# The EGI Federated Cloud e-Infrastructure

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# EGI (European Grid Infrastructure)

- ## EGI Council
  - 26 participants: 24 NGIs and 2 EIROs (CERN, EBI)
  - Opening membership to research communities
  - Affiliation programme for countries

- ## Shared interest in
  - Developing and providing e-infrastructure services that enable open science

- ## Sustainability
  - Sustainable core services (HW, SW, human!)
  - Project-driven innovation
    - H2020: EGI-Engage, AARC, INDIGO, ELI-Trans, etc.
    - FP7: BioVeL, FitSM, SCI-BUS, Cloud-SME, …

EGI.eu in Amsterdam
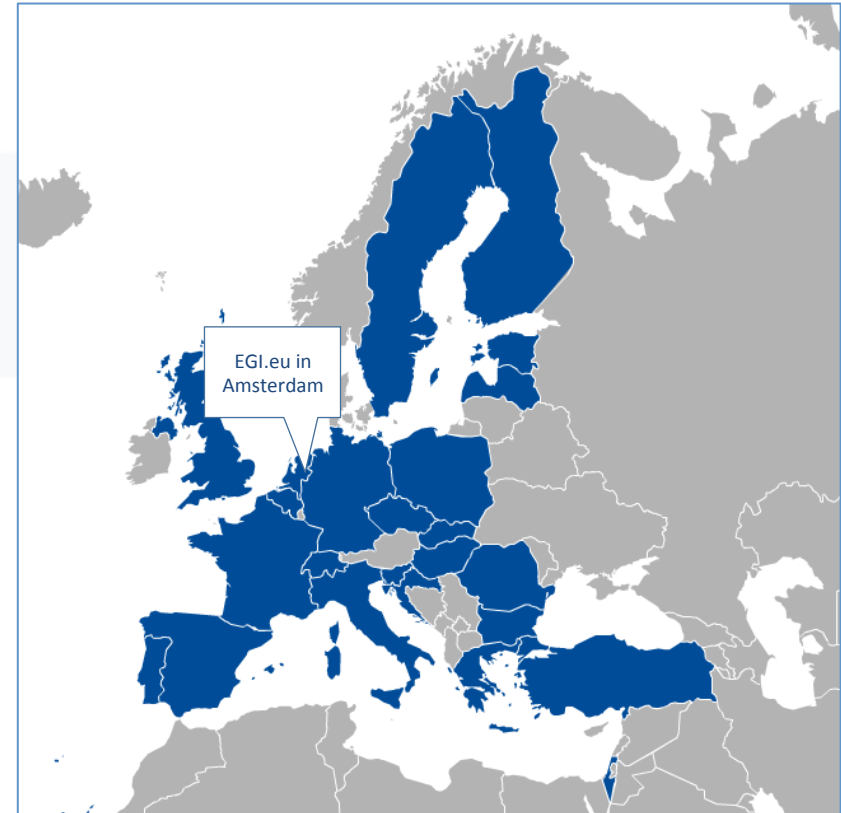
**Membership under discussion**
Armenia, Austria, Belarus, Denmark, Moldova, Norway, Russia, Ukraine

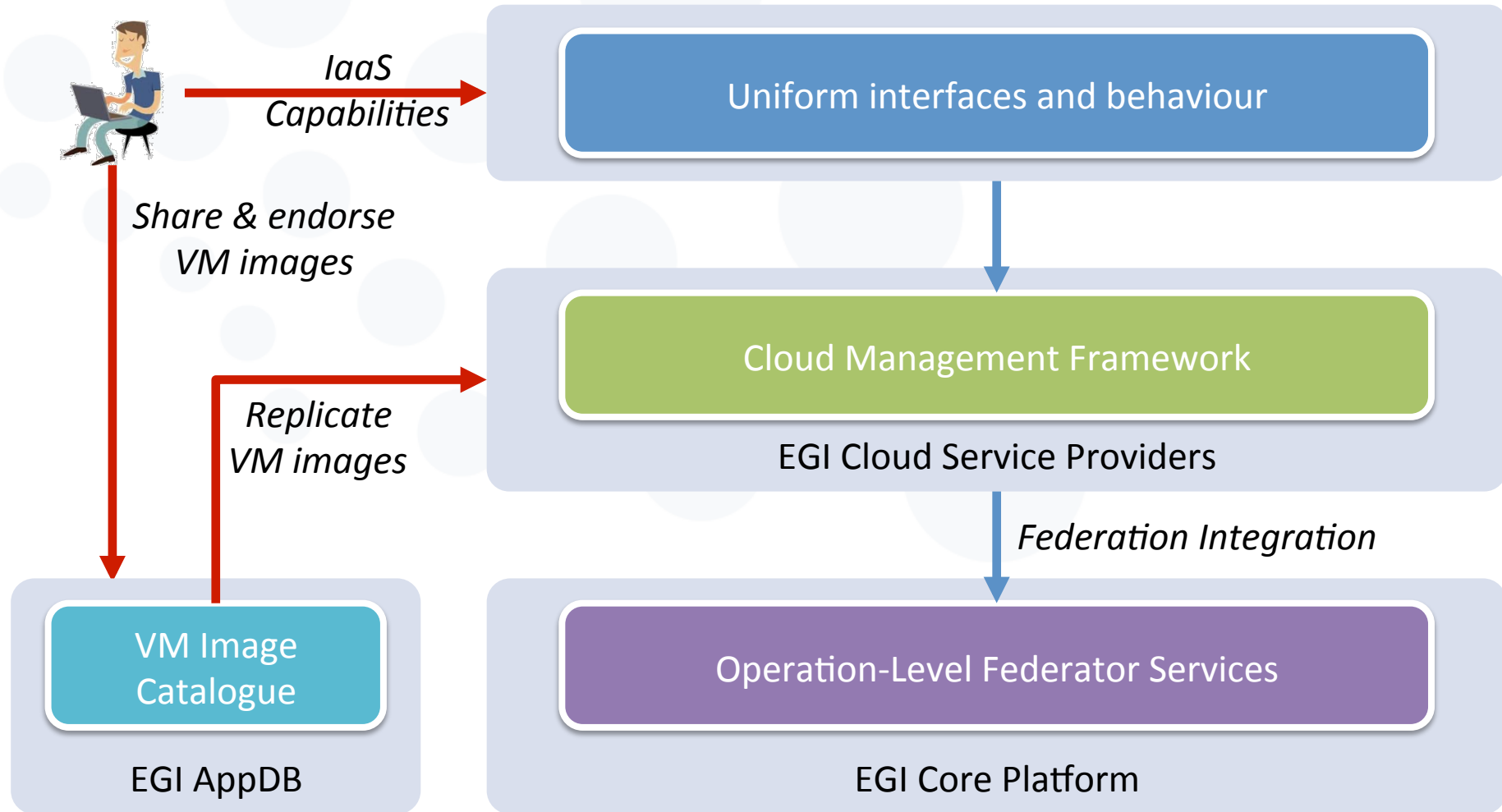# Enabling Global Infrastructures
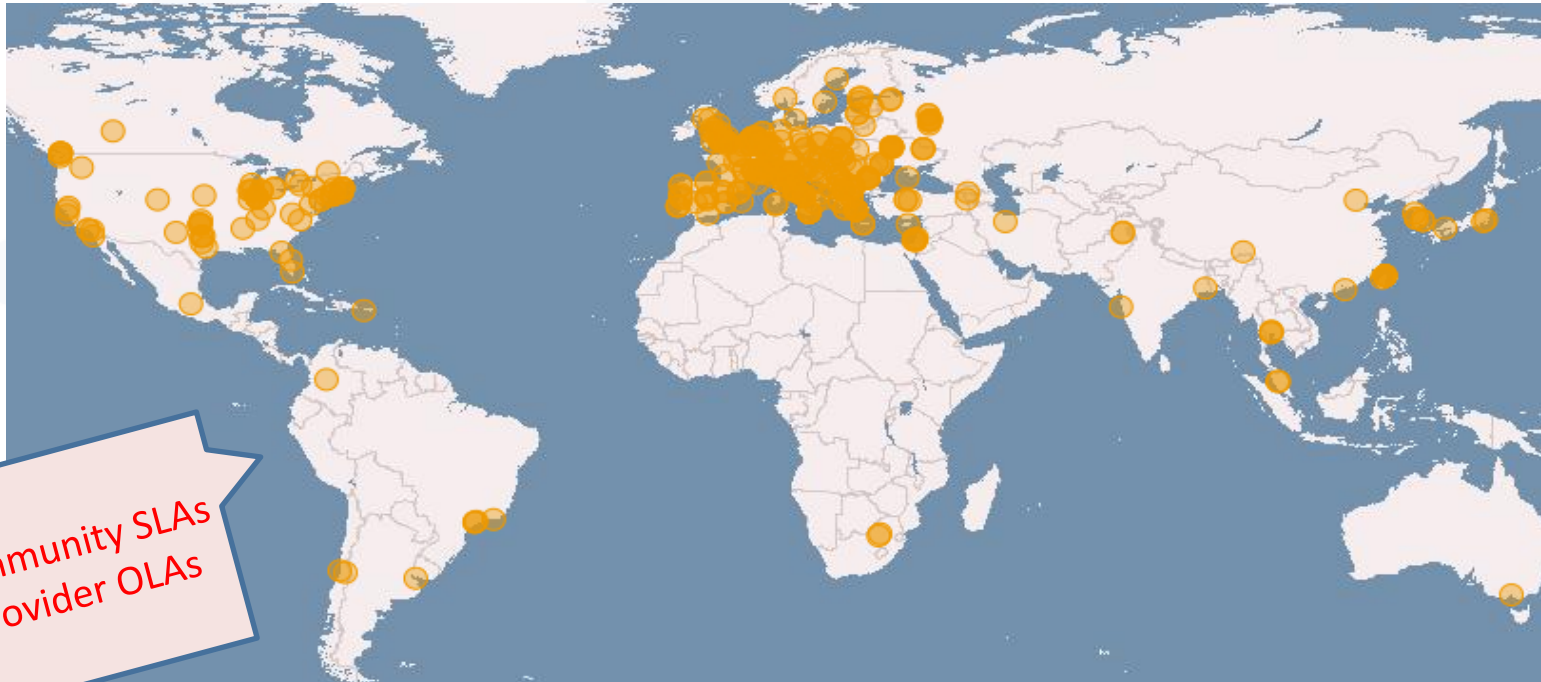


Community SLAs
Provider OLAs

- Distributed, federated storage and compute facilities
- Compute platforms (Grid, Cloud)
- Virtual Research Environments
- > 200 user research projects

Total capacity (grid + cloud):
- 340 resource centres in 54 countries
- 550,000 logical CPU cores
- 290 PB disk, 180 PB tape

# EGI Federated Cloud

- **EGI Federated Cloud is a collaboration** of communities developing, innovating, operating and using cloud federations for research and education.

- Design (2011-2014)
  - Establishment of the FedCloud Task Force
  - Collect requirements, architecture design, deploy testbed services to expand EGI compute capabilities
- Production (Since May 2014)
  - Start of production activity of the Federated Cloud as a a standards-based, open cloud IaaS system
- New federation model (2015)
  - Expansion of the federation to become a collaboration to enable cloud federations

# EGI Federated Cloud Architecture

IaaS Capabilities

Share & endorse VM images

Replicate VM images

Uniform interfaces and behaviour

Cloud Management Framework

EGI Cloud Service Providers

Federation Integration

VM Image Catalogue

EGI AppDB

Operation-Level Federator Services

EGI Core Platform

# Federation Principles

- ## The EGI Cloud is a open hybrid cloud federation
  - Different levels of federation are possible offering various degrees of interoperability
  - All cloud providers pooling resources and data in a multi tenant model
    - Need to adhere to a set of common policies, procedures and processes for federated service management
    - Can join in by adopting the federation model that provides the interoperability needs of the target groups
    - Can choose among federated services offered by EGI in a modular way, while still relying on local tools and exposing own service interfaces to the federation, as applicable
  - Low barriers to join the federation

# EGI Cloud Federations

## Public Cloud (1)

- **Open to any research community, maintained by EGI FC Task Force**

- **Open Standards**: use of open standards to implement federation: OCCI, OVF, GLUE2, APEL, (CDMI), … Standards required.

- **Stronger integration profile**: Cloud Computing integrated into the existing production infrastructure.

## Community Clouds (n)

- **Available for specific communities, maintained by them**

- **Community choices:** Services and APIs to implement federation is community choice. Standards encouraged.

- **Looser Federation profile**: Based on a subset of EGI components (accounting, monitoring, …)

# IaaS Capabilities

## VMs & Block Storage

- On demand compute to run any kind of workloads on virtual machines
- Persistent Block Level Storage to attach to VMs
- User control of the computing infrastructure
- OGF OCCI API

## Object Storage

- Data storage infrastructure for storing and retrieving data from anywhere at any time
- Sharing and serving of data in a scalable infrastructure
- SNIA CDMI API as

# VM Image Catalogue and Management

## VM Image Catalogue

- Open Library of Virtual Appliances
- Use on clouds or for personal download
- Re-use, share, associate contextualization
- EGI endorsed set of VM images prepared to run in a cloud in a secure manner

## VM Image Management

- Community curated sets of images
- Automatic and secure distribution of sets to cloud providers
- HEPiX lists format for distribution

# Federation Services

## AAI

- IGTF Federation with X509 certificates + VOMS extensions
- Credential translation for other IdP federations

## Accounting

- Collect, aggregate and display usage information across the whole federation.
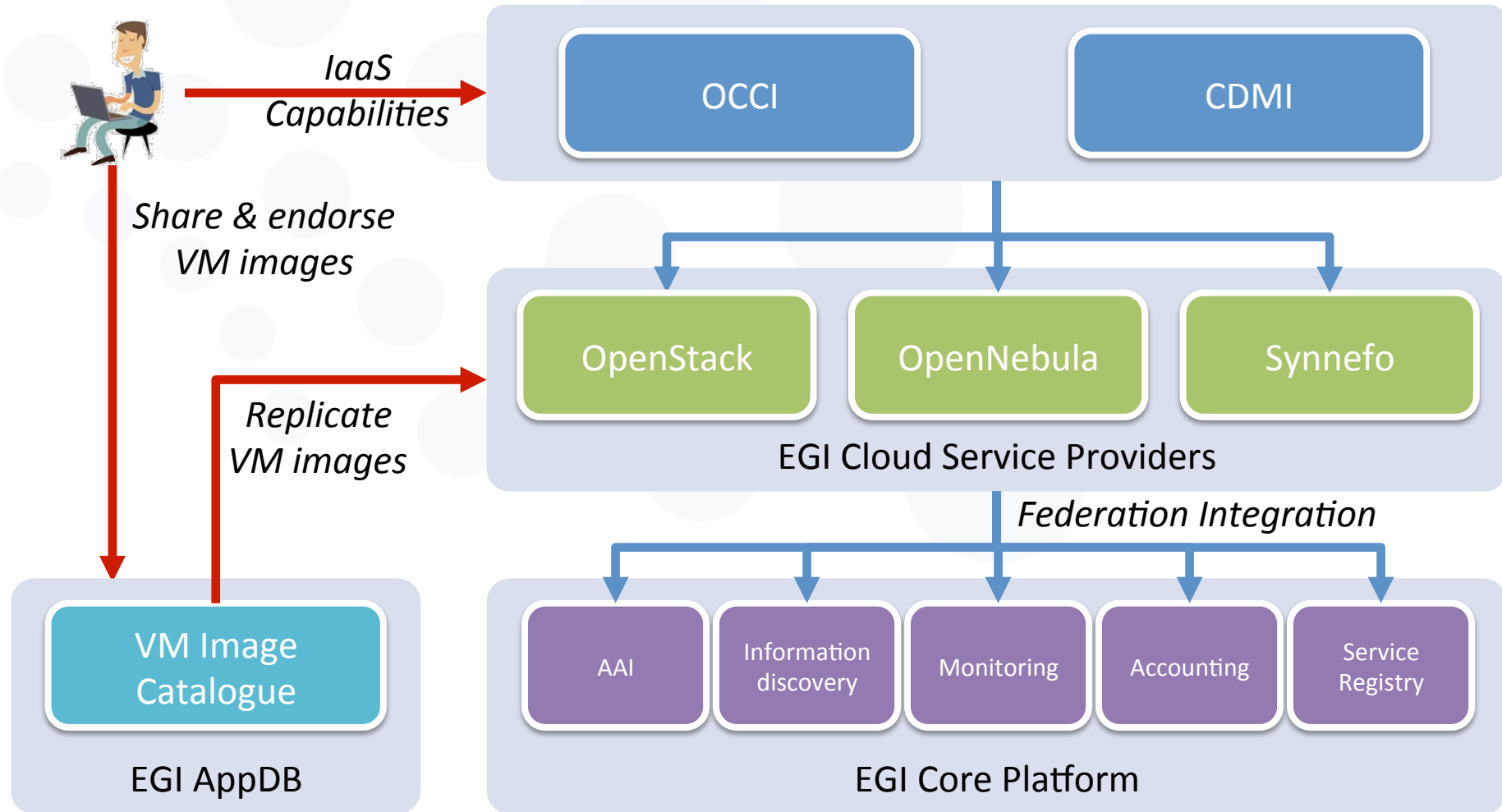- OGF Usage Record extended for Cloud

## Service Registry & Information Discovery

- Central service catalogue with static information
- Real-time view of the actual capabilities of the federation
- OGF GlueSchema 2

## Availability Monitoring

- Health monitoring of services
- A/R metrics for SLA/OLAs
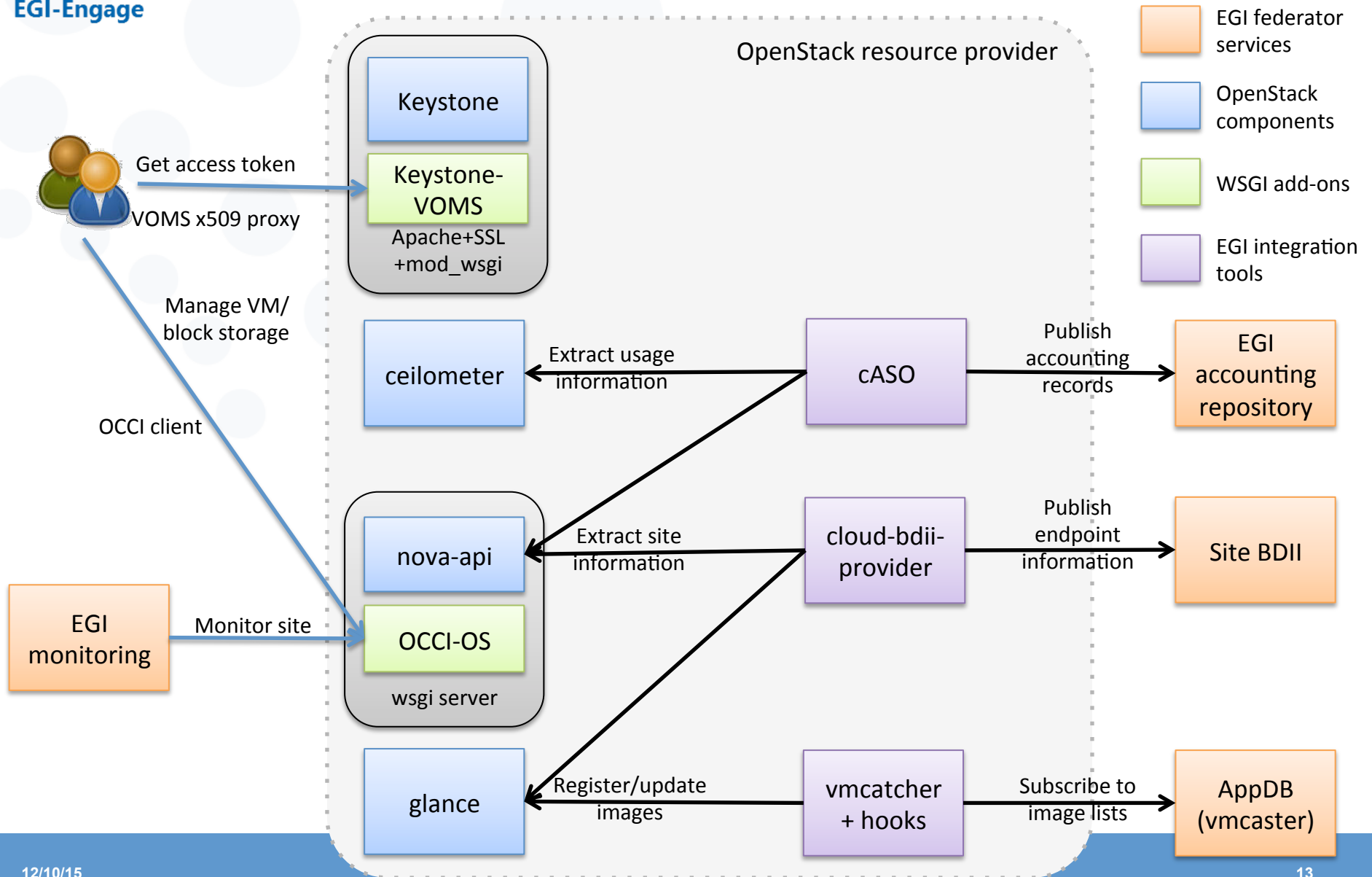- EGI ARGO

# Public Cloud Architecture

# EGI Federated Public Cloud Status

| Capability | OpenStack | OpenNebula | Synnefo |
|---|---|---|---|
| OCCI VM Management | Yes | Yes | Yes |
| Integration with VM image management | Yes | Yes | Yes |
| Contextualization | Yes | Yes | Yes |
| OCCI Block Storage | Yes | Yes | In Progress |
| CDMI Object Storage | In Progress | N/A | Yes |
| EGI AAI Integration | Yes | Yes | Yes |
| Monitoring* | Yes | Yes | Yes |
| Accounting records | Yes | Yes | Yes |
| Information System | Yes | Yes | Yes |

# Example: OpenStack Integration



**EGI-Engage**

**OpenStack resource provider**

Legend:
- EGI federator services (orange)
- OpenStack components (blue)
- WSGI add-ons (green)
- EGI integration tools (purple)

Keystone

Keystone-VOMS

Apache+SSL +mod_wsgi

Get access token

VOMS x509 proxy

Manage VM/ block storage

OCCI client

EGI monitoring — Monitor site

ceilometer — Extract usage information — cASO — Publish accounting records — EGI accounting repository

nova-api

OCCI-OS

wsgi server

Extract site information — cloud-bdii-provider — Publish endpoint information — Site BDII

glance — Register/update images — vmcatcher + hooks — Subscribe to image lists — AppDB (vmcaster)

# Beyond IaaS

- EGI FedCloud capabilities focus on IaaS
- But open to external developments to provide PaaS/SaaS
  - Hide IaaS complexity, provide higher level programming models
  - FedCloud task force evaluates tools and offers them to support new use cases when they fit

| Catania Science Gateway | • SaaS<br>• Identity Federation |
| --- | --- |
| Slipstream | • PaaS for automating deployments<br>• Used in Helix Nebula |
| COMPSs | • Framework for auto-parallelisation |

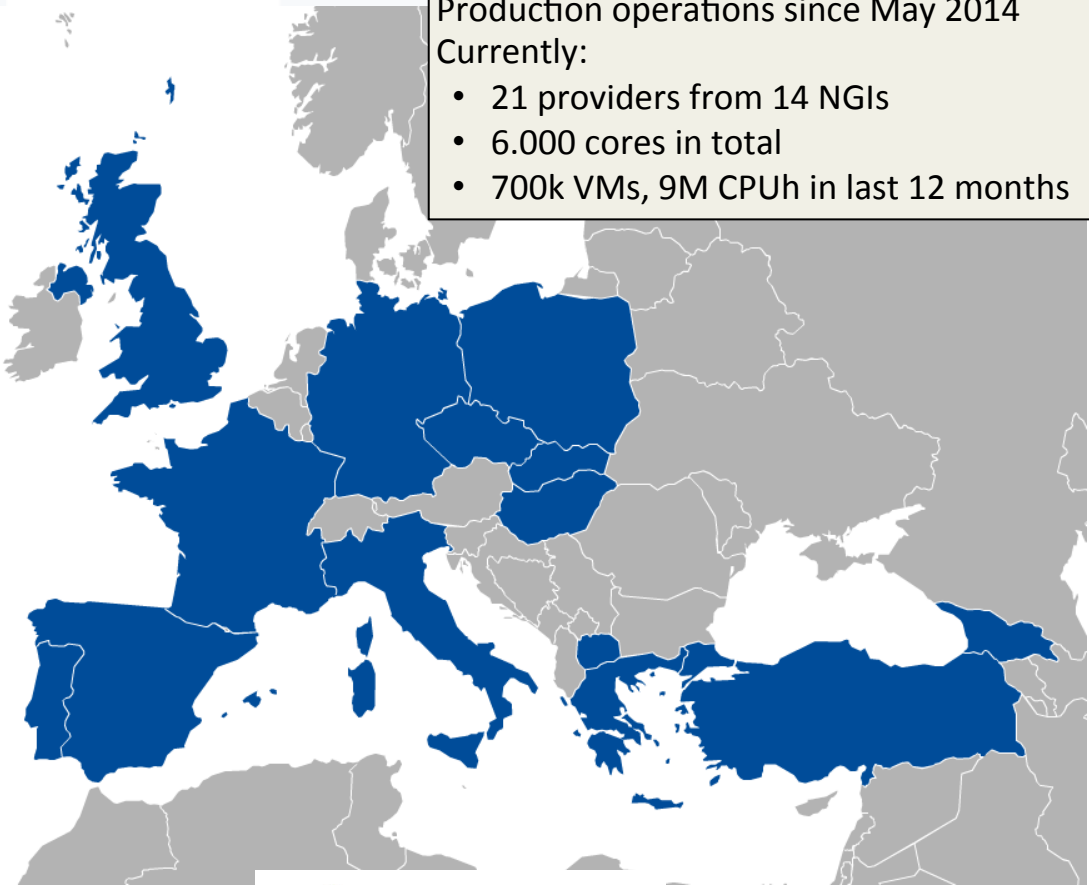| VMDIRAC | • Abstraction on top of various HPC/HTC/cloud |
| --- | --- |
| WS-PGRADE | • Workflow development and enactment |
| Vcycle | • VM lifecycle manager |

# FedCloud: the infrastructure

Production operations since May 2014
Currently:
- 21 providers from 14 NGIs
- 6.000 cores in total
- 700k VMs, 9M CPUh in last 12 months

# Support for the Federated Cloud

## Dedicated technical consultancy for each community (Request at support@egi.eu)

| **F2F/Web Meetings** | • Identify suitable setup<br>• Allocate technical experts<br>• Define milestones |
|---|---|

| **Continuous tracking and support** | • Technical integration<br>• Periodic meetings |
|---|---|

| **fedcloud VO** | • Resources for prototyping<br>• Enabled on all sites<br>• Usable for 2x6 months |
|---|---|

| **Docs** | • Step by step guides<br>• Tutorials<br>• Examples |
|---|---|

| **EGI VM Images** | • Main OS versions<br>• Secure, up-to-date<br>• Contextualisation |
|---|---|

| **Migration into production** | • Identifying committed resource providers<br>• Support for VO setup |
|---|---|

# FedCloud Evolution

- In the IaaS layer:
  - Docker support (2015 Q4)
  - New abstractions in the rOCCI client (2016 Q1)
  - VA instantiation interface in AppDB (2016-17)
  - Create VM snapshots, resize VMs on sites (2016 Q1)
- In the PaaS layer:
  - Tutorials and SLAs for high-level services
  - Complete the integration and guides of emerging tools, e.g. OCCO
- In the SaaS layer
  - Community specific service developments:
    - BBMRI, ELIXIR, DARIAH, MoBrain, EISCAT_3D, LifeWatch, EPOS, Disaster Mitigation
    - HumanBrainProject, Marine and Fisheries, etc.
  - Operation of community SaaS based on SLAs
- Collaborations with cloud federations
  - Canfar, FogBow, HARNESS, Nectar, CERN, etc.
  - Technology exchange; Interoperability; User support and training
  - Consolidation of new federation model

# References

- FedCloud entry point: http://go.egi.eu/fedcloud

- User support:
  https://wiki.egi.eu/wiki/
  Federated_Cloud_user_support

- Federated Cloud Communities:
  https://wiki.egi.eu/wiki/
  Federated_Cloud_Communities

- User support e-mail: support@egi.eu

# Thank you for your attention.

*Questions?*