Using Docker to deliver Java Enterprise Applications

one year later...

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Agenda

- What problems we had?
- Docker introduction
- How to "dockerize" a sample application?
- Docker technologies
- What about VMs?
- Lessons learnt….

problems

inadequate packaging
of application artifacts

inconsistencies across *environments*

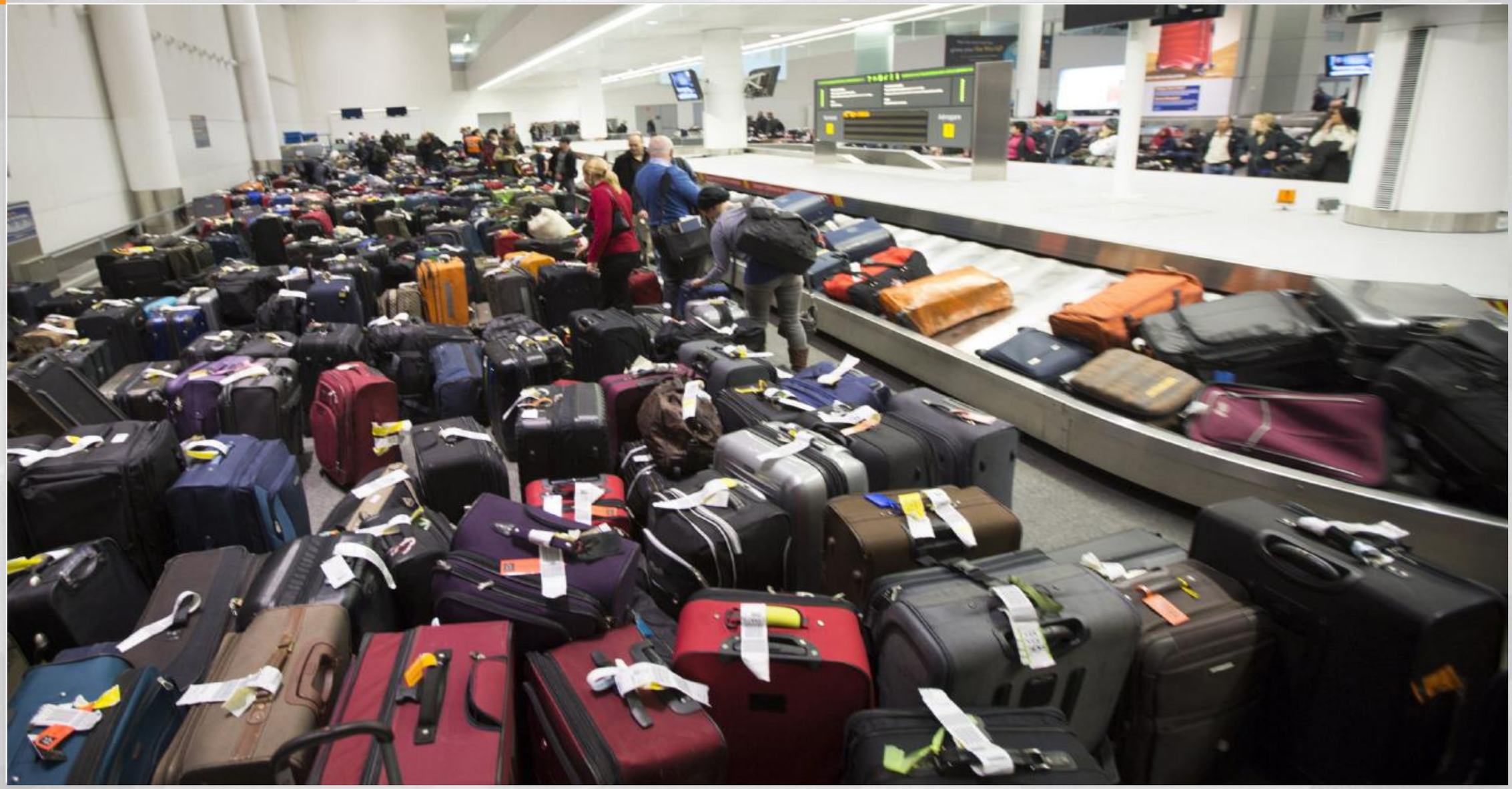
high cost

supporting multiple static environments

lack of freedom

experimenting with new languages, technologies and frameworks

Sea-free analogy



Developers

- care about apps
- put stuff in containers
  - code & data
  - libraries
  - applications

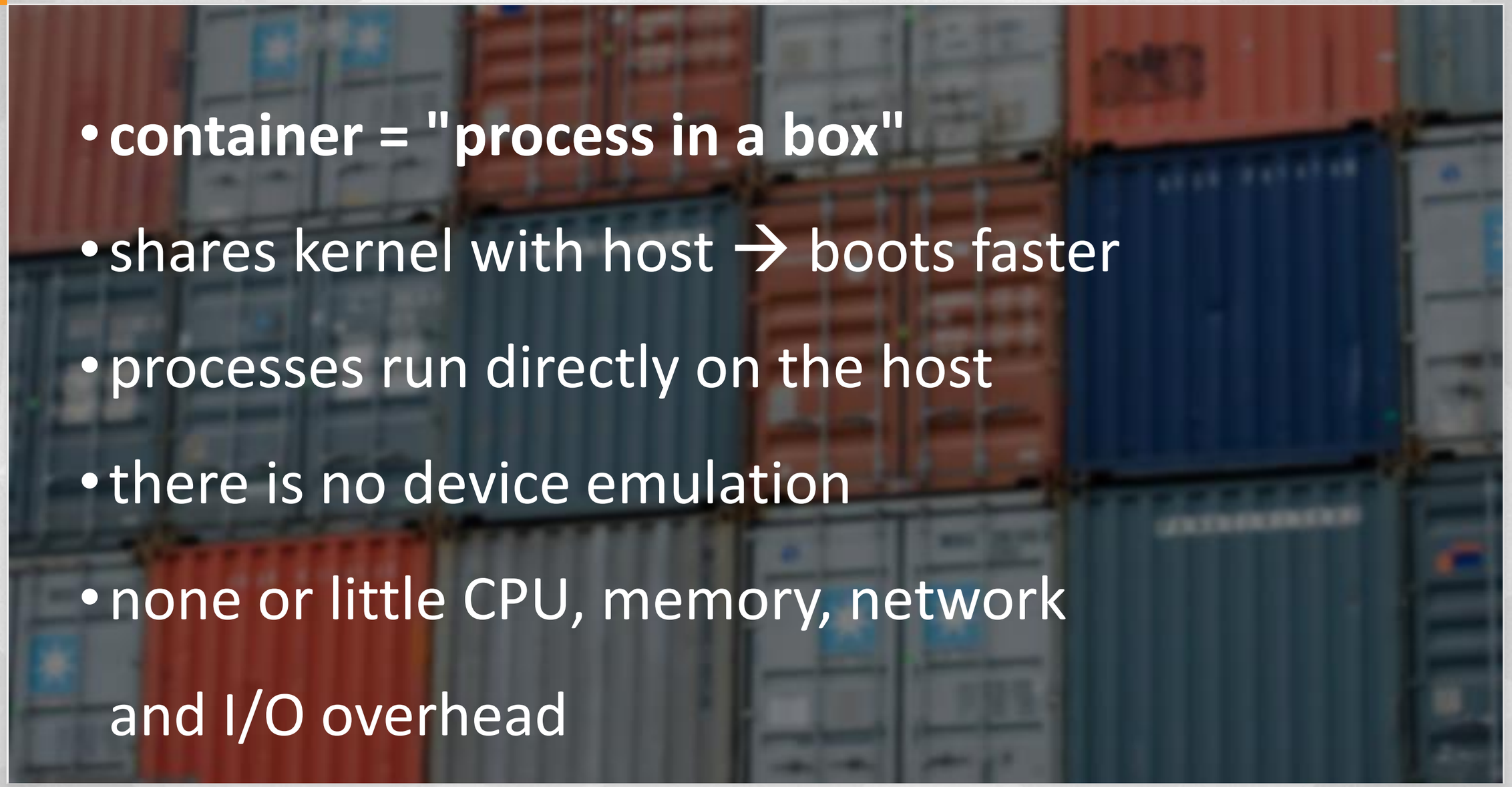
Operations

- care about containers
- work with containers
  - logging & monitoring
  - networking
  - scaling

High level view of a container

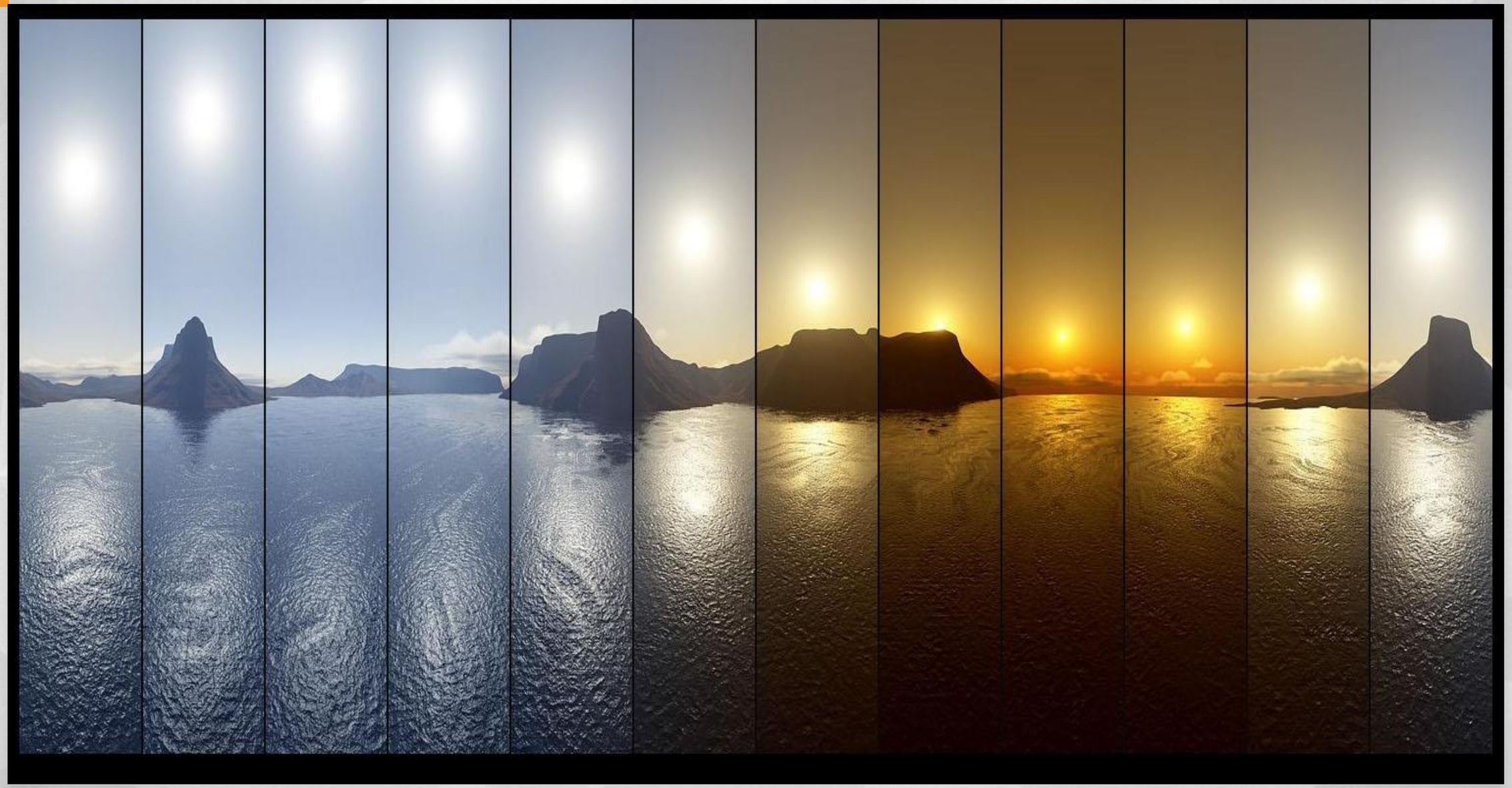
- **it is like a lightweight Virtual Machine**
- it provides:
  - own process space
  - own network interface
  - running stuff as root

Low level view of a container



- **container = "process in a box"**
- shares kernel with host → boots faster
- processes run directly on the host
- there is no device emulation
- none or little CPU, memory, network and I/O overhead

Fast forward one year



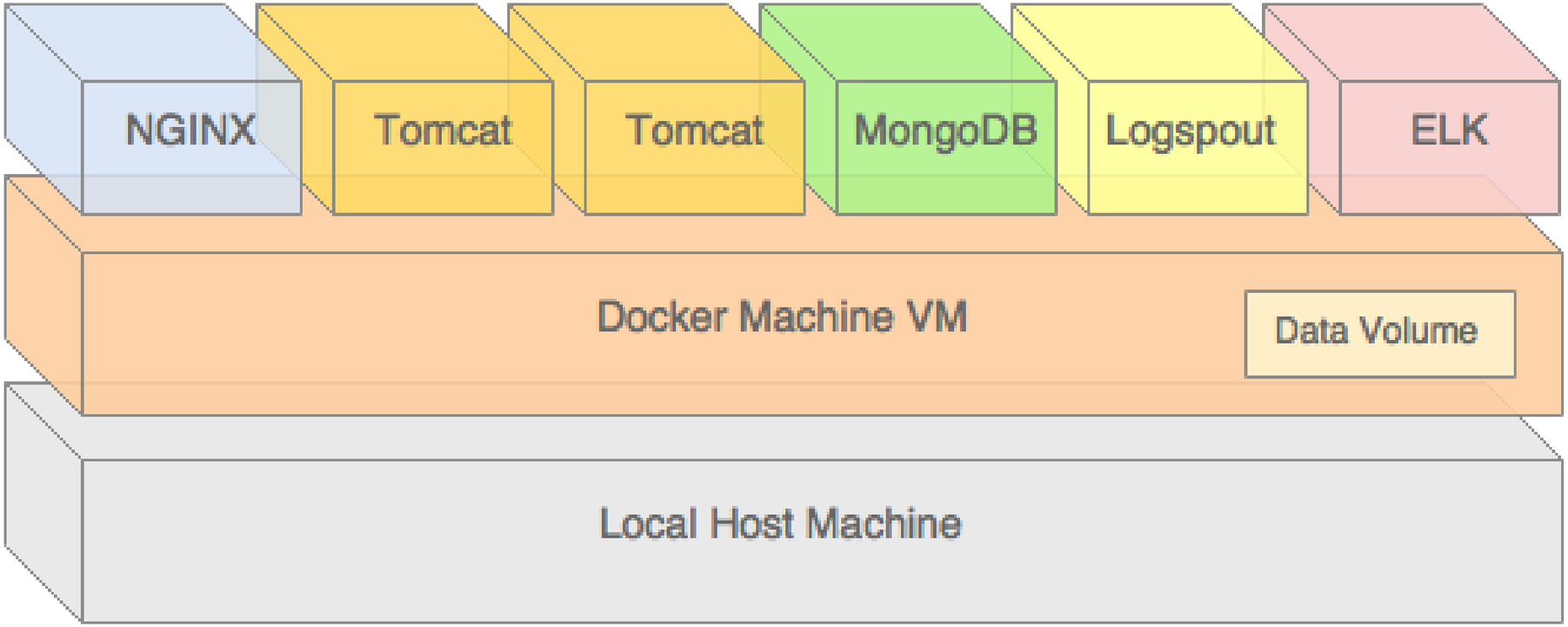
Demonstration

https://github.com/petyodimitrov/spring-music.git
https://github.com/petyodimitrov/app-setup.git
https://github.com/petyodimitrov/ci-setup.git

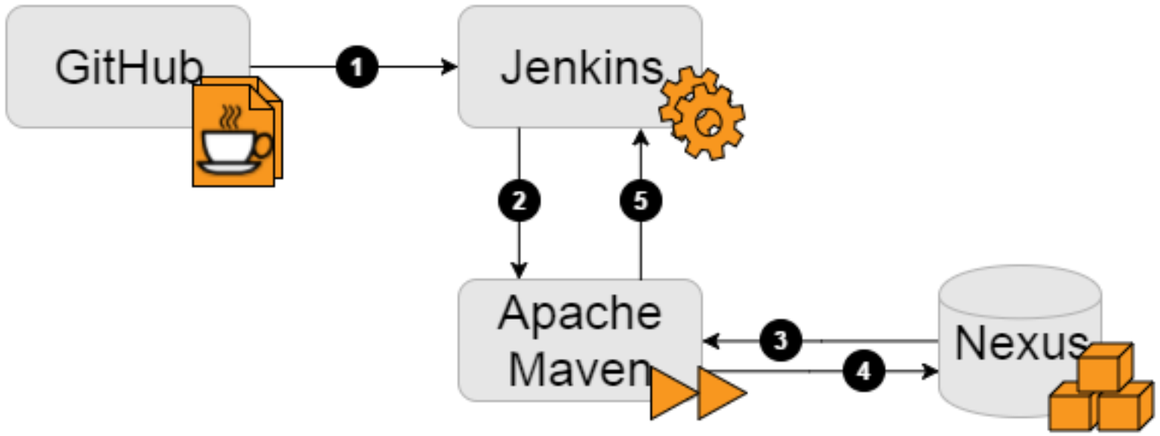
Used technologies

maven

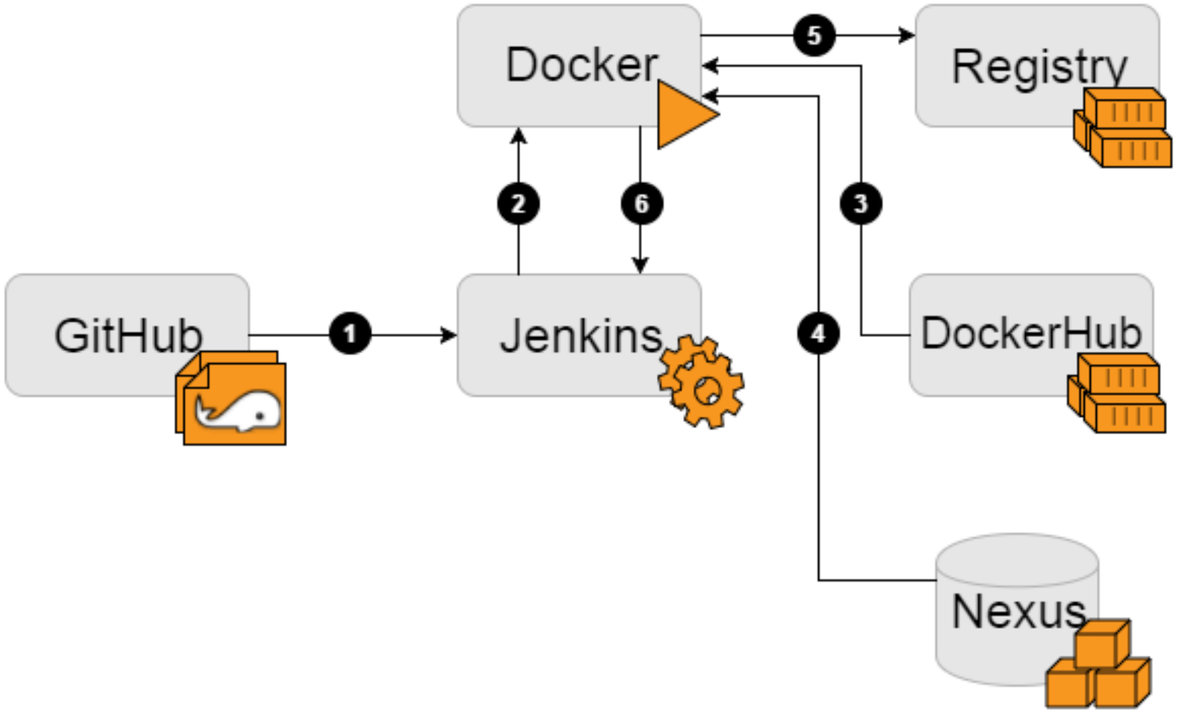
Runtime view of containers



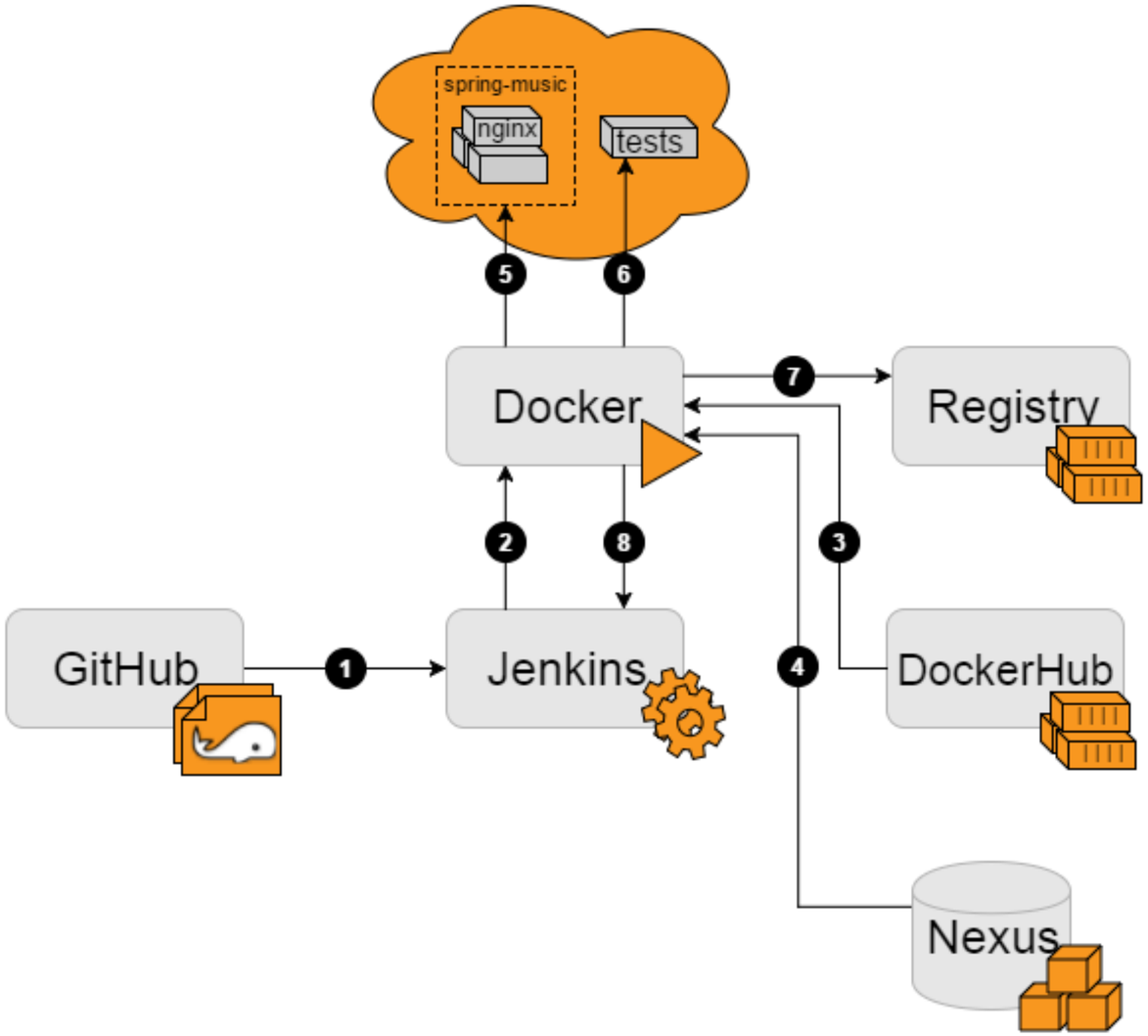
Standard Java application build



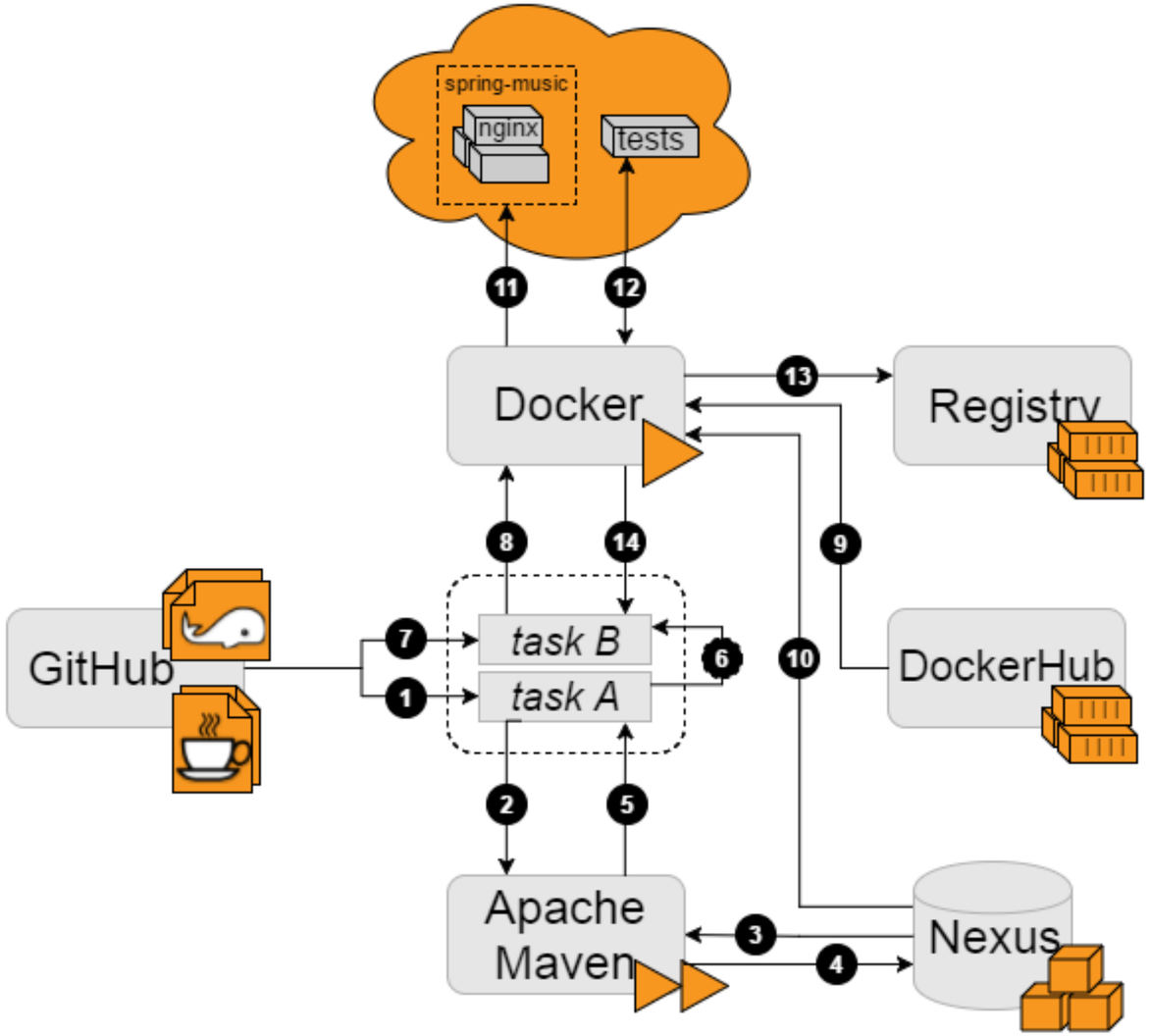
Docker containers build



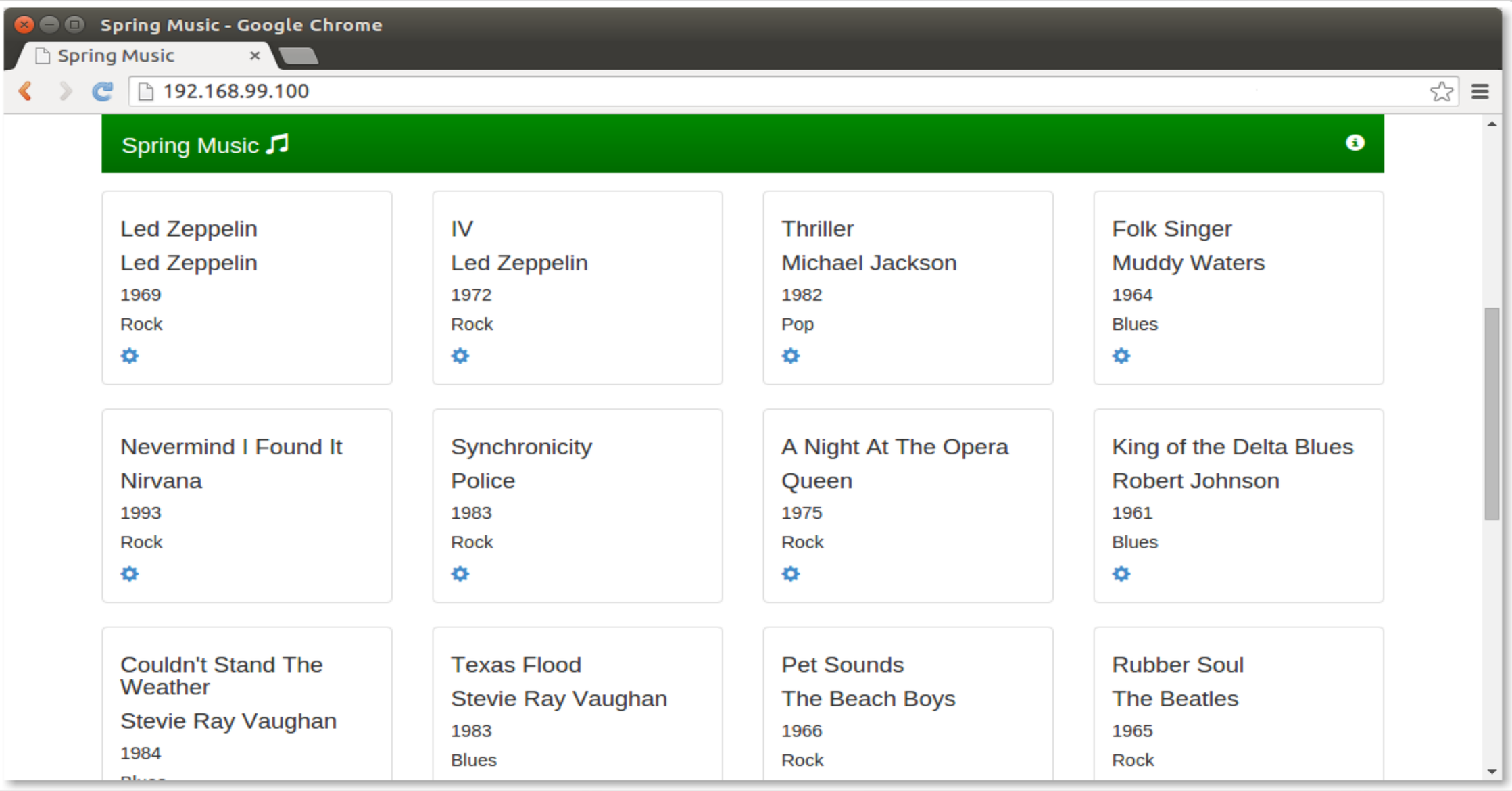
Adding system testing



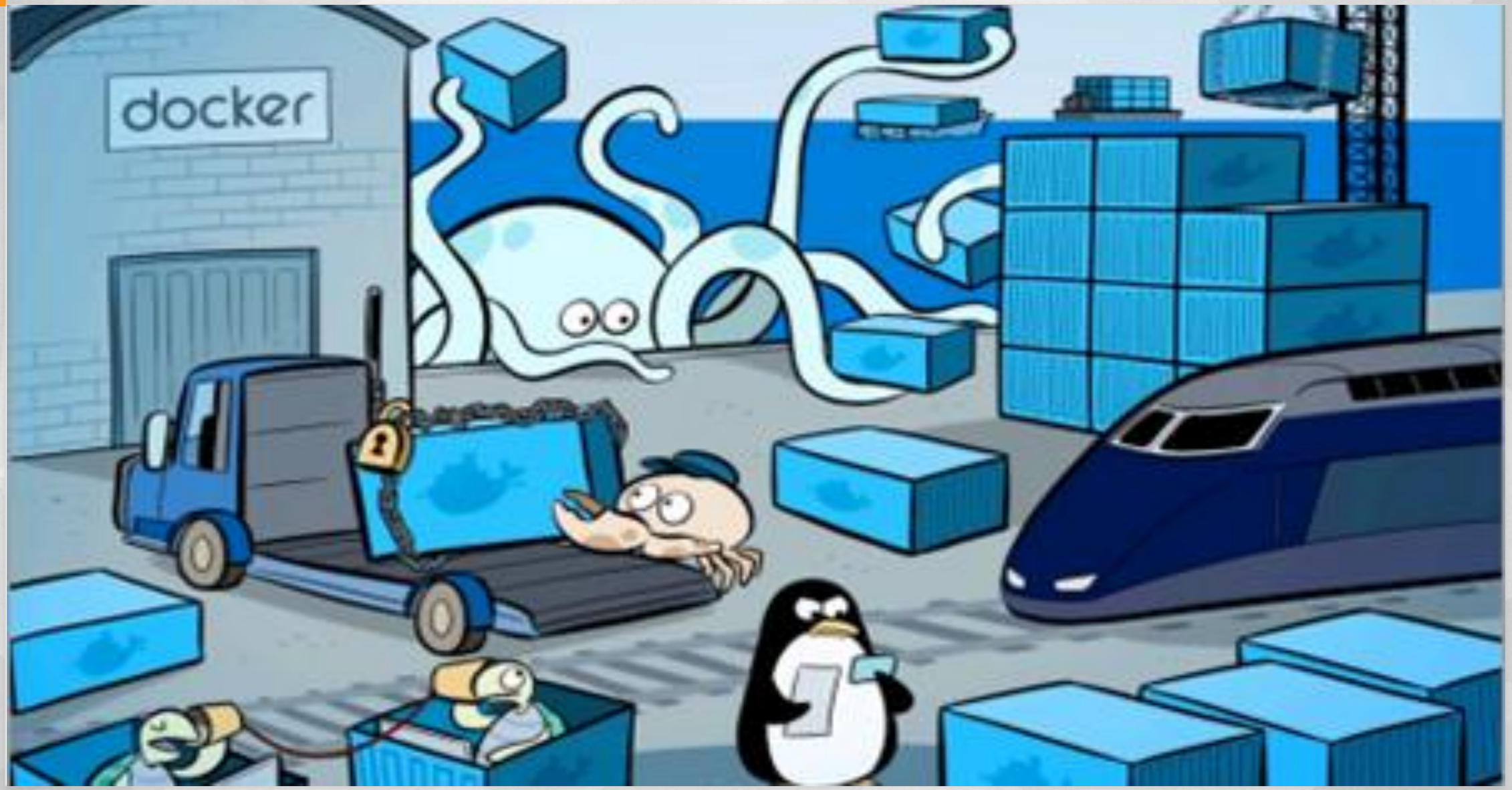
Combining all the parts



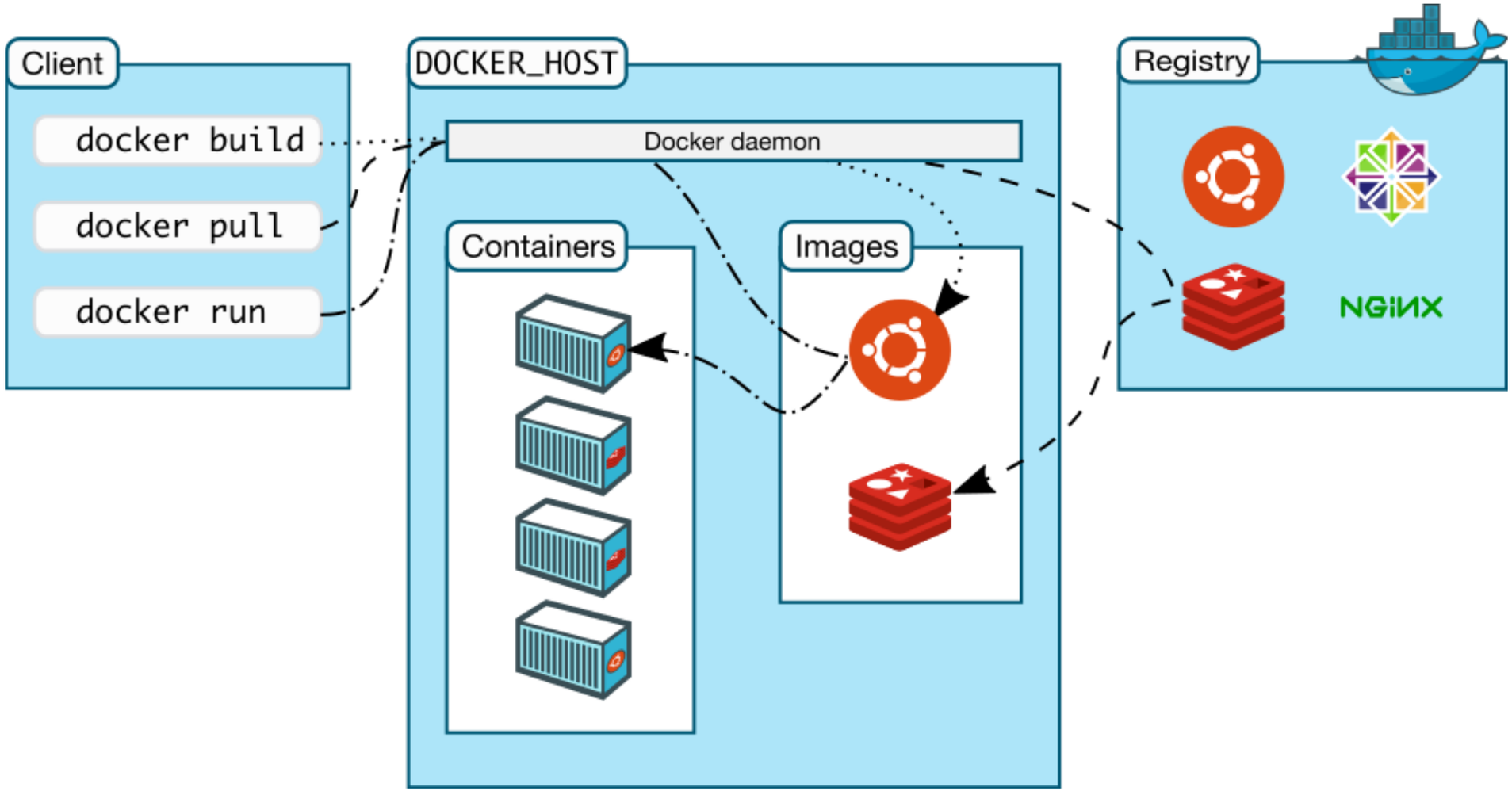
Demonstration



Docker "ecosystem"



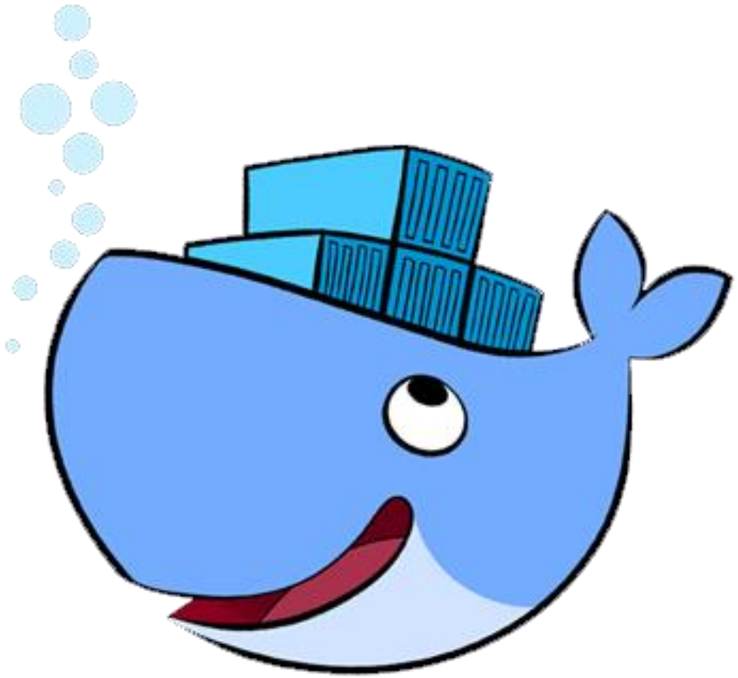
Client-Server model



Docker Engine

- runs and commoditizes Linux containers
- allows building and sharing images
- runs as daemon and has CLI
- functionality is exposed via REST API
- moves towards standardization

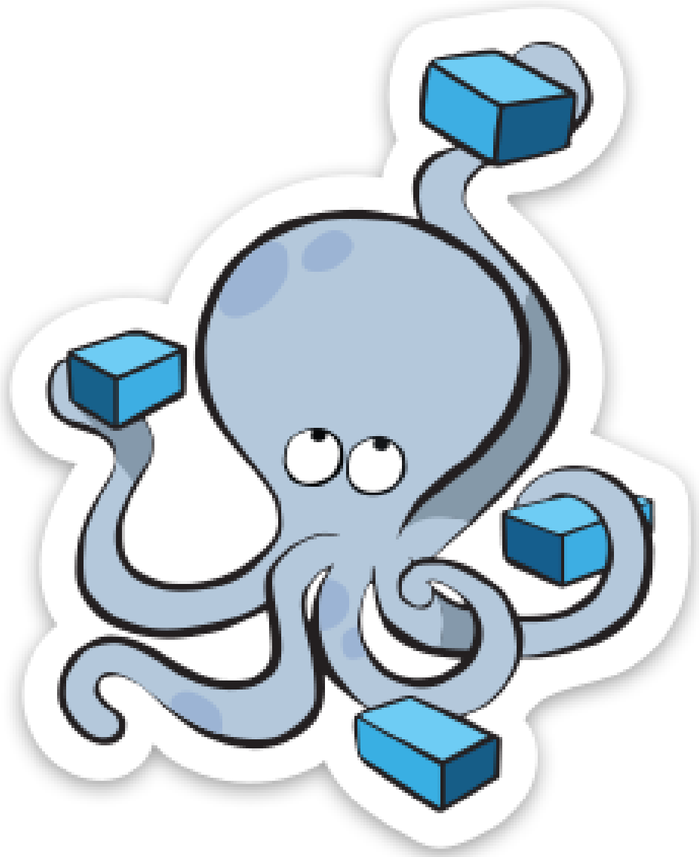
  (runC, containerd)



Docker Compose

- manages a collection of containers
- fast, isolated development environments using Docker
- define environment via YAML file
- quick and easy to start

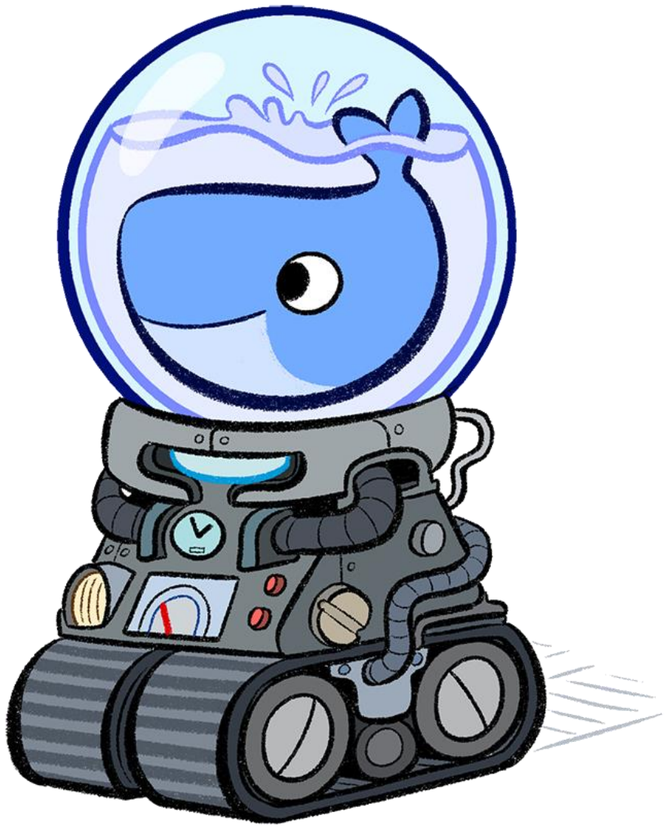
```
docker-compose up -d
```



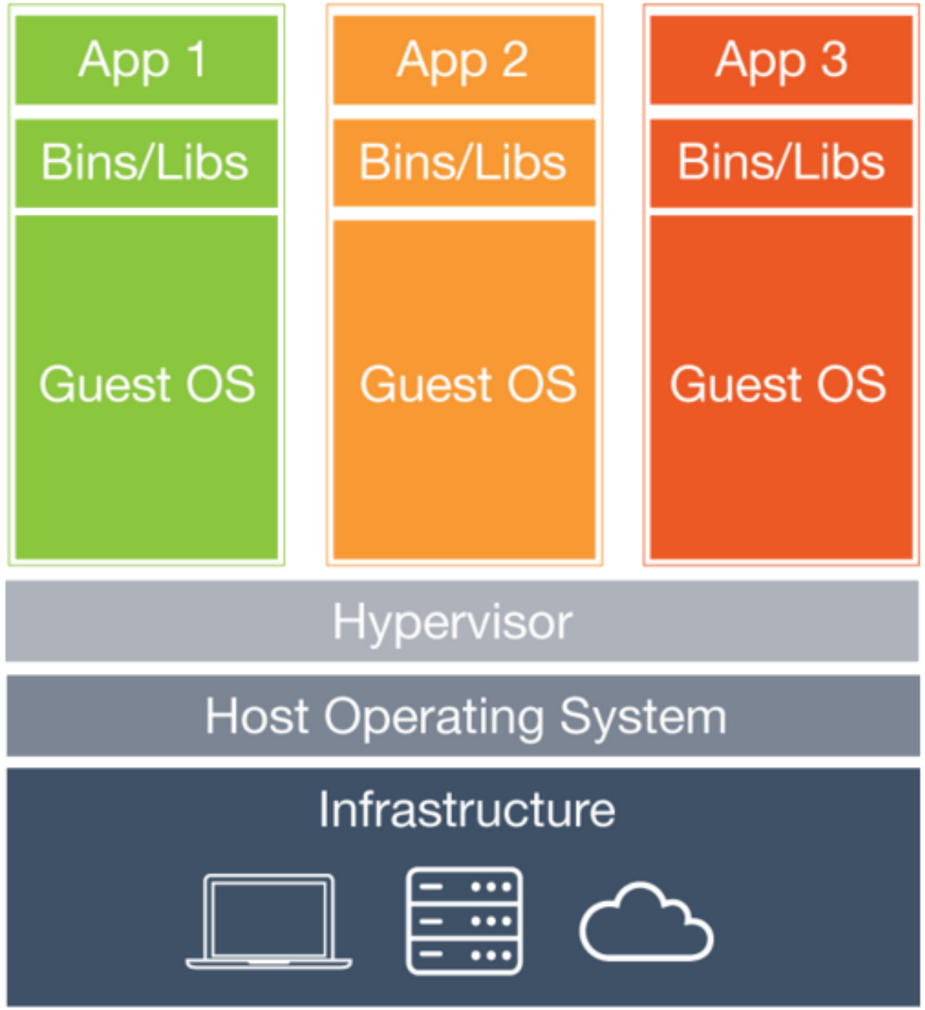
Docker Machine

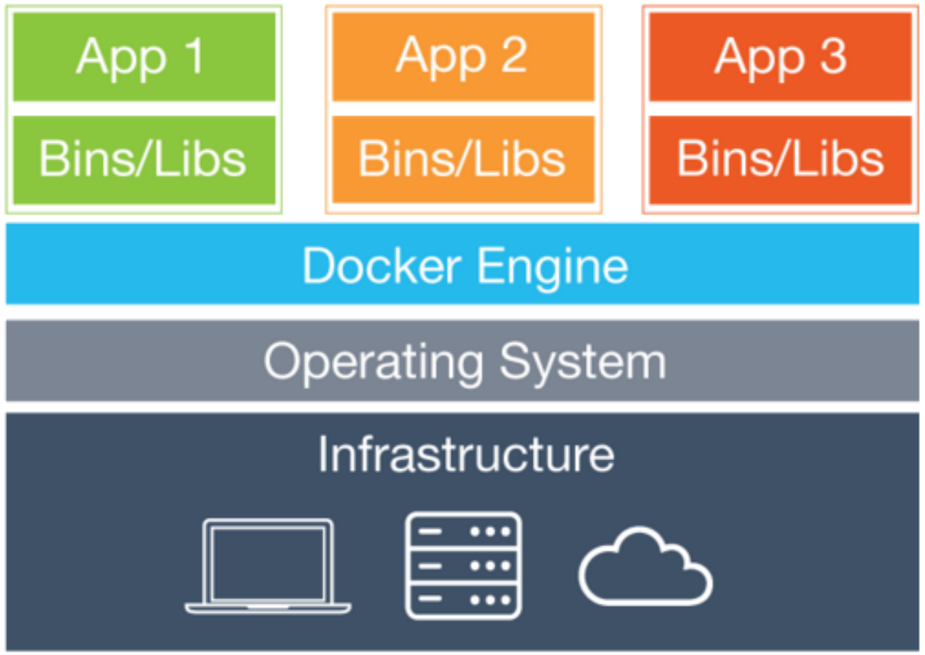
- allows creating Docker hosts on local computer or in cloud providers
- automatically creates host, installs Docker and configures the client
- offers commands to start, stop, restart and inspect a host

```
docker-machine create
--driver virtualbox default
```



Virtual machines vs. Containers





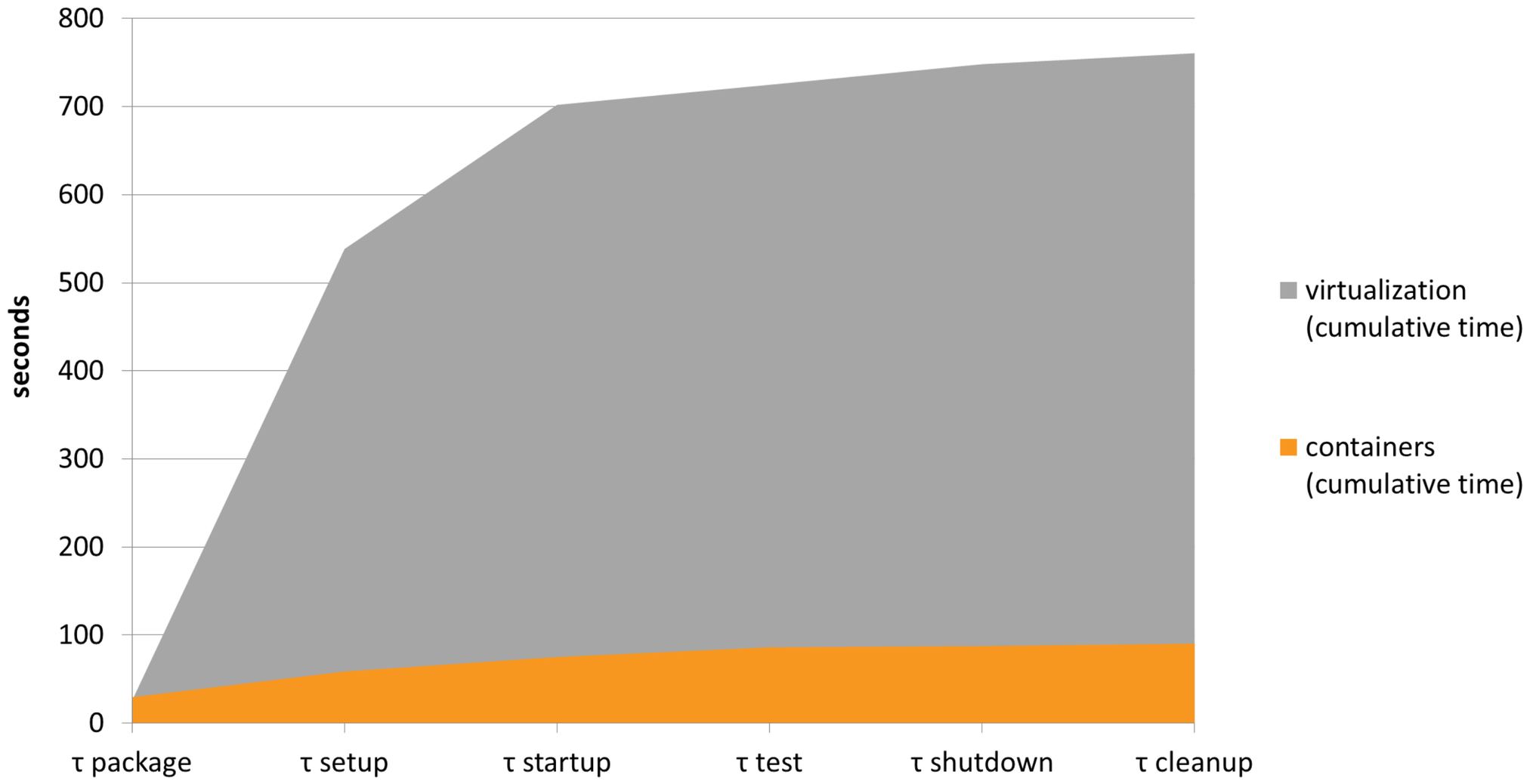
Comparison with VMs

https://github.com/petyodimitrov/ci-setup.git
https://github.com/petyodimitrov/vagrant-setup.git
https://github.com/petyodimitrov/vm-container-comparison.git

Application delivery time

$\tau_{delivery}$ (сек.)	virtualization	containers
τ package	25,6	29,6
τ setup	**512,8**	**29,2**
τ startup	**163,6**	**16,4**
τ test	22,8	11
τ shutdown	**23,4**	**1,4**
τ cleanup	12,4	2,8
total	760,6	90,4

Application delivery time (2)



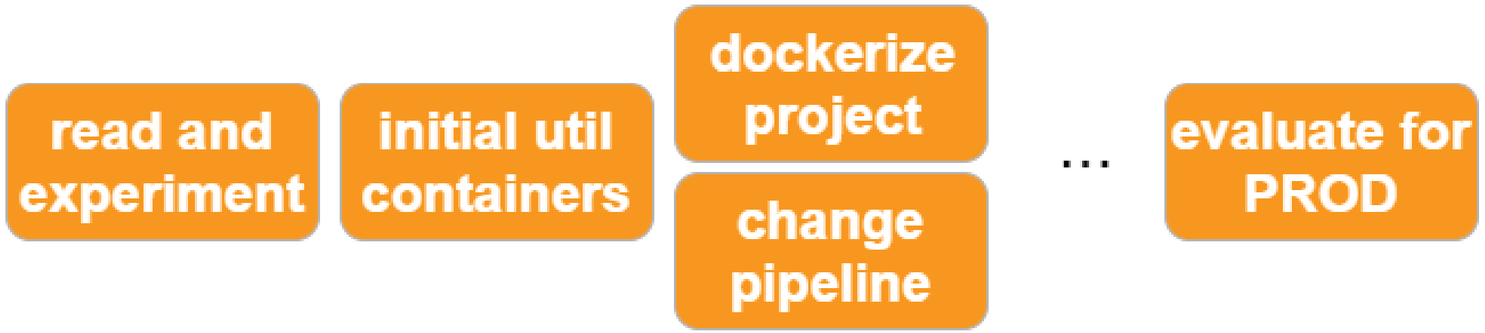
Performance benchmarks (cpu, memory, net)

- CPU performance [MFLOPS]: 2%
- Compression speed [MB/s]: 11%
- Memory bandwidth [MB/s]: 3%
- Serial/Parallel memory access speed [MB/s]: 19%
- Network efficiency [Mbps] & latency [µs]: ?
- Privisioning speed [s]: 60 times

average improvement with containers

Lessons learnt (1)

- Decide on a strategy for introducing Docker in the project



- Keep and eye for improvements & changes (e.g. networks)
- Keep containers simple (i.e. only one/few processes)
- Automate, automate, automate … (via docker or other CM tools)
- Use initialization & validation scripts (e.g. init, supervisord)

Lessons learnt (2)

- Review Dockerfile-s as part of development process (e.g. peer reviews)

```
FROM alpine-java 14.04.3
ENV REPO=10.0.1.1:1236
RUN apt-get update -y && \
    apt-get install curl
# unnecessary
RUN curl -L https://${REPO}/something.jar
USER nobody
CMD java -jar something.jar
```

verify checksum

add volume

Lessons learnt (3)

- Use internal Docker registry for image distribution (unless OSS)
- Invest time to setup container monitoring (e.g. logspout + ELK)
- Consider using JARs instead of other *ARs
- Shared Docker pattern overall works better than DinD
- to be continued…

THANK YOU :)

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