



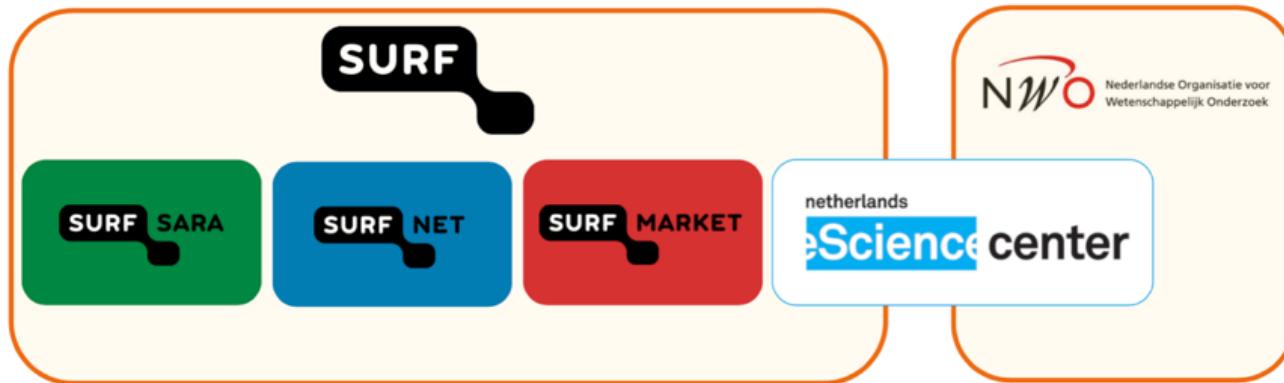
# HPC Cloud at SURFsara

— Offering computing resources as a commodity

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



# The SURF family



# SURFsara services: compute

## Which compute service for which research question?

SURF offers several services in the area of High Performance Computing (HPC). Which one do you need for your research?

[Learn more](#)



## Lisa Compute Cluster: extra processing power for research

Lisa Compute Cluster combines processing power with user friendliness. Are the limits of your own system inhibiting your research?

[Read more >](#)

## Dutch National Supercomputer Cartesius

The Dutch National Supercomputer Cartesius is especially suited to large-scale parallel applications, such as extensive and complex simulations.

[Read more >](#)

## HPC Cloud: your flexible compute infrastructure

HPC Cloud gives you and your project team complete control over your computing infrastructure, from a single work station to a complete cluster.

[Read more >](#)

## Use Grid for calculations with extremely large research data sets

Do you want to process and store large-scale and complex data? The Grid may very well be suitable for your research project.

[Read more >](#)

# SURFsara services: storage

## Object Store: store large quantities of data

Object Store provides a general purpose online storage service that may be used for storing large quantities of data.

[Read more >](#)

## Secure, long-term storage with Data Archive

The Data Archive is the centralised location for data archiving and (long-term) storage, even in volumes running into the petabytes.

[Read more >](#)

## SURFdrive: Personal cloud storage service

Store, synchronise and share your documents easily with SURFdrive. SURFdrive is a personal cloudservice for the Dutch education and research.

[Read more >](#)

## Data Persistent Identifier: permanent references to find data always

Persistent identifiers (PIPs) ensure the findability of your data, now and always. PIPs are comparable to the ISBN numbers assigned to books.

[Learn more](#)

## Research Drive: securely and easily store and share research data

Research Drive is a cloud-based shared-storage environment specifically designed for large storage quotas. Learn more!

[Learn more](#)



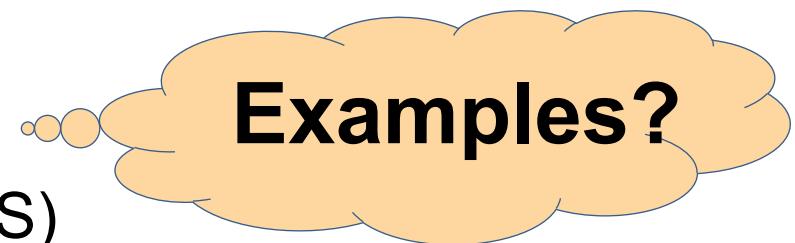
# A definition: cloud computing

## 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)



# Cloud computing landscape

**Atlantic.net** Cloud VPS hosting and servers

4.0 ★★★★☆ 4 REVIEWS >

"We use all of the features. It has performed exceptionally for us."

Senior Manager, IT

**IBM Cloud** Multifaceted cloud

4.4 ★★★★★ 49 REVIEWS >

"IBM cloud provides more scalability and reliability with high-end security. It is used for data storage..."

Associate, IT

**Verizon Cloud** Managed services

4.9 ★★★★★ 7 REVIEWS >

"We felt they understood our customers and the need to keep data secure."

Vice President, Administration

**Rackspace** Dedicated servers

4.5 ★★★★★ 33 REVIEWS >

"Rackspace handles so much that it's hard to imagine our business running smoothly without them."

Vice President, Administration

**1&1** Website and hosting tool

4.6 ★★★★★ 7 REVIEWS >

"Overall we are happy with 1and1.com, they have allowed more control and flexibility than the previous host arrangement..."

Manager, IT

**DigitalOcean** Simple cloud

4.5 ★★★★★ 8 REVIEWS >

"It has been great so far, we hope they will grow even bigger."

Director, Sales

**VMware** Virtualization public cloud

4.3 ★★★★★ 15 REVIEWS >

"VMware has the best 3rd party applications and support, and is a gold standard in virtualization."

Chief Technology Officer, OArea

**Oracle Cloud** Integrated public cloud for business applications

4.4 ★★★★★ 25 REVIEWS >

"Oracle cloud has increased business agility, lowered costs, and reduced complexity..."

Manager, IT

**Red Hat** Open cloud technology for enterprise

5.0 ★★★★★ 1 REVIEW >

"Red hat was chosen for the cost and flexibility. It's used for security of data..."

Associate, IT

**MageCloud eCommerce**

5.0 ★★★★★ 1 REVIEW >

"As a result [of MageCloud], our feedback cycle has dramatically improved."

Analytics Consultant, IT Consultancy

**CloudSigma** International IaaS provider

4.5 ★★★★★ 31 REVIEWS >

"I'm glad that CloudSigma exists because they protected my data for a long time, which also benefited my organization..."

Vice President, IT

**Hyve** Enterprise-level cloud and infrastructure

4.6 ★★★★★ 5 REVIEWS >

"Hyve has performed much better than our previous product and the benefits are numerous..."

Senior Manager, Administration

**Ubiquity Hosting**

4.8 ★★★★★ 2 REVIEWS >

"It has performed great and really helped improve our organization..."

Manager, IT

**Togglebox** VPS hosting and cloud

4.6 ★★★★★ 4 REVIEWS >

"We had many other choices before Togglebox, but Togglebox had the most flexible, low-cost solutions for cloud services..."

Manager

**Navisite** Hosting, app management

4.7 ★★★★★ 3 REVIEWS >

"The DaaS solution has been one of the primary differentiators of NaviSite."

Marketing Technology Manager, DoubleHorn

**Vultr** Cloud servers for compute

5.0 ★★★★★ 2 REVIEWS >

"It is quite convenient to use and easy to configure, also it has many options."

Director, IT

Screen captures: <https://clutch.co/cloud>

# Agenda

- 1.- SURFsara's HPC Cloud **service**
- 2.- **User** experience
- 3.- Demo
- 4.- SURFsara's HPC Cloud **implementation**



# SURFsara's HPC Cloud service

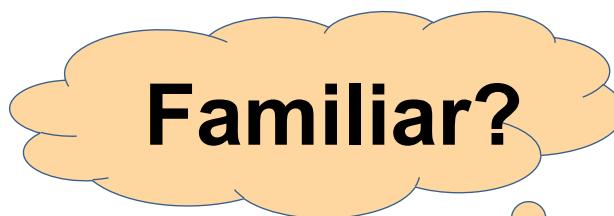


# What do we (SURFsara) want to offer?

## Services for **scientists** ...scientists $\neq$ 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

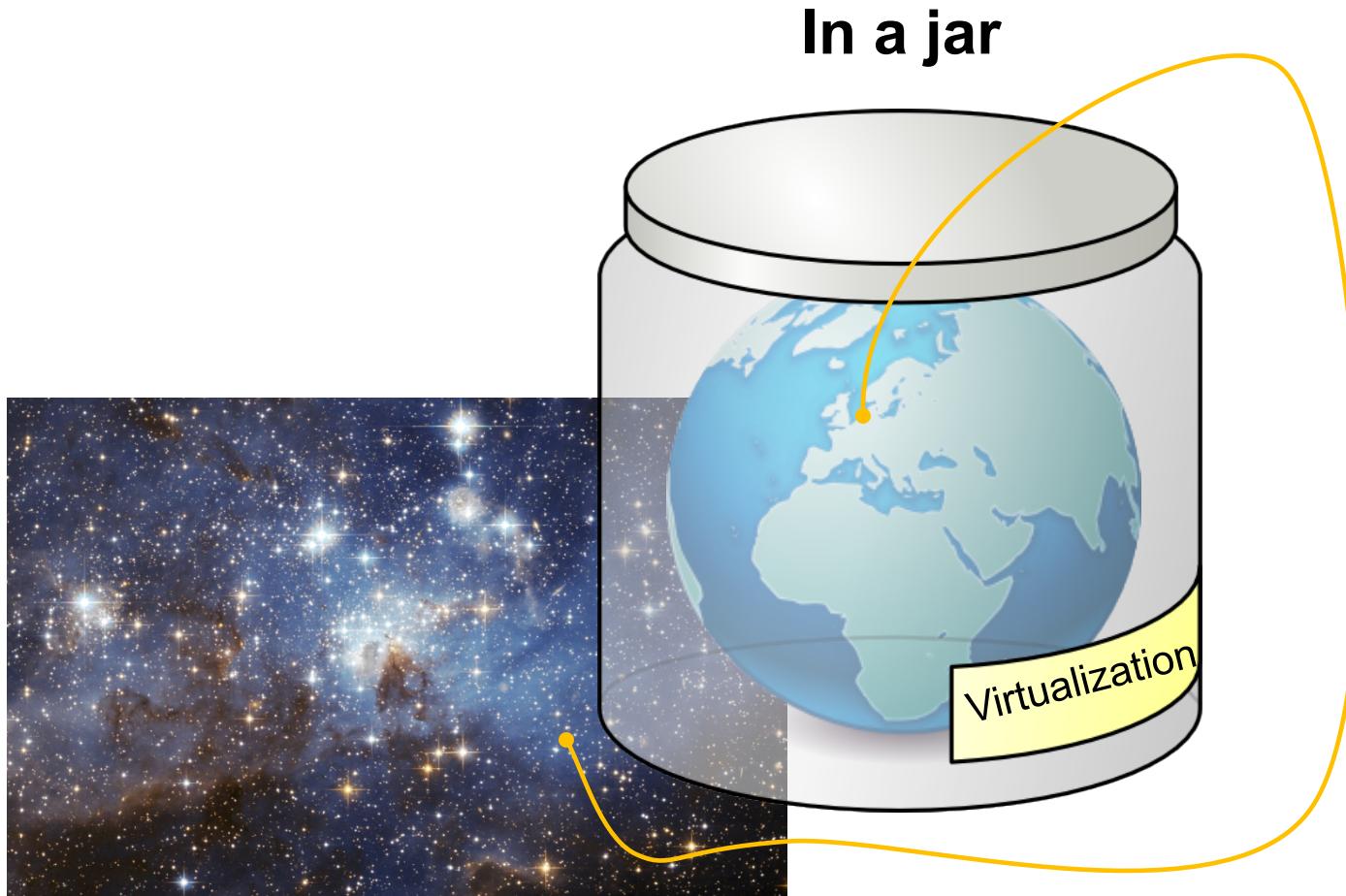
... show

... cooperate

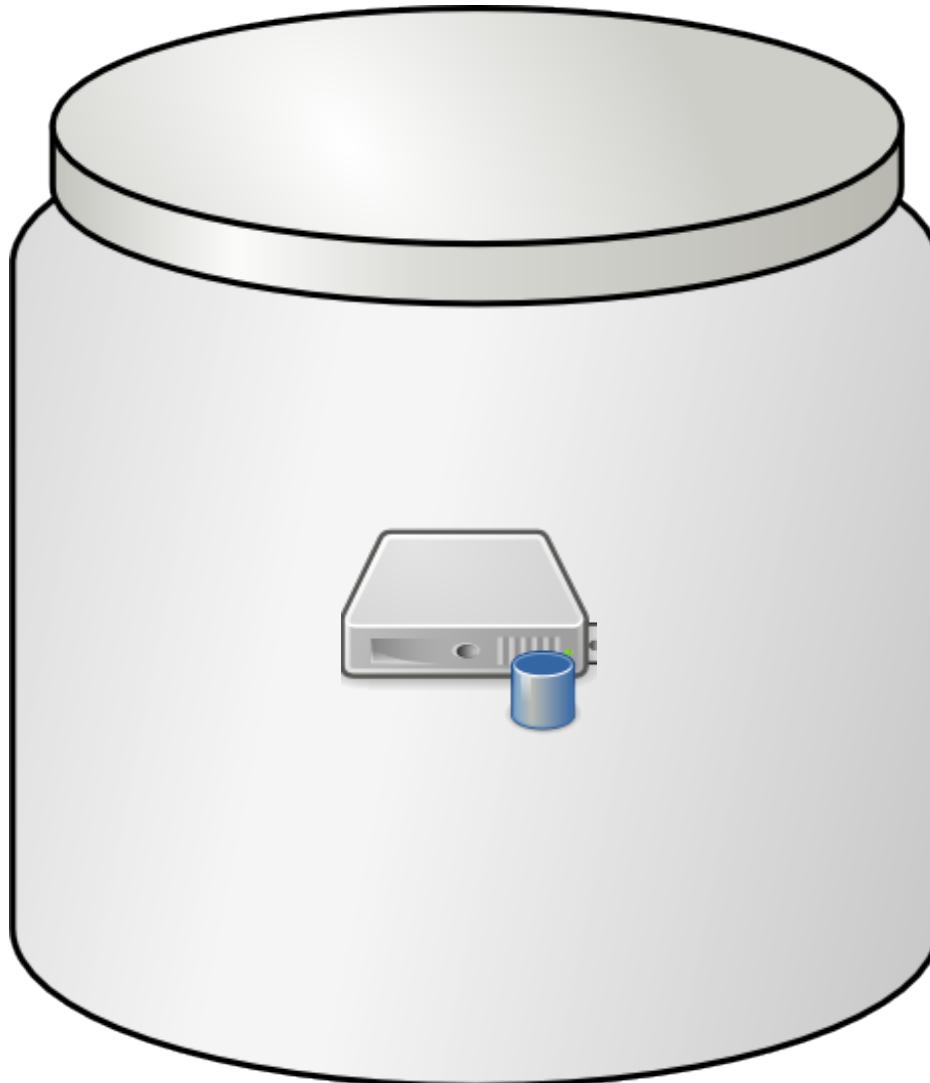
... flexibility

... privacy

# What does our HPC Cloud offer?



# What do you see, as a user?

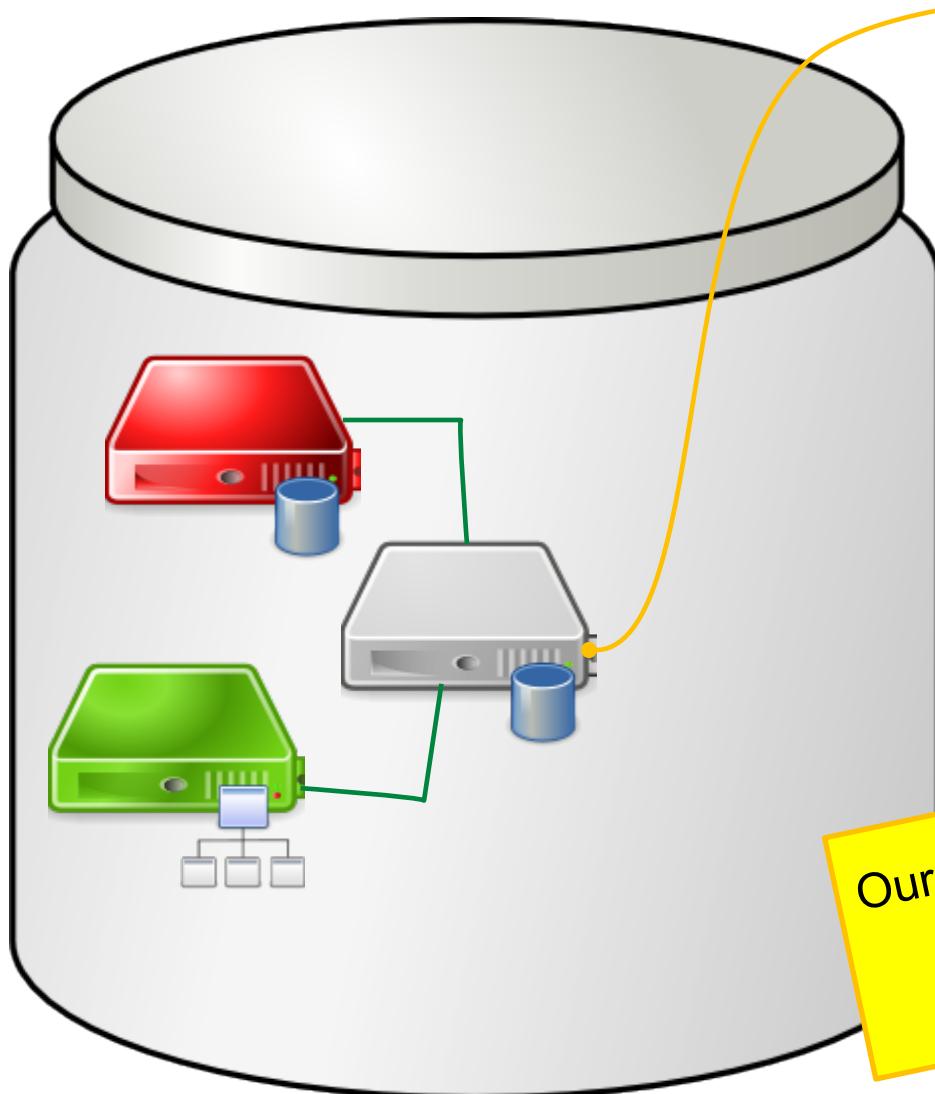


**A place to build a running system**

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? (and II)



A place to build a bunch of systems

Build your own cluster:

- Private network
- Internet access



Our say:

IaaS

Powered by...  
**OpenNebula**

# User experience

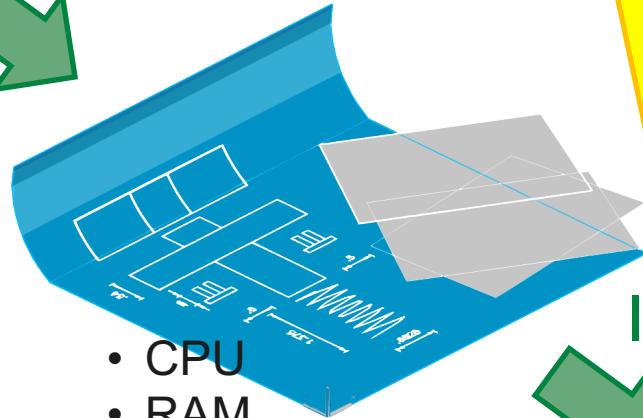


# IaaS: Your place to run VMs



- Data store
- Persistence
- ...

**Images**

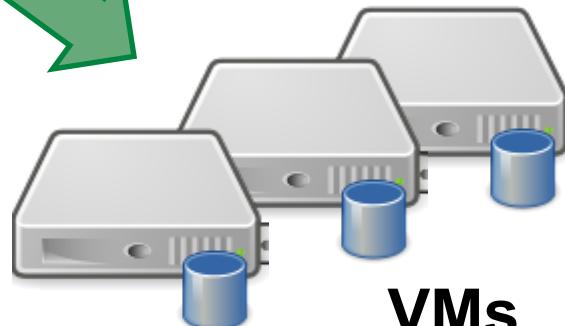


- CPU
- RAM
- I/O
  - Disks
  - Network
- ...

**Template**

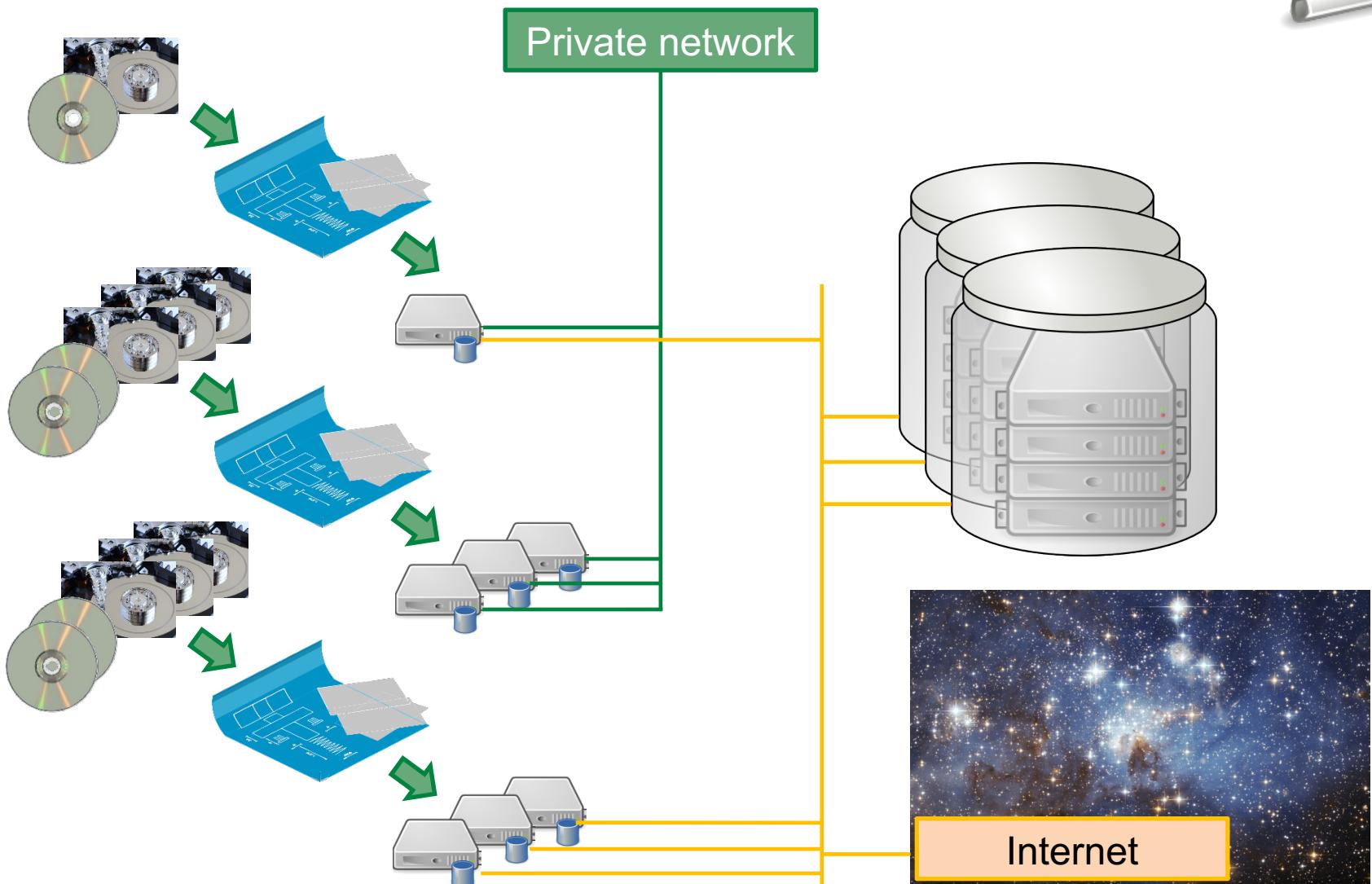


**Instantiate**



**VMs**

# IaaS: your interconnected VMs





## 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
- Pre-built Apps
- Accounting



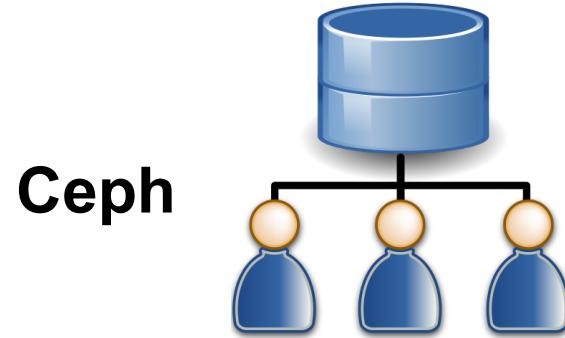
## Per project



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** • Ceph storage; expansion

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



• **GPU processing**

- Highly parallel structure
- Program specifically to use it

**SURF**

• **SURFconext; federated authentication**

# Demo

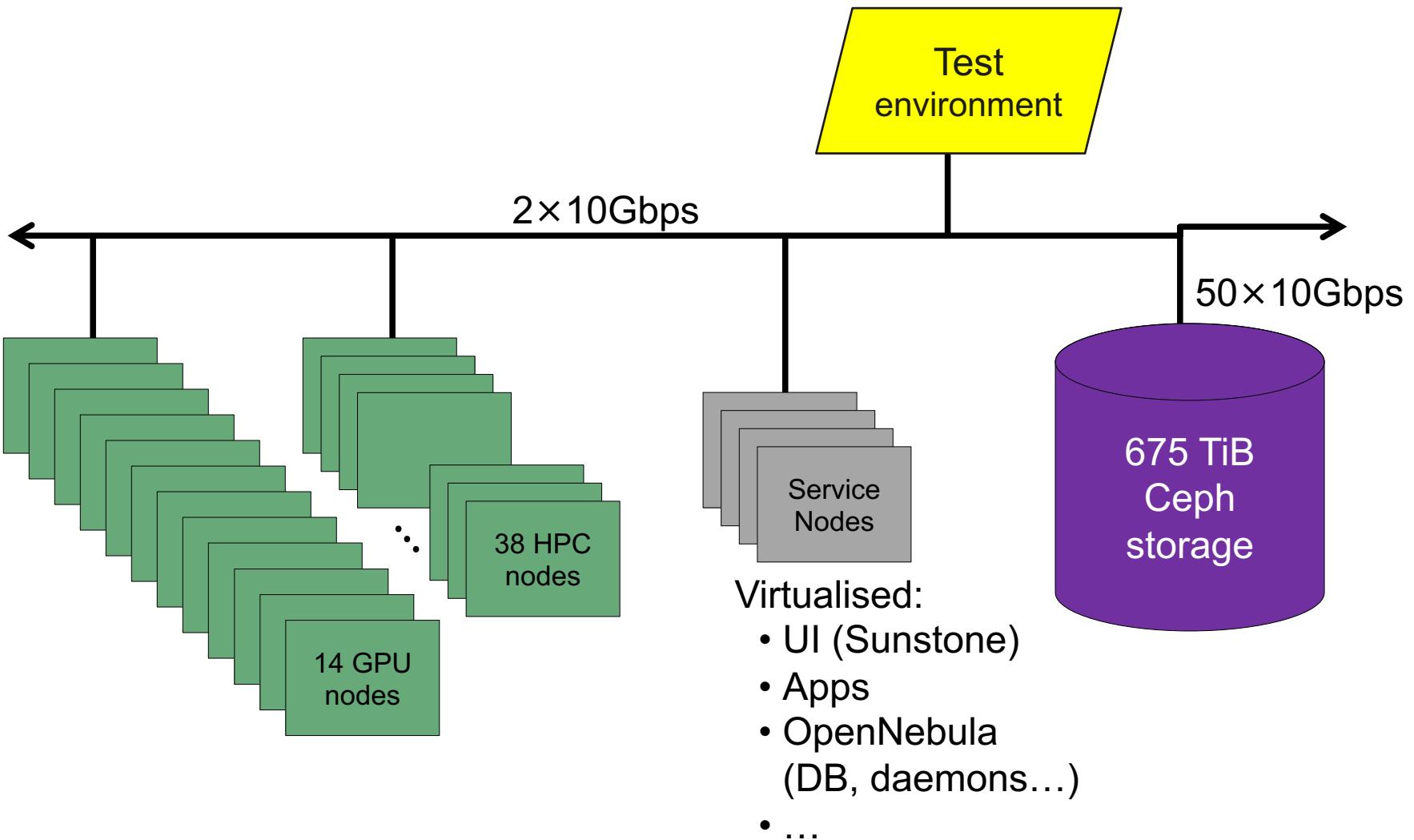
3



# SURFsara's HPC Cloud implementation



# 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

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



<<EOF