2015-12-08

MESOS CODE FEST

MESOSPHERE

WHO?

Matthias Veit: Tech Lead Marathon

Jan Repnak: Product Support Engineer

AGENDA

1. Theory (90 Min)
    1. Goals & teams
    2. Container 101
    3. Apache Mesos
    4. Marathon
    5. Datacenter Operating System (DCOS)
    6. Learning Resources
2. Hands-on Session

GOALS & TEAMS

GOALS

- Understand container basics incl. Docker
- Understand Mesos and Marathon
- Understand orchestration and scheduling of containers
- Able to implement an application using Docker and Apache Mesos+Marathon

YOUR TEAM ...

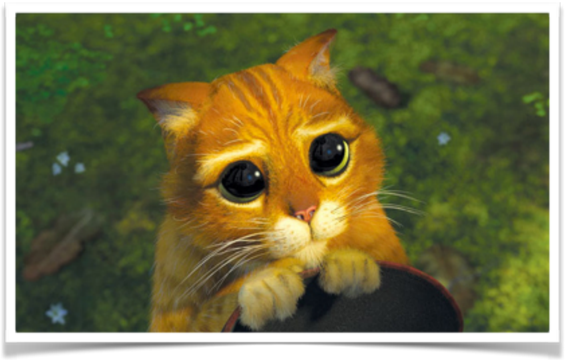
- We have DCOS clusters prepared → team up in groups of three
- Find a place where you can work together
- One person should drive, others help/comment/plan
- Reach out to one of the Mesosphere team members to announce team
- Check out: http://bit.ly/mesoscodefest

CONTAINER 101

Pets vs Cattle

WHAT IS THIS ALL ABOUT?

Pets: treat machines as individuals that you give names and when they get ill you nurse them back to health.



Cattle: anonymous, identical to each other; you assign numbers and when they get ill you get rid of it.

http://www.theregister.co.uk/2013/03/18/servers_pets_or_cattle_cern/

Pets vs Cattle

CONSEQUENCES OF GOING ALL-IN WITH CATTLE APPROACH

- scale out on commodity hardware
- elasticity
- 'cheap' & 'simple'
- R U on pager duty? Just sleep through!

- social » technology challenge
- new technical challenges such as service discovery

http://www.theregister.co.uk/2013/03/18/servers_pets_or_cattle_cern/

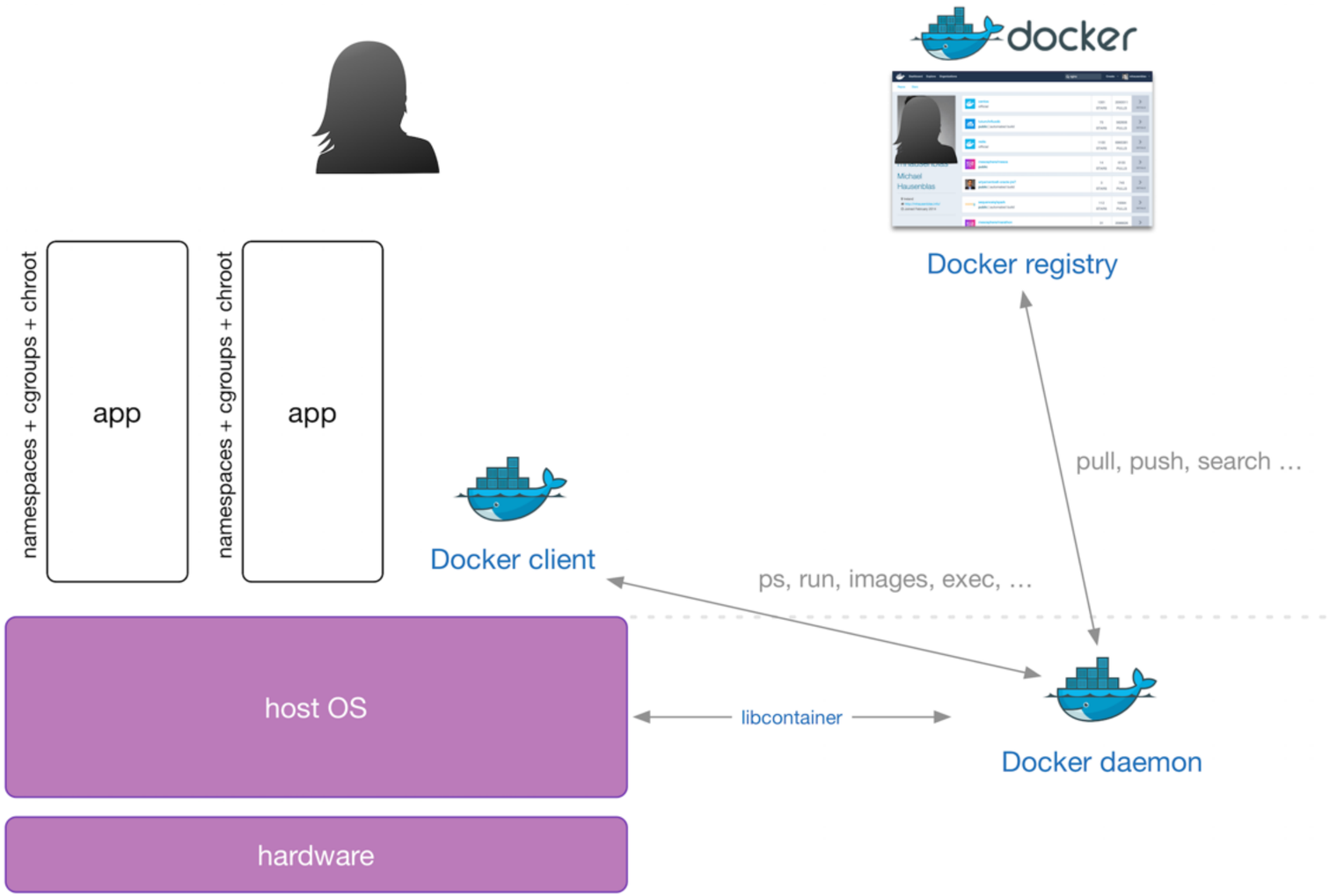
LINUX CONTAINERS

HOW TO ISOLATE PROCESSES

- namespaces
  - Isolate PIDs between processes
  - Isolate network resources (stacks, devices, etc.)
  - Isolate hostname/NIS (UTS)
  - Isolate filesystem mount (chroot)
  - Isolate inter process communication (IPC)
- cgroups

  https://sysadmincasts.com/episodes/14-introduction-to-linux-control-groups-cgroups

DOCKER



DOCKER

- Package an application with all dependencies (e.g. python 2.7, python 3)
- Create new docker containers by extending existing ones (e.g. ubuntu:latest, java:7,)
- Always run the same way (always have the exact same environment)
- Run docker containers is easy
  - Test locally
  - Run in production

DOCKER

Registries

- Docker Hub

  https://hub.docker.com/

- Google Cloud

  https://cloud.google.com/tools/container-registry/

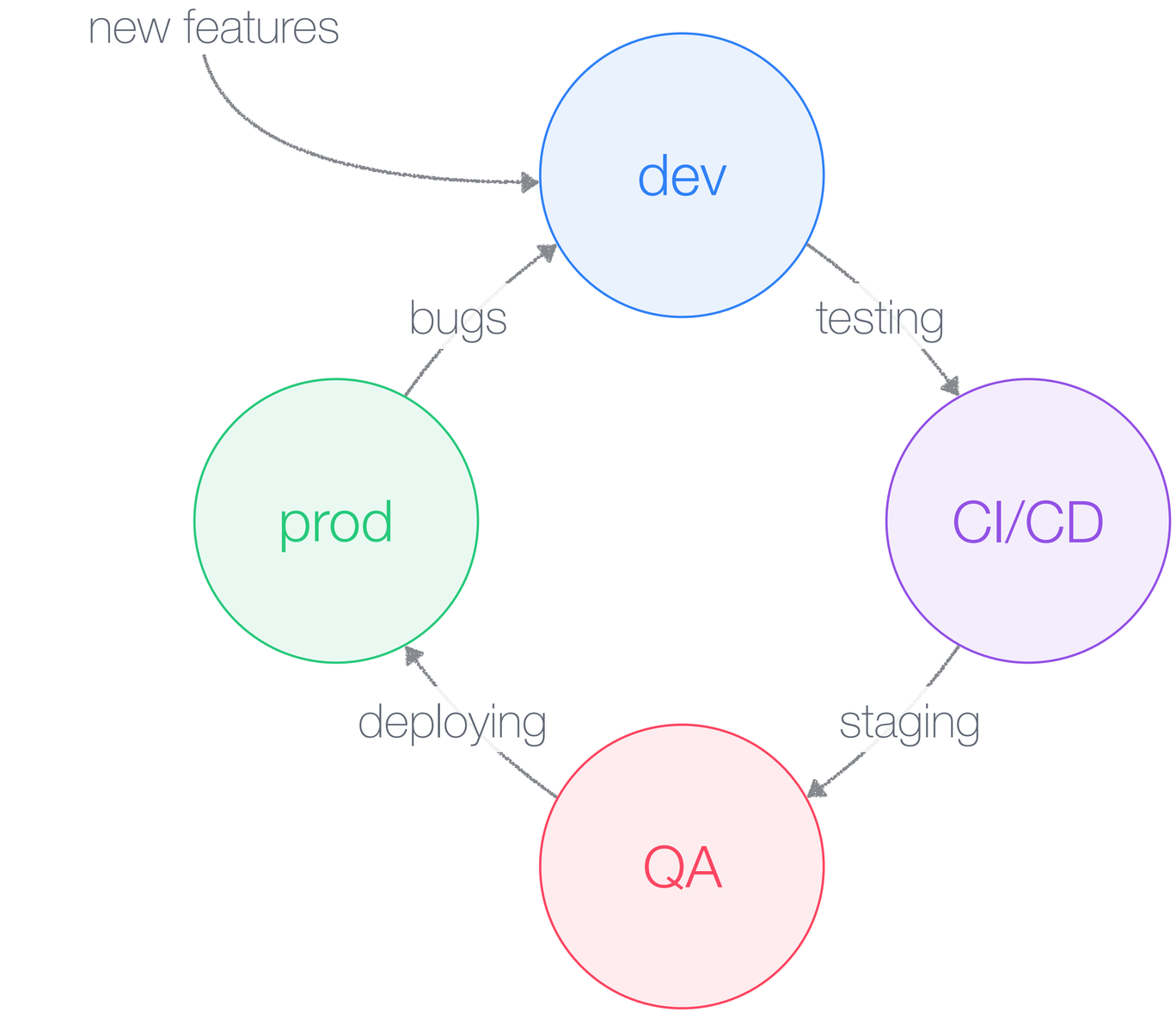
- AWS

  https://aws.amazon.com/ecr/

- Run your own

  https://docs.docker.com/registry/deploying/

CONTAINER LIFE CYCLE

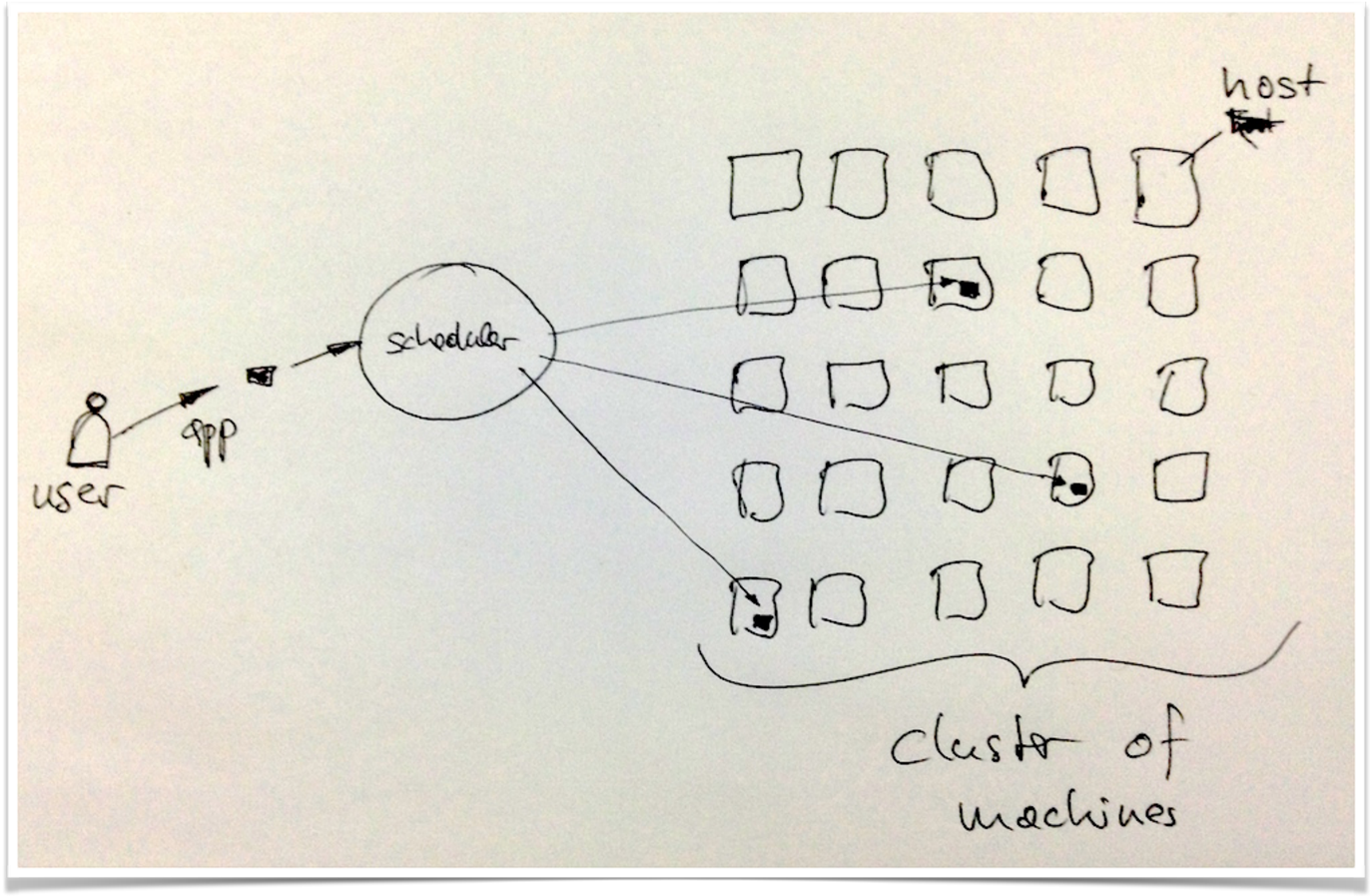


APACHE MESOS

Apache Mesos

- A top-level ASF project
- A cluster resource negotiator
- Scalable to 10,000s of nodes but also useful for a handful of nodes
- Fault-tolerant, battle-tested
- An SDK for distributed apps
- Native Docker support

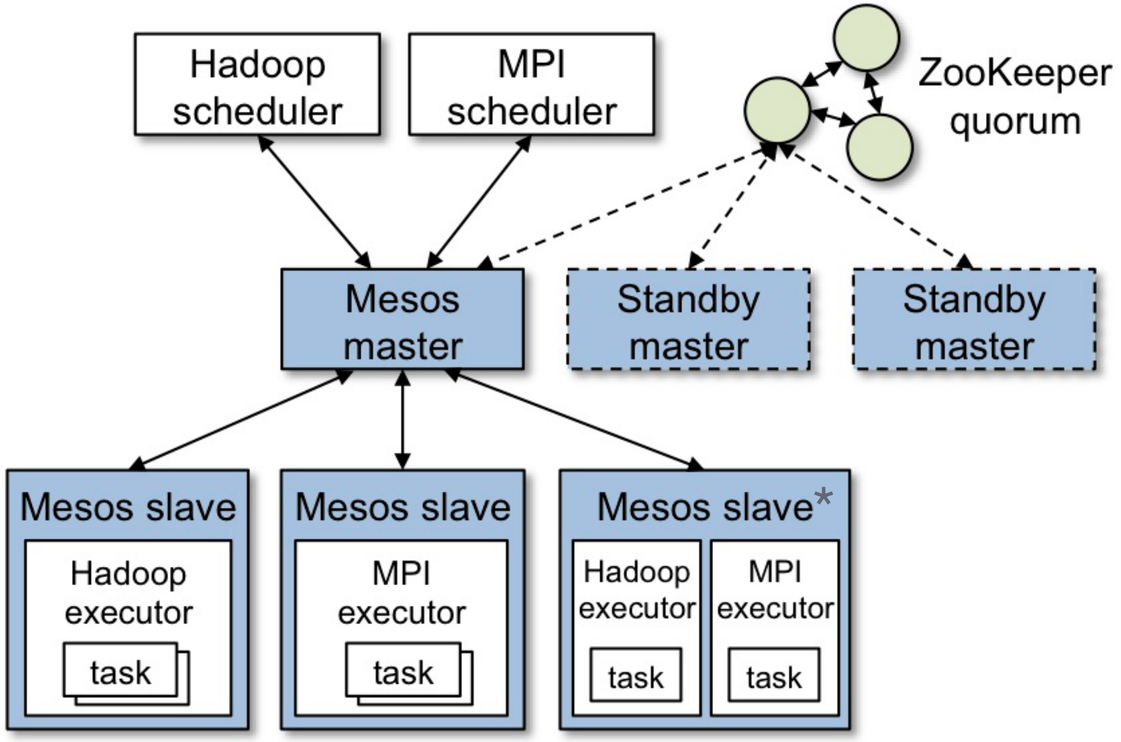
WHAT'S THE GOAL?



Apache Mesos

ARCHITECTURE

*) now: agent

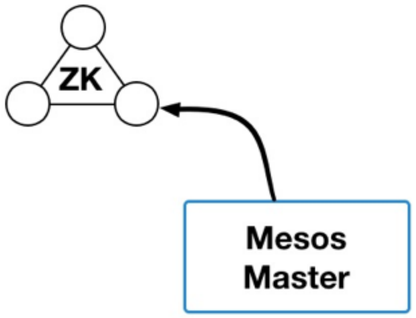


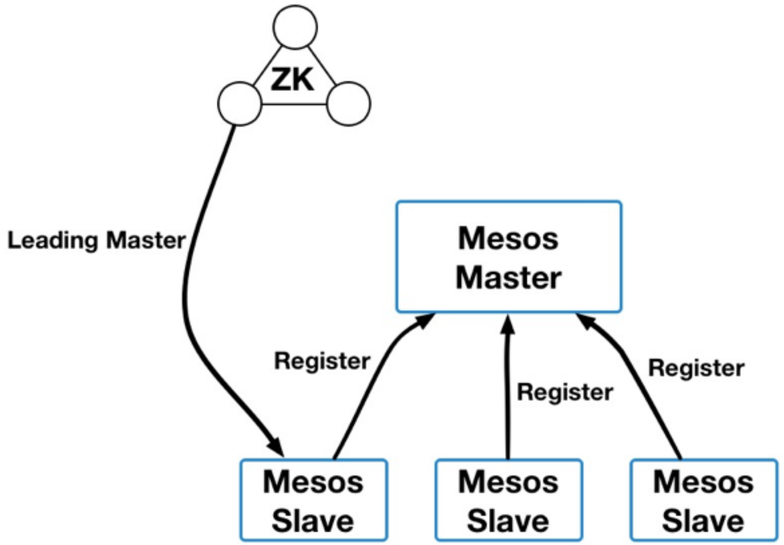
http://mesos.berkeley.edu/mesos_tech_report.pdf

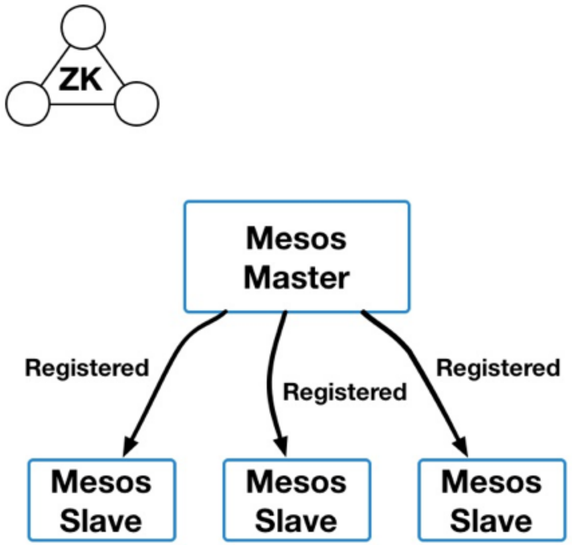
Apache Mesos

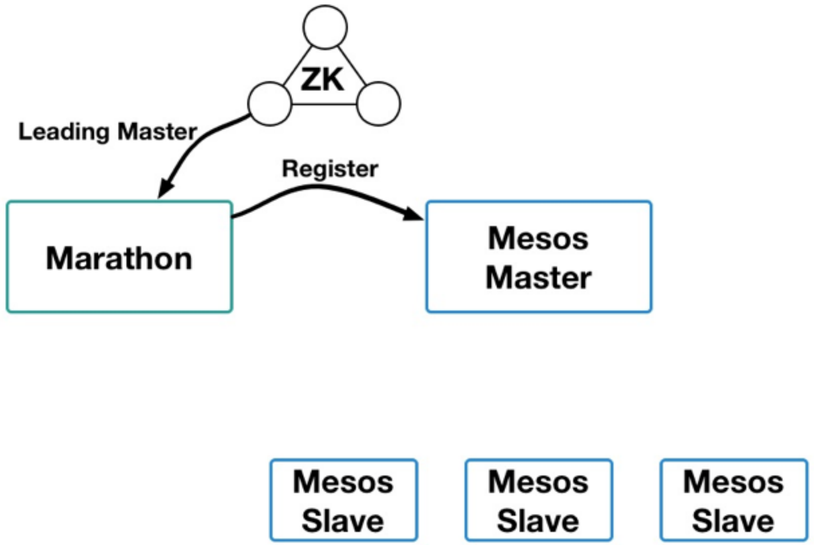
RESOURCES

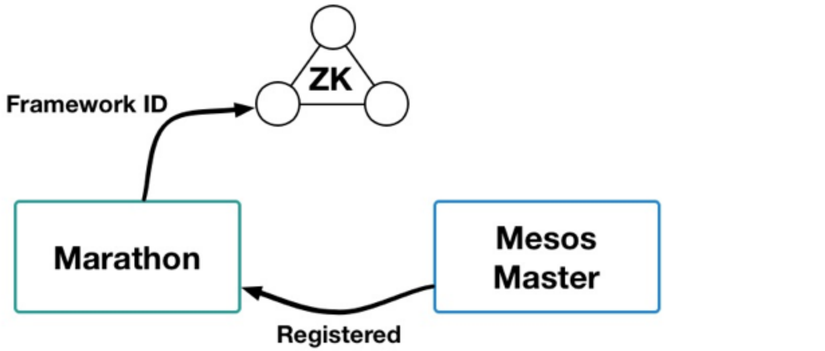
- **resource** == anything a task/executor consumes in order to do their work
- standard resources: `cpu`, `mem`, `disk`, `ports`
- at its core: DRF (Dominant Resource Fairness) algorithm, for fair sharing across-resource types

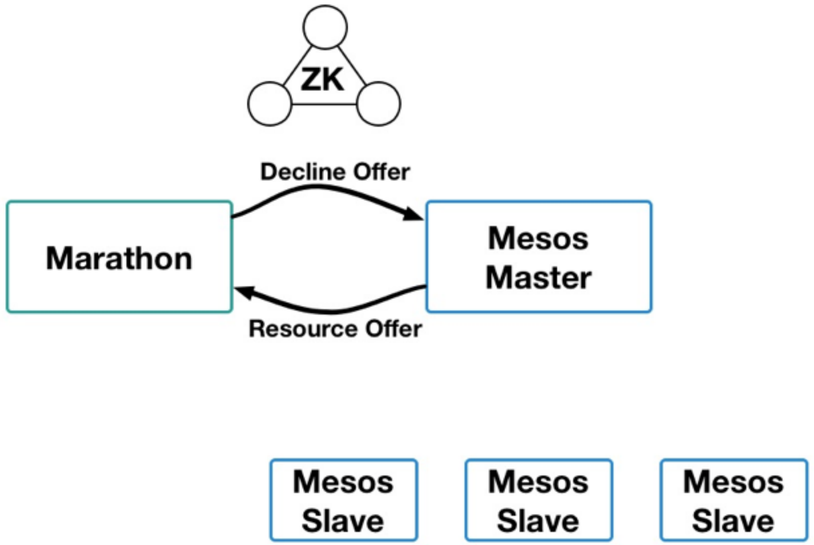


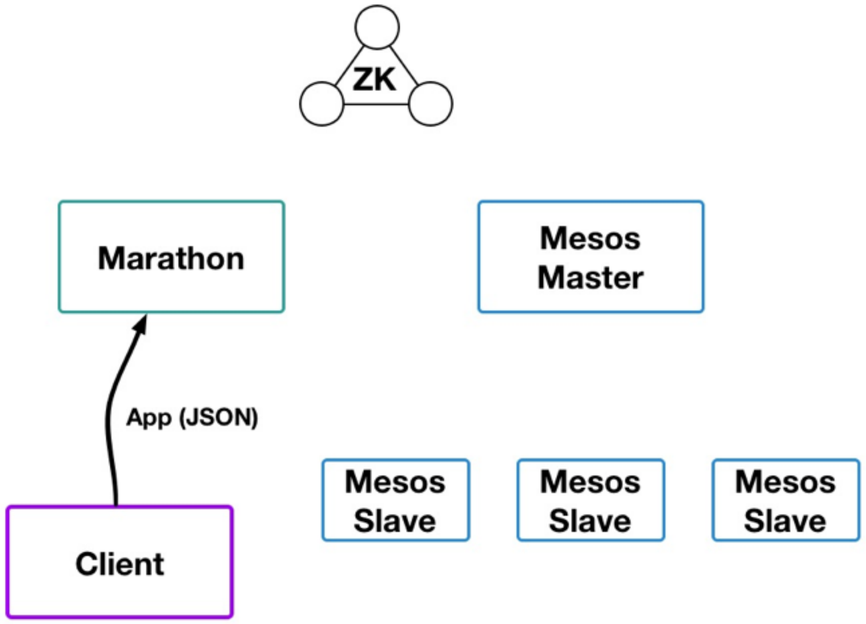


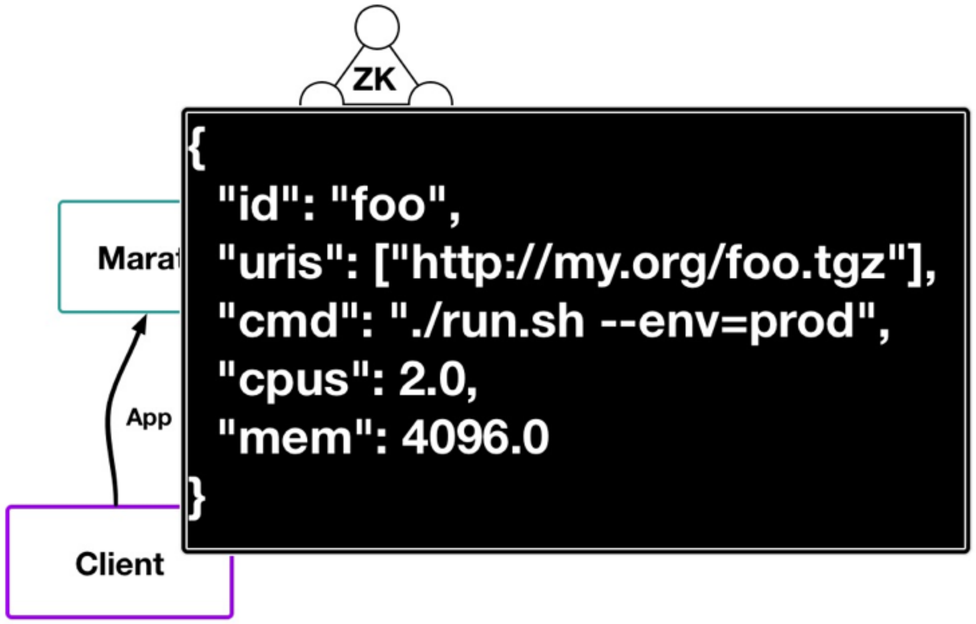


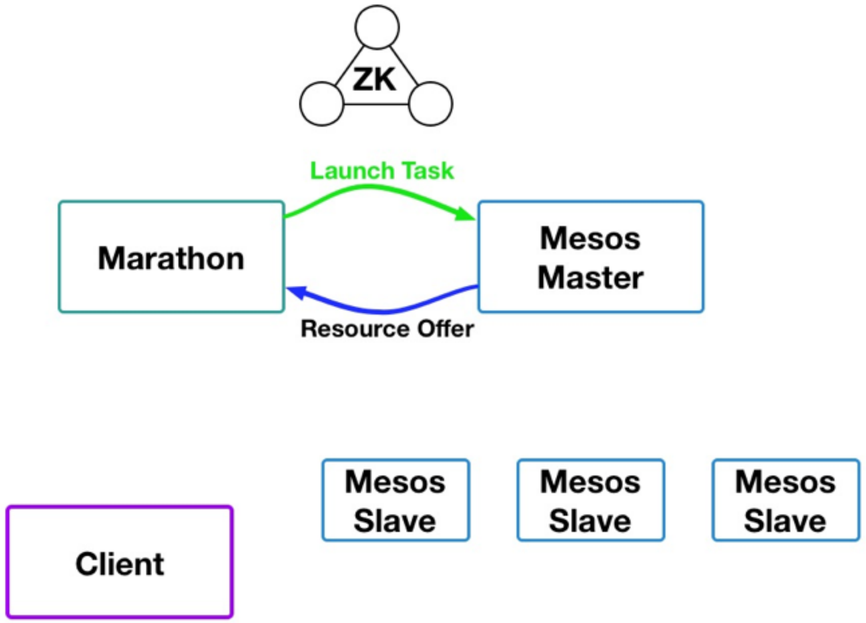


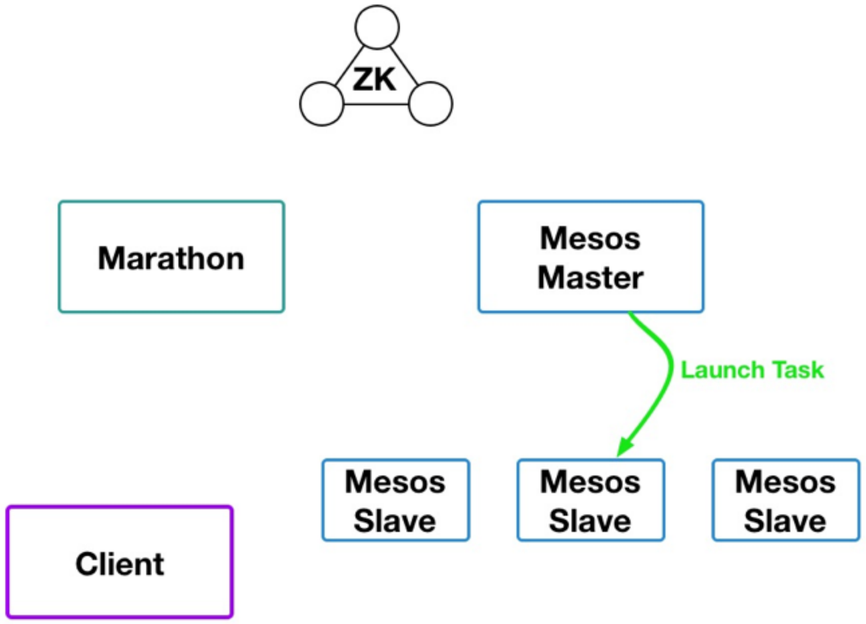


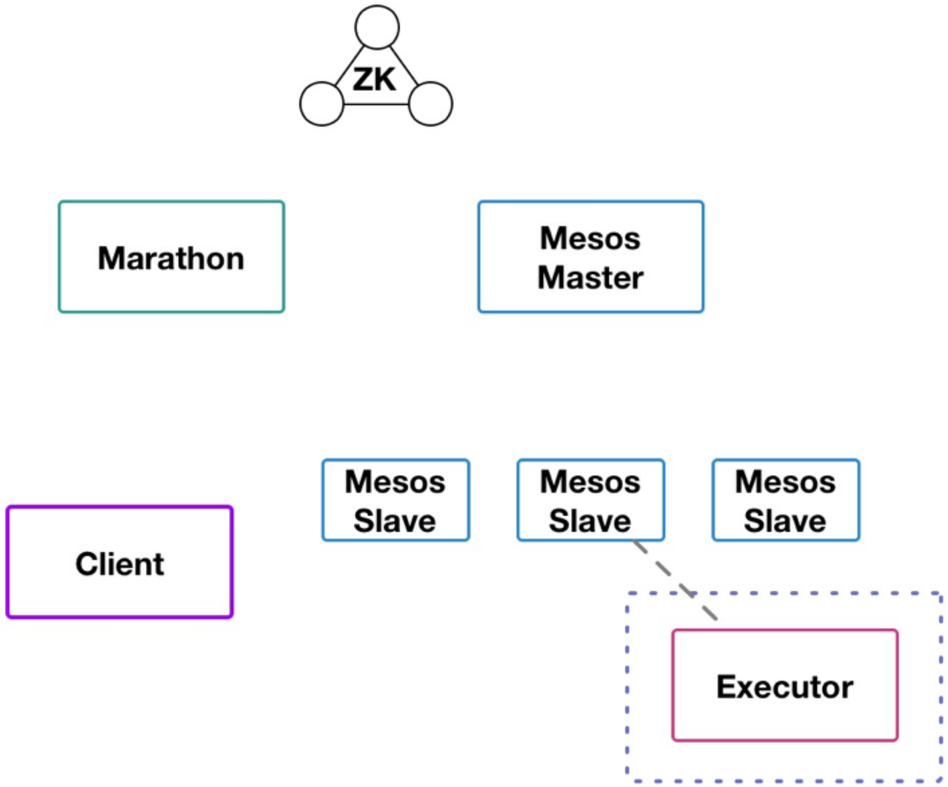


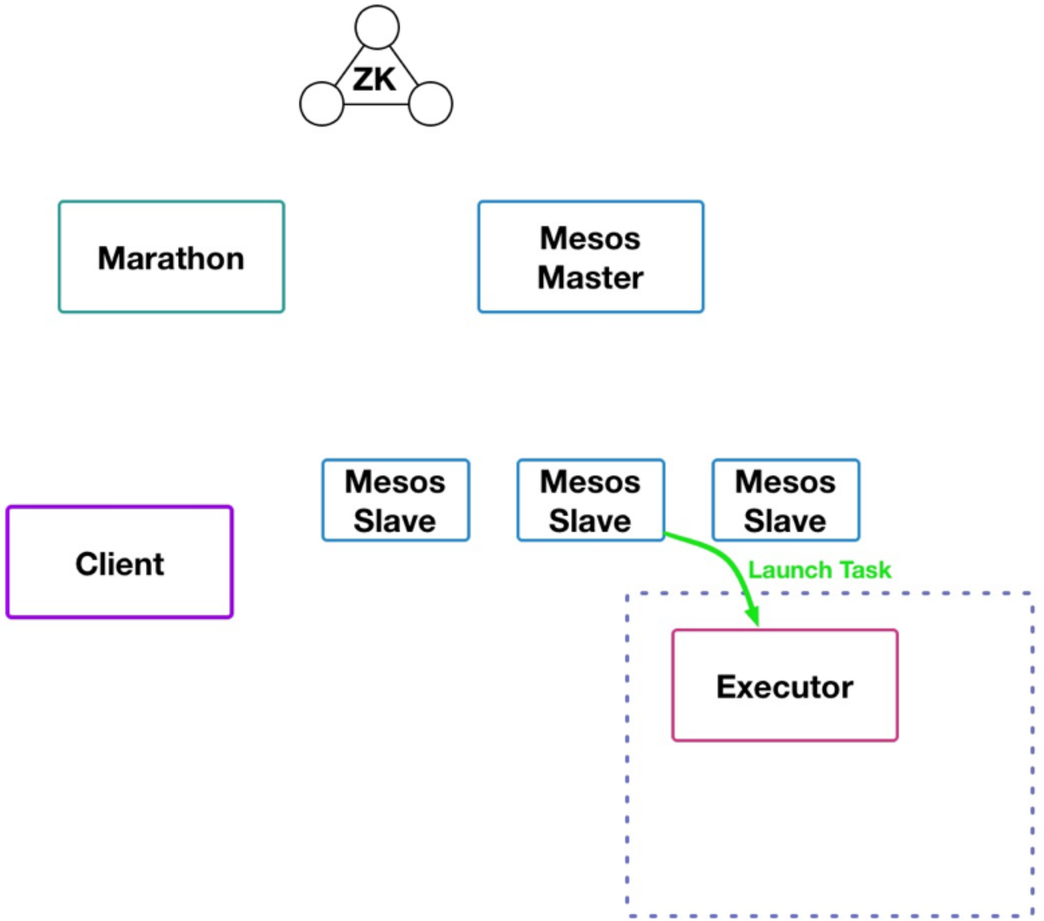


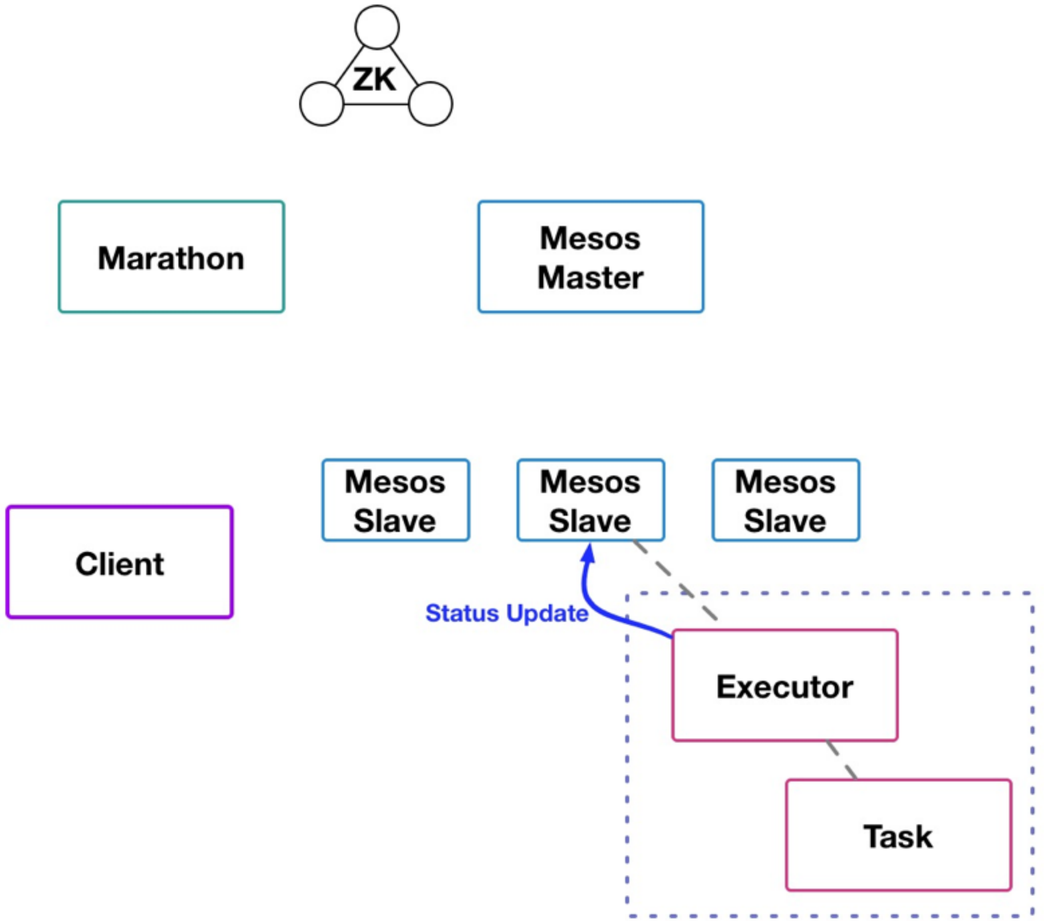


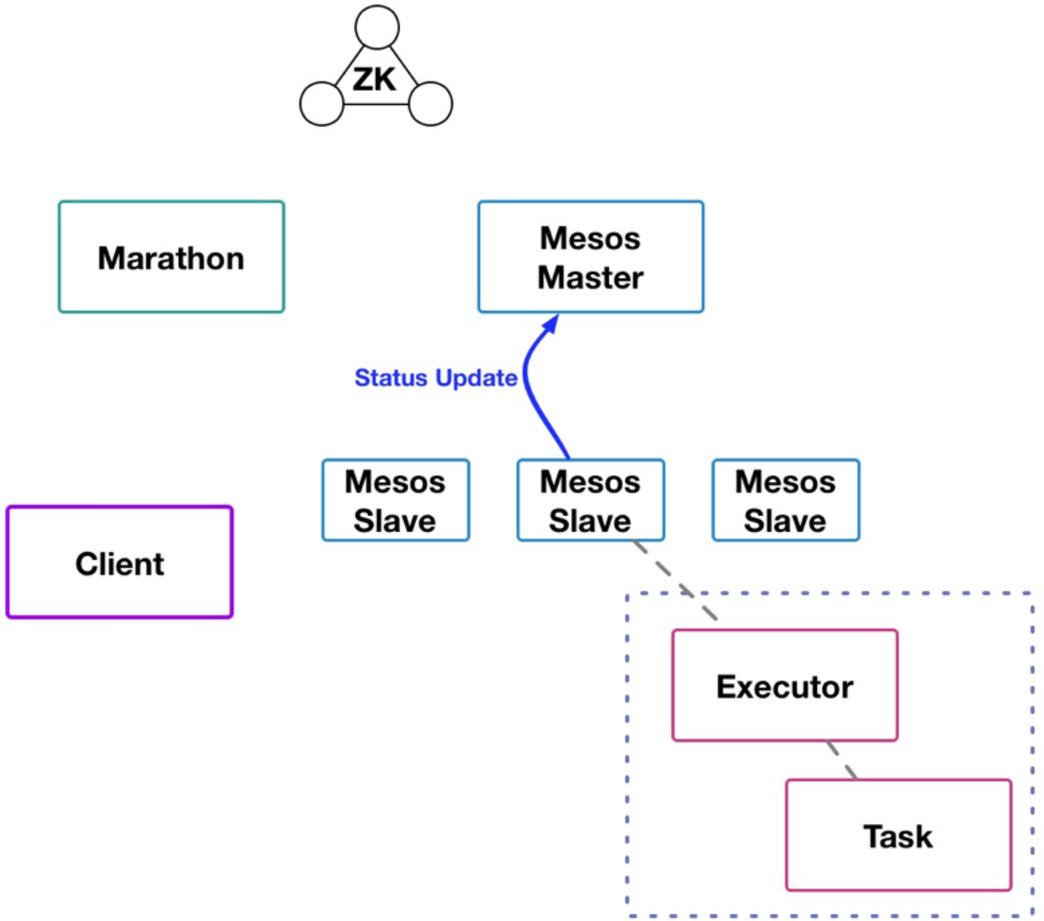


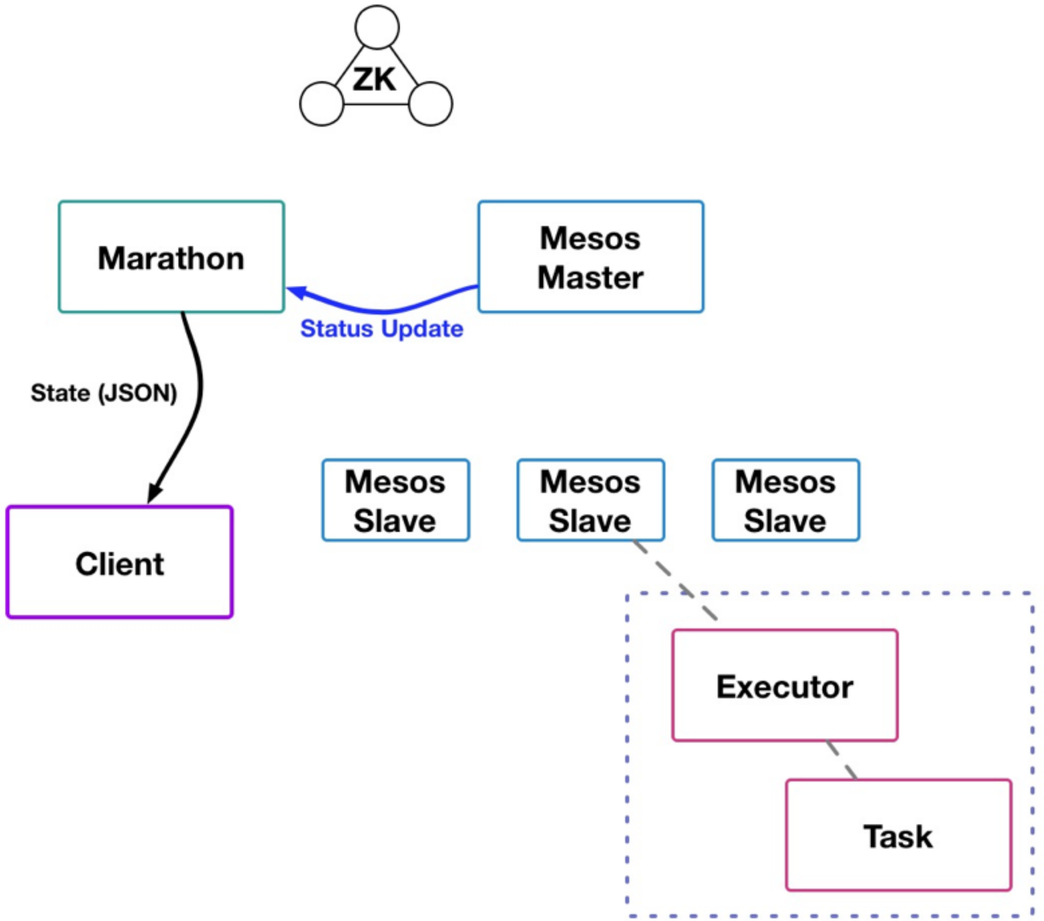


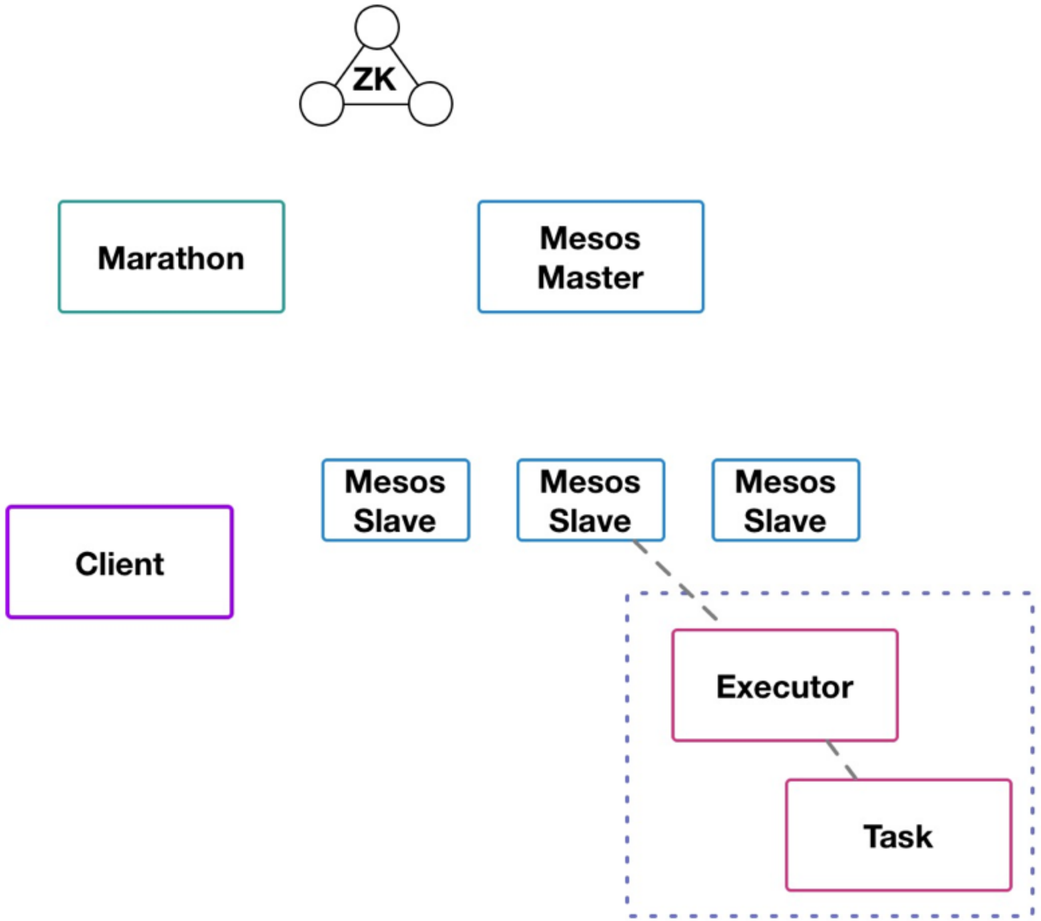












WORKLOADS …

batch streaming PaaS

CHRONOS

Spark

STORM

kubernetes

MapReduce

hadoop

Flink

samza

MARATHON

MESOS FUTURE TOPICS

- Dynamic Reservations (mesos 0.25)
- Persistent Volumes (mesos 0.23)
- IP per Container (mesos 0.26)
- Quota (??)
- Maintenance Primitives (??)

MARATHON

MARATHON

An init System for datacenters

- starts instances of a long-running service somewhere in the cluster, for example, as Docker containers
- restarts the instances if they crash
- provides composition primitives
- supports health checks
- supports rolling upgrades

MARATHON 101

BASICS

- application is a blueprint for mesos tasks
- group is a container for apps and groups

UI

- HTTP Rest Endpoint
- Web UI
- DCOS CLI

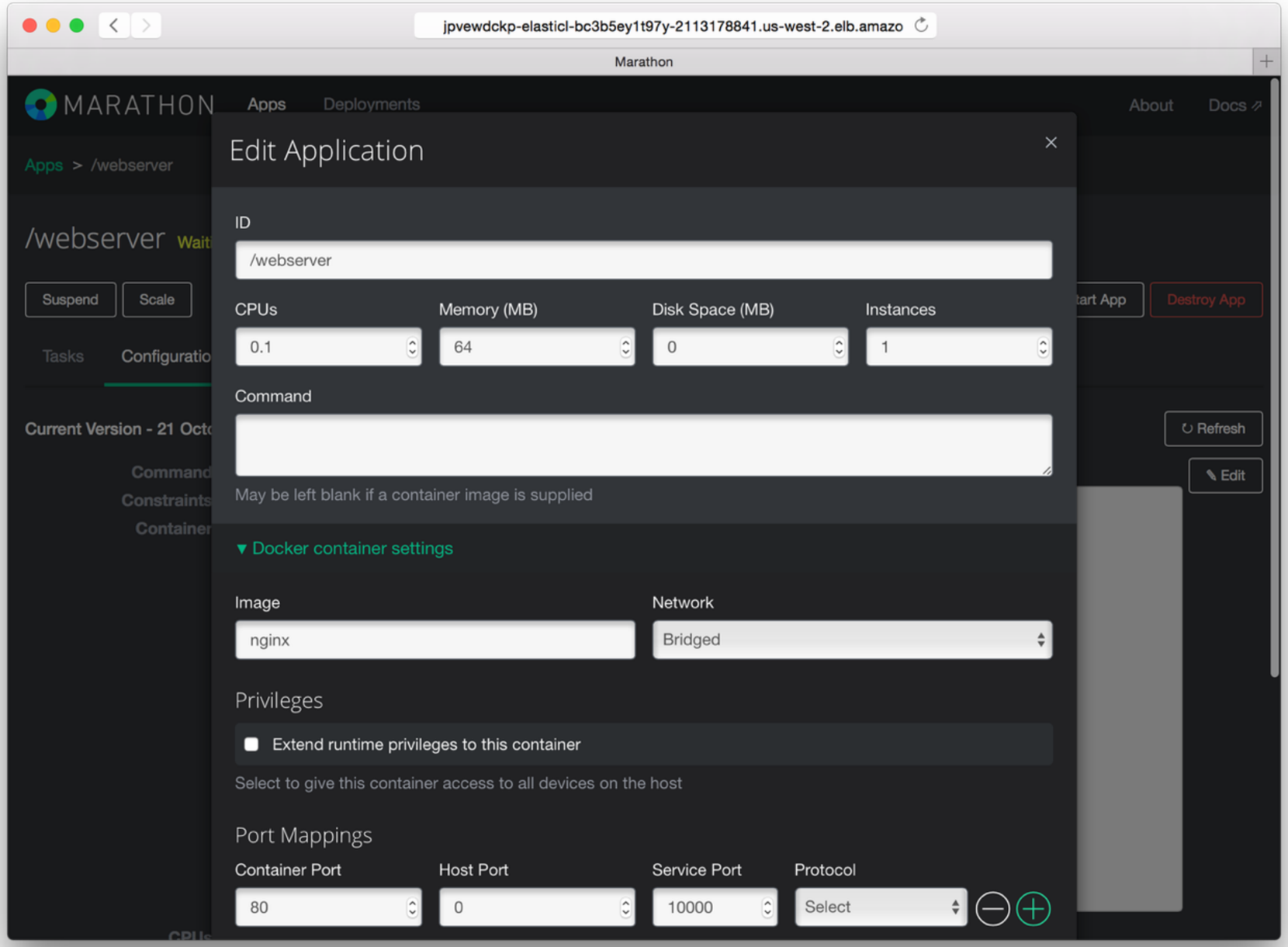
TEAM PLAYER

- Integrates nicely into the DCOS ecosystem
- Doesn’t try to solve everything itself

MARATHON APPLICATION JSON EXAMPLE

```
{
  "id": "webserver",
  "cmd": "python3 -m http.server 8080",
  "cpus": 0.5,
  "mem": 32.0,
  "container": {
    "type": "DOCKER",
    "docker": {
      "image": "python:3",
      "network": "BRIDGE",
      "portMappings": [
        { "containerPort": 8080, "hostPort": 0 }
      ]
    }
  },
  "acceptedResourceRoles": [
      "slave_public"
  ],
  "constraints": [
      ["hostname", "UNIQUE"]
  ]
}
```

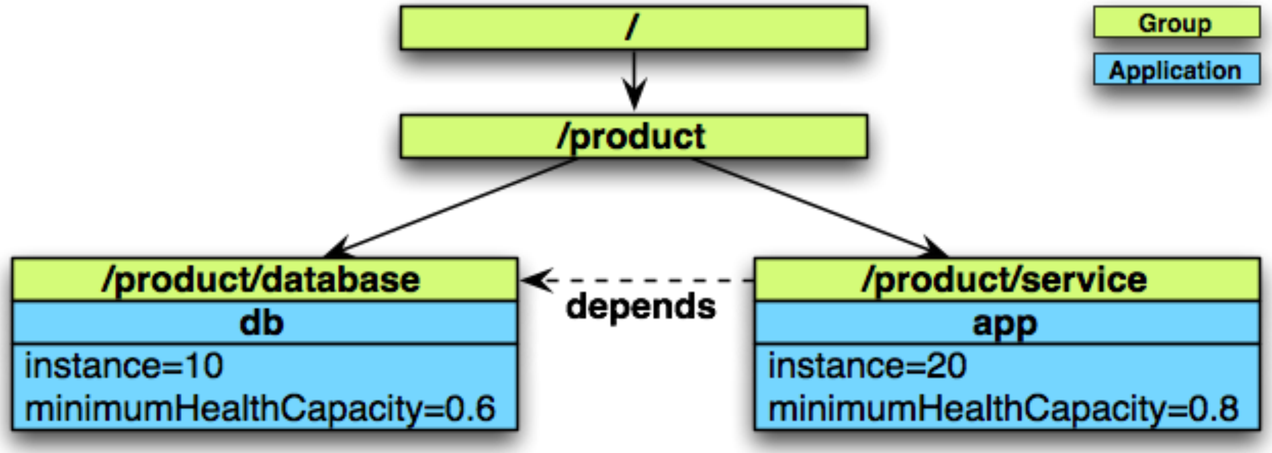
MARATHON APPLICATION WEB-UI EXAMPLE



MARATHON EXAMPLE APPLICATION

id: "webserver"	Naming
args: [sample, keywords] env: [... twitter api auth, kafka brokers ...] container: type: "DOCKER" image: "python:3"	Run
cpus: 0.5 mem: 2048 ports: [8080, 8081, 9090]	Resources
instances: 123	Scale
healtChecks: type: "HTTP", path: "/health"	Health
dependencies: ["/db/memsql"]	Dependencies
minimumHealthCapacity: 0.5	UpgradeStrategy
constraints: [[gpu LIKE "NVD-*"], [rack GROUP_BY]]	Constraints
	…

MARATHON GROUP



- Groups can hold zero or more Apps or Groups
- Groups can build a tree
- Dependencies can be expressed on App and Group level
- Deployments can be executed on the level of Groups
- Example Use Cases
  - map application tiers to groups
  - map organization tiers to groups

SERVICE DISCOVERY

- Well known port: marathon_lb, bamboo, …
- DNS: MesosDNS, Consul, Weave-DNS, …
- Programmatic: zookeeper, etcd, …

DATACENTER OPERATING SYSTEM (DCOS)

DCOS IS A DISTRIBUTED OPERATING SYSTEM

- kernel == Apache Mesos, scaling to 10,000 of nodes
- fault-tolerant in all components, rolling upgrades throughout
- containers first class citizens (LXC, Docker)
- local OS per node (container enabled)
- scheduling (long-lived, batch)
- service discovery, monitoring, logging, debugging

Services & Containers

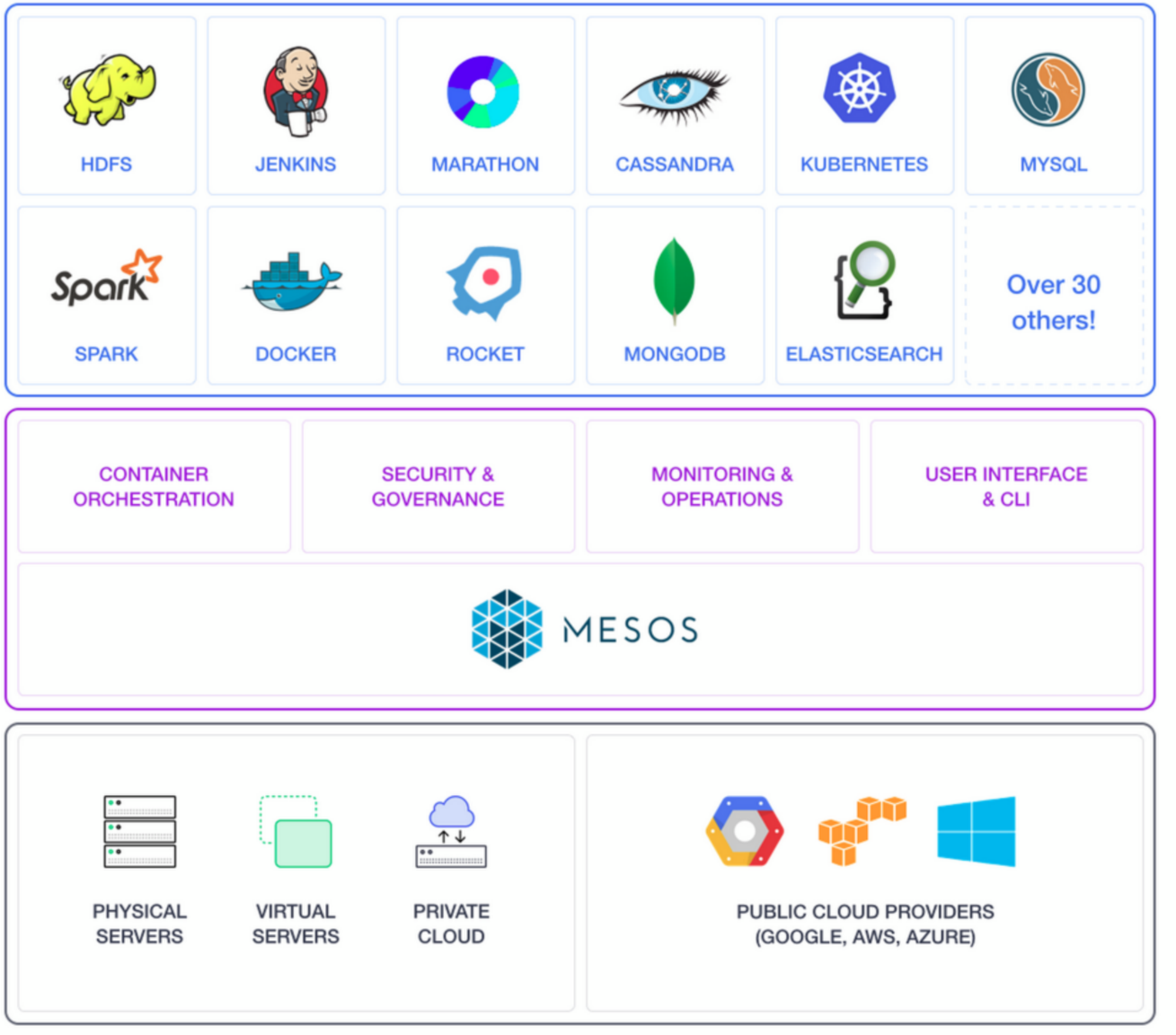
Your favorite services, container formats, and those yet to come.

Mesosphere DCOS

Runs distributed apps anywhere as simply as running apps on your laptop.

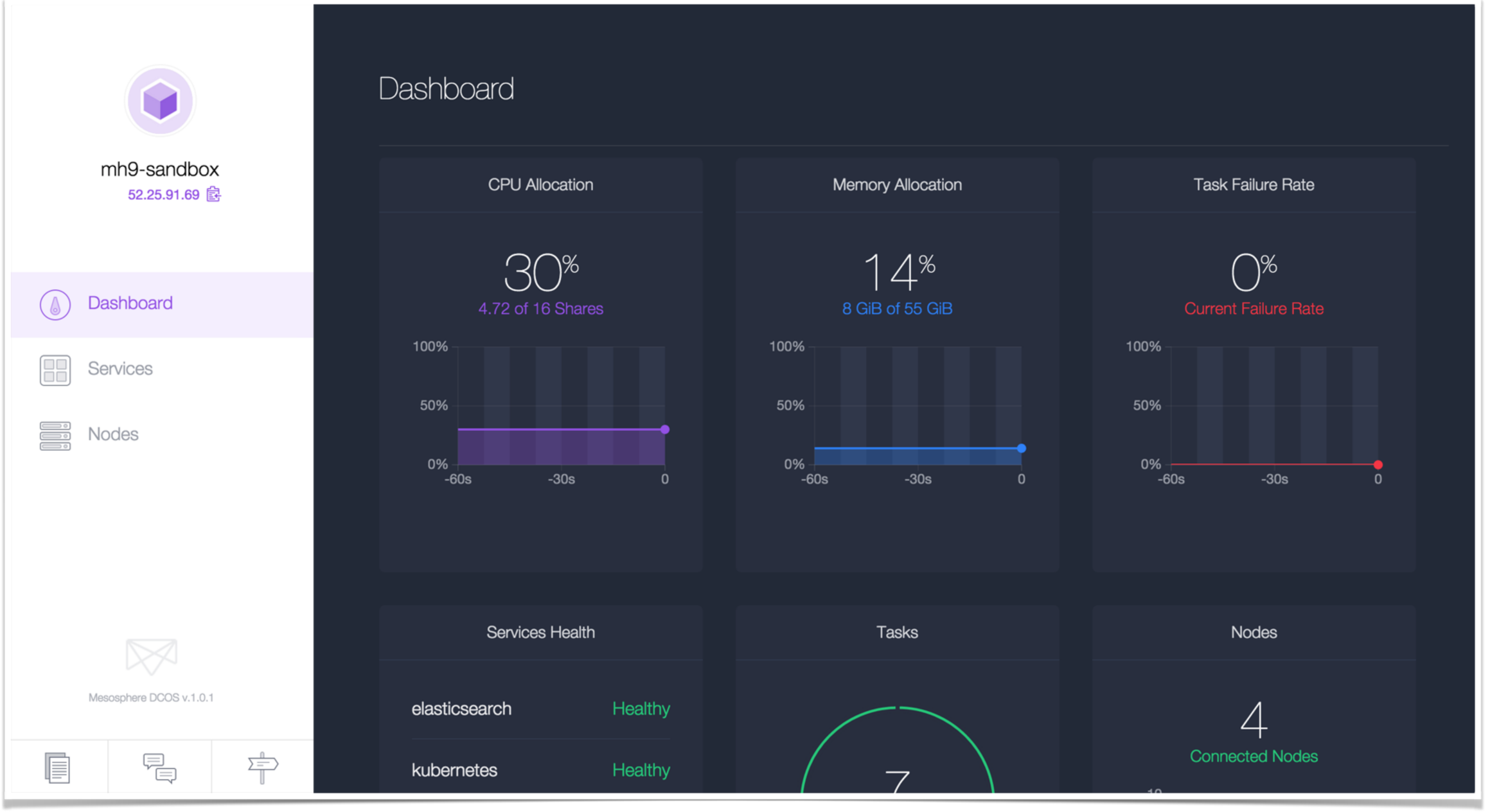
Any Infrastructure

Build apps once on DCOS, and run it anywhere.



BENEFITS

- Run stateless services such as Web servers, app servers (via Marathon) and stateful services like Crate, Kafka, HDFS, Cassandra, ArangoDB etc. together on one cluster
- Dynamic partitioning of your cluster, depending on your needs (business requirements)
- Increased utilization (10% → 80% an more)



DCOS CLI

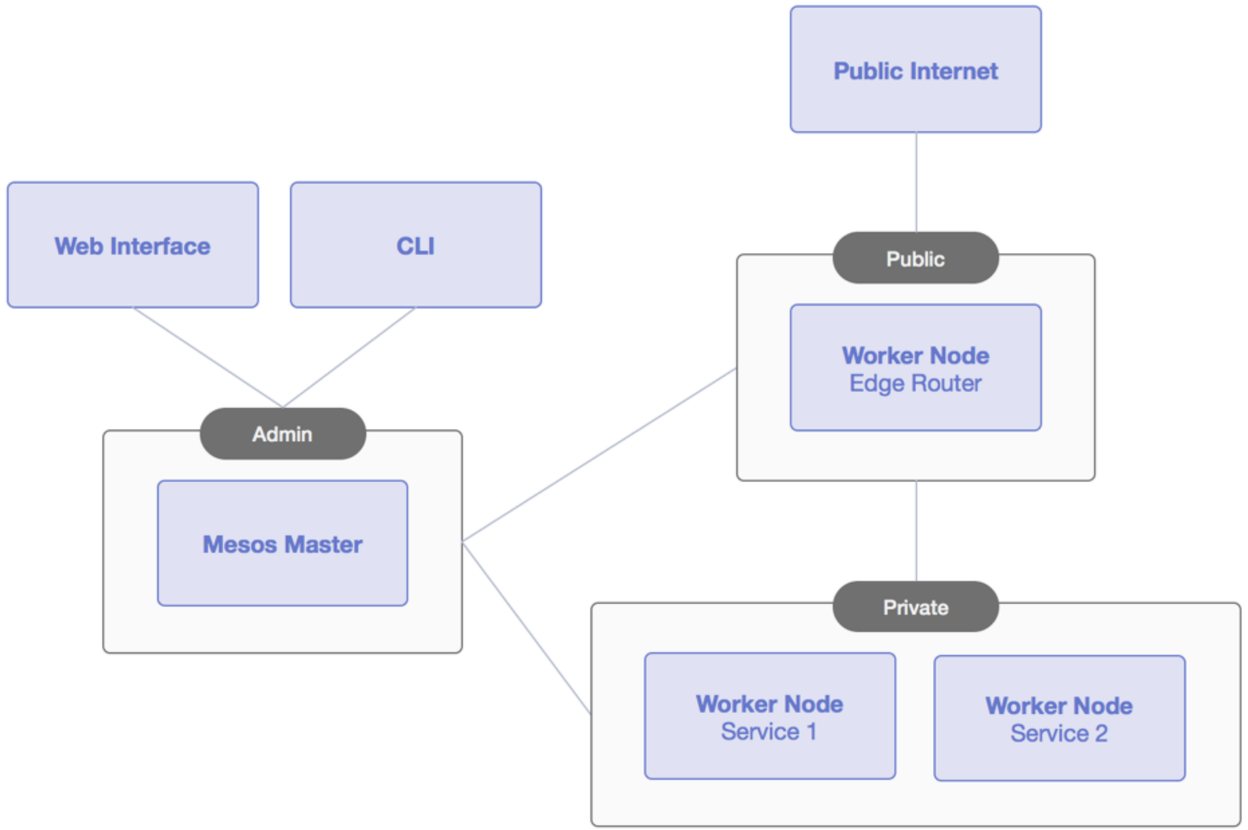
```
~/sandbox/dcos/ccm/dcos $ dcos package list
NAME           VERSION              APP             COMMAND  DESCRIPTION
elasticsearch  0.2.0                /elasticsearch  ---      DCOS implementation of the Mesos-Elasticsearch framework
kubernetes     v1.0.5-v0.6.4-alpha  /kubernetes     ---      Manage a cluster of Linux containers as a single system to accelerate Dev and simplify Ops.
~/sandbox/dcos/ccm/dcos $ dcos help
Command line utility for the Mesosphere Datacenter Operating
System (DCOS). The Mesosphere DCOS is a distributed operating
system built around Apache Mesos. This utility provides tools
for easy management of a DCOS installation.

Available DCOS commands:

        config          Get and set DCOS CLI configuration properties
        help            Display command line usage information
        marathon        Deploy and manage applications on the DCOS
        node            Manage DCOS nodes
        package         Install and manage DCOS packages
        service         Manage DCOS services
        task            Manage DCOS tasks

Get detailed command description with 'dcos <command> --help'.
~/sandbox/dcos/ccm/dcos $ _
```

DCOS ARCHITECTURE

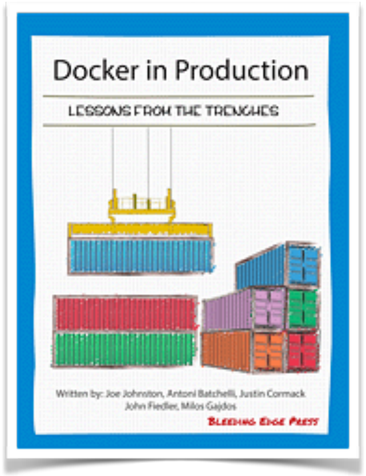


https://docs.mesosphere.com/getting-started/dcosarchitecture/

LEARNING RESOURCES

WHERE CAN I LEARN MORE?

http://shop.oreilly.com/product/9781939902184.do



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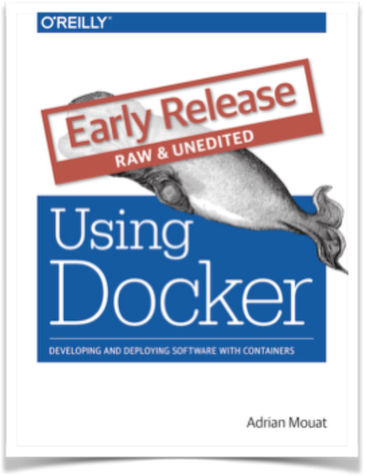
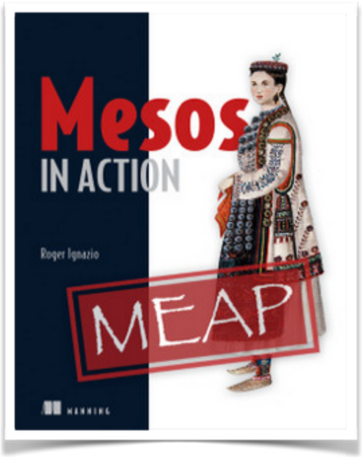


WHERE CAN I LEARN MORE?

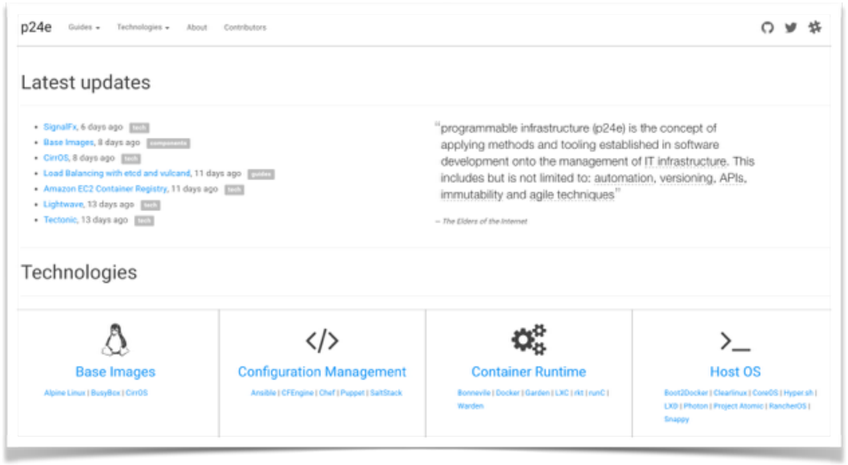
http://shop.oreilly.com/product/0636920039952.do

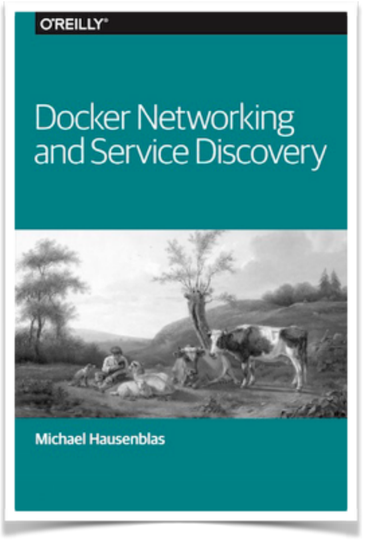
https://manning.com/books/mesos-in-action



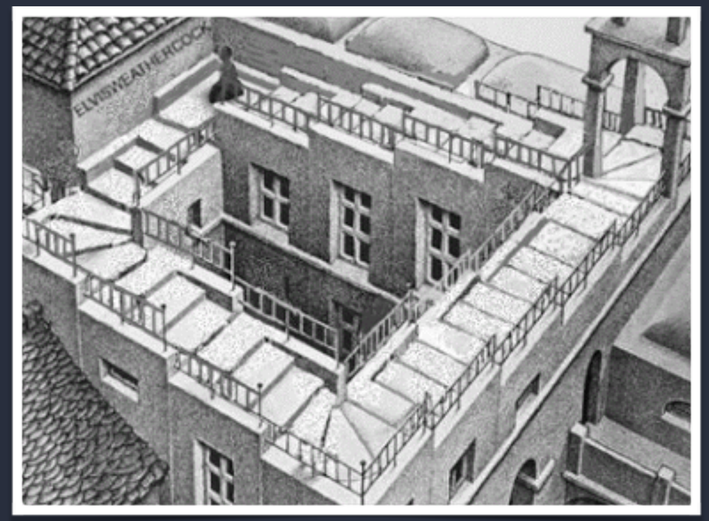
WHERE CAN I LEARN MORE?

http://p24e.io





HANDS-ON



LABS

- Container 101
- Apache Mesos + Marathon