

# HPC Cloud at SURFsara

— Offering cloud as a service

**SURF Research Boot Camp**

21<sup>st</sup> April 2016



Ander Astudillo <[ander.astudillo@surfsara.nl](mailto:ander.astudillo@surfsara.nl)>  
Markus van Dijk <[markus.vandijk@surfsara.nl](mailto:markus.vandijk@surfsara.nl)>



# What is cloud computing?



Wikipedia:

**“**Cloud computing is a jargon term **without** a commonly accepted non-ambiguous scientific or technical definition**”**



(July 2013)

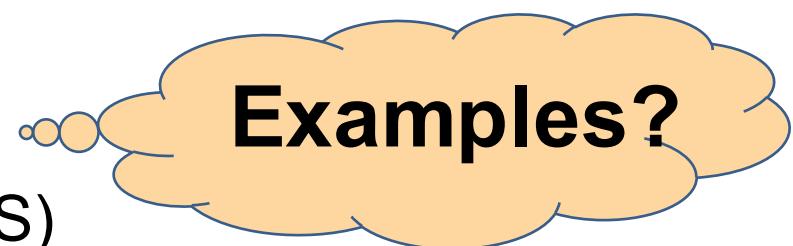
# What is cloud computing?

## Essential characteristics:

- On-demand self-service
- Broad network access
- Resource pooling
- Rapid elasticity
- Measured service

## Service models:

- Software as a Service (SaaS)
- Platform as a Service (PaaS)
- Infrastructure as a Service (IaaS)



# Agenda

- 1.- SURFsara's HPC Cloud **service**
- 2.- User experience
- 3.- Calculating  $\pi$



# SURFsara's HPC Cloud **service**



# What do we (SURFsara) want to offer?

## Services for **scientists** ...scientists ≠ systems gurus

... complex users' problems

- **Data:** big, dirty, non-structured...
- **Computation:** complex (e.g.: modeling, simulation)
  - Libraries nightmare
  - 3rd party, incompatibility, maintenance...



Familiar?

... test

... scratch

... trial and error

... share

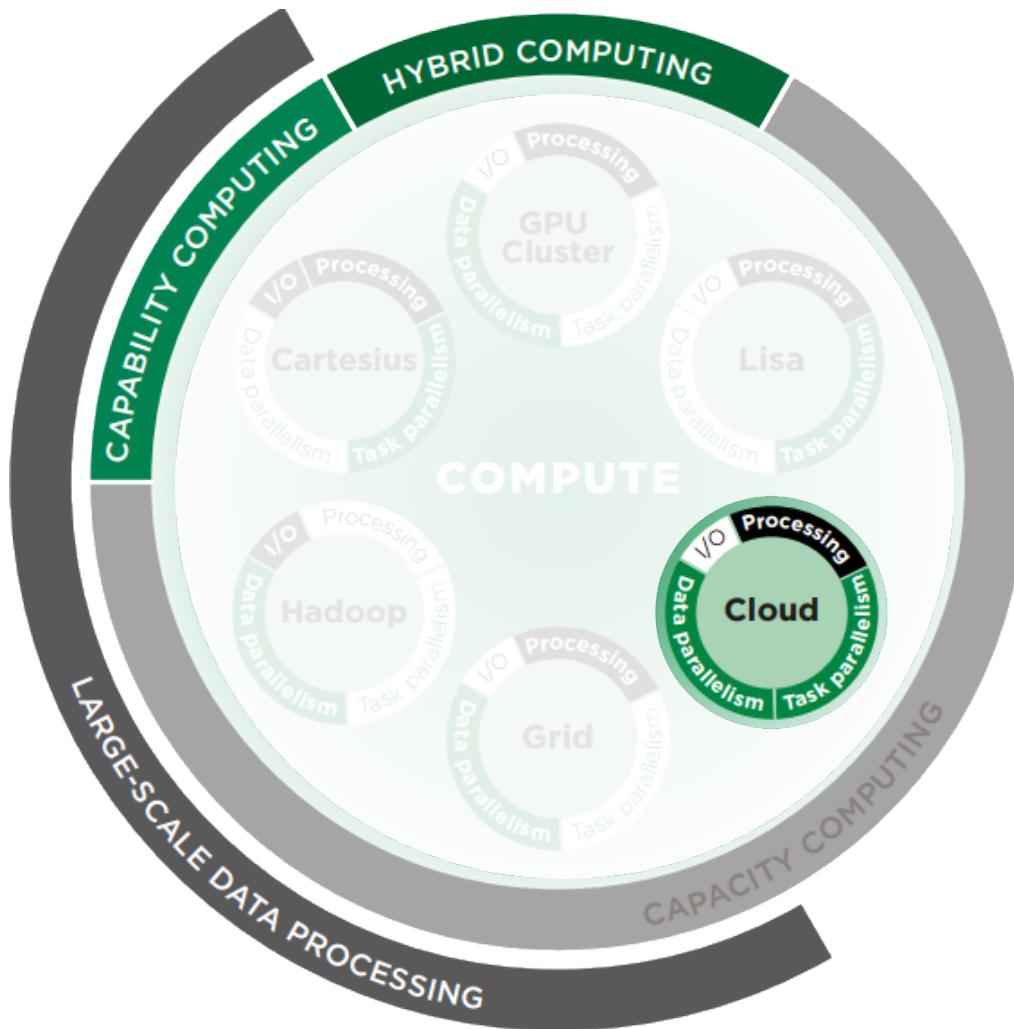
... show

... cooperate

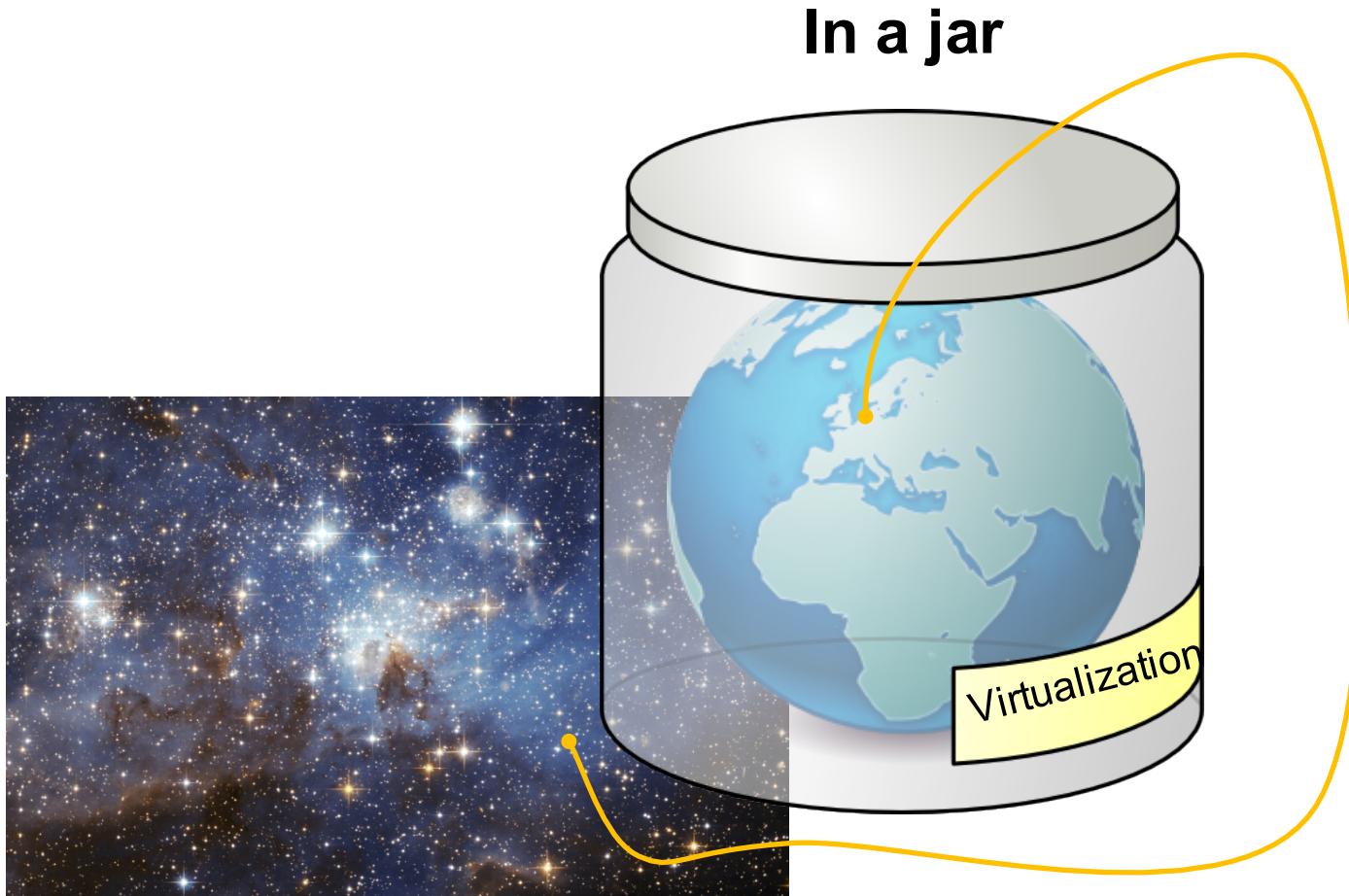
... flexibility

... privacy

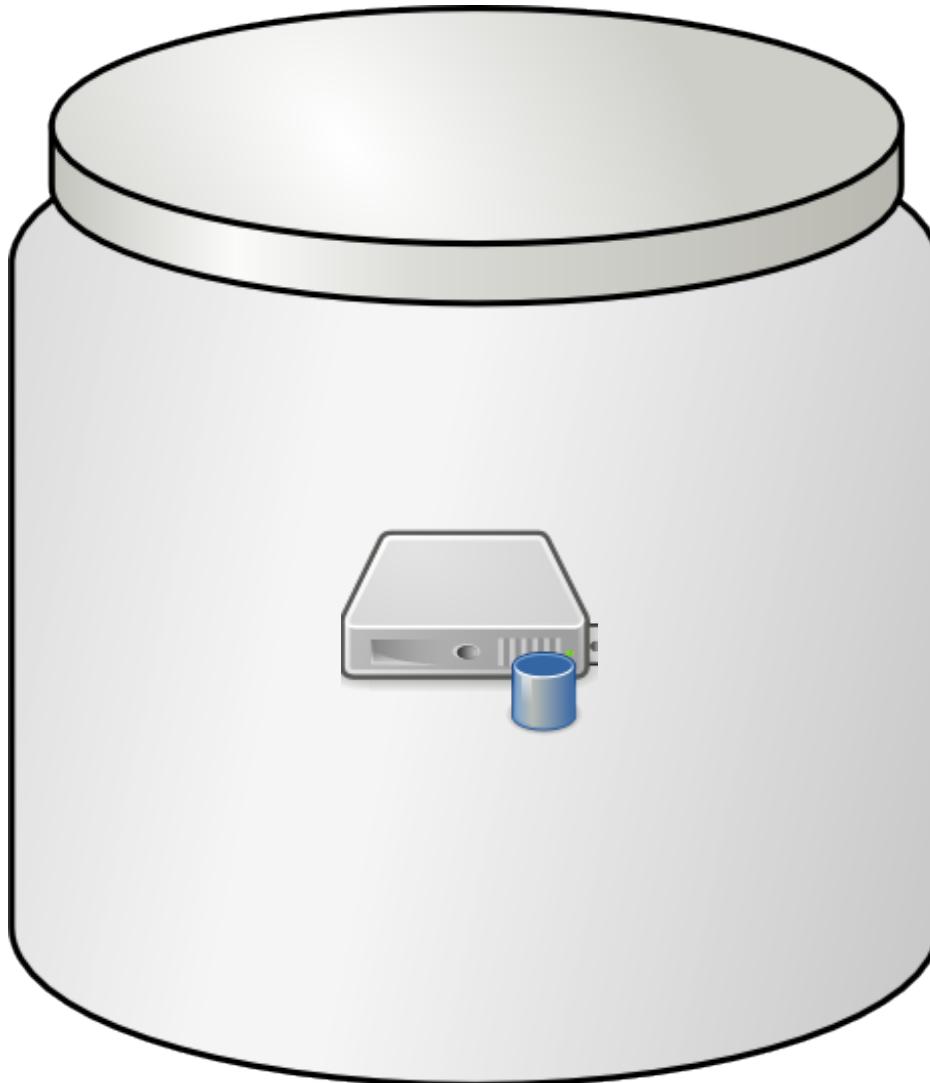
# Where does the HPC Cloud fit?



# What does our HPC Cloud offer?



# What do you see, as a user?

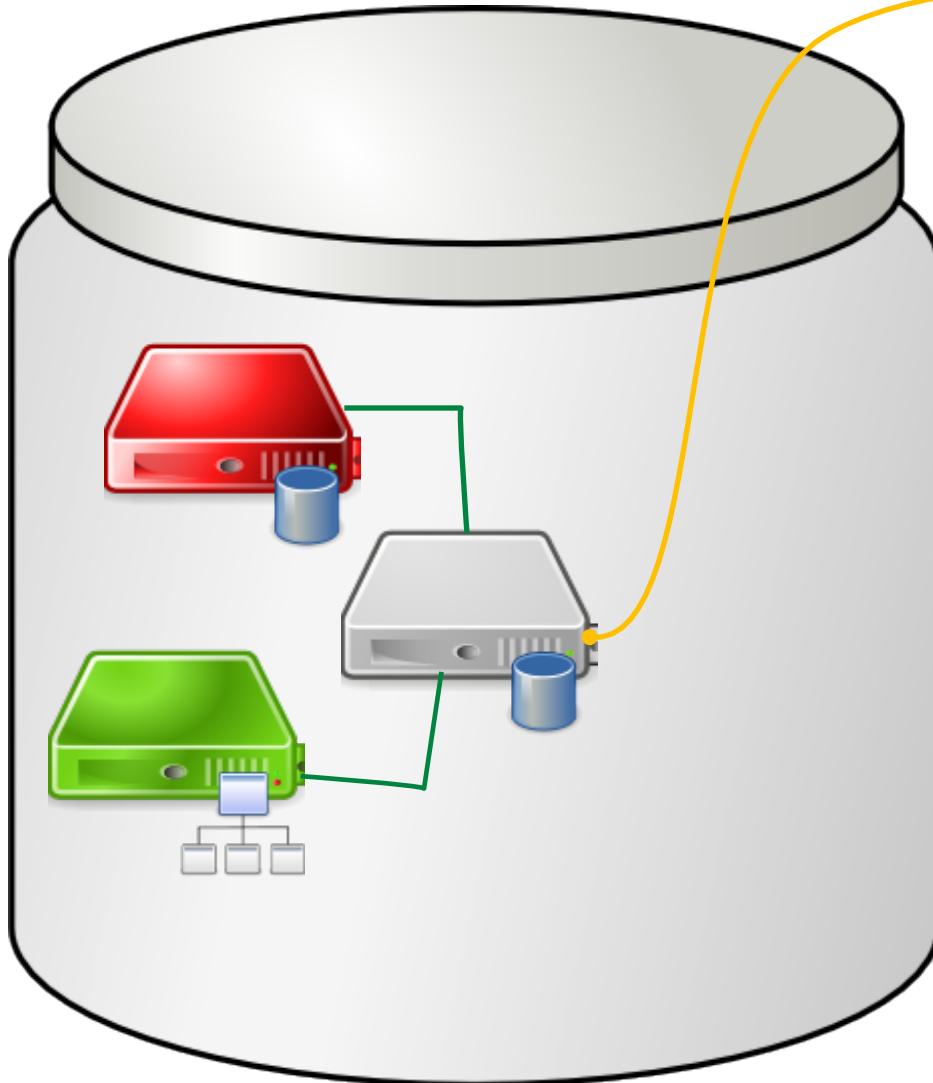


**A place to build a running system**

Build your own (virtual) machine:

- Hardware
  - CPU
  - Memory
  - Input/Output
    - Disk
    - Network interfaces
- Software
  - Operating System
  - Programs
  - Libraries

# What do you see, as a user? (II)



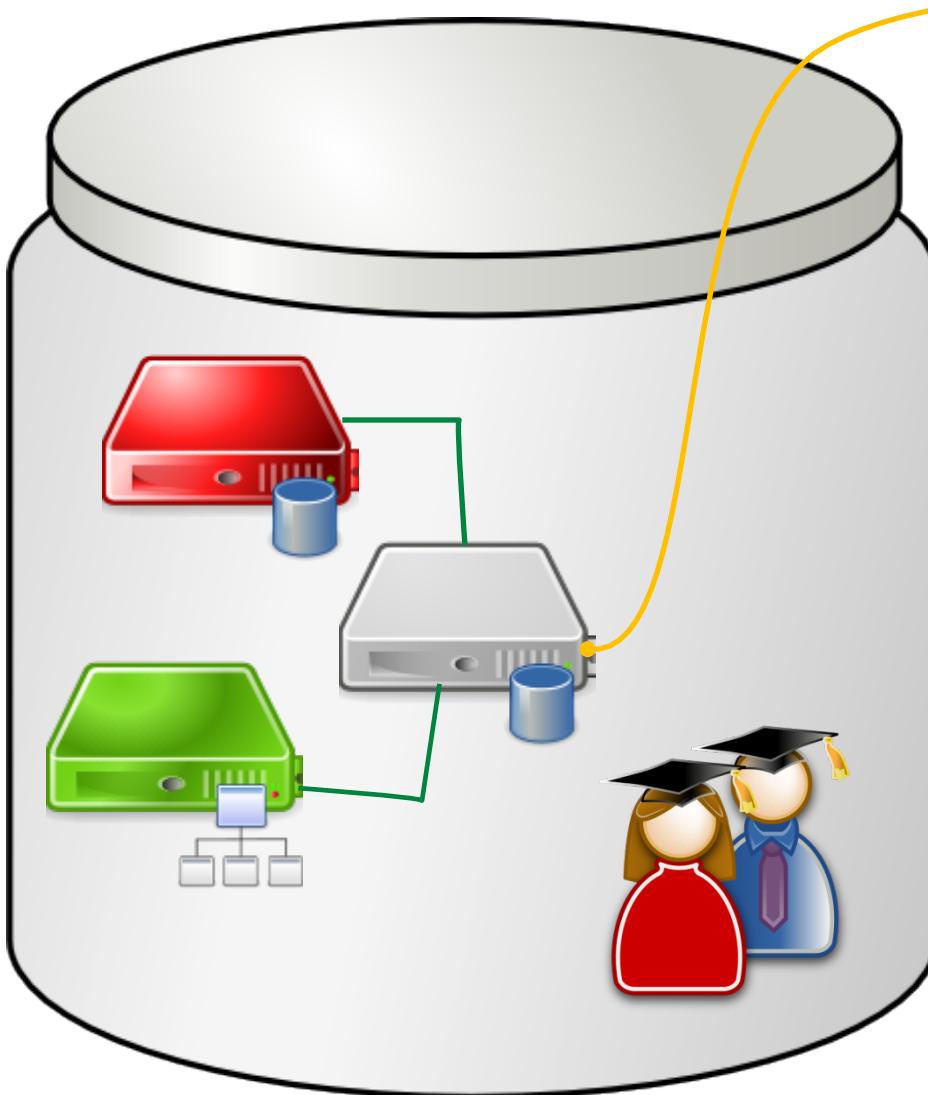
**A place to build a bunch of systems**

Build your own cluster:

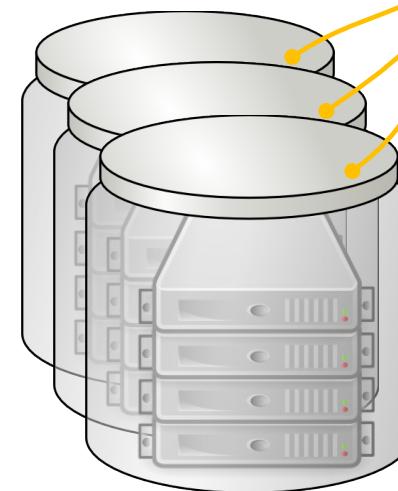
- Private network
- Internet access



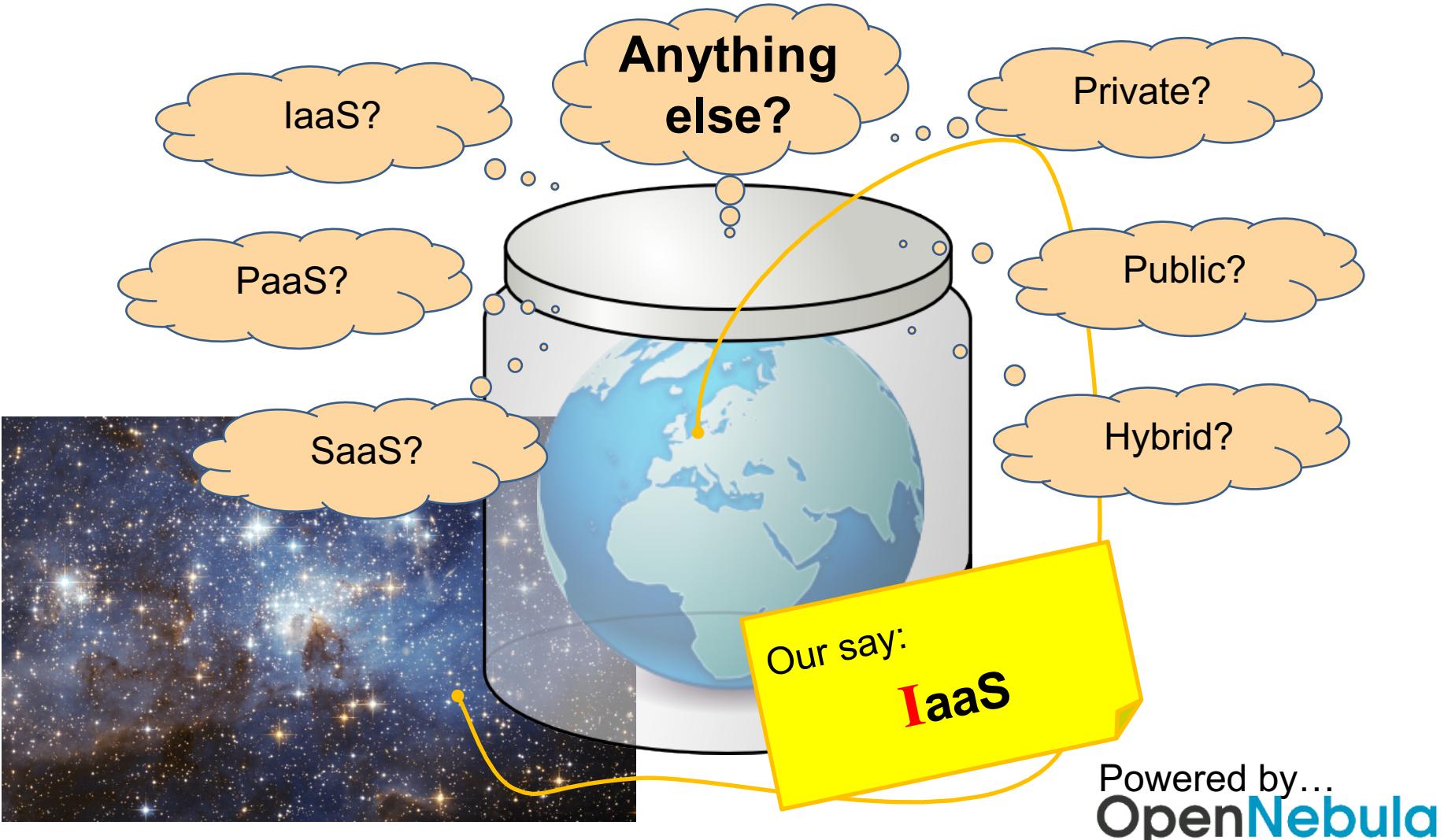
# What do you see, as a user? (and III)



A place to  
collaborate



# Thus...?



# User experience

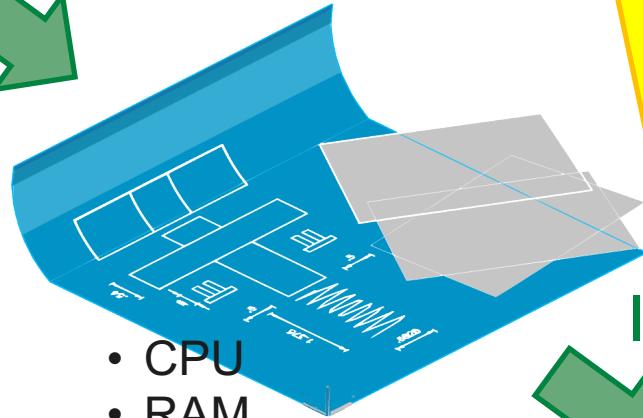


# IaaS: Your place to run VMs



- Data store
- Persistence
- ...

**Images**

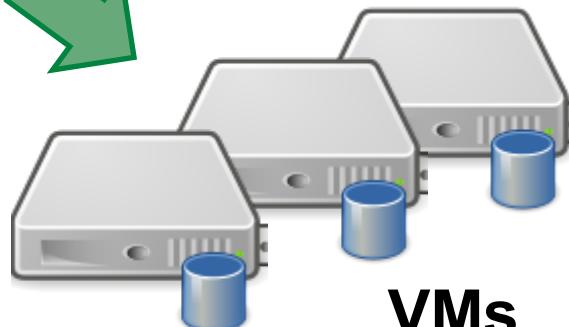


**Template**

- CPU
- RAM
- I/O
  - Disks
  - Network
- ...

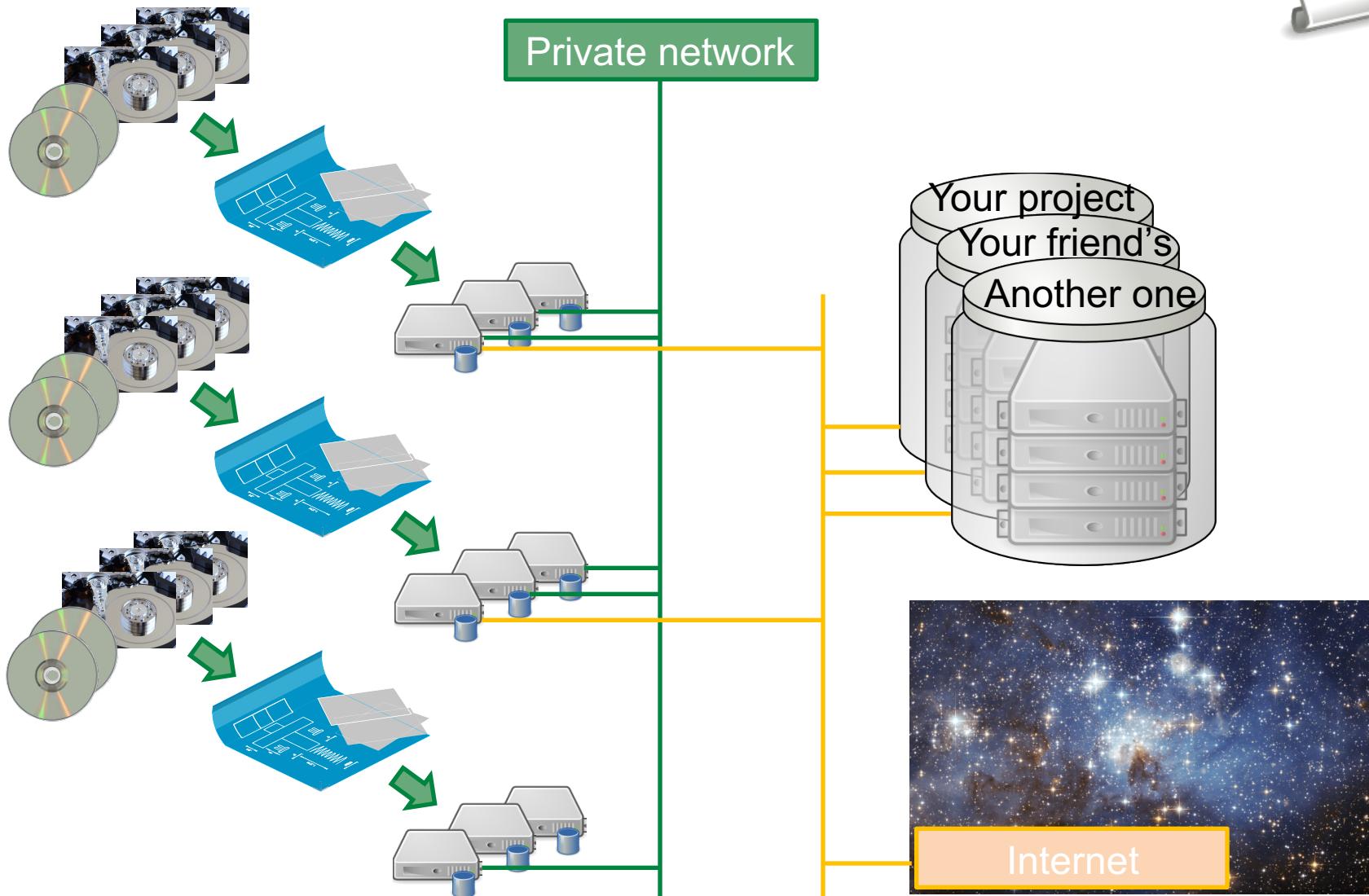


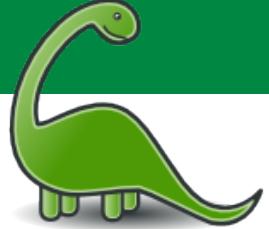
**Instantiate**



**VMs**

# IaaS: your interconnected VMs





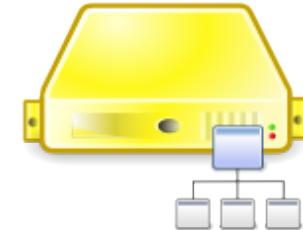
# Your application may need more...



**Scale up**

vs.

**Scale out**



# You get



## HPC

- Many nodes
  - Big nodes
- Fast interconnect
- Plenty of storage
  - Diverse storage
- Large memory

## Cloud

- Multi-purpose **versatility**
- Shape **elasticity**
- **Self-service** on-demand

## Service

- Project-based
  - Own quotas
  - Private network
  - Block storage
- Dynamic DNS
- Documentation
- Support

## OpenNebula

- Web interface
- User groups
- (Custom) AppMarket
- Accounting



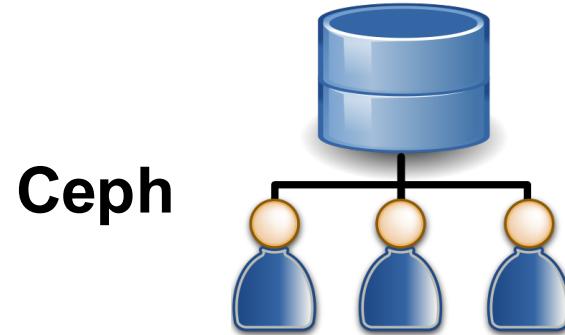
## Per project



User accounts



CPU time



Ceph



Local SSD



## Users like & leverage...

- Flexible software **mix**
- **Big VMs**
- **Elasticity**
- Provide their own service to **their own users**
- Software that requires **licenses**
- Set up, test and deploy **workflows**
- Deliver training; **courses**
- **Intensive** computing

...from diverse **fields**:

- Biology
- Genetics
- Informatics
- Chemistry
- Ecology
- Linguistics
- Robotics
- Business
- Social sciences
- Engineering
- Humanities
- Water management
- ...



## Recently **added** and near **future** features:

Open**Nebula** • Latest release of OpenNebula



**Ceph storage; expansion**

- Distributed object store and file system
- Cope with increasing load



• **GPU processing**

- Highly parallel structure
- Program specifically to use it

# Calculating $\pi$

3



# MARKUS HERE

## MARKUS HERE

- Hands-on: Calculating PI

**Request:** <https://e-infra.surfsara.nl>  
**UI:** <https://ui.hpccloud.surfsara.nl>  
**Doc:** <https://doc.hpccloud.surfsara.nl>

## Credits

Images: Wikipedia, Science Park, RRZE icons,  
NIST, nVidia, Ceph  
Slides: SURFsara colleagues

Ander Astudillo  
[<ander.astudillo@surfsara.nl>](mailto:ander.astudillo@surfsara.nl)

Markus van Dijk  
[<markus.vandijk@surfsara.nl>](mailto:markus.vandijk@surfsara.nl)



# Practicalities:

**Start at:** <http://doc.hpccloud.surfsara.nl/wshop-uihe-2015-12-11>

**Work *in pairs***

*each with your own credentials on your own laptop*

**Follow** *the instructions at your own pace*

*focus on **Part A***

**Call** *Markus and Ander*

*for: a) doubts; b) when feeling stuck; c) “food for brain” hints*

**UI:** <https://ui.hpccloud.surfsara.nl>

**Project:** surfcursus

**Username:** bootcamp1xz

**Password:** HPCI@@rzen1xz

**tutorial**

**SURF SARA**

# SURFsara's HPC Cloud implementation

Appendix



# Hardware



## 1 High-mem node

1x 40-core Intel(R) Xeon(R)  
CPU E7- 4850 @ 2.00GHz

## 2 TB RAM

Ethernet 2x10GE  
2.9 TB local SSD disk

## 32 HPC nodes

11x **64 with HT**  
32-core Intel(R)  
Xeon(R) CPU E5-2640  
v3 @ 2.60GHz  
256 GB RAM  
Ethernet 2x10GE  
1.1 TB local SSD disk

21x **64 with HT**  
32-core Intel(R)  
Xeon(R) CPU E5-2698  
v3 @ 2.30GHz  
256 GB RAM  
Ethernet 2x10GE  
2.9 TB local SSD disk

## 12 GPU nodes

12x **32 with HT**  
32-core Intel E5-2640  
256 GB RAM  
Ethernet 2x10GE  
800 GB local SSD disk  
4x Nvidia K2 Grid **GPU**



## Network

(Arista DCS-7504)  
144 ports **10GE, 1-hop**

## Storage

900TB Ceph

**& 85.5 TB  
local SSD**

# Network overview

