EGI: Advanced Computing for Research

www.egi.eu
@EGI_eInfra

Compute Services in EGI

Overview and use cases

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Session outline

- EGI Compute Services
  - Cloud Compute
  - Cloud Container Compute
  - High Throughput Computing
- Users experiences
  - NextGEOSS EO data processing campaigns on EGI.eu Federated Cloud
  - AiiDAlab - an ecosystem for developing, executing, and sharing scientific workflows
  - Simulation of high power laser experiments by using high performance computer
- Q & A

EGI Service Catalogue

https://www.egi.eu/services/

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

Workload Manager
Manage computing workloads in an efficient way

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

Applications

Applications on Demand
Use online applications for your data & compute intensive research

Notebooks
Create interactive documents with live code, visualisations and text

Security

Check-in
Login with your own credentials

Training

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

ISO 27001 Training
Learn how to manage and secure information assets

Training Infrastructure
Dedicated computing and storage for training and education

ISO 9001
Certified Quality Management System
www.tuv-sud.com/ms-cert

ISO 20000
Certified IT Service Management System
www.tuv-sud.com/ms-cert

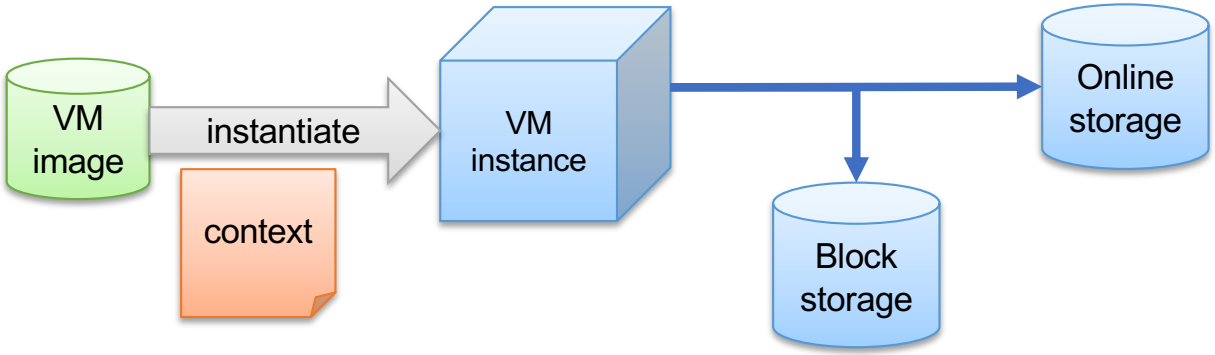
EGI Compute Services

Run your workloads on the distributed resources on the EGI Federation

IaaS: Virtual Machines

IaaS gives you API-based deployment of virtual machines (VMs) on-demand:

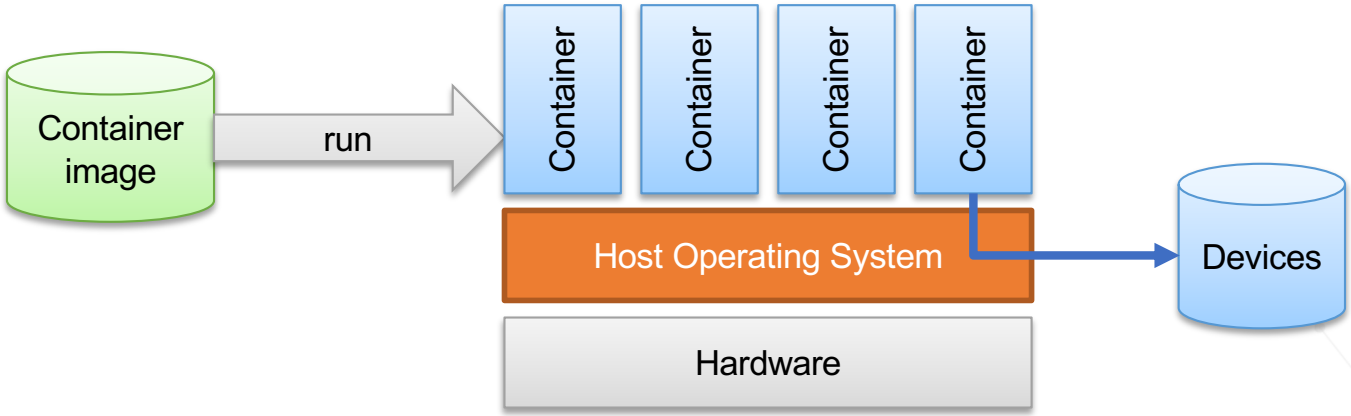
- control the hardware (CPU, memory, disk) and software (OS & any other software stacks) configuration
- without managing physical servers



Containers

Containers provide OS-level virtualisation

- Isolated runtime built on namespaces and cgroups, without VMM overhead



Docker

"Open-platform for building, shipping and running distributed applications"

Docker commoditizes containers

- Hides and automates container management process
- One-command-line deployment of applications
- Easy to move from development to production
- Provides ecosystem to create and share images

Kubernetes

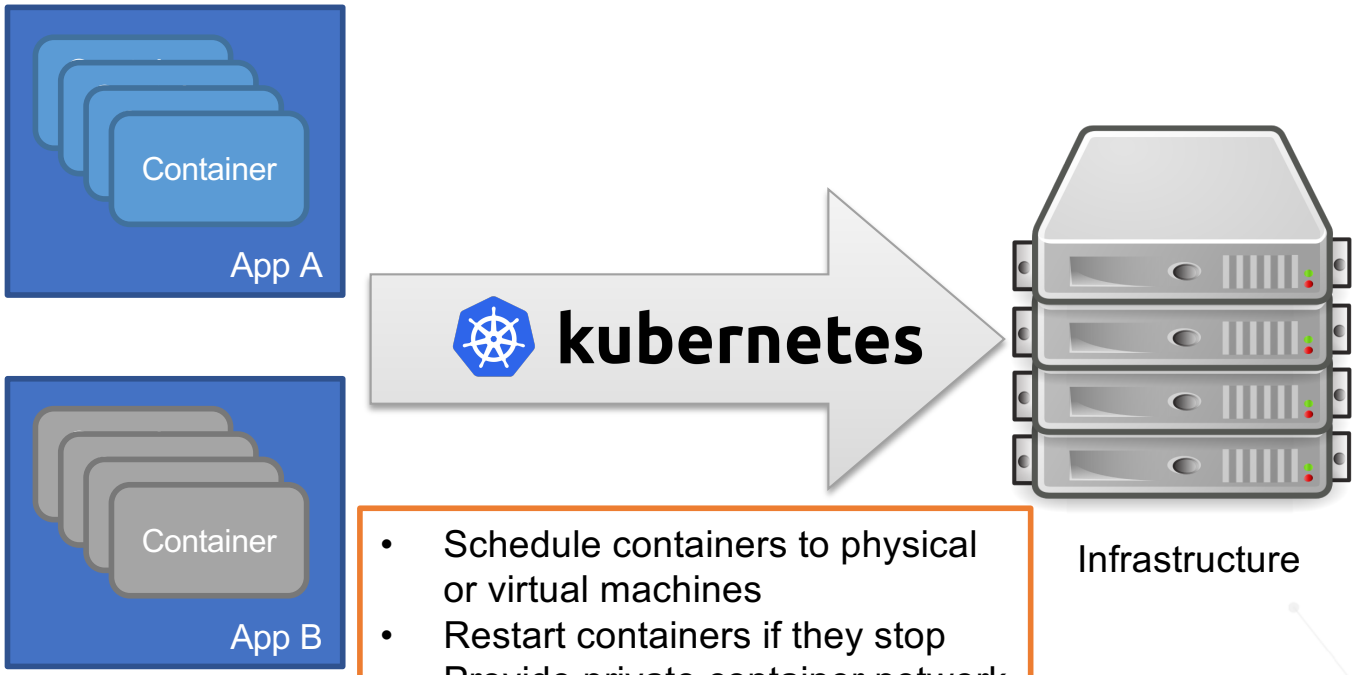
Kubernetes is an ***open-source*** *platform for automating deployment, scaling, and operations of application containers across clusters of hosts, providing container-centric infrastructure.*

Kubernetes:

- Places containers on nodes
- Recovers automatically from failure
- Basic monitoring, logging, health checking
- Enables containers to find each other

Kubernetes

Container orchestration

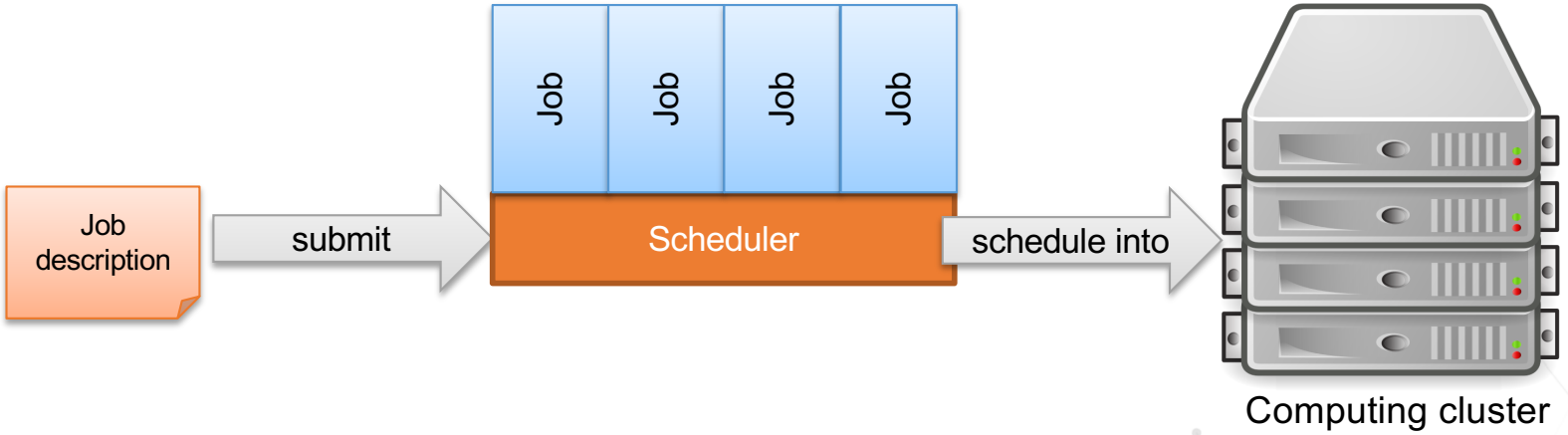


- Schedule containers to physical or virtual machines
- Restart containers if they stop
- Provide private container network
- Scale up and down
- Service discovery

Jobs

Jobs are a command (or series of commands) managed by a scheduler

- Unprivileged (no servers) and time limited (no long running services)
- Capable of delivering large amounts of processing capacity over long periods of time.



	Cloud Compute	Cloud Container Compute	High Throughput Compute
What is it?	Distributed IaaS	Kubernetes on top of EGI Cloud Compute	The *grid,* a scalable batch system
What you run?	VMs	(Docker) Containers	Jobs
Typical workloads	Lift and shift existing applications Specific OS (kernel) requirements Long running servers	Cloud-native containerised applications.	Execution of parallel computing tasks to analyse large datasets.
Pros / Cons	[+] Complete control on resources, run (almost) anything you'd like [-] Complex operation	[+] Industry standard [+] Hides complexity of Kubernetes setup [-] Kubernetes steep learning curve	[+] No management of resources, just submit jobs [-] Legacy interfaces [-] Jobs may not match any computational need

Configurability → Abstraction

EGI Cloud Compute

Run virtual machines on-demand with complete control over computing resources

EGI Cloud Compute Service

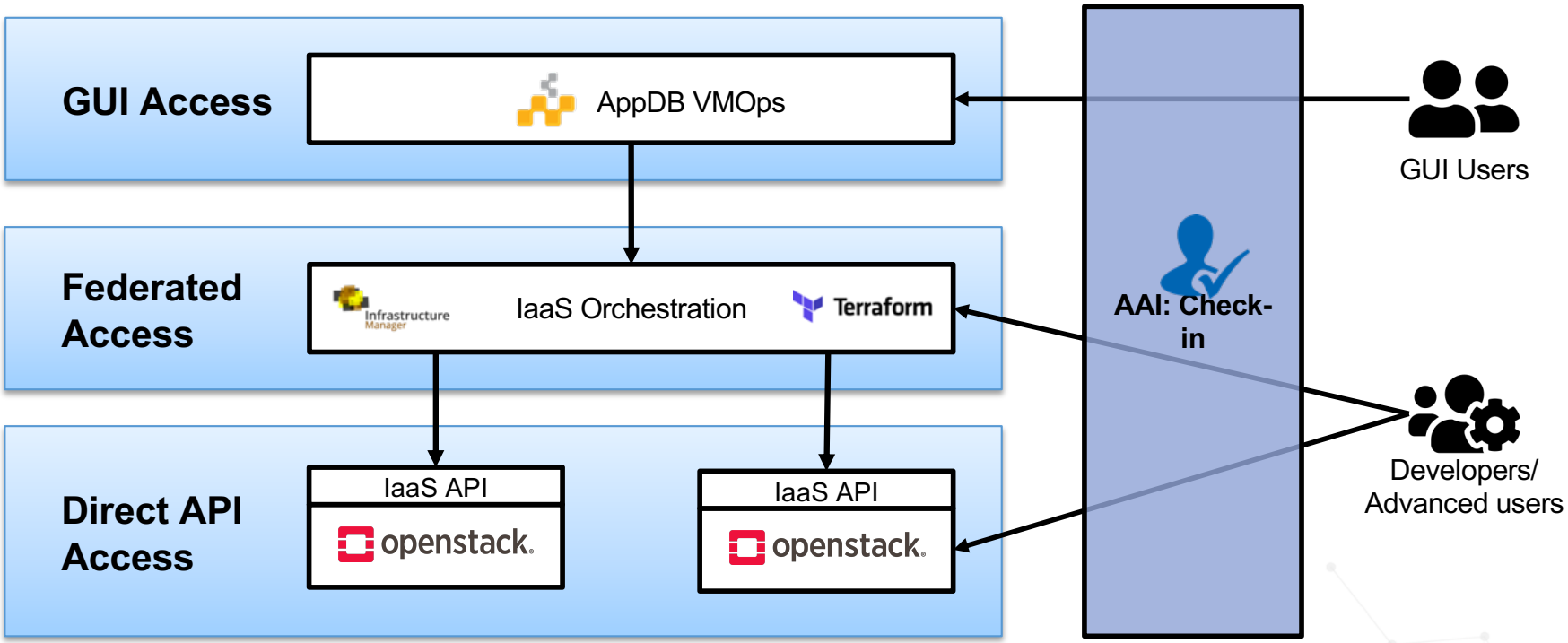
Distributed Infrastructure as a Service (IaaS) powered by the EGI Federated Cloud

- Allows international collaborations to perform distributed data analysis with VM-based workloads

Features:

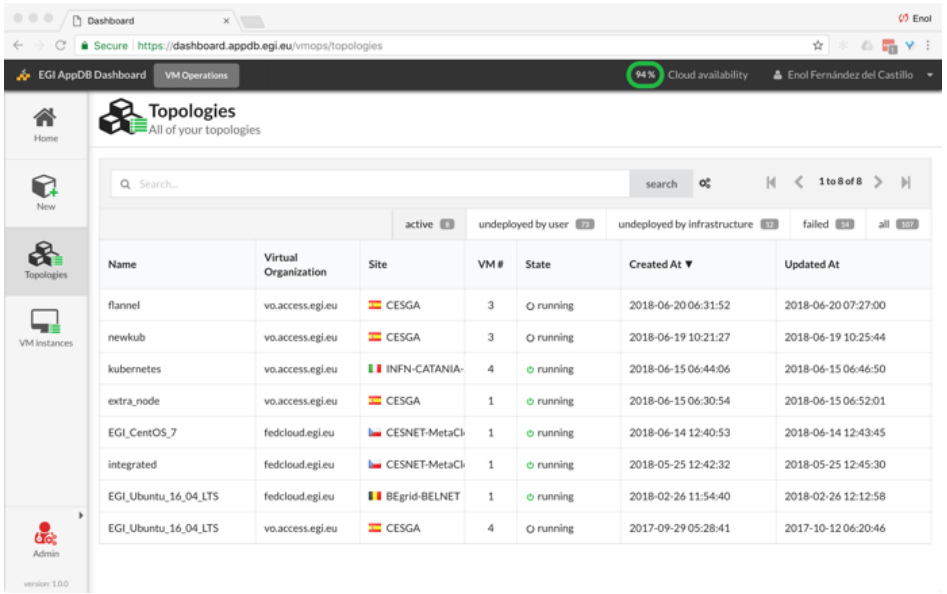
- Execution of VMs on a distributed infrastructure
- Federated identity
- Common VM image catalogue
- GUI and CLI/API based access
- Support for IaaS orchestration
- Central accounting and monitoring

Access layers



AppDB VMOps

A Federated GUI



Single Web dashboard to manage VMs in the federation

- Point-and-click wizard solution to create new VMs

Integrated with all the features of the federation

Powered by Infrastructure Manager orchestrator

IaaS Orchestration

Manage heterogeneous providers

Infrastructure Manager

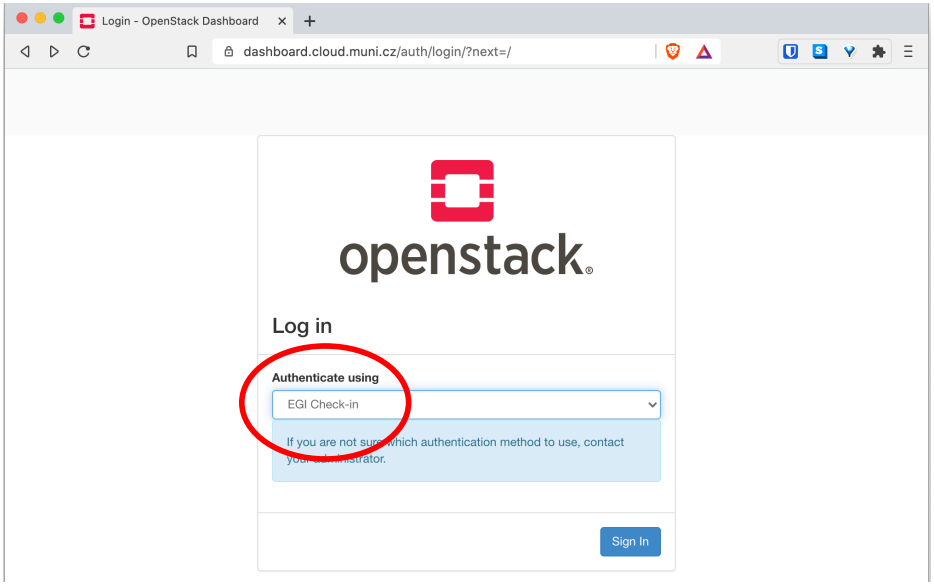
Deploy IaaS resources on all kind of IaaS providers (including OpenStack)
TOSCA standard support
Integration with EGI Cloud features (image catalogue, authentication)

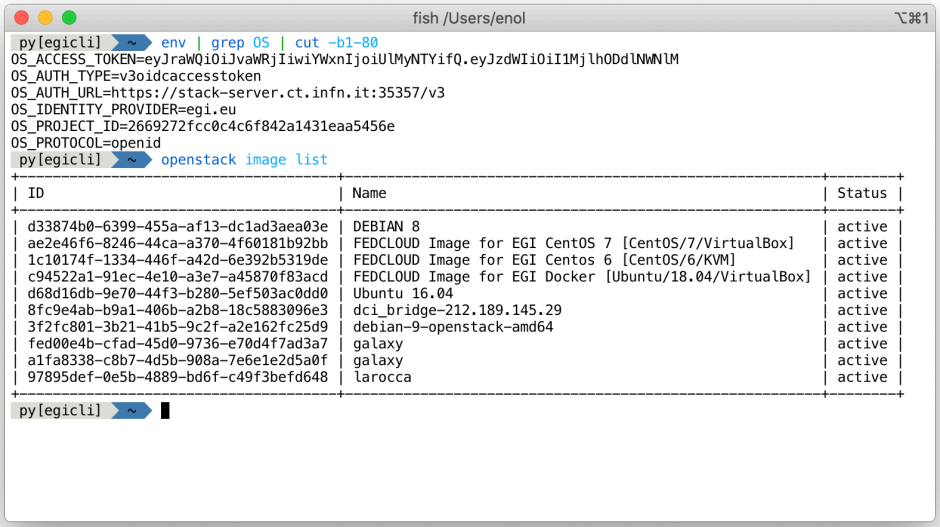
Terraform

Open Source tool with support for multiple IaaS providers (including OpenStack)
Near API-level abstraction, but useful for interacting with different providers in a uniform way

IaaS access

Full access to OpenStack APIs with federated identity





Virtual Machines Images and AppDB

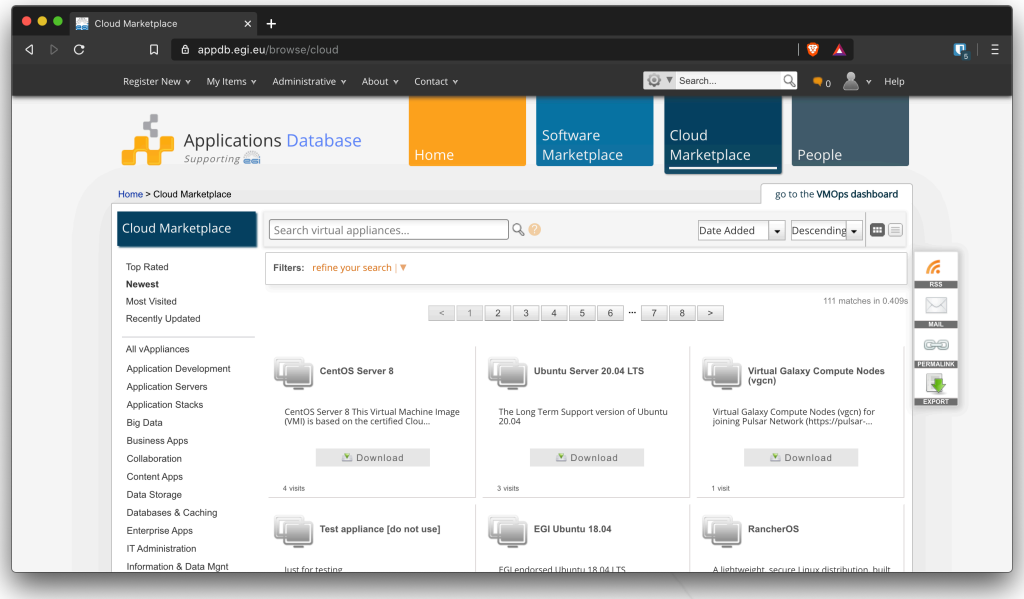
Bring your software to the cloud

Common registry for Virtual Appliances (VA)

- VM image + metadata
- Available for running at the EGI providers or on any hypervisor

Community-level management of VAs

- Get the needed software on all providers automatically
- Control what can be executed



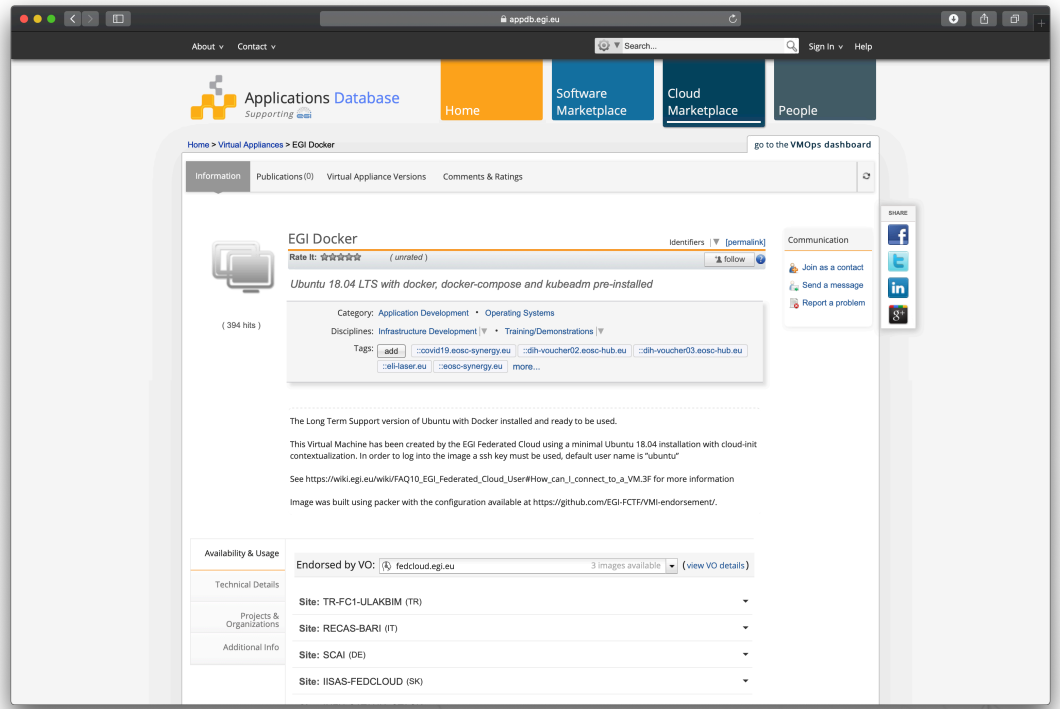
Containers on EGI Cloud Compute

Run docker on VMs

Pre-built image with Docker, Docker-compose and Kubernetes installed

Instantiate at one provider, ssh and:

```
$ docker run …
```



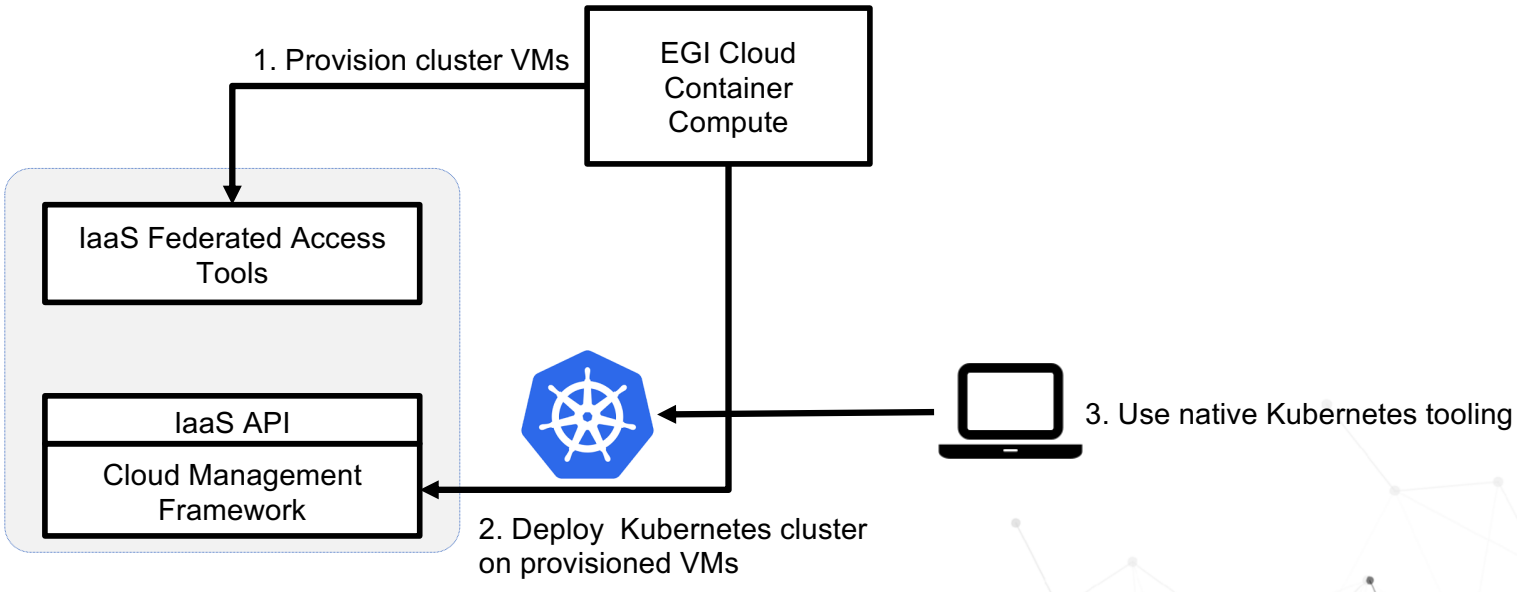
EGI Cloud Container Compute

Run docker containers on-demand with complete control over computing resources

Cloud Container Compute

Automated provision of Kubernetes clusters on EGI Cloud Compute providers

- Built on EC3 for scalable management of resources



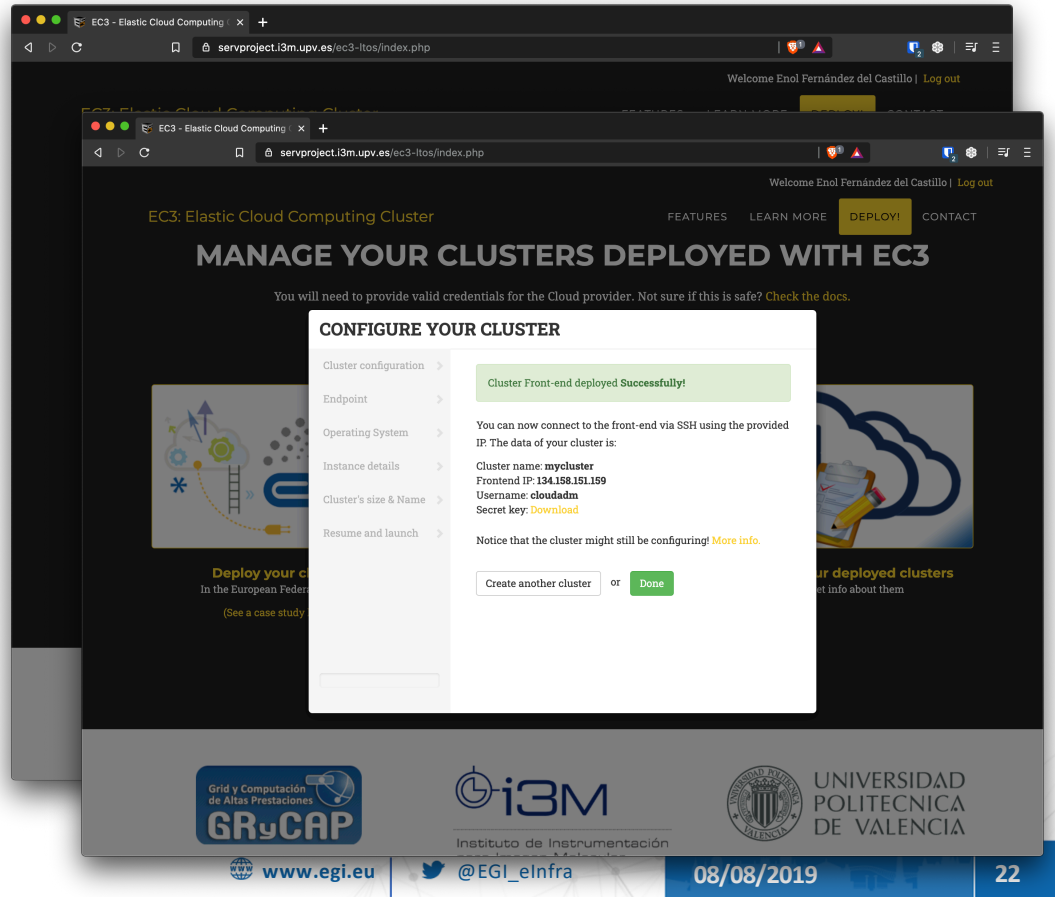
Cloud Container Compute

EC3: Elastic Cloud Computing Cluster

Deploys and configures Kubernetes

- Elasticity – can grow/shrink depending on your load
- GUI and CLI access
- Integrated with Check-in and AppDB

Builds on ansible and kubeadm



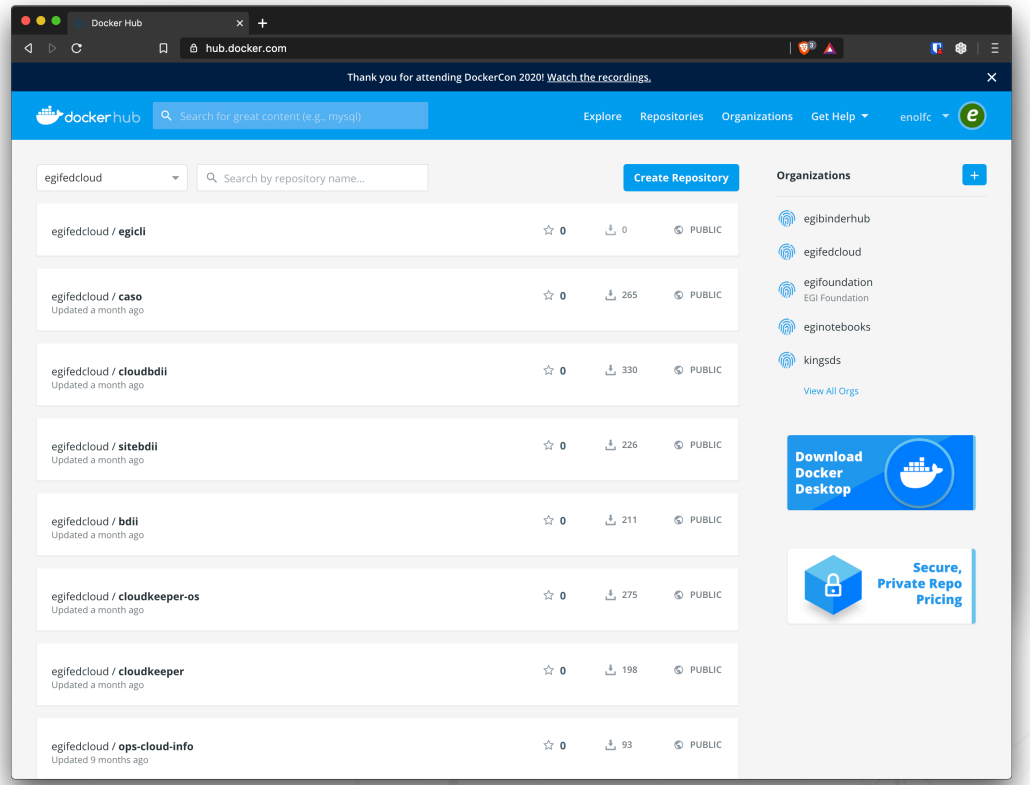
Container registries

Getting your software into EGI Cloud Container Compute

Container registry service for sharing applications

DockerHub is the main registry available

- Public and private repositories
- Official repositories
- Automated builds
- **Free accounts conditions recently changed!**



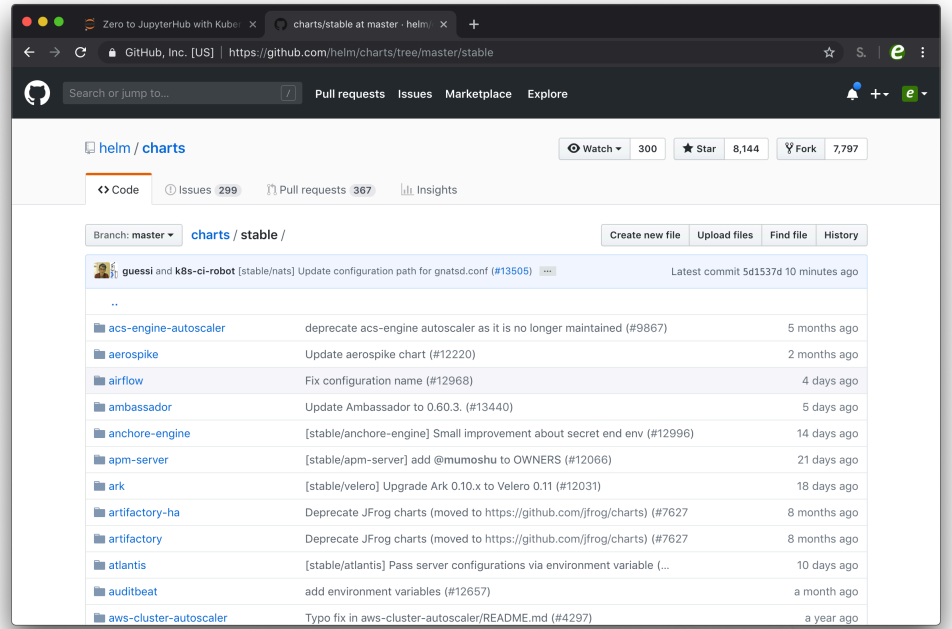
Helm

Helm is a package manager for Kubernetes

Allows to easily install applications/services easily

Creates from templates all the k8s objects needed to run the application

Wide catalogue of *charts* with (normally) sane defaults

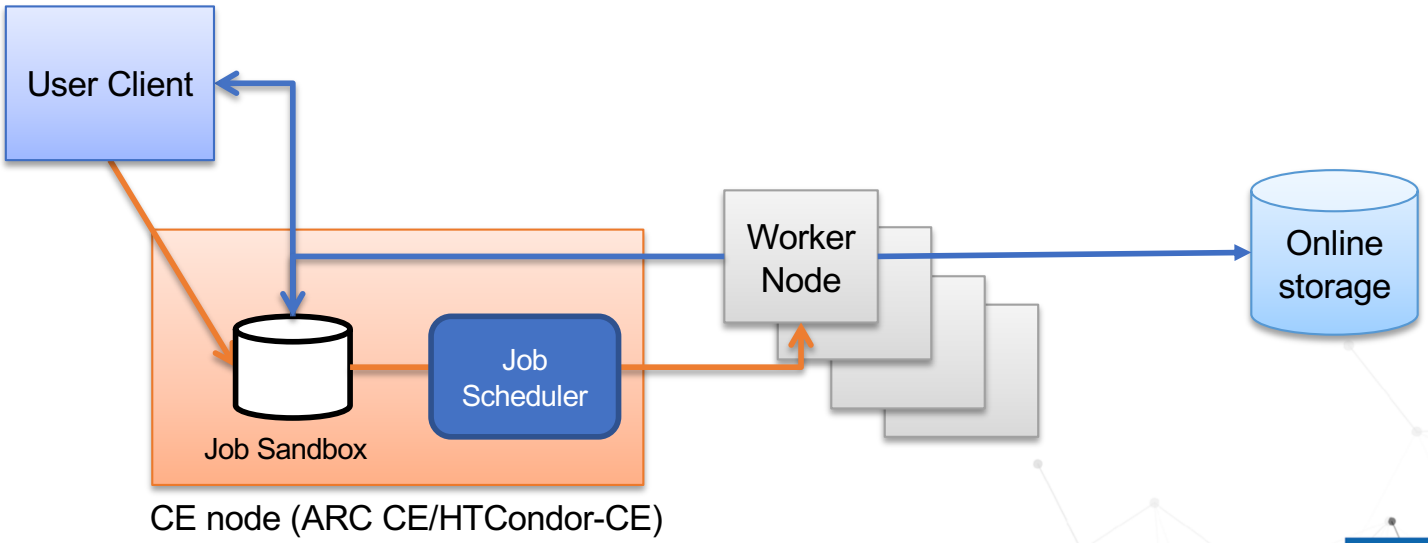


EGI High Throughput Compute

Execute thousands of computational tasks to analyse large datasets

EGI High Througput Compute

The EGI High-Throughput compute (HTC) provides users with the capability to access large amounts of computing resources, and to submit hundreds or thousands of computational tasks.

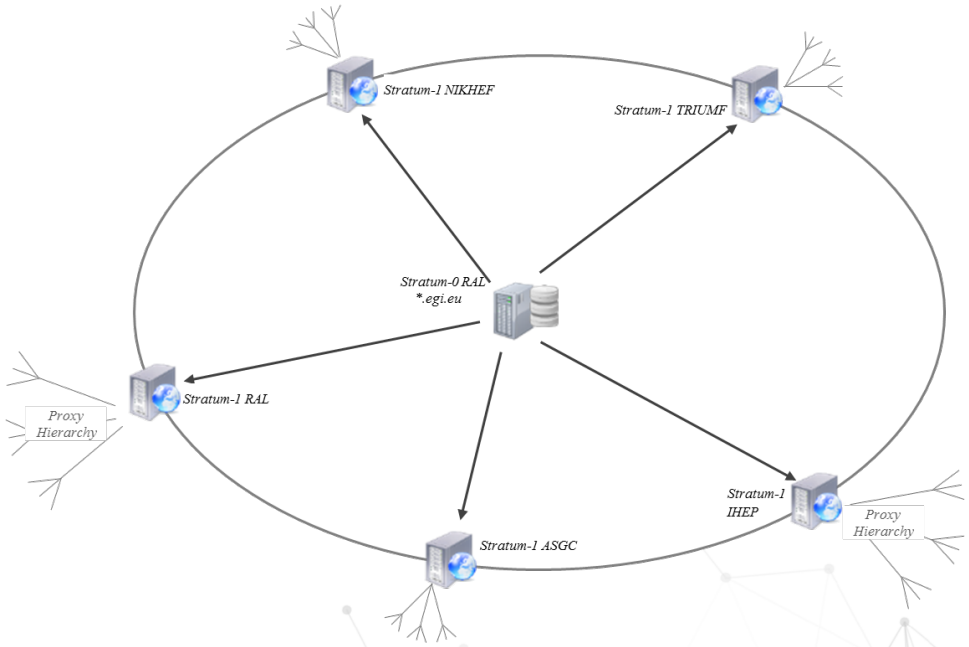


CVMFS

Getting software into EGI High Throughput Compute

CernVM FileSystem provides scalable software distribution across the federation

- POSIX read-only filesytem in user space
- Uploader interface for software managers of each CVMFS repository
- Available at all providers of EGI HTC
  - Files cached at providers for fast access to frequently used software



Containers as jobs

Using HTC for running containers

❌ Docker

- Requires root access to run your container

✅ Singularity

- Container image and runtime designed to run on multi-tenant computational resources
- Conversion of images from docker (automatic)
- Requires system administrator to configure

✅ udocker

- run applications encapsulated in docker containers without using docker, without using privileges, without system administrators intervention and without additional system software
- Run as a normal user, with the normal process controls and accounting, in interactive or batch systems

Workload Manager

Go beyond a single provider

The Workload Manager service is based on DIRAC technology and is suitable for users that need to exploit distributed resources in a transparent way.

- User-friendly interface and API access for advanced usage
- Combine Cloud / HTC providers for job execution
- Optimise workload placement across all kind of resources

Learn more tomorrow 4th Nov @ 13.15 on the **Data analytics services in EGI - Overview and use cases** session!

GPUs

Accelerators on EGI Compute services

GPUs on EGI Compute Services

All EGI Compute Services are GPU-ready!

Cloud Compute

- Specific VM *flavors* with GPUs available at CESNET-MCC, IFCA-LCG2, IISAS, and NCG-INGRID-PT providers, more coming in the next months
- VM images with GPU drivers ready to use

Cloud Container Compute

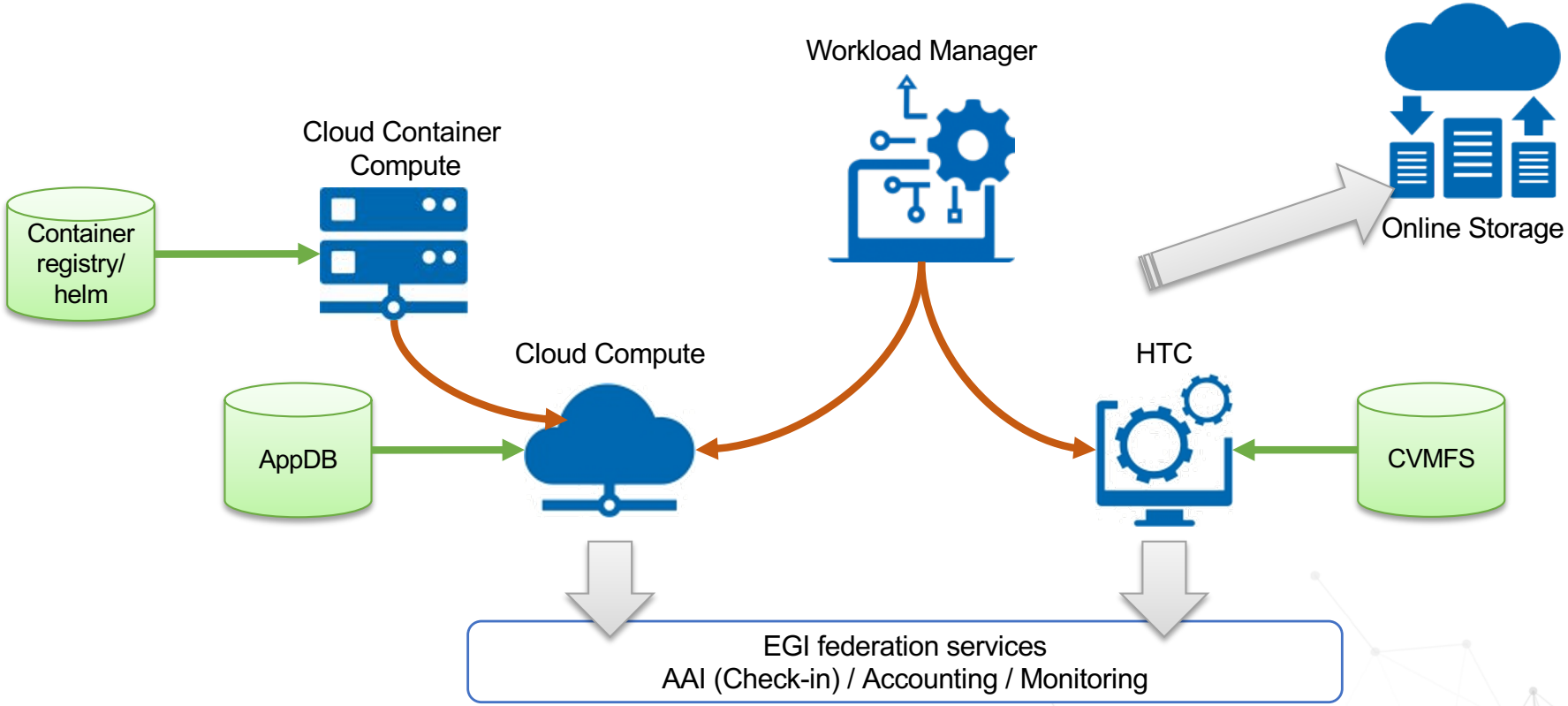
- Docker plugin and kubernetes configuration also ready

High Throughput Compute

- Selected sites support jobs with GPUs, just tag the jobs

Summary

EGI Compute Services



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Thank you
for your attention.

Questions?

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