

IsolPharm

computing needs



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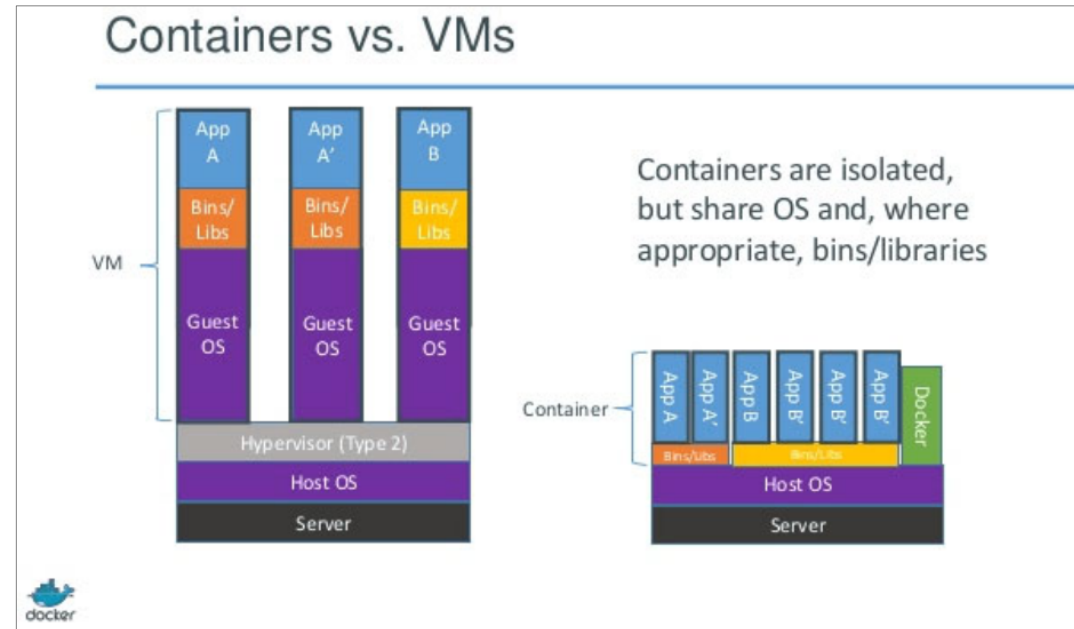
Padova, 05/12/2017

IsolPharm computing needs

- Infrastructure for executing:
 - long-running tasks (e.g. web server, databases)
 - batch jobs (e.g. docker geant4 app)
- IsolPharm relies on the Cloud Area Padovana for the provisioning of the required computing resources
 - created ISOLPHARM_Ag OpenStack project
 - assigned: 50 vcpus, 50GB ram, 700GB storage

A possible computing architecture

- Our computing architecture must be:
 - provide support for containerized applications (e.g. docker)
 - easily deployable (in cloud)
 - easily scalable
 - fault tolerant



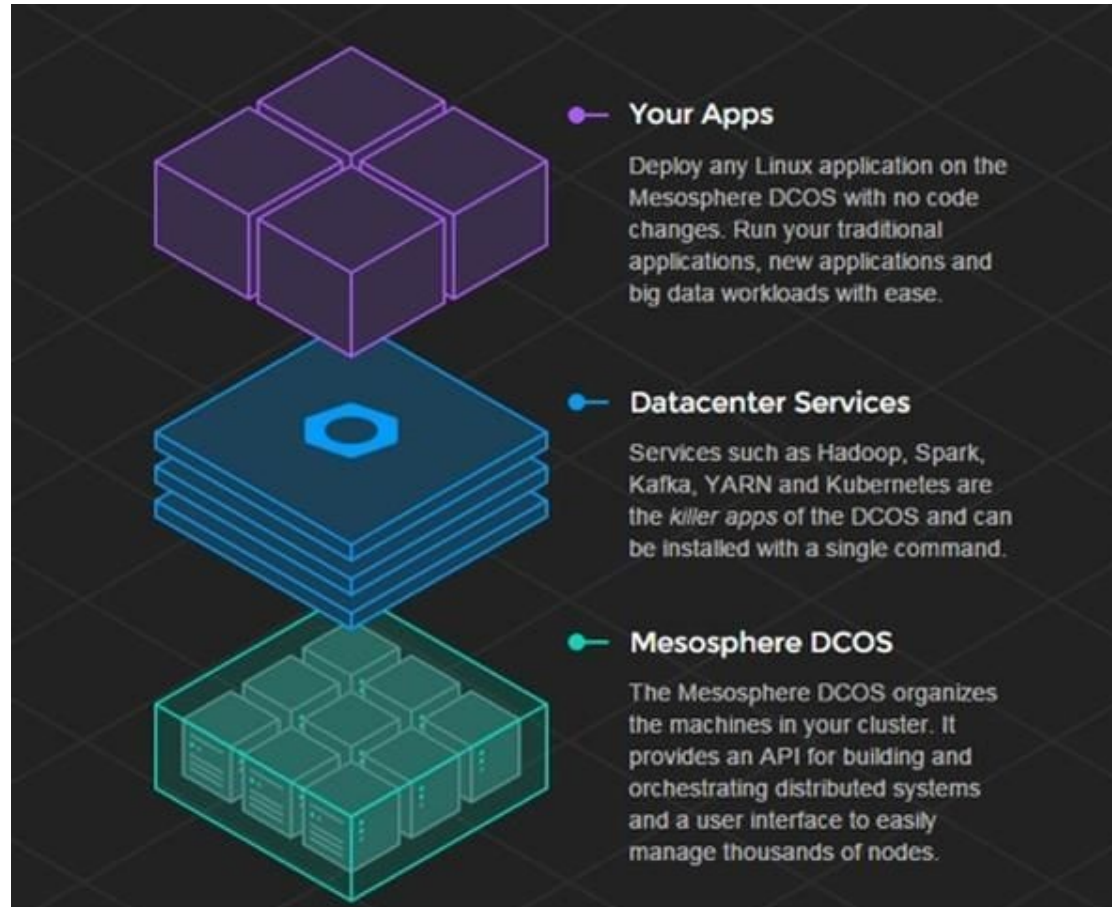
A possible computing architecture

- Several approaches:
 - Kubernetes: open-source system for automating deployment, scaling, and management of containerized applications.
 - <https://kubernetes.io/>
 - Docker swarm: cluster management and orchestration features embedded in the Docker Engine (open-source)
 - <https://docs.docker.com/engine/swarm/>
 - Apache Mesos: open-source platform the manage large computing cluster
 - <https://mesosphere.com/>

Apache Mesos

- Selected by the INDIGO-DataCloud European Project
- Advanced platform able to manage large cluster of resources (cpu, mem), providing isolation and sharing across distributed applications (frameworks)
- From a resource perspective, it's a cluster manager:
 - pools of (cloud) resources to be centrally managed as a single unit
- From an application perspective, it's a scheduler:
 - dispatches workloads to consume pooled resources
- Often described as a Data Center Operating System (DCOS)

Apache Mesos architecture



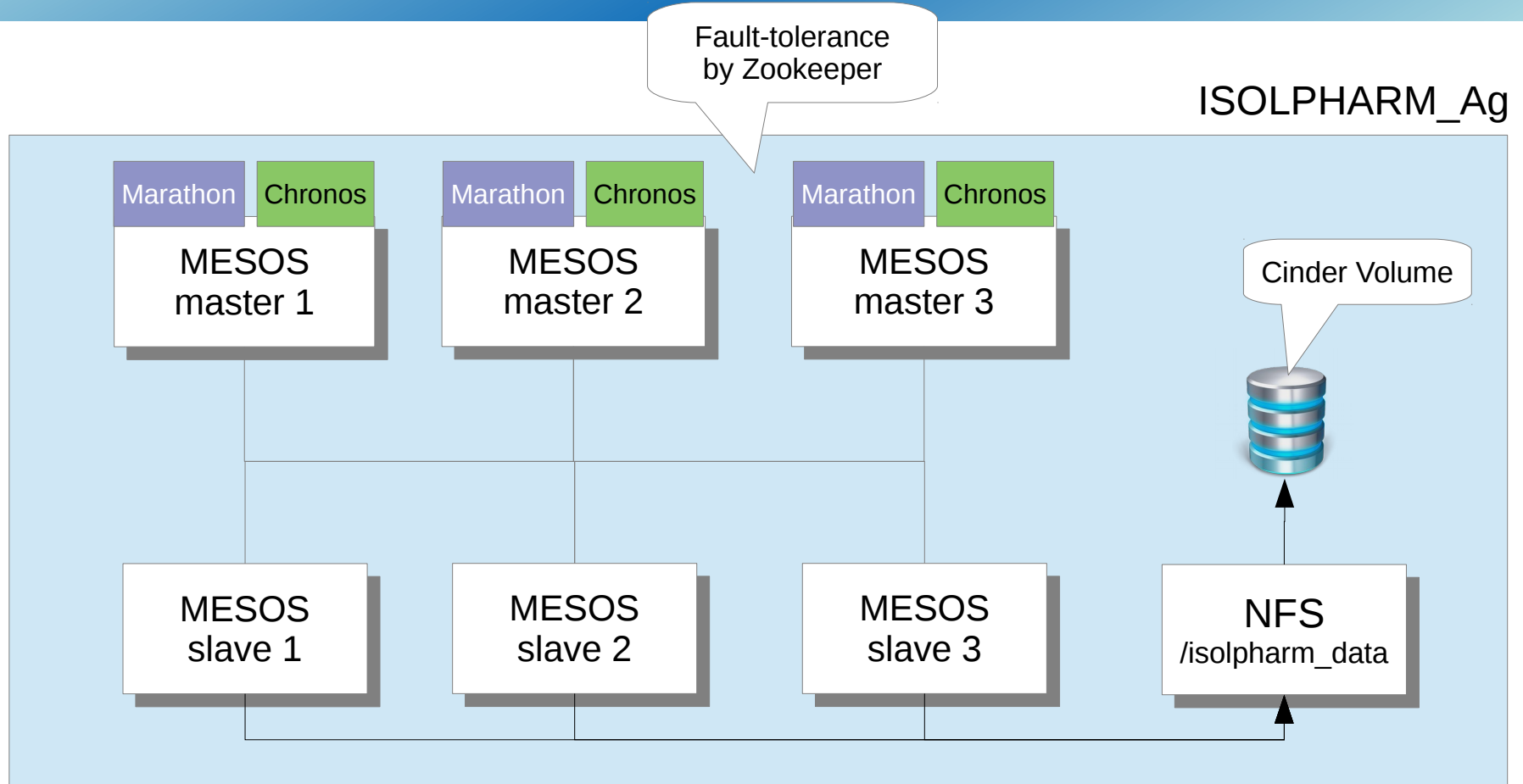
Apache Mesos

- Supports several frameworks for:
 - Big Data Processing
 - Machine Learning
 - Data Storage
 - Long Running Services
 - Aurora, **Marathon**, Singularity, SSSP
 - Batch Scheduling
 - **Chronos**, Cook (like Torque), Elastic-Job-Cloud, GoDocker (like SGE, Torque), Jenkins, JobServer
- <http://mesos.apache.org/documentation/latest/frameworks/>

Marathon and Chronos overview

- both frameworks deployed on top of a Mesos Cluster
- Marathon: automatically handles hardware or software failures and ensures that long-running services (e.g. web server, databases, etc) are always up and running
- Chronos: distributed and fault-tolerant cron-like system, that can express dependencies between jobs
- Both frameworks provide:
 - support for docker apps
 - REST API
 - simple dashboard

MESOS testbed



Marathon and Chronos tests

- Preliminary tests done on Marathon and Chronos
- Marathon:
 - deployment based on bash script invoking REST API via curl
 - executed simple docker based web-server
- Chronos:
 - deployment based on bash script invoking REST API via curl
 - executed successfully our geant4 app (EF10) in parallel
 - 96 jobs
 - input files (macros) and output files (.tgz) stored into the shared nfs partition /isolpharm_data (Cinder volume)

Chronos tests: geant_ef10.json

```
{
  "schedule": "R1/_TIME_/P10M",
  "name": "_MACRO_",
  "container": {
    "type": "DOCKER",
    "image": "ebagli/isolpharm",
    "network": "BRIDGE",
    "volumes": [
      { "containerPath": "/macros/", "hostPath": "/isolpharm_data/EF10/mac/", "mode": "RO" },
      { "containerPath": "/output/", "hostPath": "/isolpharm_data/sim_lisa", "mode": "RW" },
      { "containerPath": "/runme.sh", "hostPath": "/isolpharm_data/runme.sh", "mode": "RO" }
    ]
  },
  "cpus": "0.5",
  "mem": "512",
  "command": "/entry-point.sh /runme.sh _MACRO_",
  "shell": true
}
```

EQUIVALENT TO

```
docker run --rm -v /isolpharm_data/sim2:/output:rw -v /isolpharm_data/EF10/mac:/macros:ro -v
/isolpharm_data/runme.sh:/runme.sh:ro --name _MACRO_ ebagli/isolpharm /bin/exec /runme.sh _MACRO_
```

Chronos tests

Mesos - Chromium

Instances - OpenS x Chronos x AMBULATORIO G x Apache Mesos - V x Apache Mesos - S x Chronos x Mesos x Lisa

10.64.31.105:5050/#/frameworks/7a41d459-5164-4ceb-9ffc-cd4216c9cf95-0001

Apps Assicurazione sa linux java Imported Build a USB Pow Benvenuti su AU pic Midi controller - varie bank Other bookmarks

MESOS Frameworks Agents Roles Offers Maintenance Mesos Cluster

Master / Framework 7a41d459-5164-4ceb-9ffc-cd4216c9cf95-0001

Name: chronos
Web UI: <http://10.64.31.105:4400>
User: root
Roles: *
Principal:
Registered: 5 minutes ago
Re-registered: -
Active tasks: 11

Resources

	Allocated	Offered
CPU	3.5	5.5
GPU	0	0
Memory	3.5 GB	2.9 GB
Disk	3.5 GB	2.9 GB

Active Tasks

Find...

ID ▼	Name	Role	State	Started	Host	
ct:1512392138602:0:sim_036_087_01.mac:	ChronosTask:sim_036_087_01.mac	*	RUNNING	just now	10.64.31.99	Sandbox
ct:1512392138595:0:sim_036_087_00.mac:	ChronosTask:sim_036_087_00.mac	*	RUNNING	just now	10.64.31.99	Sandbox
ct:1512392137691:0:sim_036_086_06.mac:	ChronosTask:sim_036_086_06.mac	*	FINISHED	just now	10.64.31.97	Sandbox
ct:1512392137683:0:sim_036_086_05.mac:	ChronosTask:sim_036_086_05.mac	*	FINISHED	just now	10.64.31.97	Sandbox
ct:1512392136654:0:sim_036_086_04.mac:	ChronosTask:sim_036_086_04.mac	*	FINISHED	just now	10.64.31.97	Sandbox
ct:1512392136088:0:sim_036_086_02.mac:	ChronosTask:sim_036_086_02.mac	*	FINISHED	just now	10.64.31.97	Sandbox
ct:1512392131229:0:sim_036_083_05.mac:	ChronosTask:sim_036_083_05.mac	*	STAGING		10.64.31.98	Sandbox
ct:1512392131058:0:sim_036_083_04.mac:	ChronosTask:sim_036_083_04.mac	*	STAGING		10.64.31.98	Sandbox
ct:1512392130896:0:sim_036_083_03.mac:	ChronosTask:sim_036_083_03.mac	*	RUNNING	just now	10.64.31.98	Sandbox
ct:1512392130714:0:sim_036_083_02.mac:	ChronosTask:sim_036_083_02.mac	*	STAGING		10.64.31.98	Sandbox
ct:1512392130518:0:sim_036_083_01.mac:	ChronosTask:sim_036_083_01.mac	*	STAGING		10.64.31.98	Sandbox

Unreachable Tasks

Chronos tests

The screenshot shows a web browser window displaying the Chronos interface. The browser's address bar shows the URL 10.64.31.105:4400. The Chronos header displays 'TOTAL JOBS 96' and 'FAILED JOBS 0'. A search bar is present with the placeholder text 'Search job name or status'. Below the header is a table of jobs.

NAME	LAST	STATE
sim_036_088_00.mac	success	idle
sim_036_089_03.mac	success	idle
sim_036_094_01.mac	success	idle
sim_036_089_00.mac	success	idle
sim_036_085_02.mac	success	idle
sim_036_085_05.mac	success	idle
sim_036_092_01.mac	success	idle
sim_036_086_02.mac	success	idle
sim_036_090_01.mac	success	idle
sim_036_092_06.mac	success	idle

The bottom of the image shows the Linux desktop environment with several open terminal windows and application icons in the taskbar.

Chronos tests

A screenshot of a Linux terminal window. The title bar at the top shows application icons and system status (Bluetooth, network, volume, date/time: lun dic 4, 13:59). The terminal prompt is root@mesos-s-1:/home/centos. The user enters the command ls /isolpharm_data/sim_lisa/. The output displays a long list of files in red text, organized in six columns. Each filename follows the pattern sim_036__.mac.tgz. The numbers vary across the columns, representing different simulation runs or configurations. The terminal interface includes standard menu options (File, Edit, View, Search, Terminal, Help) and window controls.

Marathon and Chronos tests

- Preliminary tests done on Marathon and Chronos
- Marathon considerations:
 - it works fine (useful for our web portal)
- Chronos considerations:
 - deployment of docker apps by using REST API needs some tricks
 - designed to perform periodic jobs (although a job can run once)
 - not multi-user (MESOS roles to be investigated)
 - experienced some issues (found workaround):
 - some job attributes produce a wrong docker command
 - failure: java.lang.ArithmeticException: / by zero

Marathon and Chronos tests

- We are still evaluating Chronos
- in the case we need a more sophisticated batch scheduler (multi user, fair-share, etc) we can investigate different solutions
 - Mesos Cook, Mesos GoDocker, Kubernetes, Docker Swarm