OpenStack on the EGI Federated Cloud

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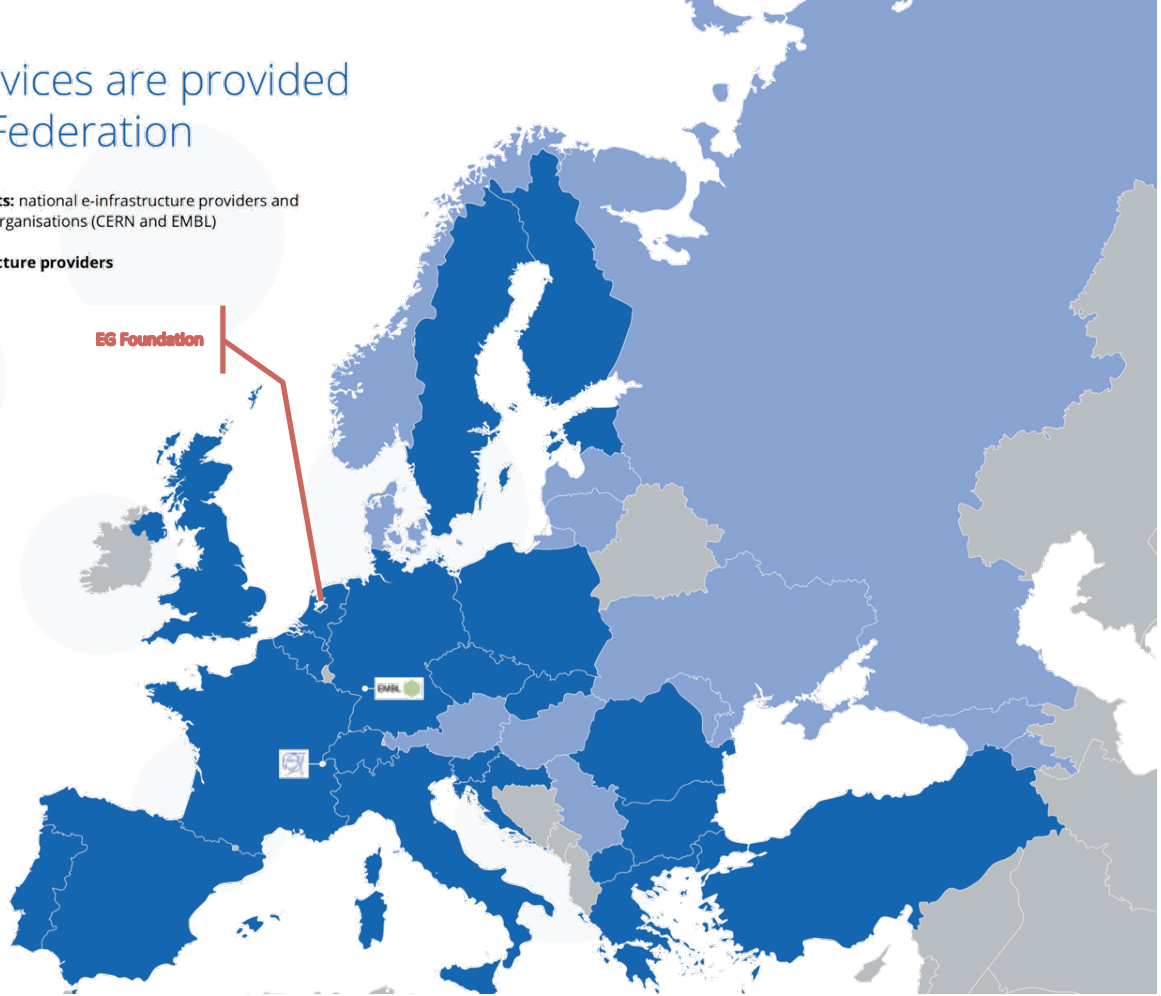
EGI: Advanced Computing for Research

EGI's mission is to create and deliver open solutions for science and research infrastructures by federating digital capabilities, resources and expertise between communities and across national boundaries.

EGI-Engage

The EGI Services are provided by the EGI Federation

- **EGI Council participants:** national e-infrastructure providers and international research organisations (CERN and EMBL)
- **Integrated e-infrastructure providers**



826,000
Cores of compute capacity

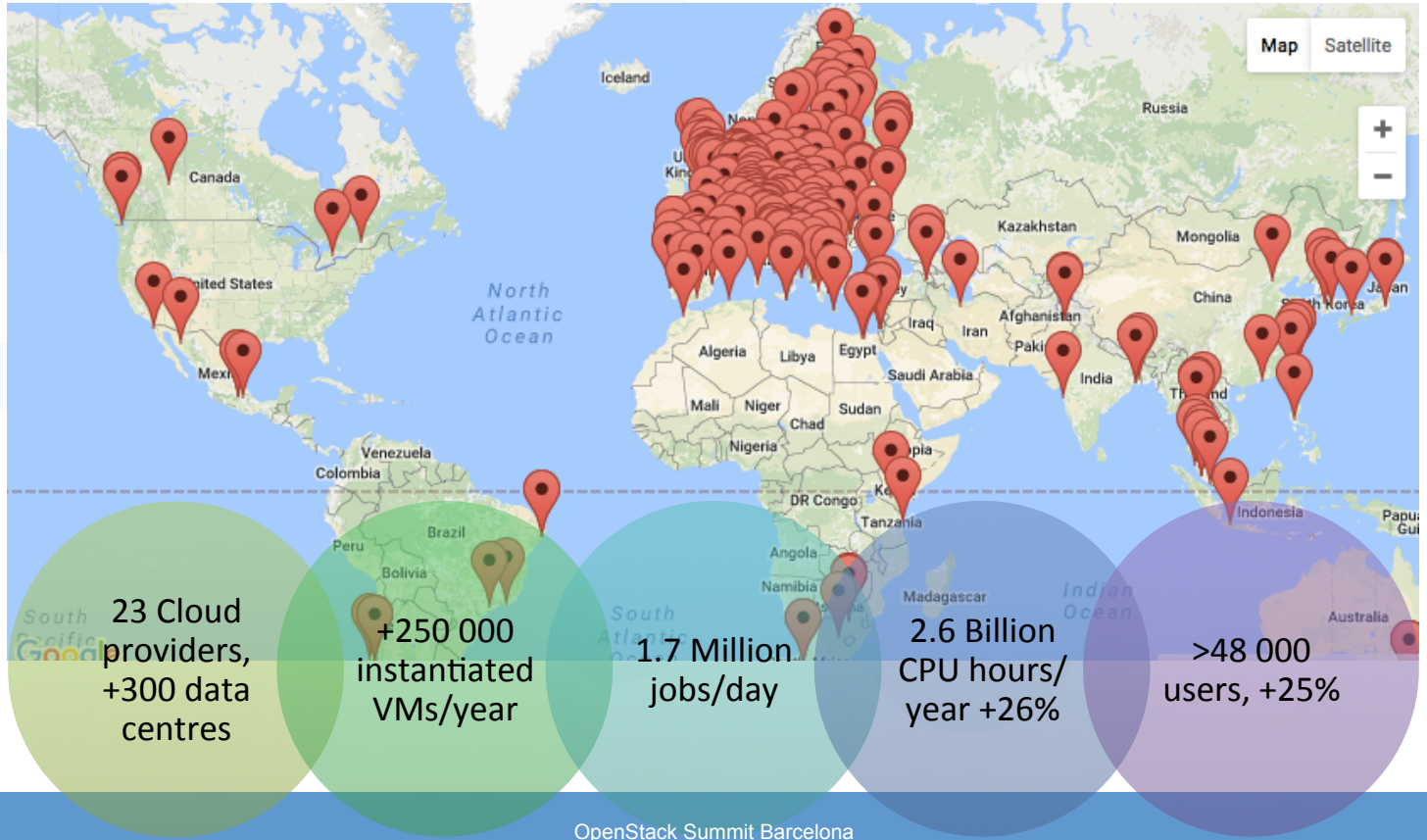
560,000
Terabytes of storage capacity

48,000
Users

15
Research Infrastructures integrated with EGI

EGI Federation, 2016 QR3

The largest distributed compute e-Infra worldwide



International Partnerships

EGI-Engage

Compute

Cloud Compute >

Run virtual machines on demand with complete control over computing resources

Cloud Container Compute >

Run Docker containers in a lightweight virtualised environment

High-Throughput Compute >

Execute thousands of computational tasks to analyse large datasets

Storage and Data

Online Storage >

Store, share and access your files and their metadata on a global scale

Archive Storage >

Back-up your data for the long term and future use in a secure environment

Data Transfer >

Transfer large sets of data from one place to another

Training

FitSM training >

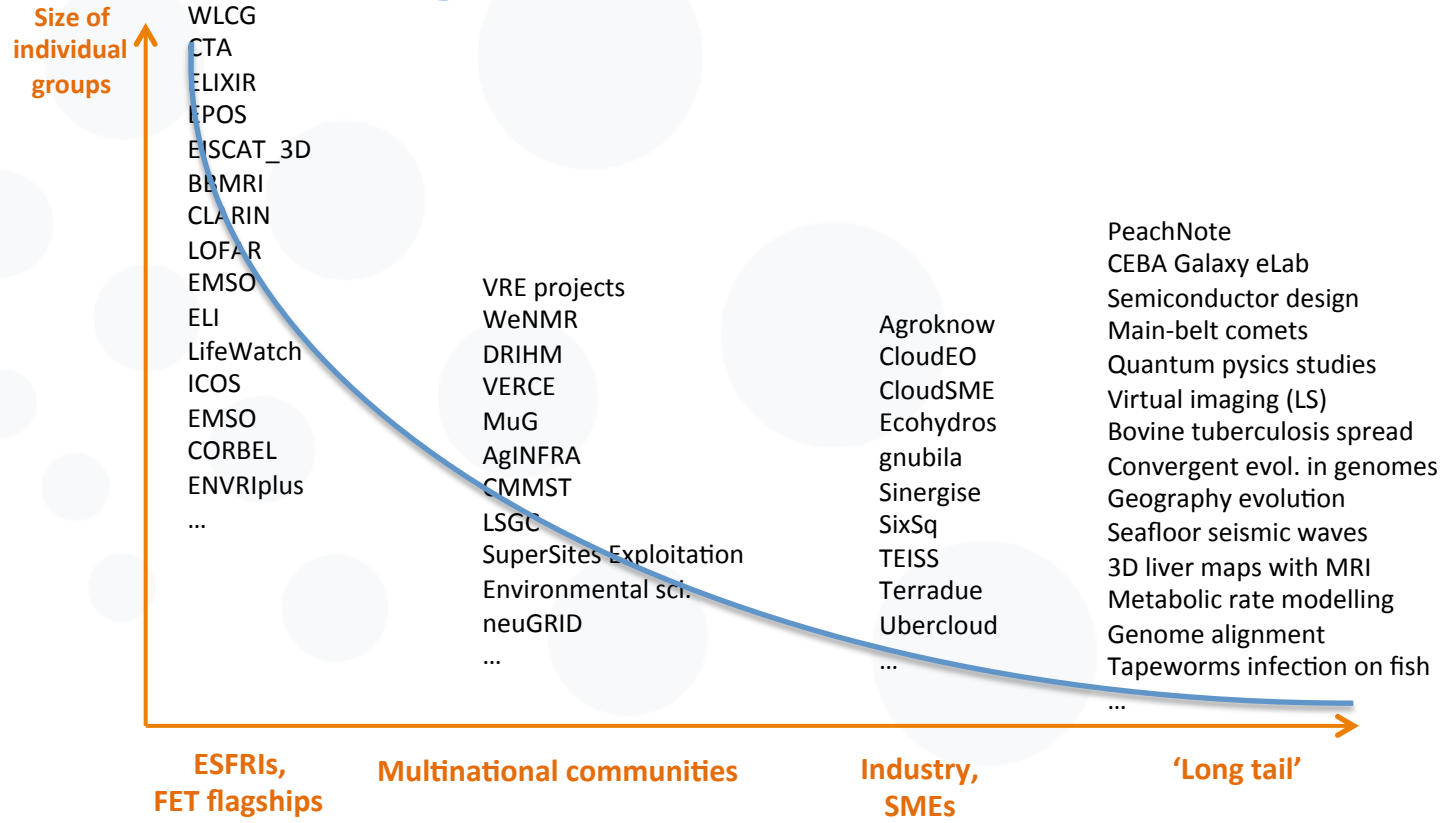
Learn how to manage IT services with a pragmatic and lightweight standard

Training infrastructure >

Dedicated computing and storage for training and education

http://go.egi.eu/ServiceCatalogue

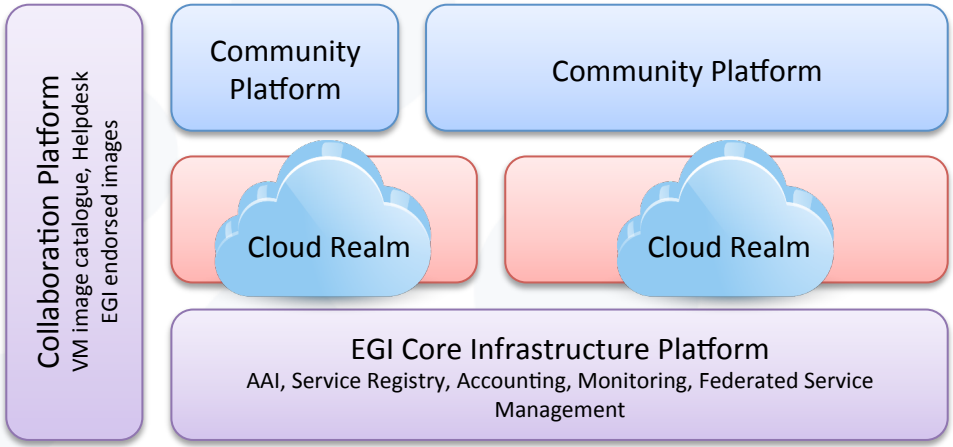
Serving researchers and innovators



EGI Federated Cloud

- EGI Federated Cloud is a collaboration of communities developing, innovating, operating and using cloud federations for research and education.
- 23 providers from 14 NGIs
  - 16 OpenStack
  - 6 OpenNebula
  - 1 Synnefo
- ~7K CPU cores

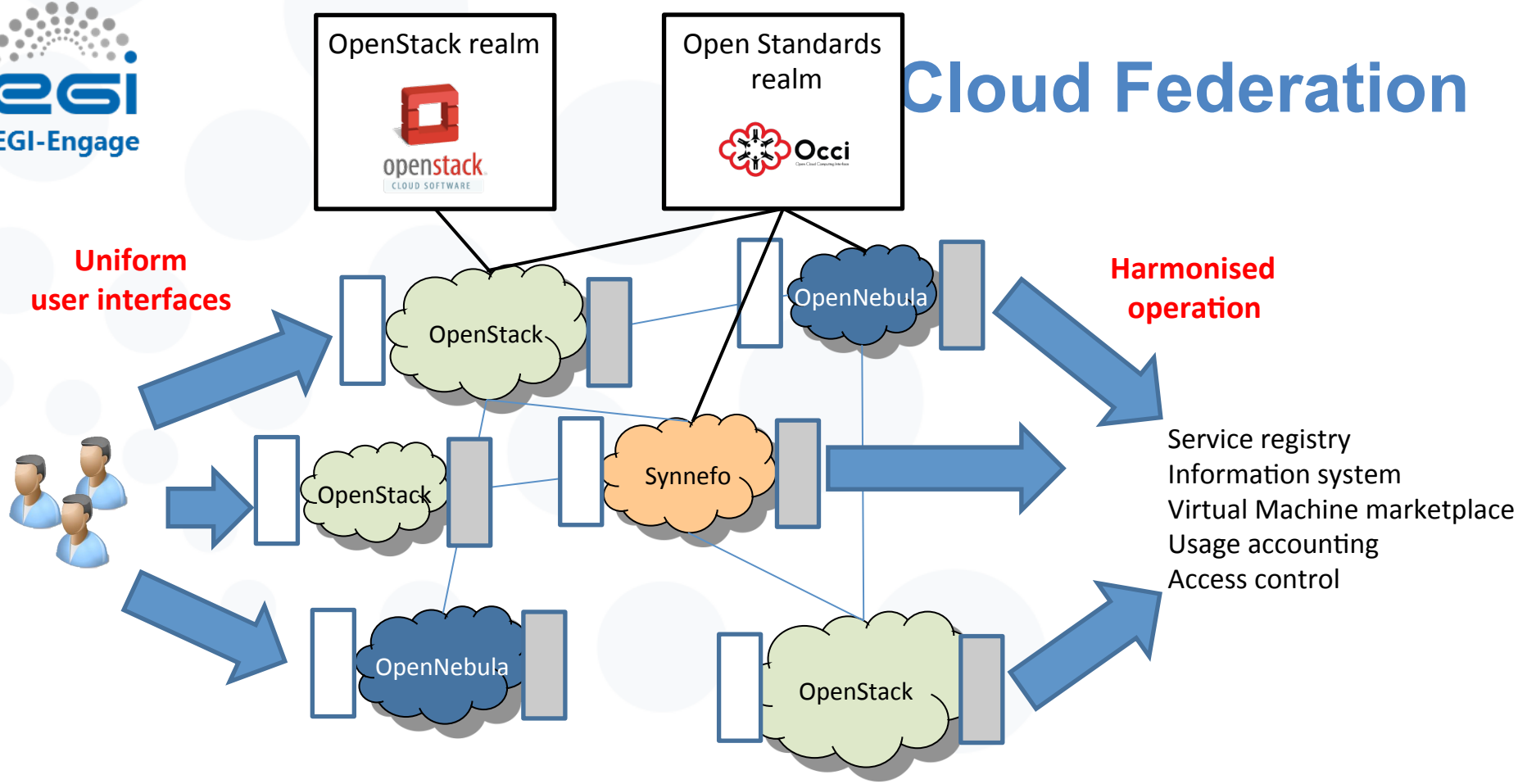
Cloud Realms



Cloud Realm
subset of cloud providers exposing homogeneous cloud management interfaces and capabilities which use the the services of the EGI Core Infrastructure Platform for creating a federation

Community Platforms
provide community-specific data, tools and applications and can be supported by one or more realms.

Cloud Federation



EGI AAI

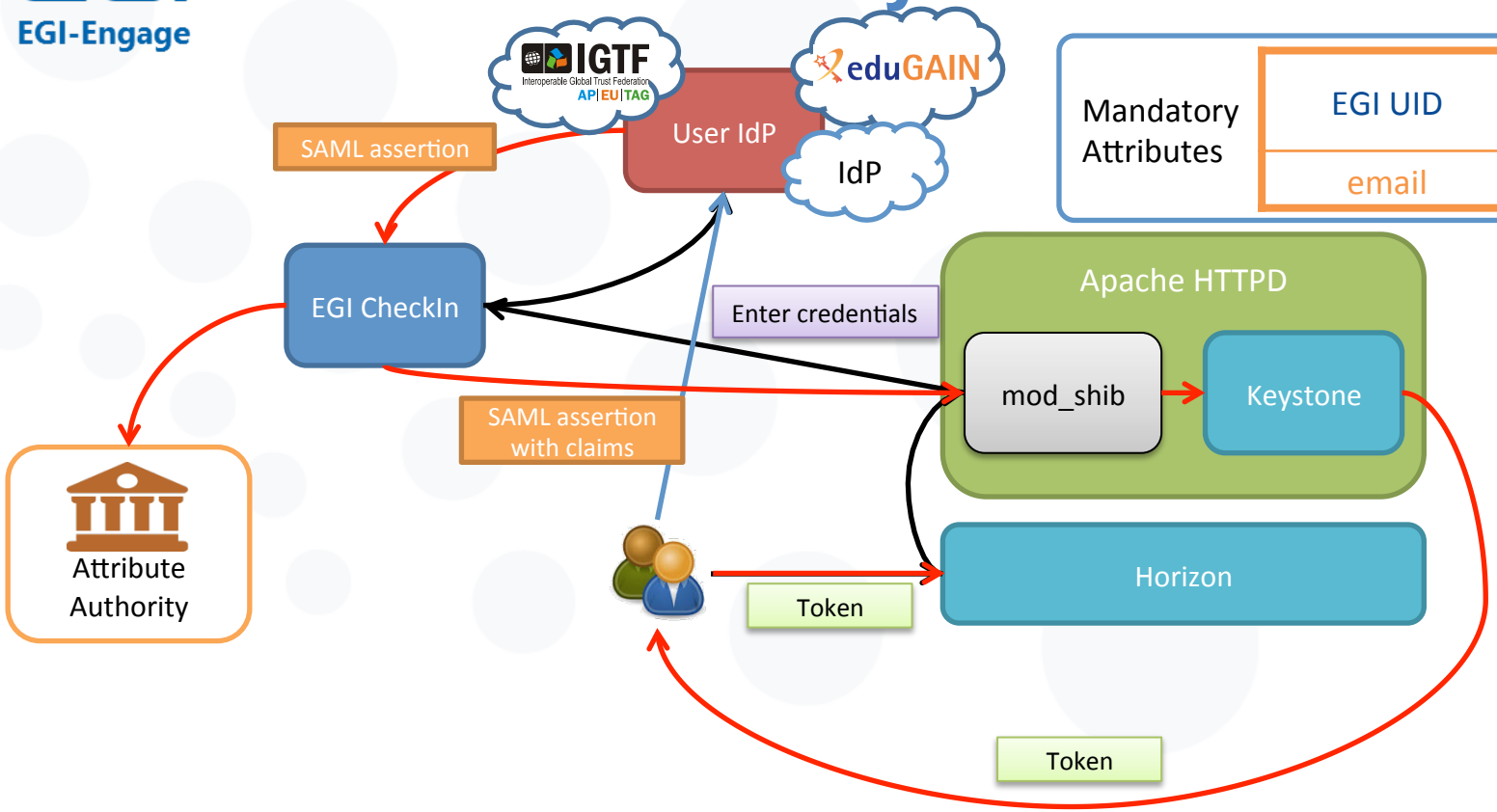
- Users identified with X.509 certificates (IGTF Federation) with VOMS extensions
  - VOMS (Virtual Organization Management System) provides attributes on membership to VOs, groups and roles on the VO
  - Not user-friendly, problematic in web-based GUIs
- Now in transition to new EGI AAI (EGI CheckIn)
  - Federated identity standards (SAML, OpenID Connect)
  - Allows users to authenticate with their institutional accounts
  - Integration with Attribute Authorities beyond VOMS

Keystone-VOMS

- WSGI filter for Keystone V2 API
- Extracts information from VOMS proxies to perform AuthN/AuthZ
- Can manage federation users
  - Add users to Keystone
  - Add roles to users in tenants
- Mapping VOMS → Keystone defined on file

https://github.com/IFCA/Keystone-VOMS

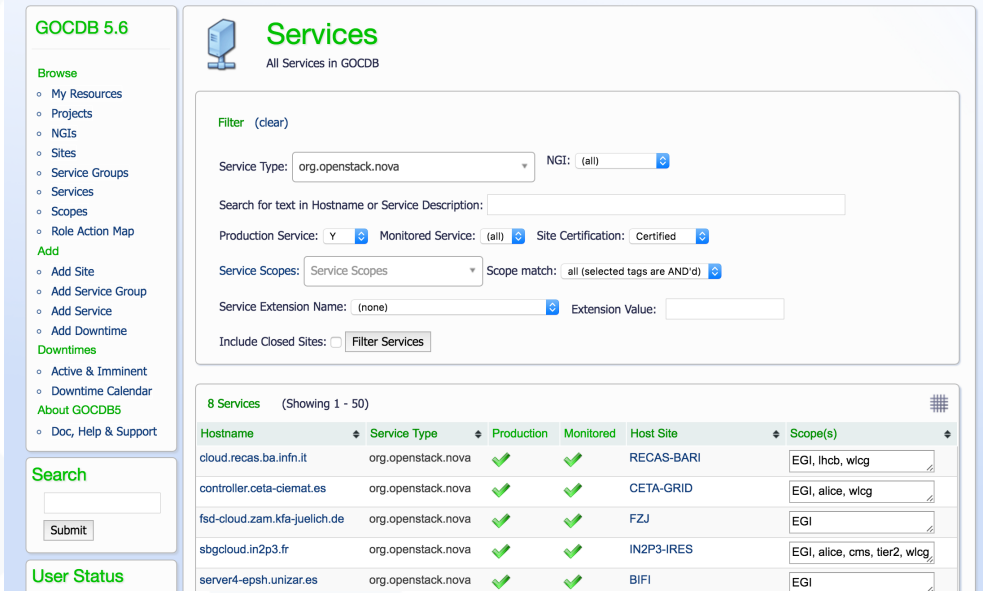
EGI AAI and Keystone OS-FEDERATION



Mandatory Attributes	EGI UID	First name, last name
	email	affiliation

Service Registry

- All Resource Centers must register their services at the EGI central catalog: https://goc.egi.eu
- Static information about services endpoints
  - org.openstack.nova and org.openstack.swift service types
- Web frontend and API access

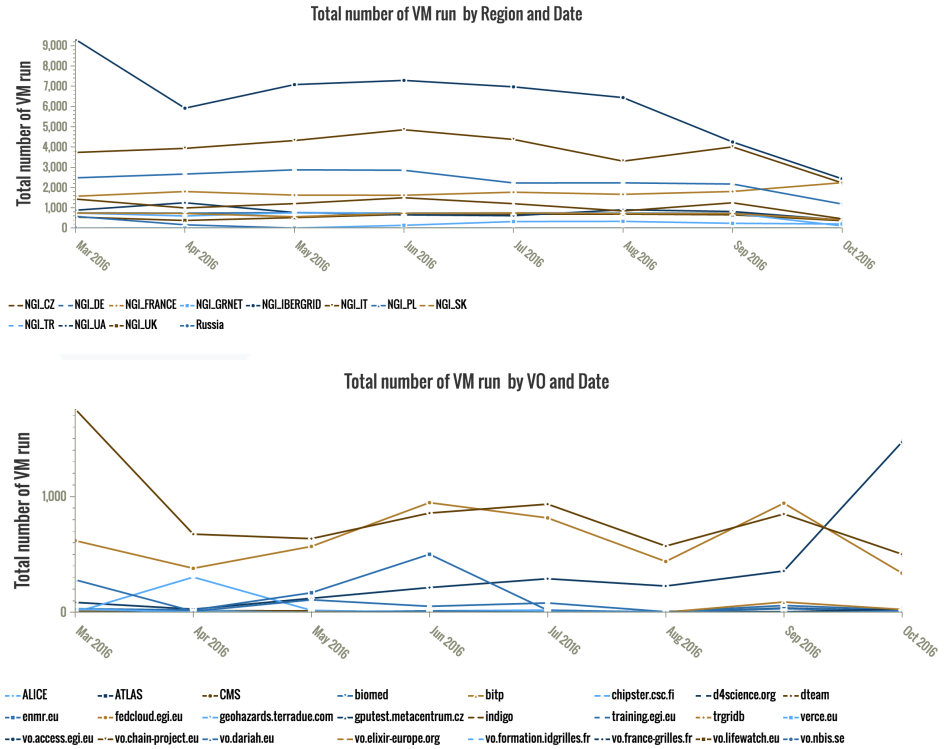


Information Discovery

- Real-time information provided by BDII
  - Hierarchical information discovery system based on LDAP
  - Using standard Glue Schema 2
- Resource Centers publish actual capabilities
  - Available images & flavors
  - Supported user groups (VOs)
  - Available resources
- Cloud-bdii-provider
  - Gathers information from OS services using public APIs and puts it into Glue Schema
  - https://github.com/EGI-FCTF/cloud-bdii-provider

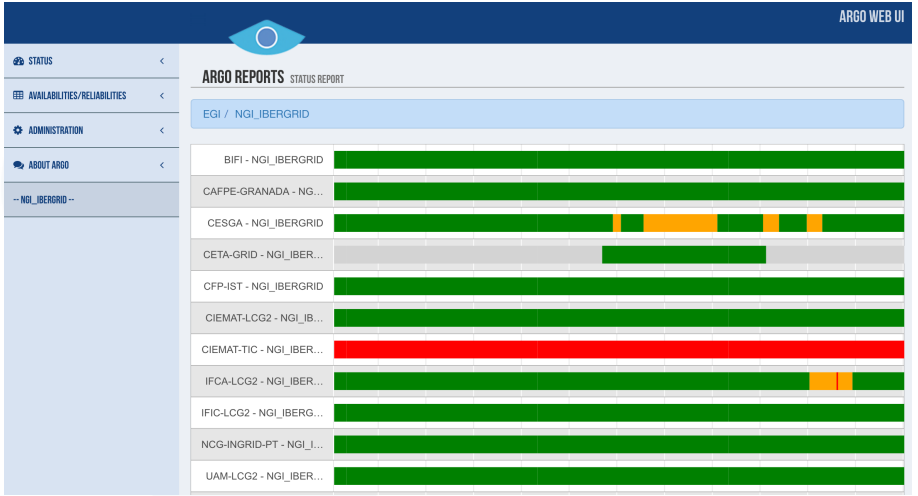
Accounting

- Collect, aggregate and display usage information across the whole federation.
- OGF Usage Record extended for Cloud
- cASO produces accounting records using nova (and optionally ceilometer) APIs
  - https://github.com/IFCA/caso



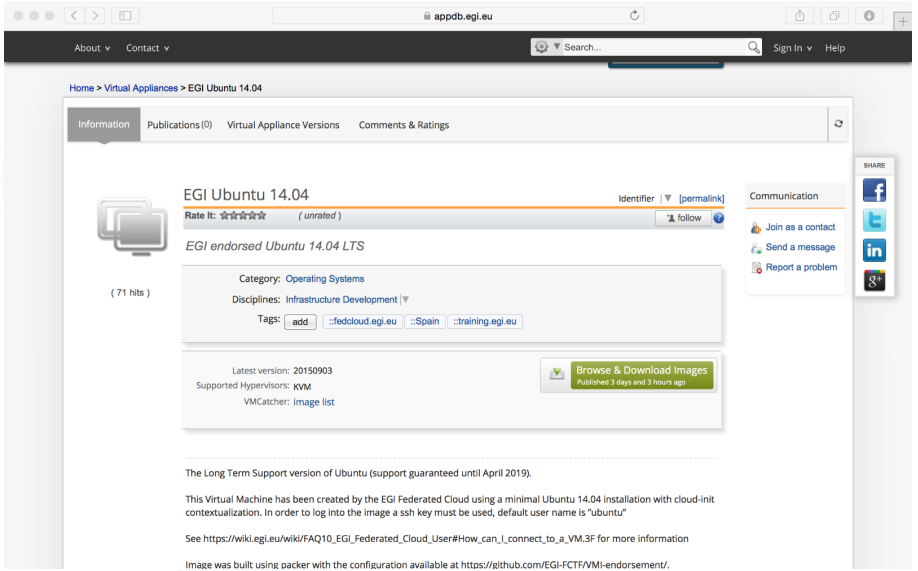
Monitoring

- Health monitoring of services
- Automatic discovery of services using GOCDB
- A/R metrics for SLA/ OLAs
- Powered by EGI ARGO
  - https://argoeu.github.io/

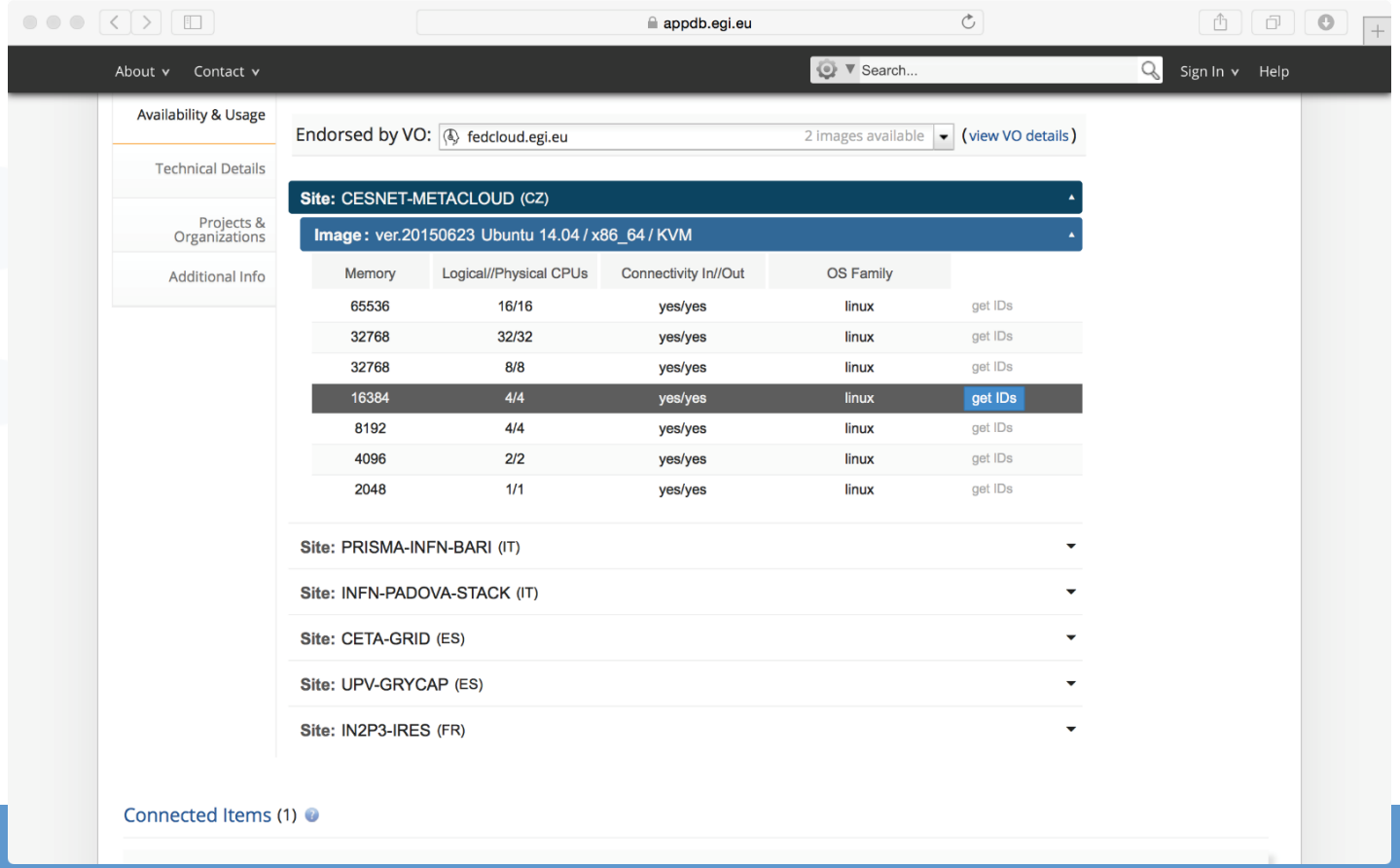


VM Image Marketplace: AppDB

- Open Library of Virtual Appliances
  - Use on clouds or for personal download
  - Re-use, share, associate contextualization
- EGI endorsed VM images, securely configured and tested
- Community curated sets of images
  - Automatic distribution of sets to cloud providers
  - https://github.com/alvarolopez/atrope



VM Image Marketplace: AppDB

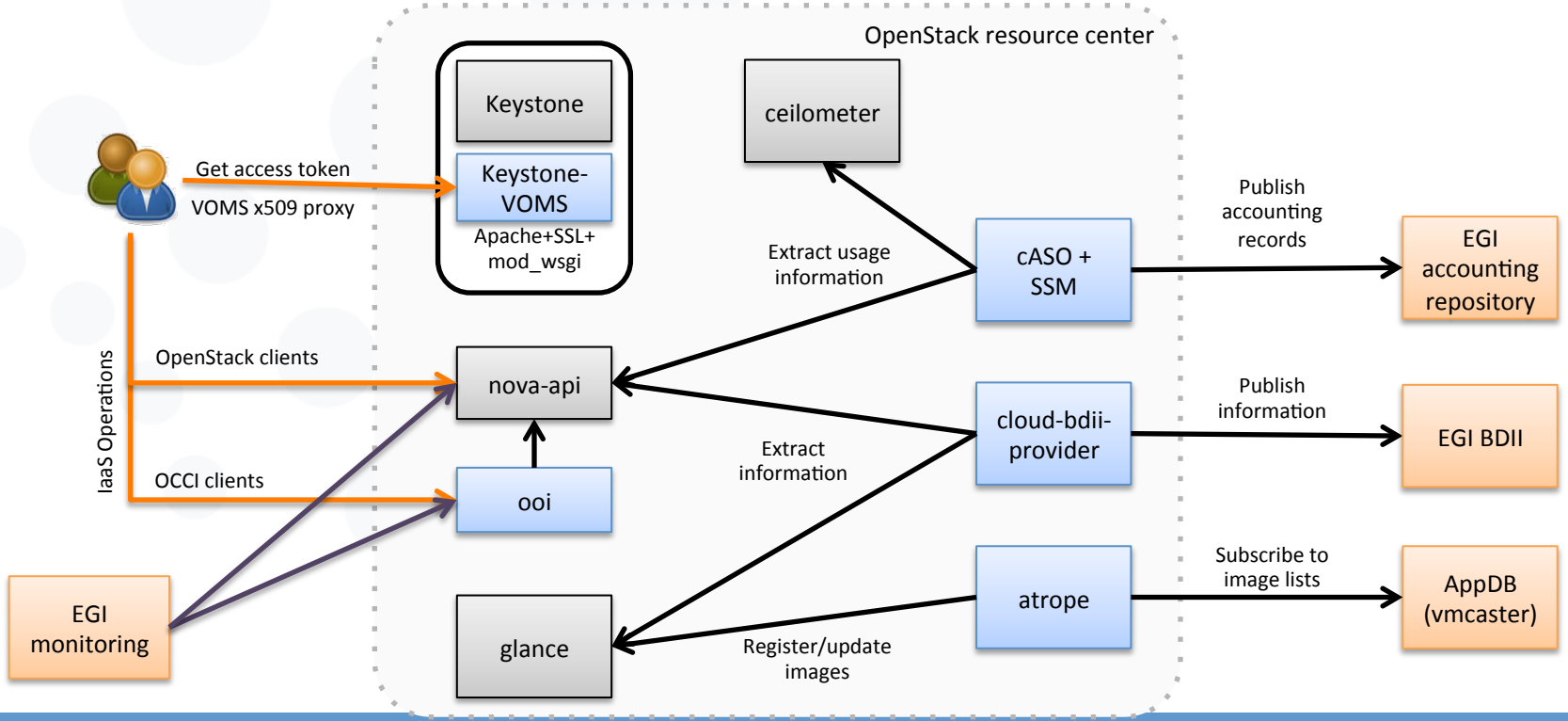


OpenStack OCCI interface (ooi)

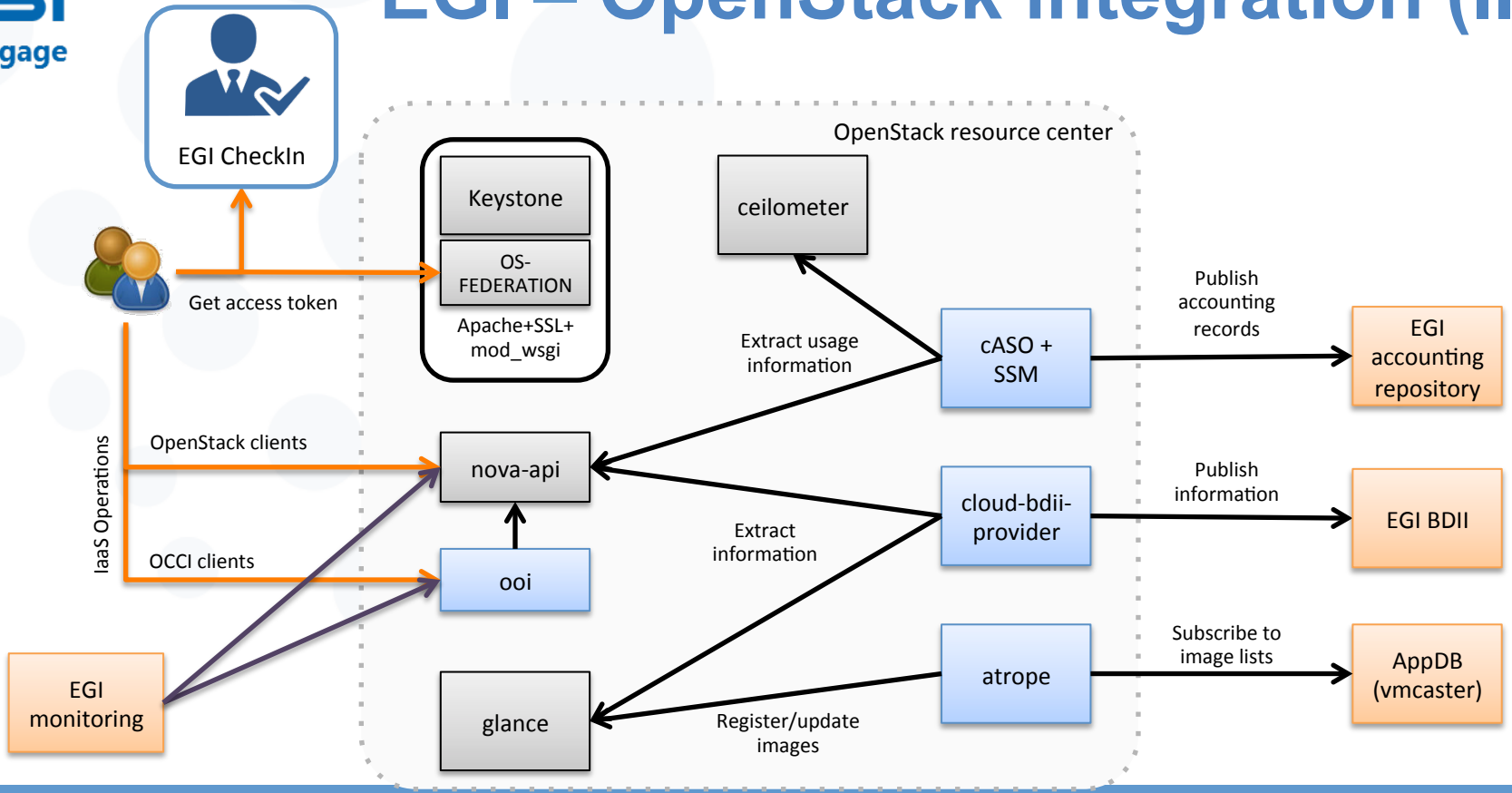
- **OCCI** (Open Cloud Computing Interface, OGF)
  - RESTFul protocol and API focusing on cloud interoperability
  - Primarily for IaaS (manage VMs and Block Storage), extensible to other areas
- ooi (OpenStack OCCI interface)
  - Completely written from scratch OCCI implementation
  - Uses only public OpenStack APIs
  - Support for VM, volumes and network operations
  - Can be installed along an existing nova-api endpoint or as a separate WSGI application

https://launchpad.net/ooi

EGI – OpenStack integration (I)



EGI – OpenStack integration (II)



OpenStack FedCloud Appliance

- A single VM with all the components using the public OpenStack interfaces
  - Accounting, Information discovery, VMI replication
  - Packaged as Docker containers, available at docker hub https://hub.docker.com/u/egifedcloud/
- Documentation:
  - https://wiki.egi.eu/wiki/MAN10#Integration_with_EGI_FedCloud_Appliance
- Appliance at AppDB:
  - https://appdb.egi.eu/store/vappliance/fedcloud.integration.appliance.openstack

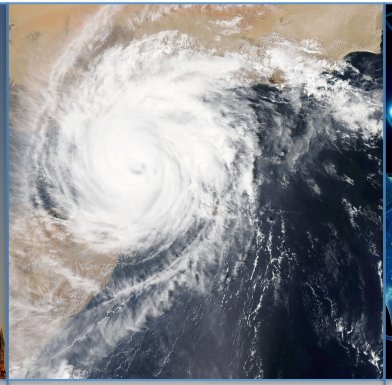
Cloud Realms: build customized federations

Service	Cloud Realm Integration	EGI Technology
EGI Federated Service Management	**mandatory**	-
EGI Service Registry	**mandatory**	**GOCDB**
EGI AAI compliance	**mandatory**	**Keystone-VOMS**
EGI Accounting	**mandatory**, depends on EGI AAI compliance	**cASO**
EGI Monitoring	**mandatory,** done externally. Monitoring of IaaS interfaces (OCCI, OpenStack, CDMI) requires EGI AAI compliance	**EGI ARGO**
EGI Information Discovery	optional	**cloud-bdii-provider**
VMI replication	optional	**atrope**
VMI catalogue	optional	**AppDB**
IaaS standard interface	*optional*, all providers of the realm must provide homogeneous interface	**ooi**
EGI helpdesk	optional	**GGUS**

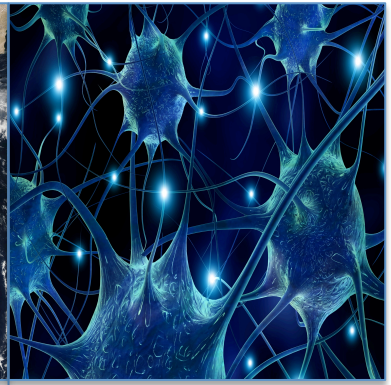
Communities using Cloud Compute (I)

The EXTraS project is harvesting 13 years of data collected on-board

the ESA's X-ray space observatory XMM-Newton. The project is using Cloud Compute to implement four lines of analysis with ad-hoc software pipelines



The DRIHM project is prototyping an e-infrastructure to simulate extreme hydro-meteorological events such as ash flooding.

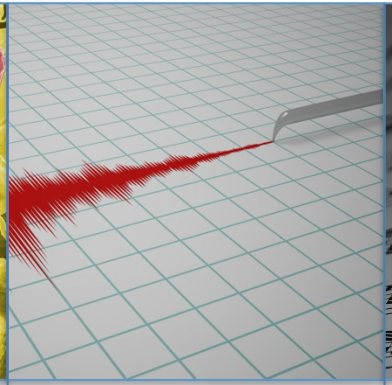


The National Bioinformatics Infrastructure of Sweden uses Cloud Compute to provide bioinformatics tools to their researchers, including high-profile tools to predict 3D protein structures, for example. So far, more than 6,700 unique users in 73 countries have made the most of these resources

https://www.egi.eu/use-cases/

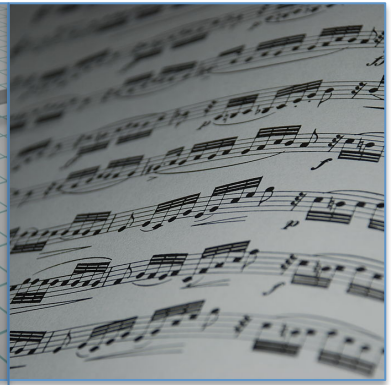
Communities using Cloud Compute (II)

Konrad Förstner and team used EGI Federacted cloud to analyse the RNAs produced by the Salmonella and humans at the same time, in the same experiments to discover that a piece of Salmonella RNA called PinT is heavily involved in what happens right after the infection. Results published in Nature.



VERCE platform is a science gateway, developed jointly by seismologists and IT experts, as a tool to create accurate earthquake simulations.

VERCE helped seismologists to make sense of the August 2016 Amatrice earthquake using the resources of EGI Cloud



Peachnote is a music score search engine and analysis platform. The system is the first of its kind and can be thought as an analog of Google Books Ngram Viewer and Google Books search for music scores. Peachnote is visited by tens of thousands of users every day from all over the world.

https://www.egi.eu/use-cases/

Pictures from wikimedia commons

EGI-Engage

What's coming

- Improve user experience
  - Certificate-less access with new EGI AAI
  - AppDB extension to provide VM management
- OCCI 1.2
  - Improved version of the standard, better networking support
- Go beyond IaaS
  - Exploit results from INDIGO-Project to offer PaaS to our users
- Get more involved in OpenStack
  - Scientific WG, identity federation, …

EGI-Engage

Some references

- EGI: http://www.egi.eu
- Federated Cloud at EGI wiki: https://wiki.egi.eu/wiki/EGI_Federated_Cloud
  - Installation manual: https://wiki.egi.eu/wiki/MAN10
- EGI Federated Cloud list: fedcloud-tf@mailman.egi.eu

Thank you for your attention.

Questions?

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