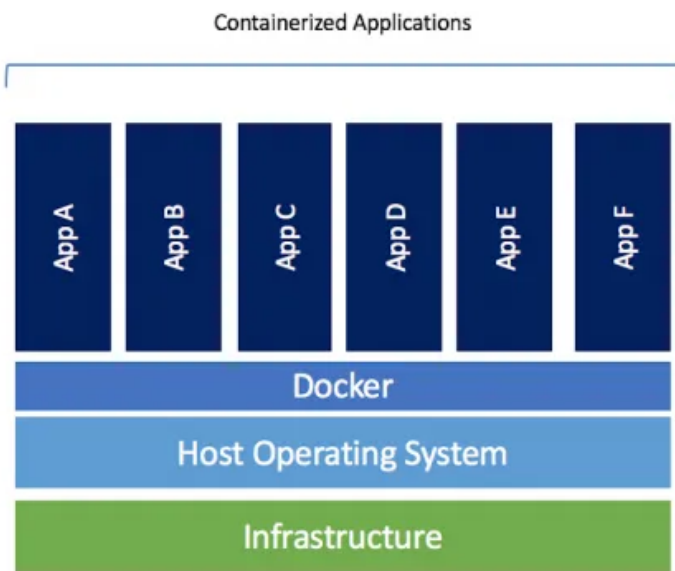
Engine (Python, Java) +
libraries

Docker Engine

Host Operating System (Linux, MacOs, Windows)

Hardware Infrastructure

The Virtual Machine Approach



<https://www.docker.com/blog/containers-replacing-virtual-machines/>

Virtual Machine vs. Container

A VM is required when:

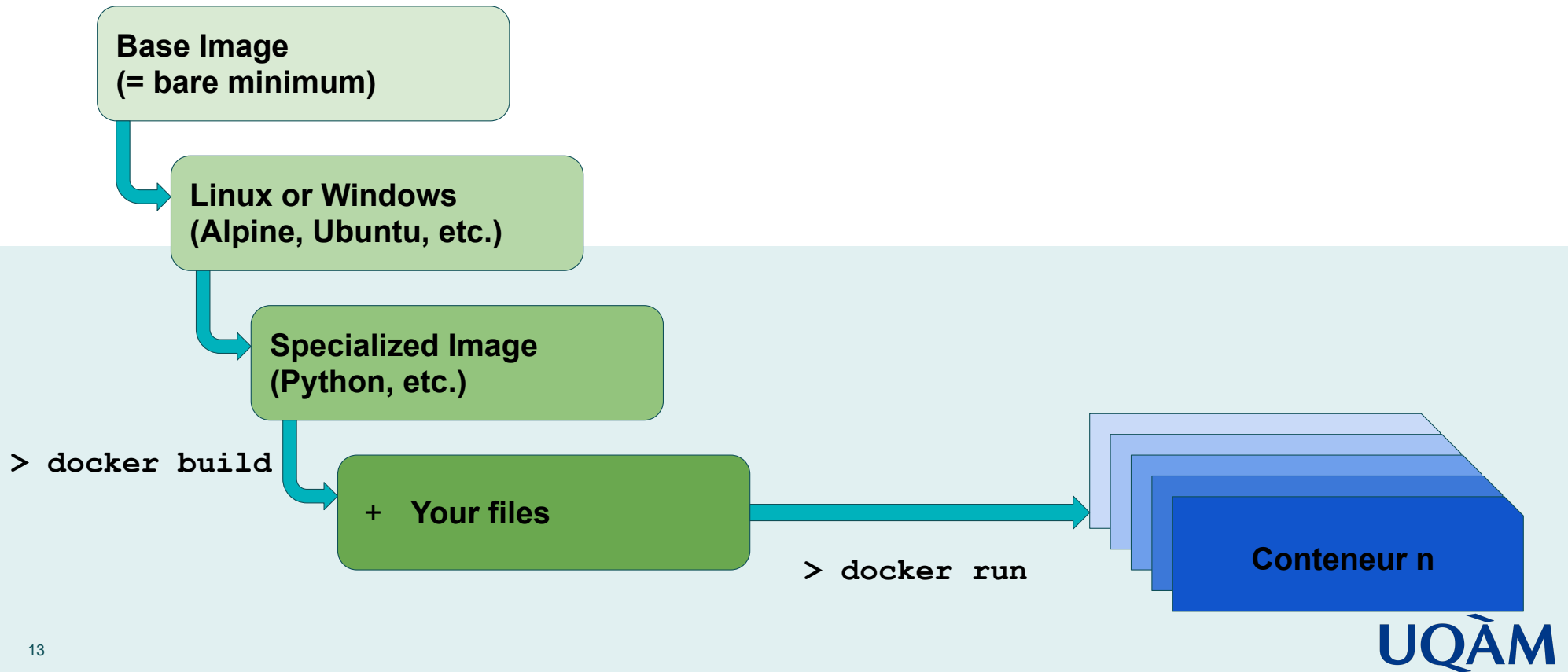
- A Graphical User Interface (GUI) is needed
- To run “classic” heavy applications

Containers are perfectly suitable when:

- Your “application” is performing a single task (one process)
- Your application is reached through
 - a command line
 - an url (REST, Web, etc.)

Docker's life cycle

From Images to Containers



“Dockerfile”, the root of the Docker Universe

```
FROM python:3.8

RUN apt-get install -yqq unzip

RUN mkdir /usr/script
WORKDIR /usr/script
COPY ./scripts .

CMD ["sh", "-c", "python3 myapp.py $ENV_VAR"]
```

RUN: construction de l'image
(plusieurs RUN permis)

CMD: Exécuté par défaut au
démarrage (une seule commande
possible)

You're now in command!

```
$ ls
Dockerfile  scripts

$ docker build -t myapp:test .

$ docker images
REPOSITORY TAG          IMAGE ID            CREATED            SIZE
python     latest       4e2d08f34f6d       4 days ago       934MB
myapp      test        919ab681963b       13 days ago      1.63GB

$ docker run myapp:test
```

You're now in command! (Cont'd)

```
$ docker images
```

REPOSITORY	TAG	IMAGE ID	CREATED	SIZE
myapp	test	919ab681963b	3 days ago	934MB

```
$ docker container ls
```

```
$ docker exec [OPTIONS] CONTAINER COMMAND [ARG...]
```

```
$ docker rmi [OPTIONS] IMAGE [IMAGE...]
```

```
$ docker rm [OPTIONS] CONTAINER [CONTAINER...]
```

```
$ docker --help
```


Docker Compose (multiple containers)

From a `docker-compose.yml` file, such as

```
version: '2.0'
services:
  web:
    build: .
    ports:
      - "5000:5000"
    volumes:
      - ./code
      - logvolume01:/var/log
    links:
      - redis
  redis:
    image: redis
volumes:
  logvolume01: {}
```

Docker Compose

It becomes possible to start together a set of related and interconnected Containers:

```
$ docker-compose up -d
```

```
$ docker container ls
```

```
$ docker-compose down
```

How to Install and/or run Docker?

To Install Docker locally

Docker Desktop (“Dev” mode)

<https://docs.docker.com/engine/install/>



Docker Desktop for Mac

A native application using the macOS sandbox security model which delivers all Docker tools to your Mac.



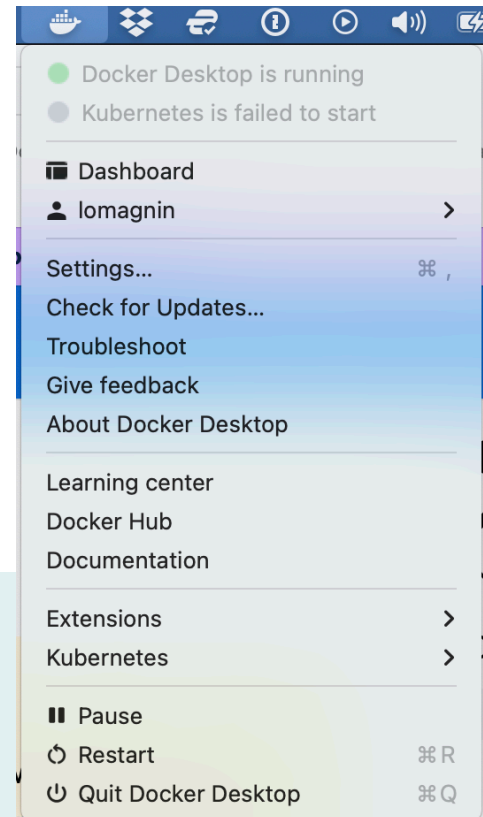
Docker Desktop for Windows

A native Windows application which delivers all Docker tools to your Windows computer.



Docker for Linux

Install Docker on a computer which already has a Linux distribution installed.



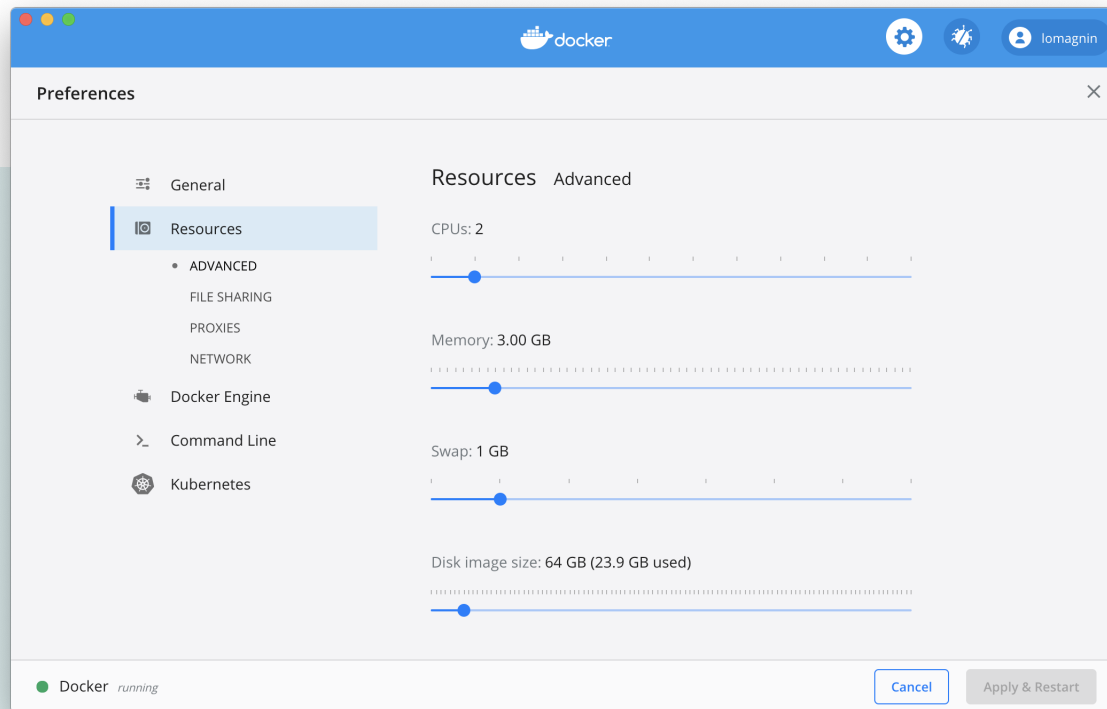
Running Docker inside a VM...

The screenshot shows a VMware Workstation window titled "Ubuntu 64-bit_brms-intact - VMware Workstation". Inside the VM, a terminal window displays the output of the command `docker container ls`. The output shows a container named `ibmcom/odm` with ID `90e19fba8ba`, created 5 weeks ago, and running. The ports section shows `0.0.0.0:9060->9060/tcp, 9080/tcp, 0.0.0.0:9443->9443/tcp, 9453/tcp`. A browser window in the background shows the REST Service interface with the URL `localhost:9060/DecisionService/run.jsp?path=/mydeployment/1.0/Miniloan_ServiceRuleset/1.1&trace=false&type=OpenAPI&kind=native`.

CONTAINER ID	IMAGE	NAMES	COMMAND	CREATED	STATUS	PORTS
90e19fba8ba	ibmcom/odm		"/script/runserver.s..."	5 weeks ago	Up 5 weeks	0.0.0.0:9060->9060/tcp, 9080/tcp, 0.0.0.0:9443->9443/tcp, 9453/tcp

Is that fundamentally different?

Actually, Docker Desktop *on Windows (or MacOS)* runs inside a dedicated Linux based Virtual Machine with preemptive resources...

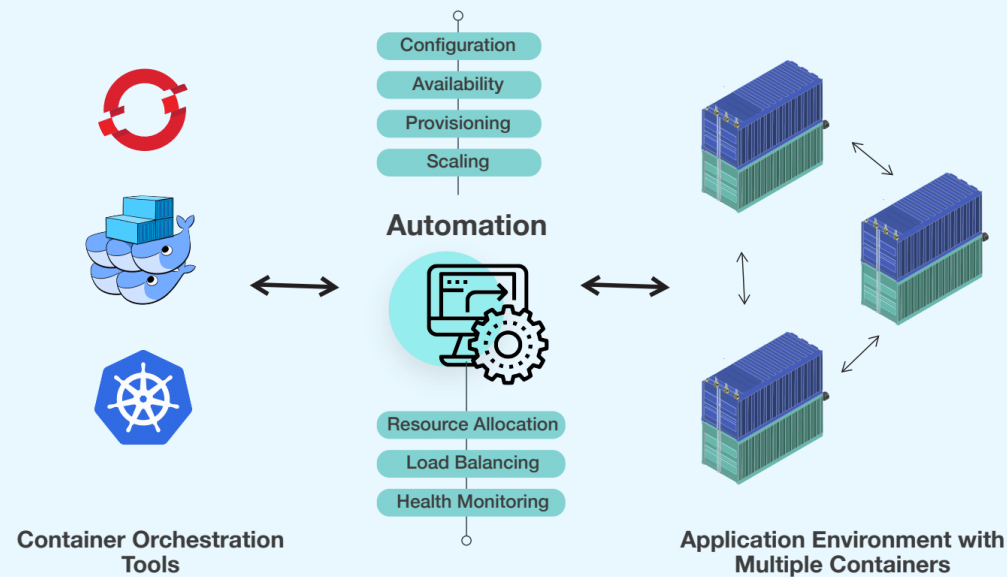


How to orchestrate multiple Docker Containers?

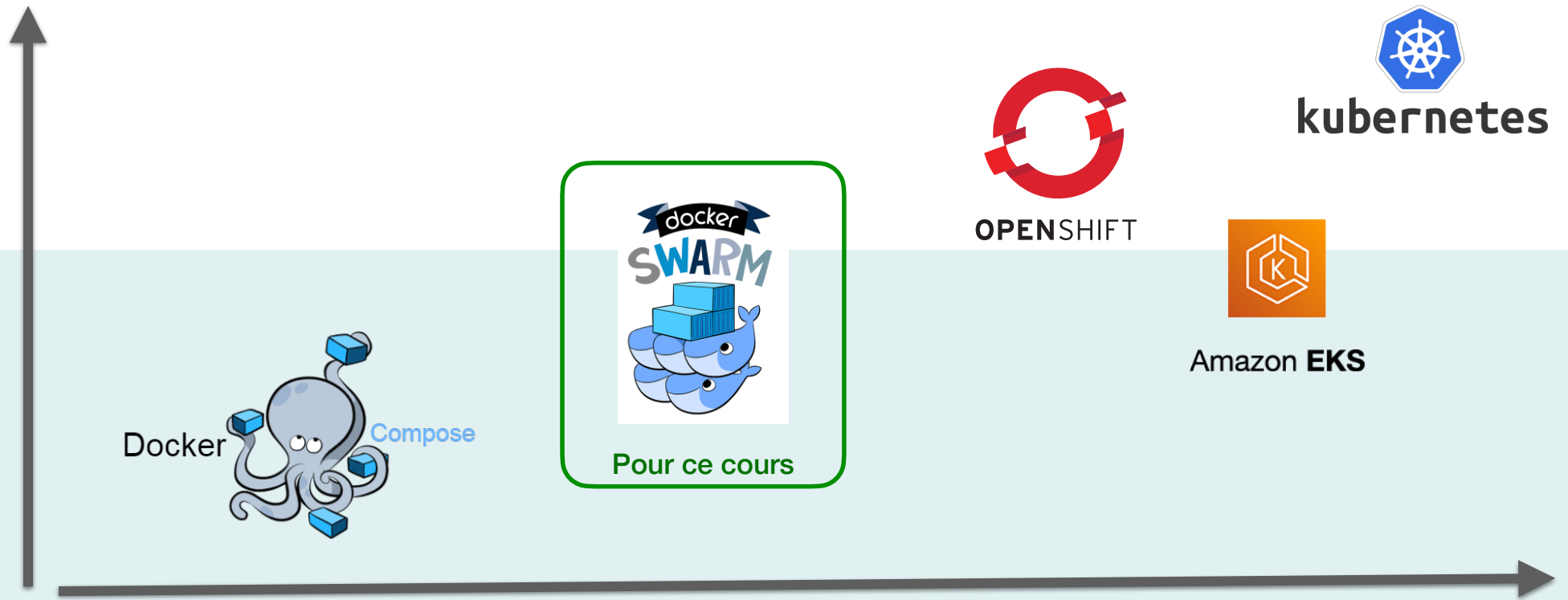


Qu'est ce que l'orchestration de conteneurs ?

Container Orchestration



From simple & easy to complex & powerful...



To run Docker on a K8s Cluster



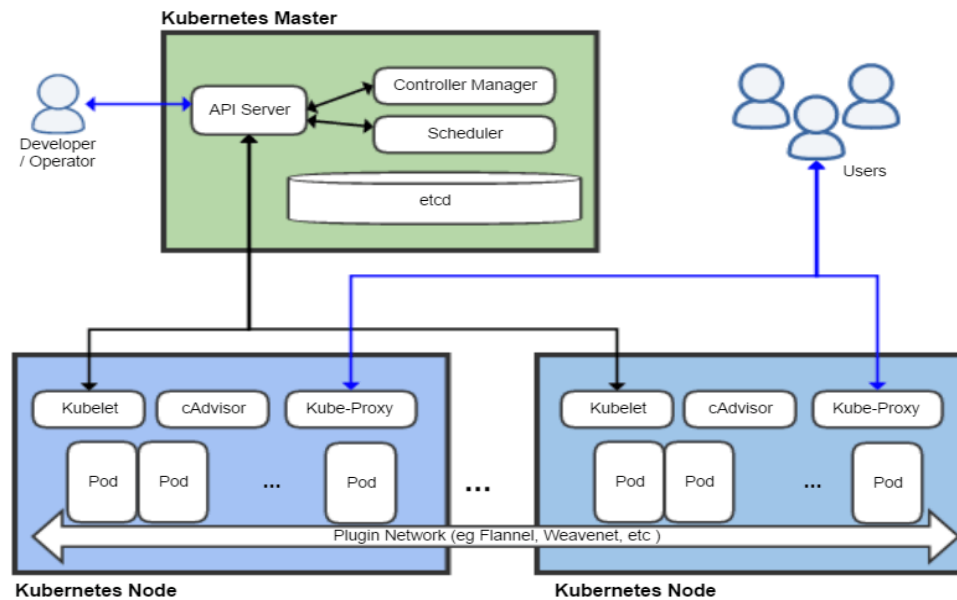
Kubernetes, the Containers Orchestrator

Kubernetes (commonly stylized as **k8s**) is an [open-source container-orchestration](#) system for automating computer [application](#) deployment, scaling, and management.

It was originally designed by [Google](#) and is now maintained by the [Cloud Native Computing Foundation](#). It aims to provide a "platform for automating deployment, scaling, and operations of application containers across clusters of hosts". It works with a range of container tools, including [Docker](#).

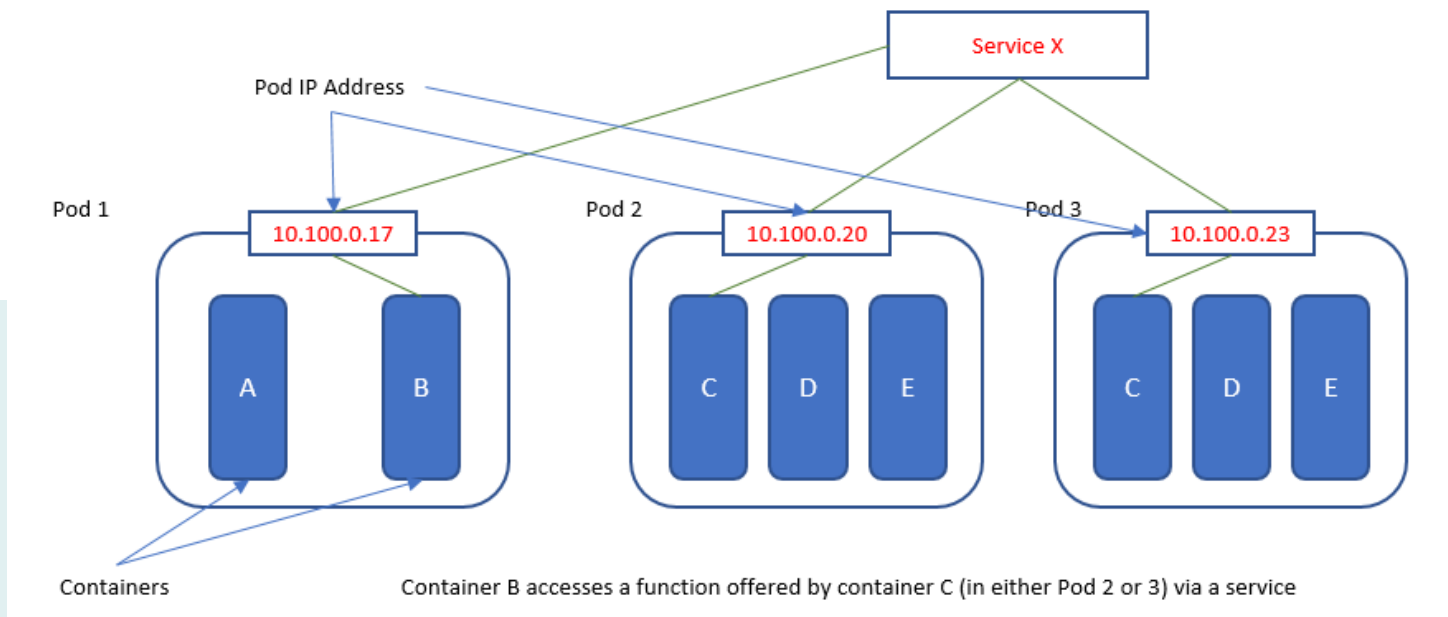
Many [cloud](#) services offer a Kubernetes-based platform or infrastructure as a service ([PaaS](#) or [IaaS](#)) on which Kubernetes can be deployed as a platform-providing service. Many vendors also provide their own branded Kubernetes distributions.

K8s, a complex machinery...



By Khtan66 —Own work, CC BY-SA 4.0, <https://commons.wikimedia.org/w/index.php?curid=53571935>

K8s, containers, pods & services



By Marvin The Paranoid - Own work, CC BY-SA 4.0, <https://commons.wikimedia.org/w/index.php?curid=75140812>

Helm, the K8s Chart Template

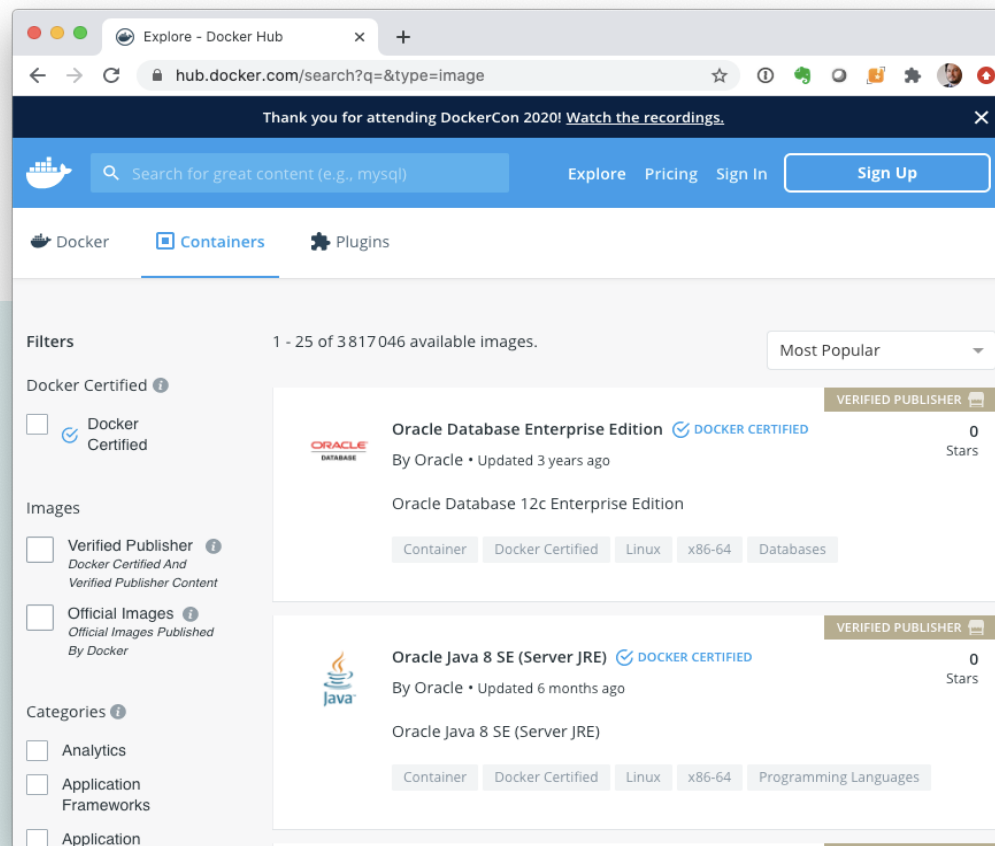
```
mychart/  
  Chart.yaml  
  values.yaml  
  charts/  
  templates/  
  ...
```

```
apiVersion: v1  
  kind: ConfigMap  
metadata:  
  name: {{ .Release.Name }}-configmap  
data:  
  myvalue: "Hello World"
```

mychart/templates/configmap.yaml

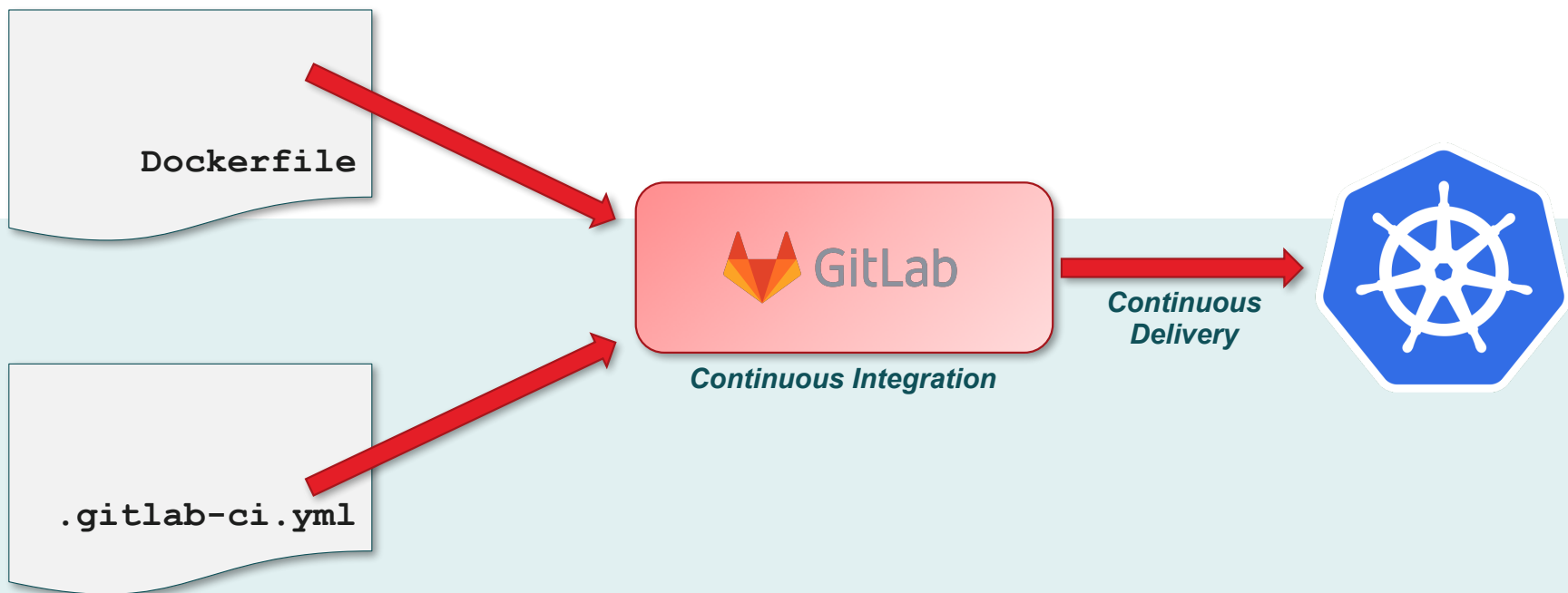
The right Docker Image...

Docker Hub, the Docker Images Registry



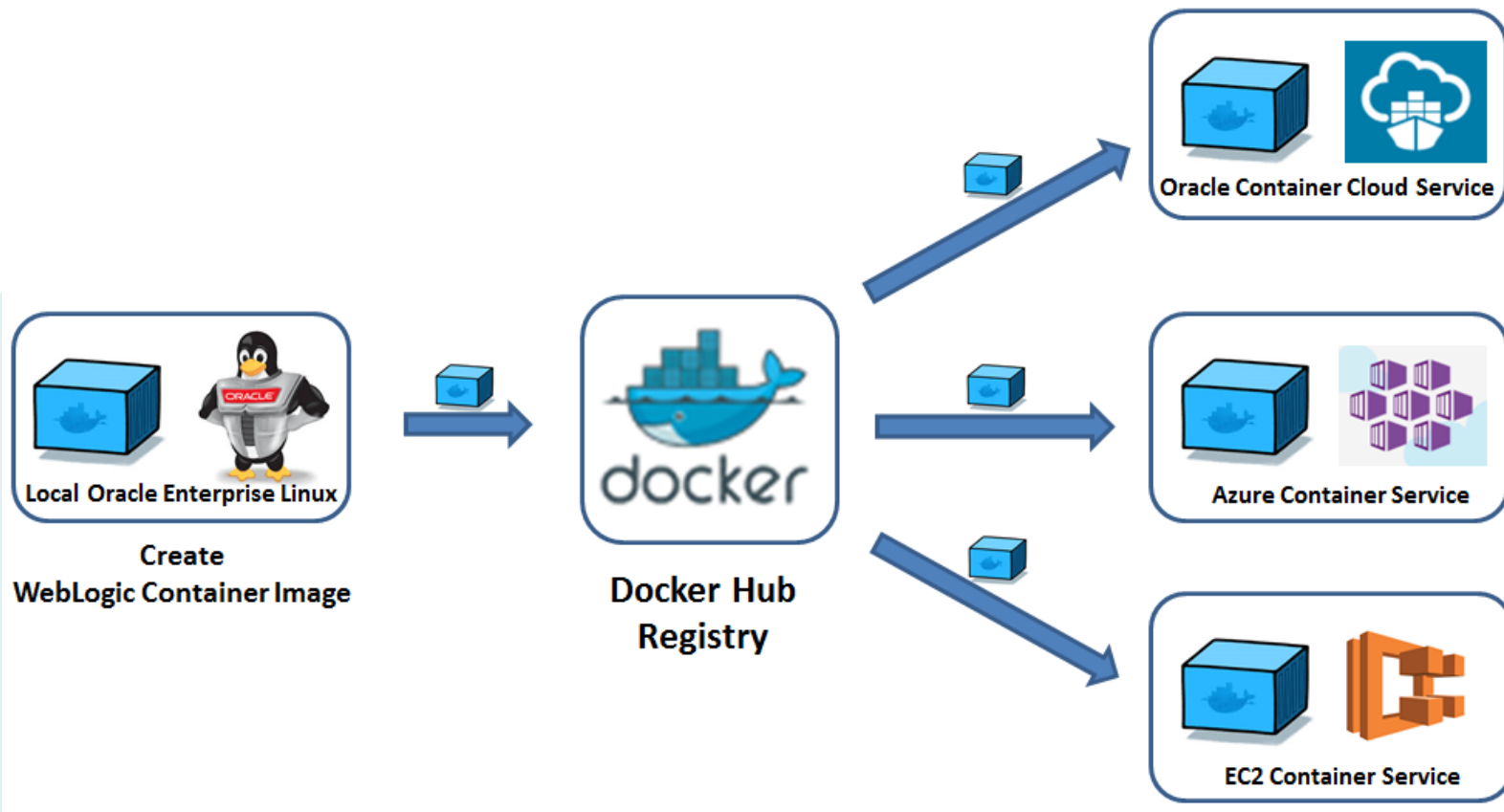
Deploying Docker Containers...

Gitlab CI/CD Pipeline is your friend!

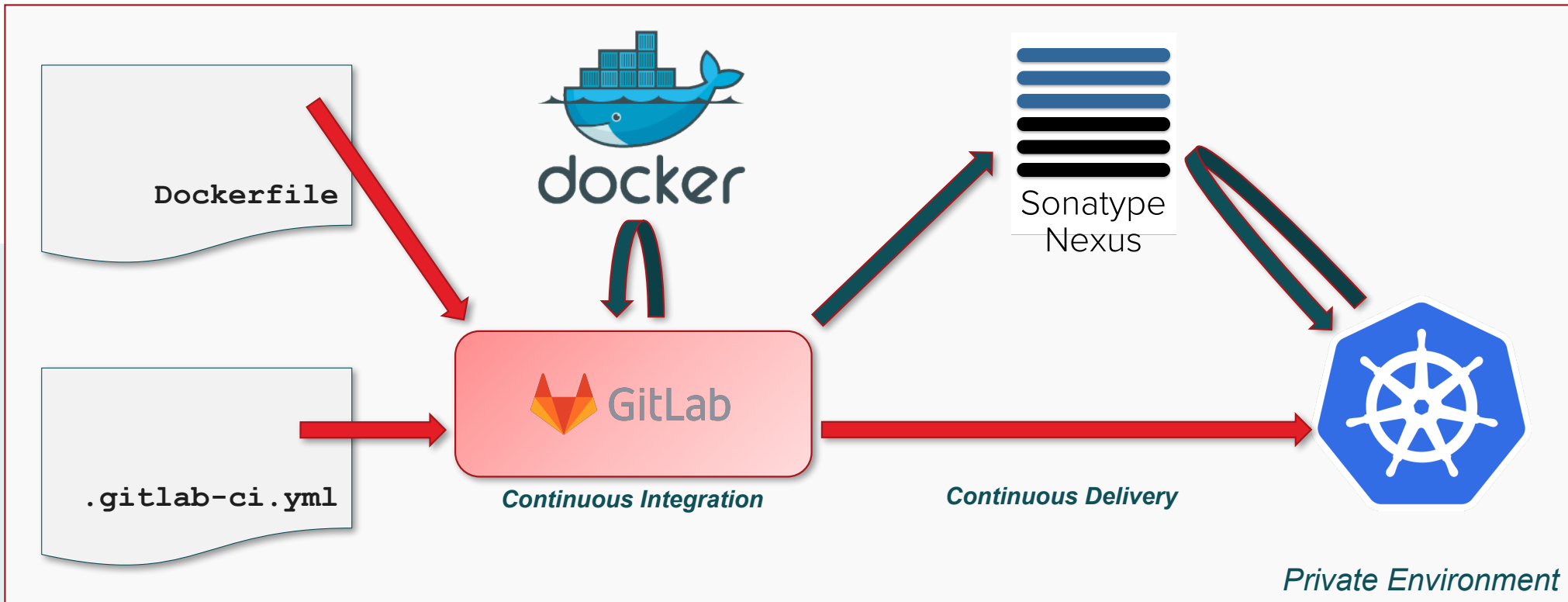


<https://confluence.tooling.intactfc.cloud/display/DVE/GitLab+and+Pipeline+Creation+Notes>

The Docker Images Hub



Nexus, a typical Docker Registry



Transferts des artéfacts

