

HPC Cloud at SURFsara

— Offering cloud as a service

SURF course
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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?

NIST:

“ Cloud computing is a model for enabling **ubiquitous**, **convenient**, **on-demand** network **access** to a **shared pool** of configurable computing resources (e.g., networks, servers, storage, applications, and **services**) that can be **rapidly** provisioned and released with **minimal** management effort or service provider interaction. ”

Piece by piece:

- Resources pool
- Shared
- Access: ubiquitous + convenient + on-demand
 - Network
- Provider releases fast
- Consumer gets **services** easily

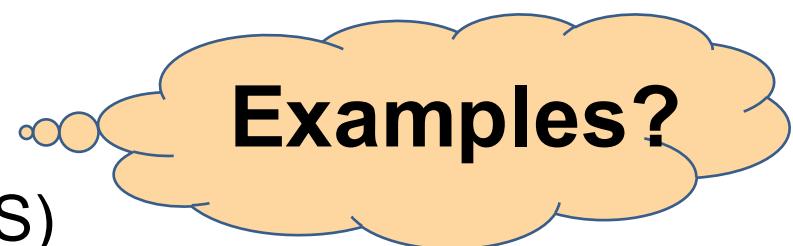
What is cloud computing?

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.- SURFsara's HPC Cloud **implementation**



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...

Agreed?

... test

... scratch

... trial and error

... share

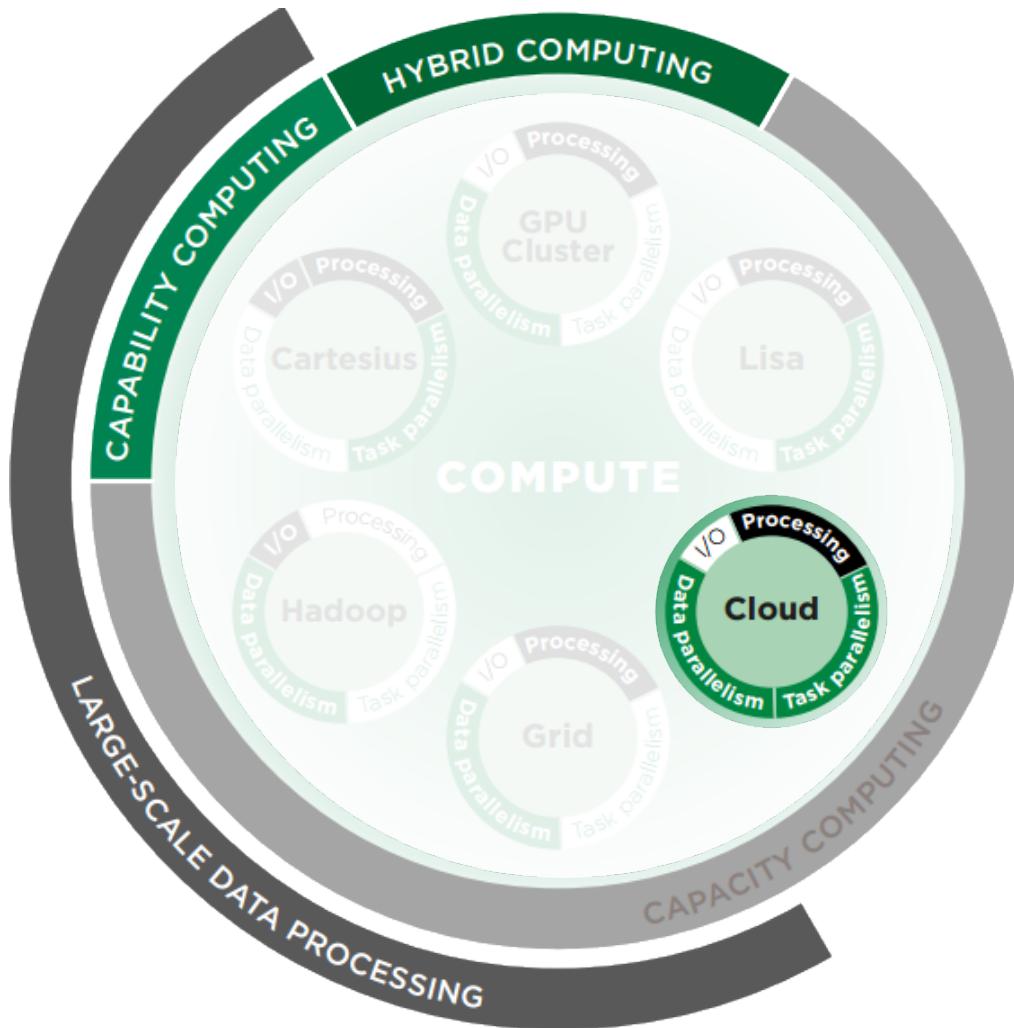
... show

... cooperate

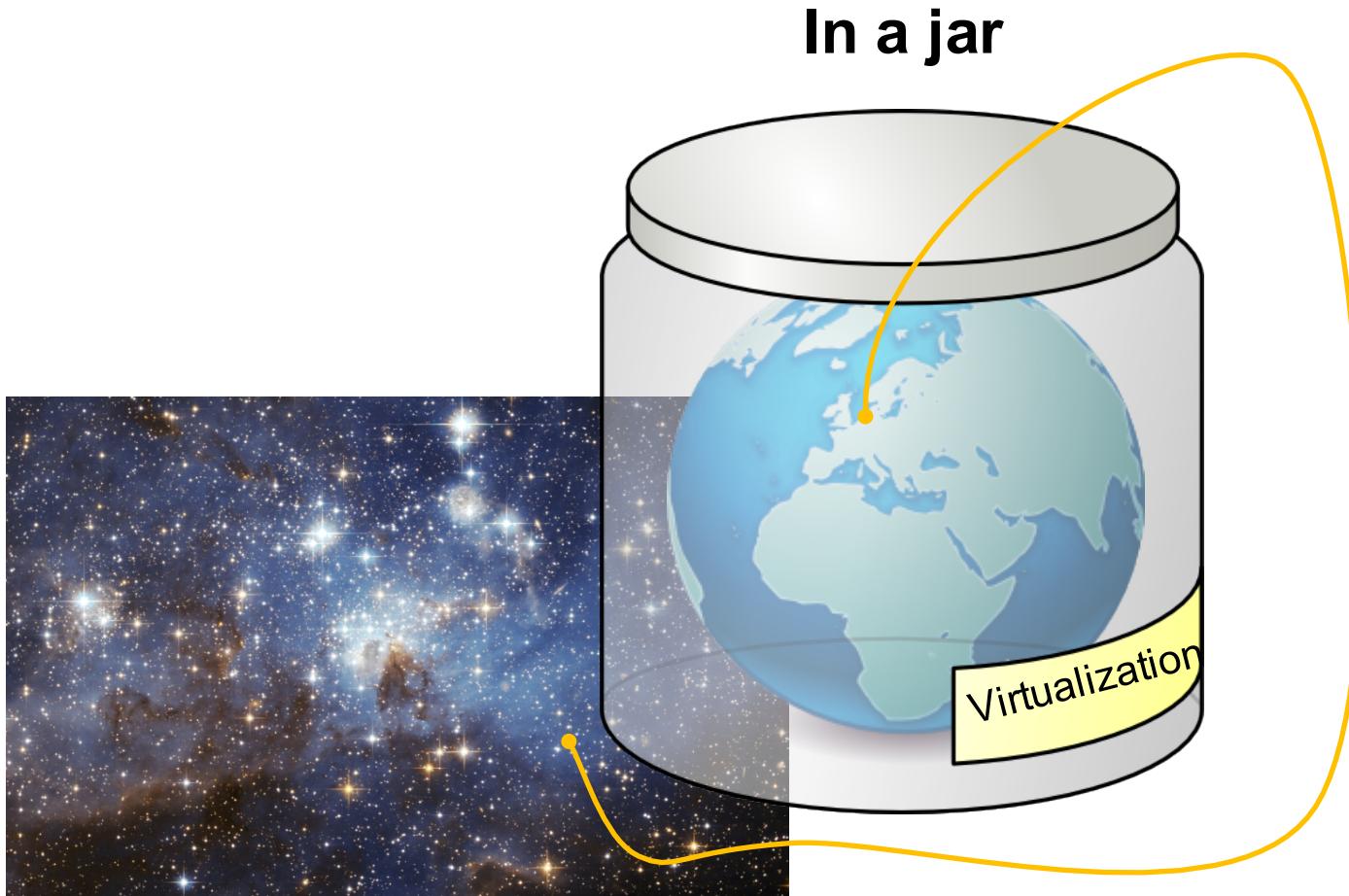
... flexibility

... privacy

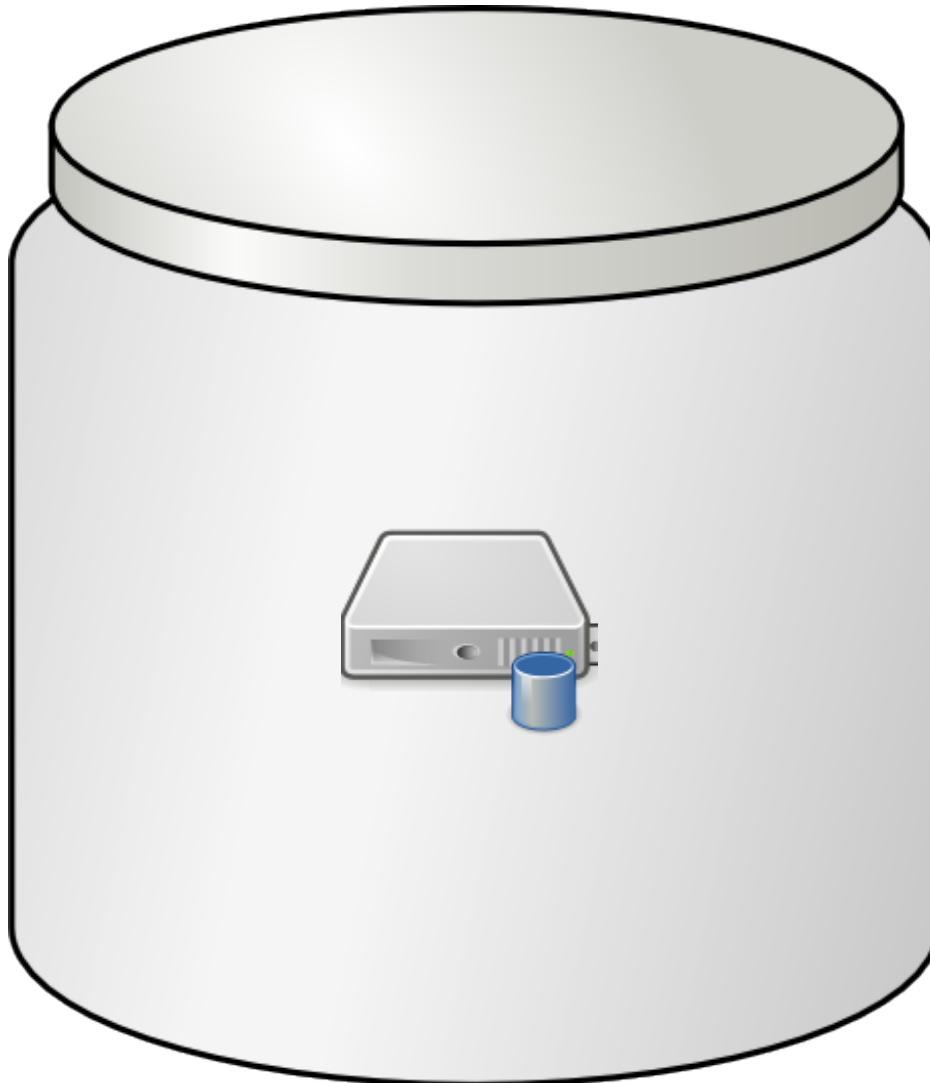
Where does the HPC Cloud fit?



What does our HPC Cloud offer?



What do you see, as a user?

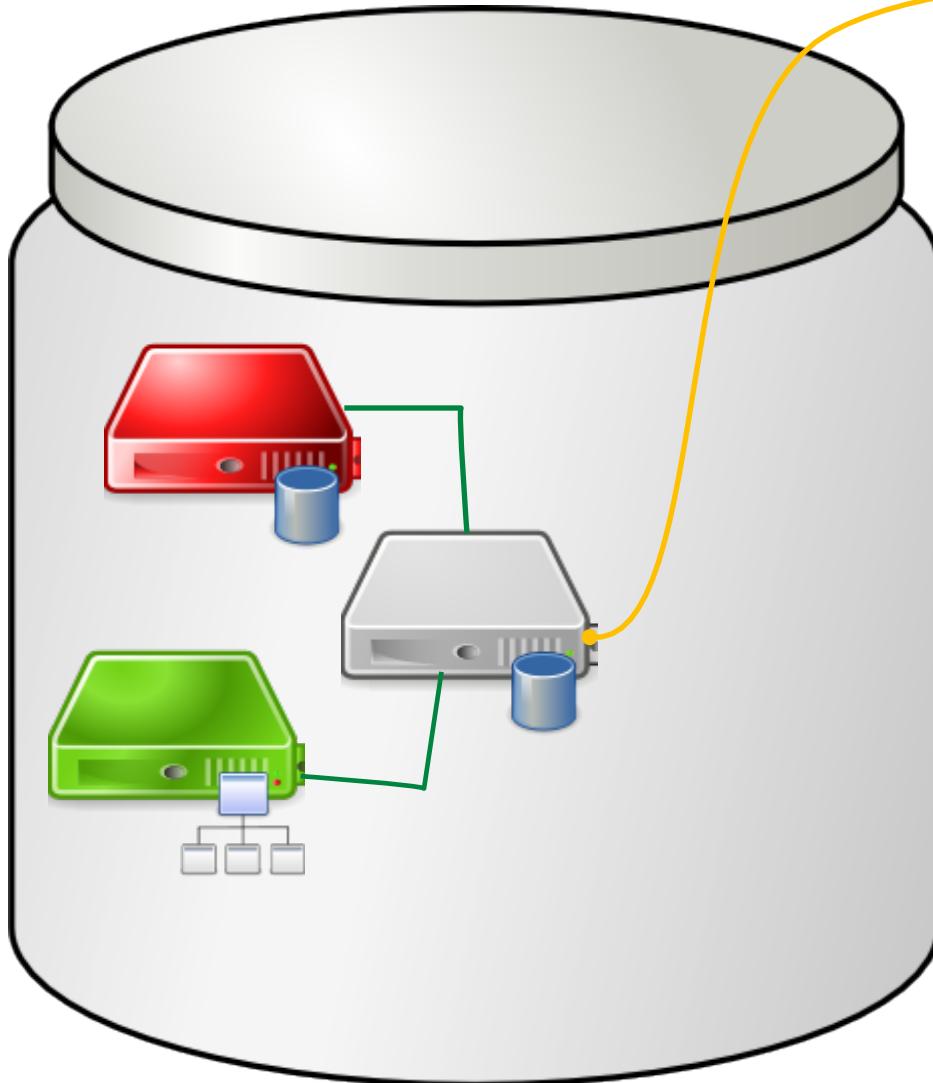


A place to build a running system

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)



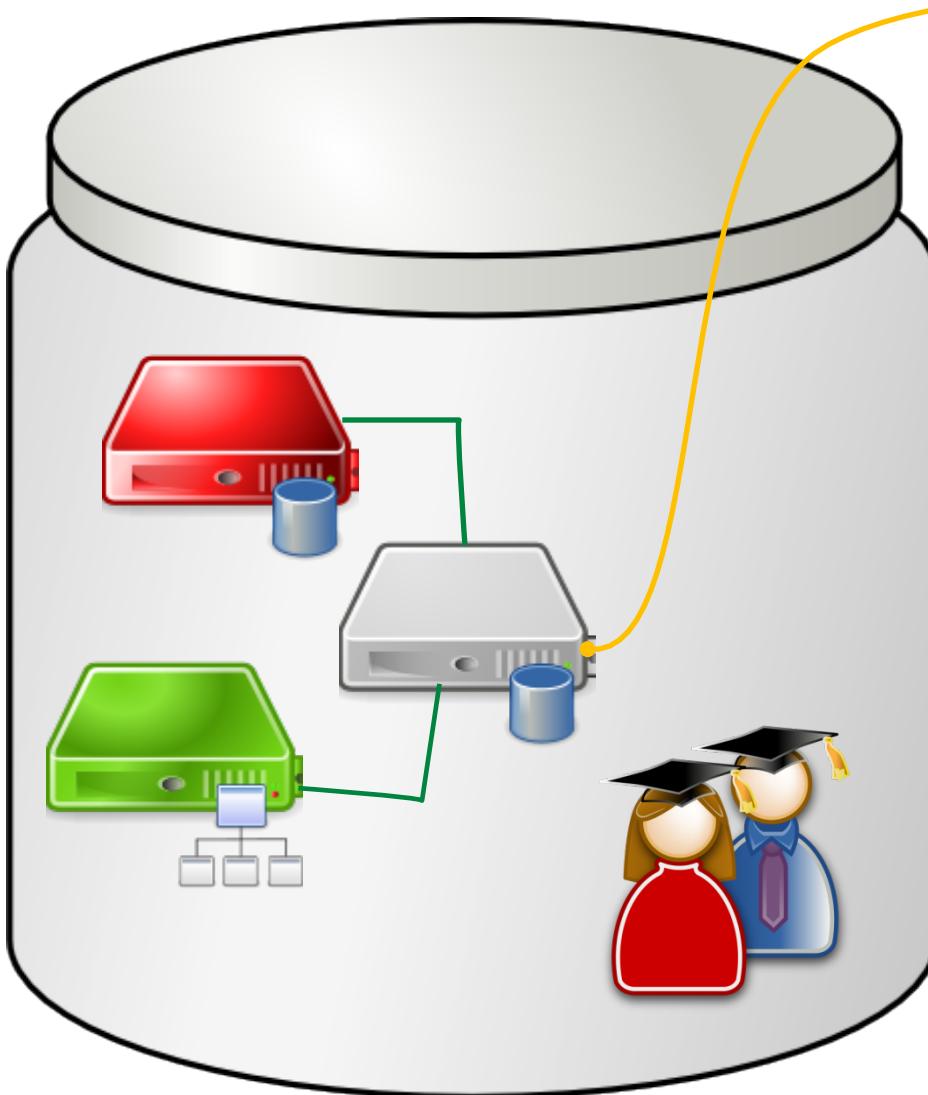
A place to build a bunch of systems

Build your own cluster:

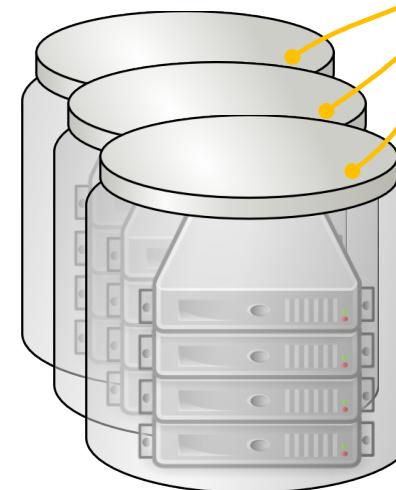
- Private network
- Internet access



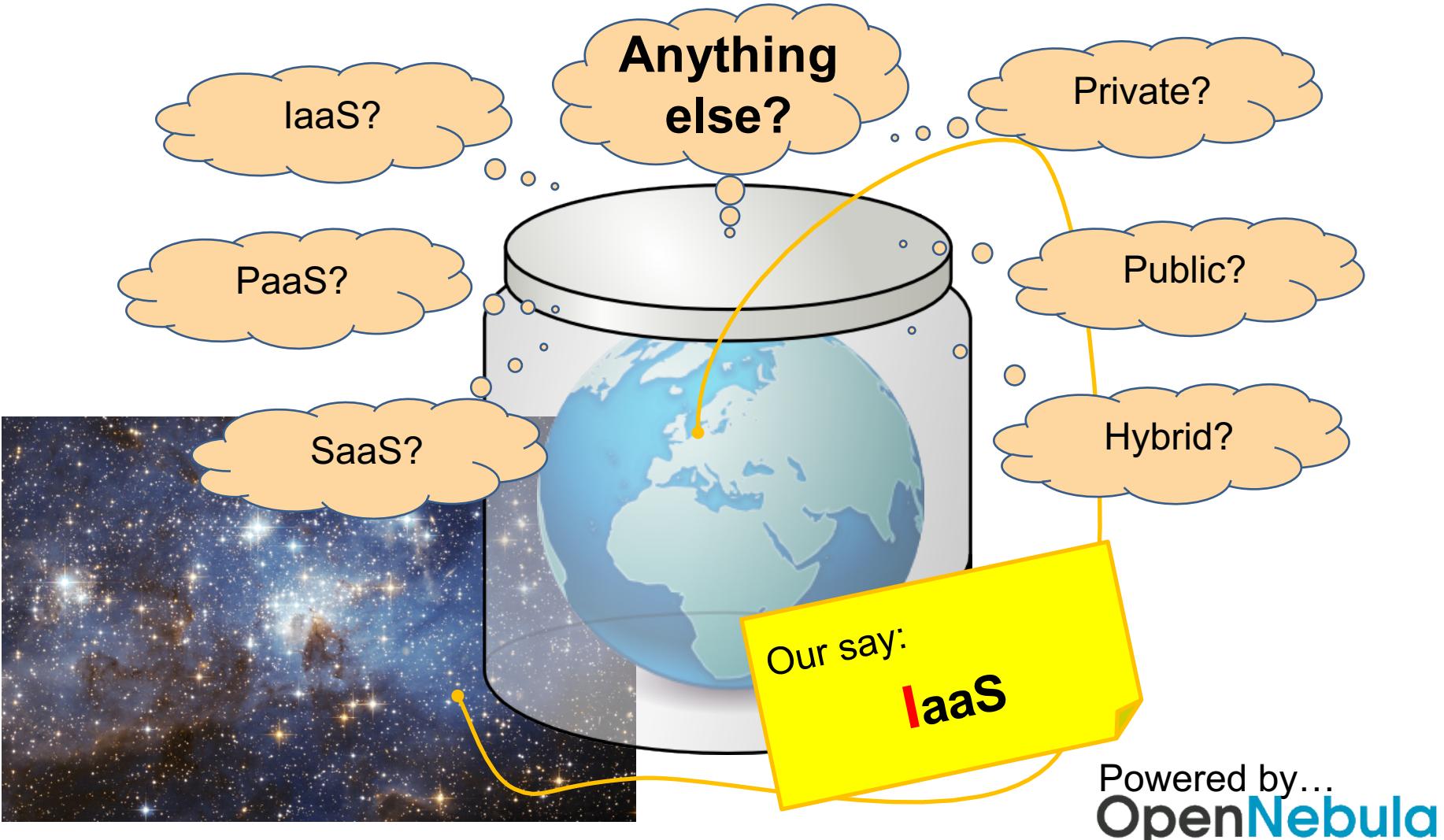
What do you see, as a user? (and III)



A place to
collaborate



Thus...?



User experience

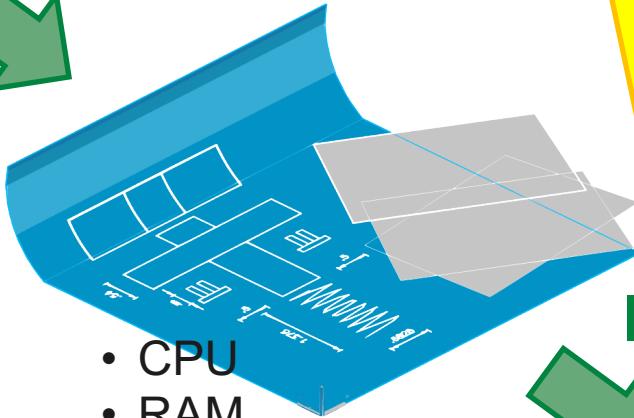


IaaS: Your place to run VMs



- Data store
- Persistence
- ...

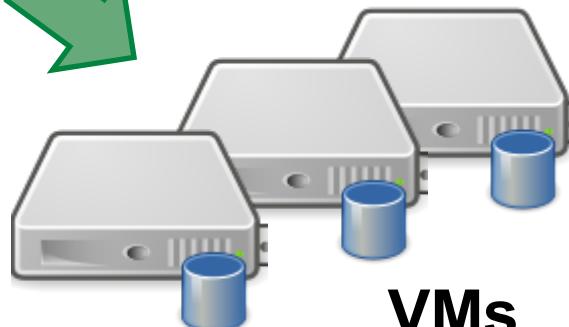
Images



Template

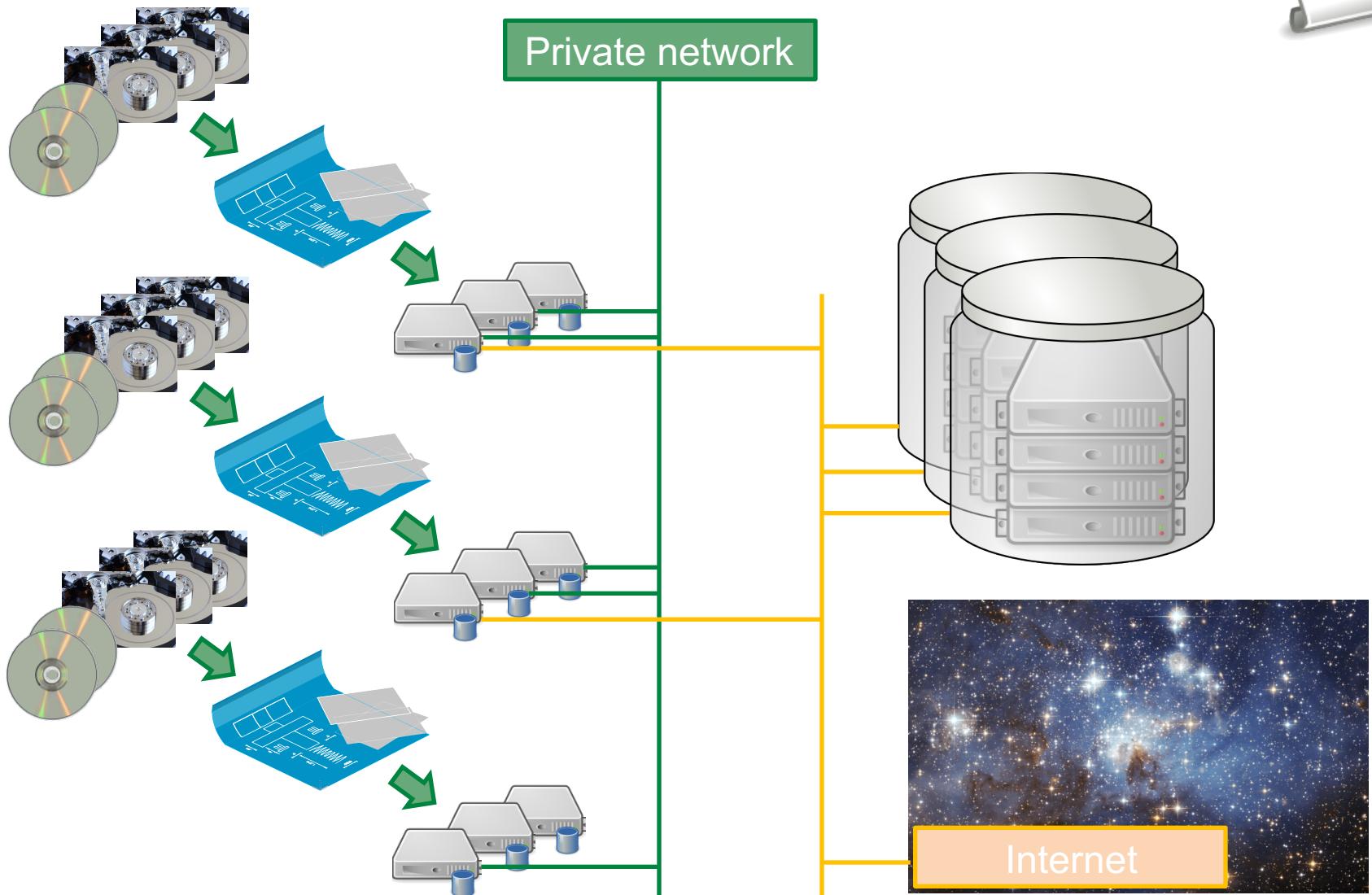


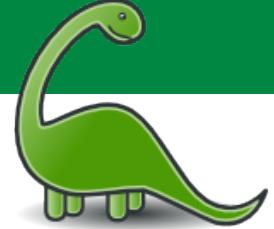
Instantiate



VMs

IaaS: your interconnected VMs





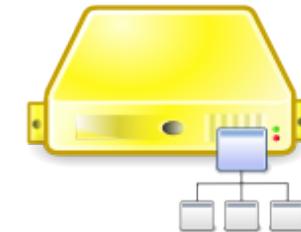
Your application may need more...

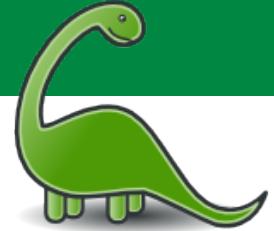


Scale up

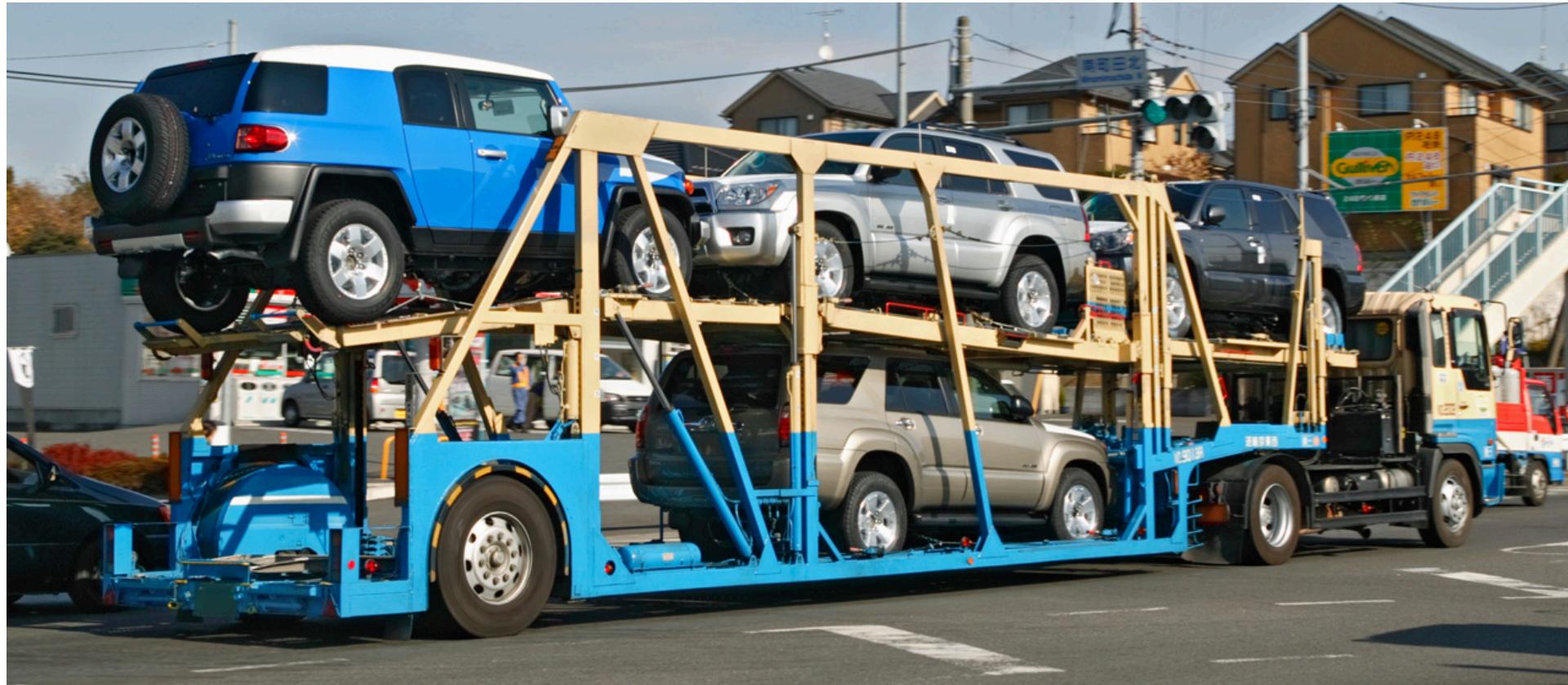
vs.

Scale out





e.g. **transport people**
may need more room...



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



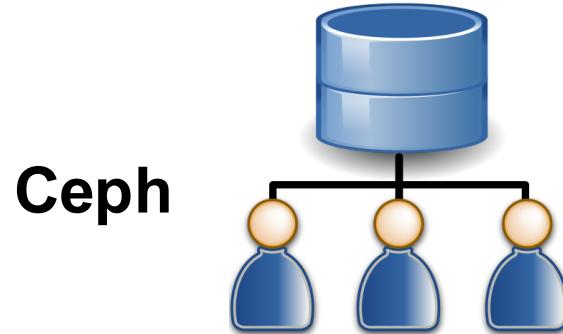
Per project



User accounts



CPU time



Ceph



Local SSD

Accounting (& figures)



Since 2009 until March 2015:

500+ requests
42.000+ VM



Per project

270+ projects
active: 240+

User accounts

500+ users
active: 400+

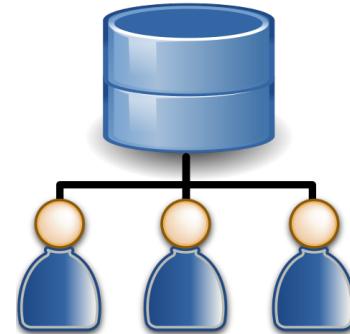


CPU time

950+ years

Ceph

80+ TB in use



Local SSD

4.800+ images



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

SURFsara's HPC Cloud implementation

3



Hardware



12 GPU nodes

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

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 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

core Intel(R)
Xeon(R) CPU E5-2698
v3 @ 2.30GHz
256 GB RAM
Ethernet 2x10GE
2.9 TB local SSD disk



Network

(Arista DCS-7504)

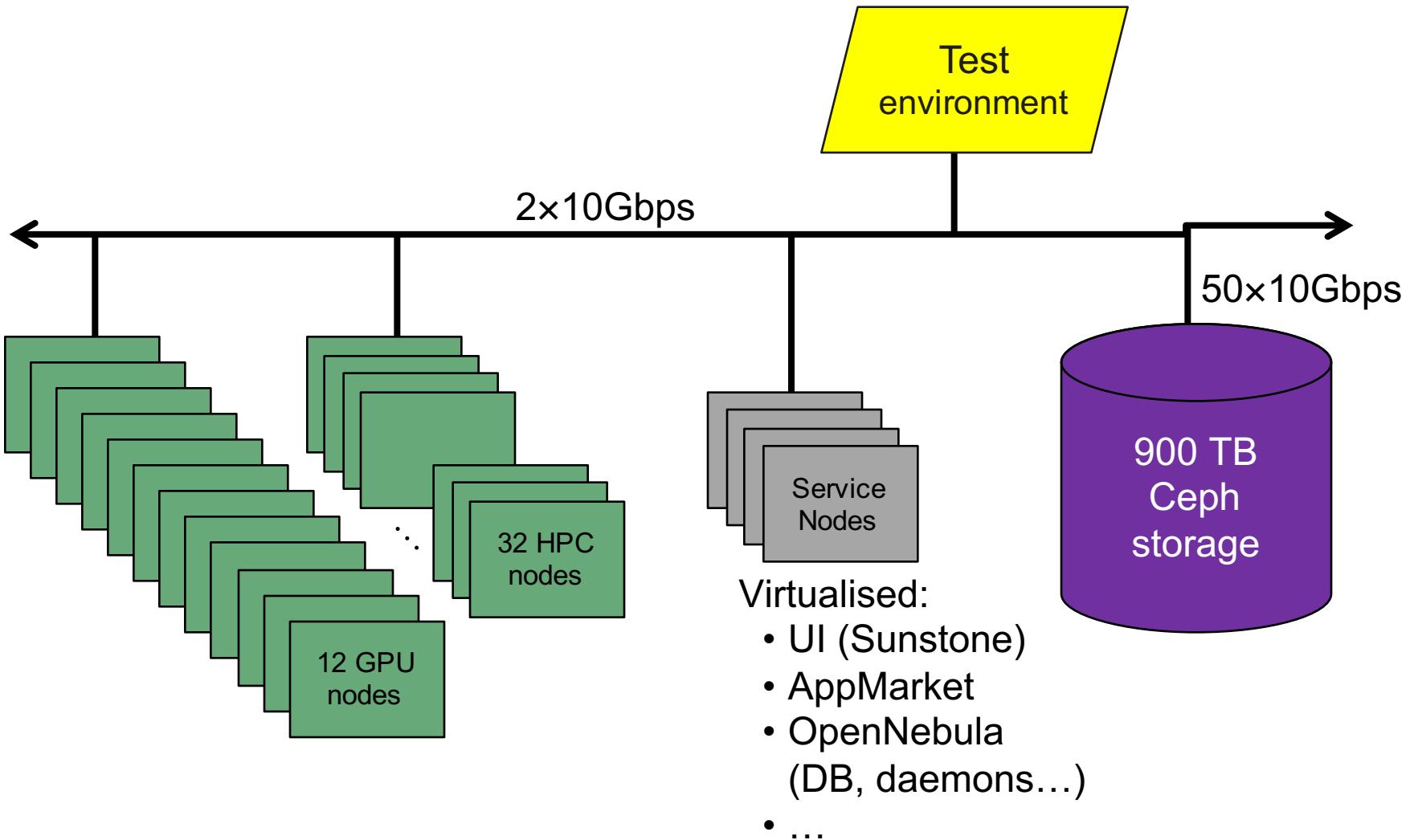
144 ports **10GE, 1-hop**

Storage

900TB Ceph

& 85.5 TB
local SSD

Network overview



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

Credits

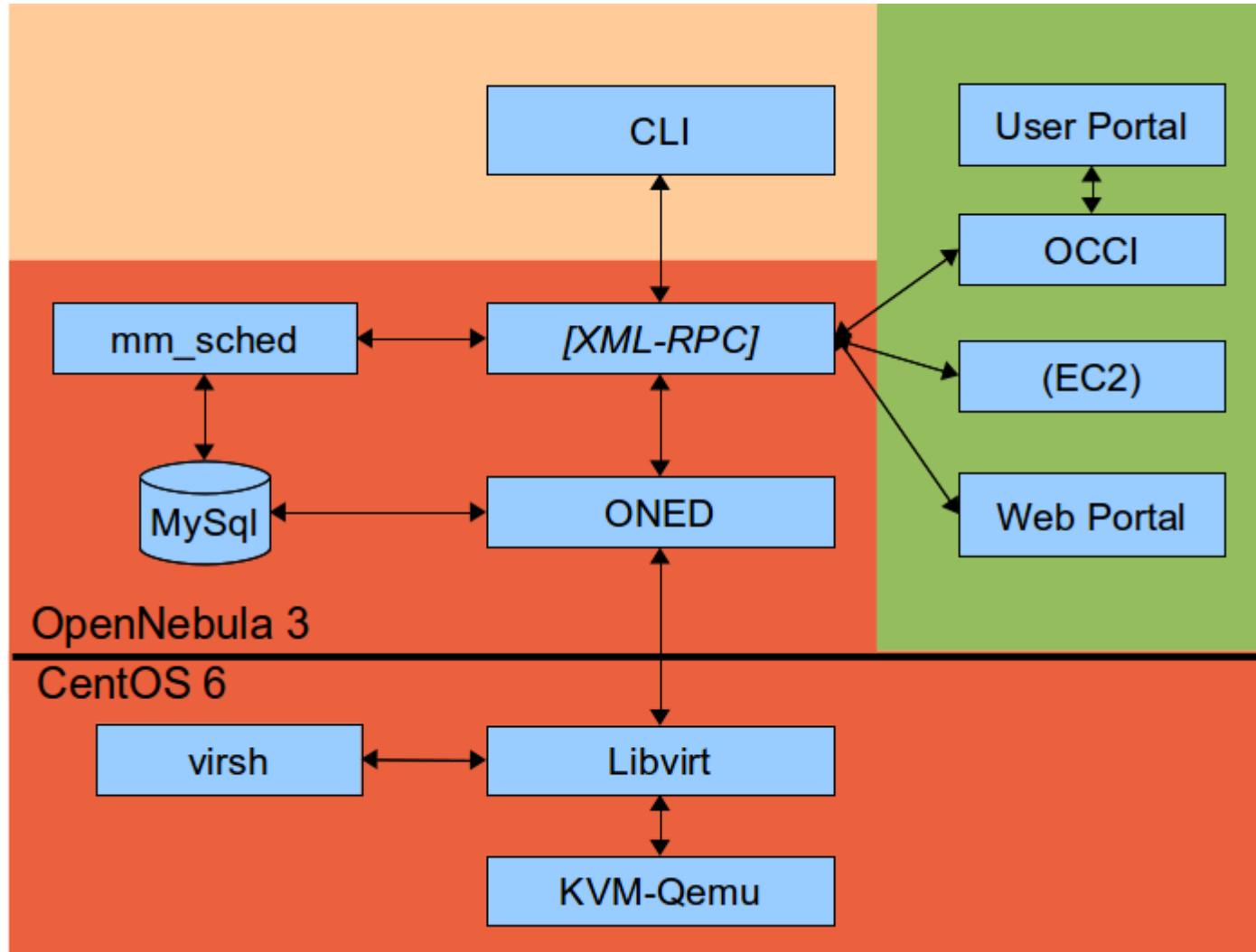
Images: Wikipedia, Science Park, RRZE icons,
NIST, nVidia, Ceph
Slides: SURFsara colleagues

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Software



Ceph

