Containers - tools

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Oct 30, 2024

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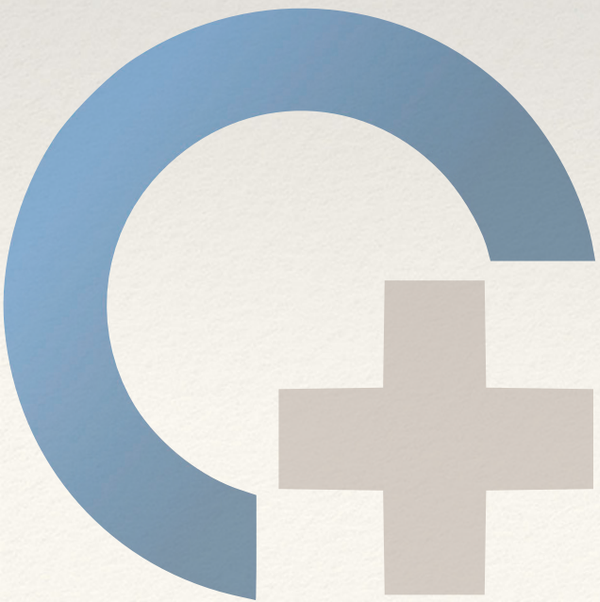
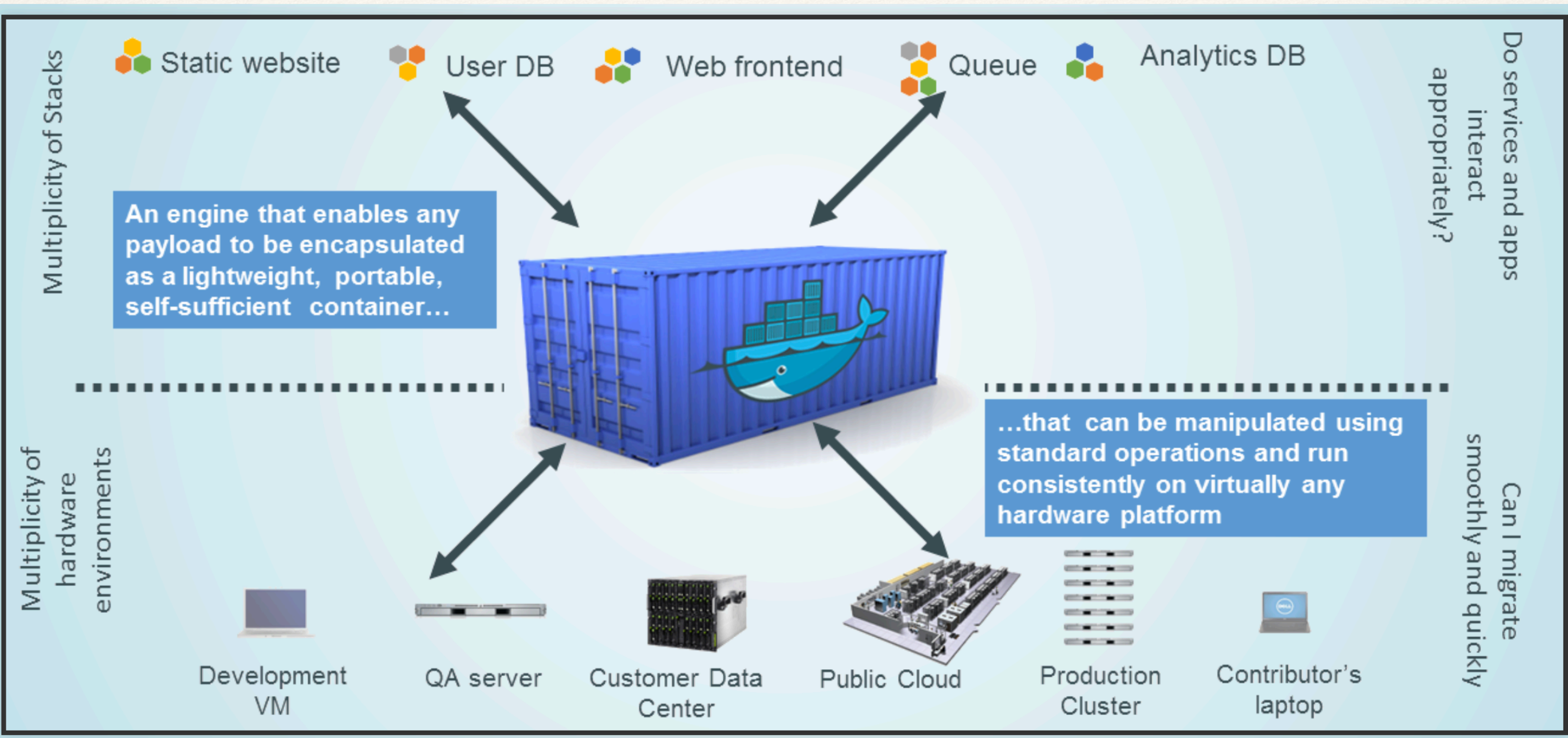


Containers for shipping

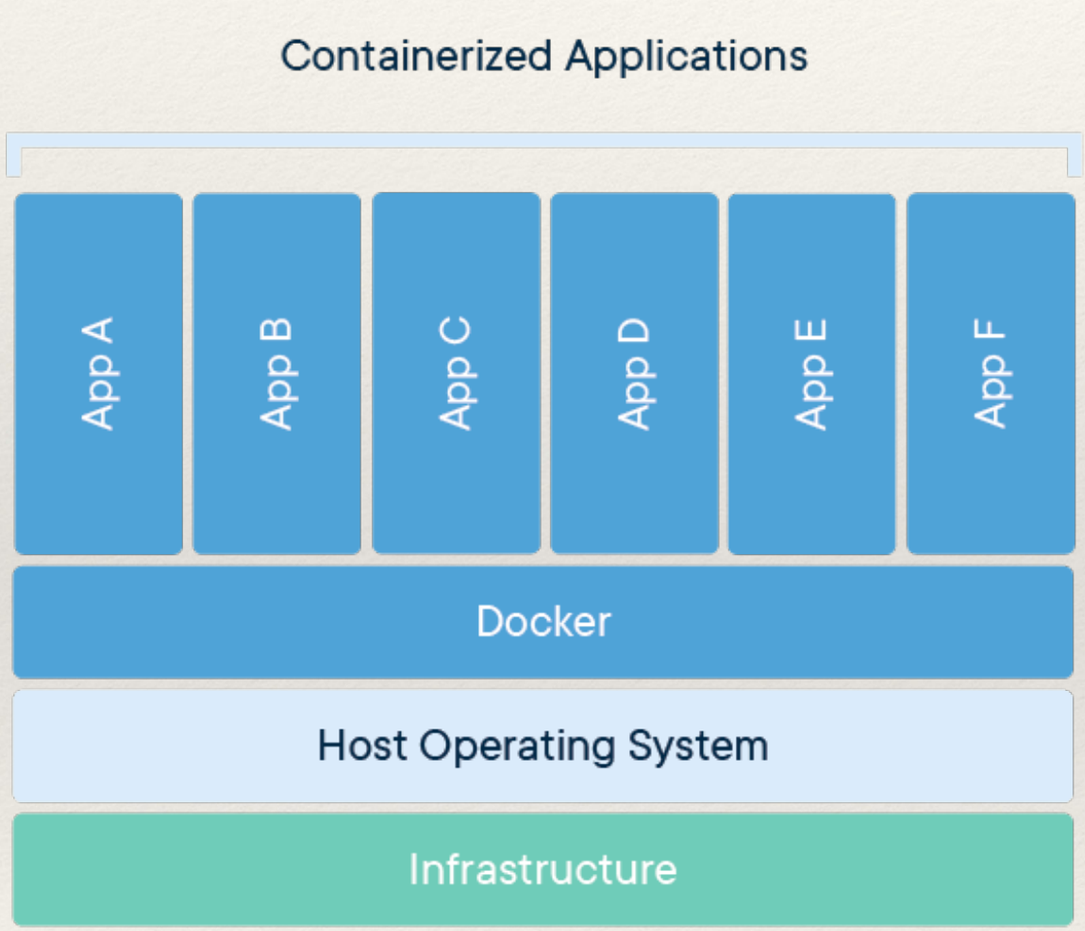
https://pointful.github.io/docker-intro/#/6

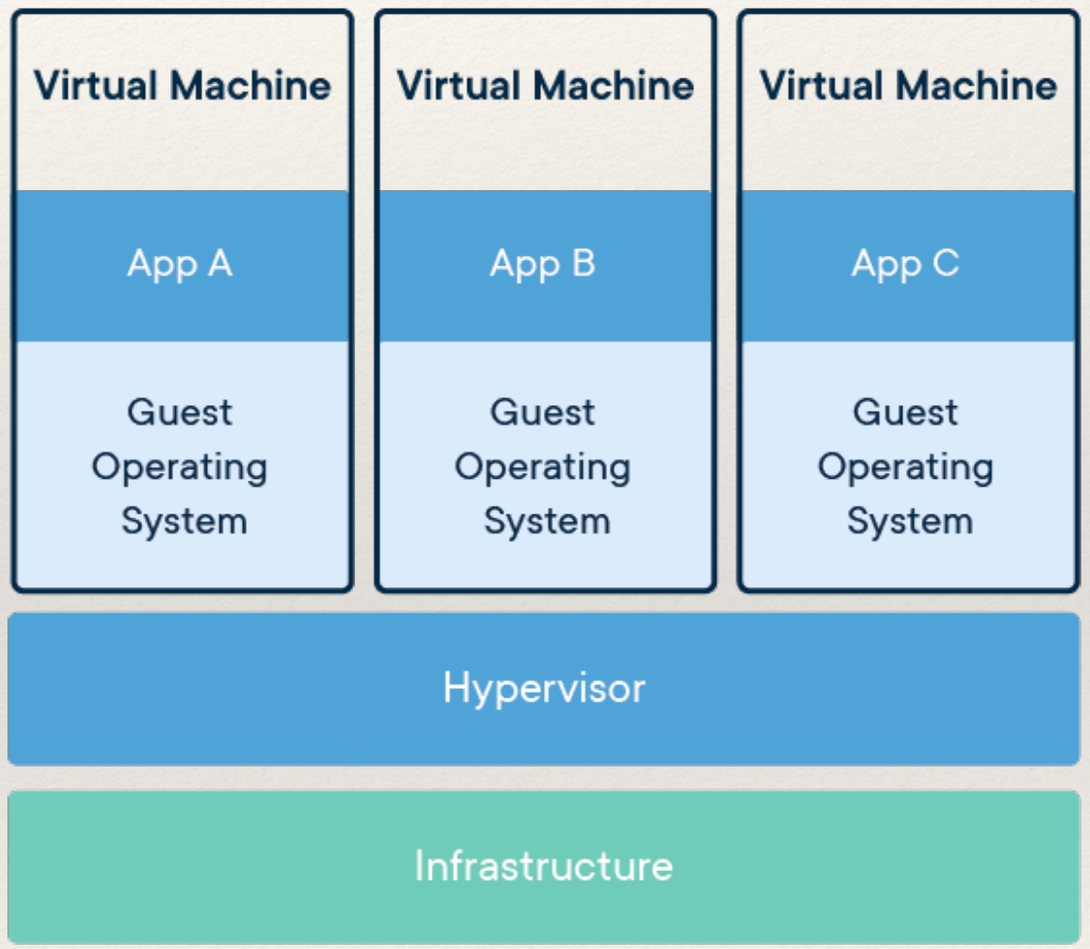
Containers for code



https://pointful.github.io/docker-intro/#/7

Containers vs VMs





https://www.docker.com/resources/what-container/

Containers

- **Standard:** Follows industry standard - portable
- **Lightweight:** Containers share the machine's OS system kernel and therefore do not require an OS per application, driving higher server efficiencies and reducing server and licensing costs
- **Secure:** Applications are safer in containers

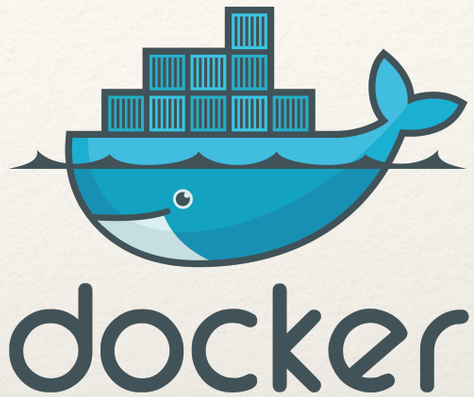
Containers

- Containers to Build, Share and Run your applications
- Package Software into Standardized Units for Development, Shipment and Deployment

- Containers can be used in two flavours:
  - One for each software/tool in the pipeline
  - Or one for the entire pipeline

Docker vs Singularity

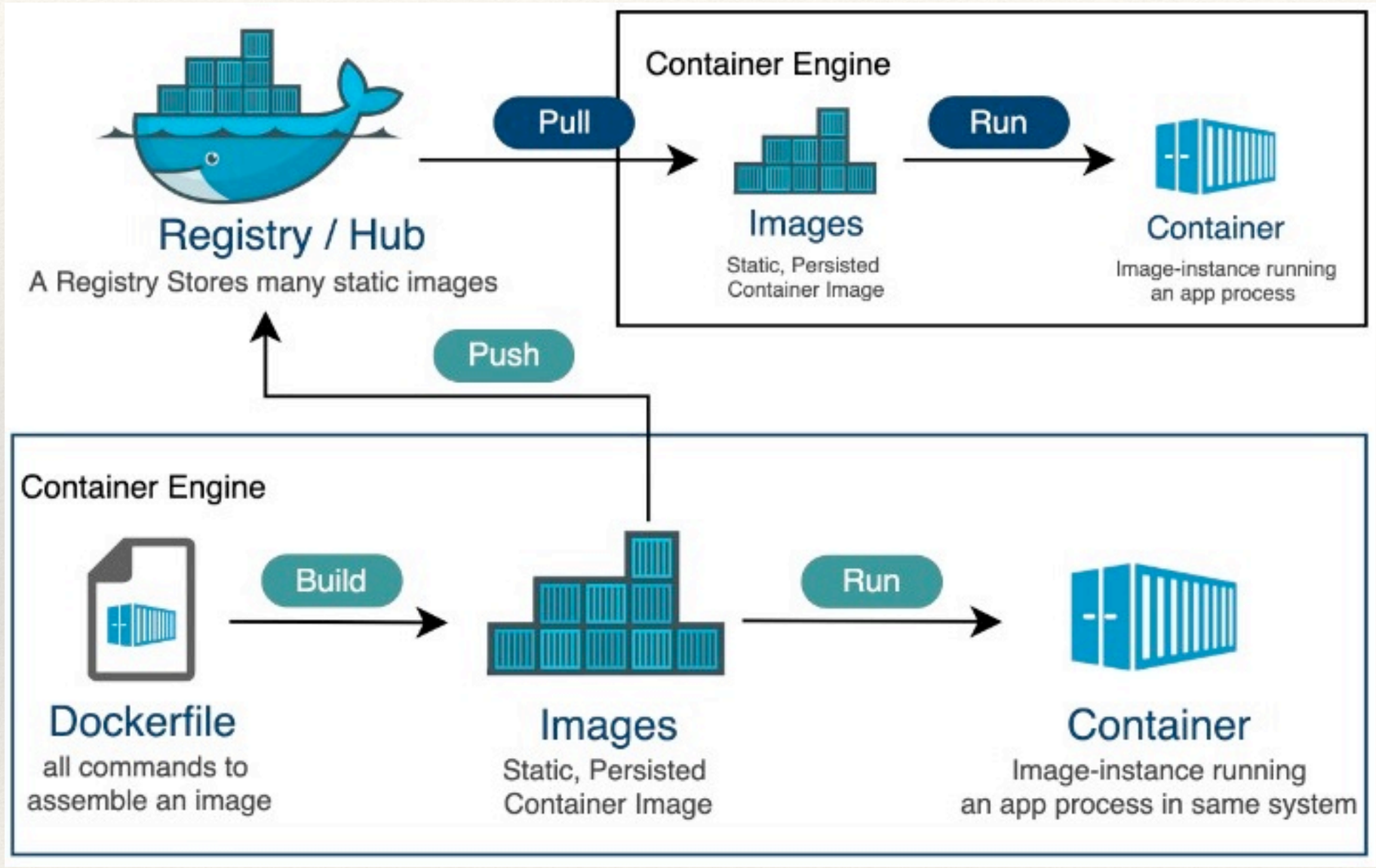
- Docker available for multiple OSs



- HPCs prefer singularity
- No root level access
- Easier use of job schedulers*
- Better use of hardware resources*

Easy to build singularity images directly from docker images

Sharing containers



docker hub https://hub.docker.com/

Advantages

- Reproducibility
- Portable/Shareable
- Version control
- Avoid install conflicts

Disadvantages - probably none!

More information online

- Intro to docker (a bit detailed):
  - https://pointful.github.io/docker-intro/
- If you want to try it yourself:
  - https://docker-curriculum.com/
- Where to find (and share) containers?
  - https://hub.docker.com/

Dockerfile

```
FROM ubuntu:latest

# Fix location and time
ENV LANG=C.UTF-8 LC_ALL=C.UTF-8
ENV PATH /opt/conda/bin:$PATH

# Update Ubuntu
# Install Java and Perl - requried by FASTQC
RUN apt-get update --fix-missing && \
    apt-get install -y wget unzip && \
    apt-get install -y default-jre perl && \
    apt-get clean && \
    rm -rf /var/lib/apt/lists/*

# Download, unzip and add to path - FASTQC
RUN wget https://www.bioinformatics.babraham.ac.uk/projects/fastqc/
fastqc_v0.12.1.zip && \
    unzip fastqc_v0.12.1.zip
ENV PATH /FastQC:$PATH
CMD [ "/bin/bash" ]
```

Running containers

```
## TO BUILD THE DOCKER IMAGE AND PUSH IT TO THE DOCKER HUB

export DOCKER_DEFAULT_PLATFORM=linux/amd64

docker build . -t fastqc:v1 -f Dockerfile
docker tag fastqc:v1 arvindsundaram/fastqc:v1
docker push arvindsundaram/fastqc:v1

## PULL DOCKER IMAGE FROM DOCKER HUB AND CREATE A SINGULARITY
IMAGE

singularity pull fastqc_v1.sif docker://arvindsundaram/fastqc:v1

singularity exec --bind $PWD:/work fastqc_v1.sif. bash
```